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ALGAE OF THE TENNESSEE VALLEY REGION:
A MANUAL FOR IDENTIFICATION OF SPECIES

By

Herman Silva

A THESIS

Submitted to the School of Graduate Studies of Michigan State College of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Department of Botany and Plant Pathology

1951

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"I am a part of all that I have met..." - Tennyson, in Ulysses

In the investigation which has led to this writing, the efforts of many persons comprise the results which bear the writer's name. They all deserve the greatest possible credit and thanks that I can give them here, since each has contributed an important part.

Dr. G. W. Prescott, my major professor, is much more than a noted scientist and teacher to his students; he is a friend as well. To become his worthy student is a high goal for any young investigator.

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My studies have been greatly aided financially by a Michigan State College Graduate Assistantship, the United States Atomic Energy Pre-Doctoral Fellowship, and by my father, Mr. William H. Silva.

Herman Silva

candidate for the degree of

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Dissertation: Algae of the Tennessee Valley Region: A Manual for Identification of Species

Outline of Studies

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AN ABSTRACT

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Year 1951

Approved G. W. Prescott

Herman Silva

This is a report on investigations of fresh water algae, which have been in progress since 1941. A study has been made of the algae of the Tennessee Valley Region, defined here as the area included by the state of Tennessee and the Tennessee River Valley. Twenty-three hundred samples have been collected in seventy-five of the ninety-five counties of Tennessee and in six surrounding states, which include portions drained by the Tennessee River System.

The treatment here is primarily systematic, because this course of pursuit grew to such proportions that the numerous attractive ramifications which presented themselves could not be followed. A total of 927 species and varieties of algae distributed among 338 genera are considered. Original observations have been supplemented with information derived from study of the literature and after consultations with specialists in the various groups of algae. In general, the systems of Pascher, Fritsch, Smith, and Drouet have been followed in the taxonomic treatment with some modifications.

A key has been developed for the identification of all genera, and keys and descriptions are included for all species except the diatoms. Forty-six maps and plates containing four hundred figures supplement the written text. Pertinent taxonomic comments are presented, including brief descriptions of genera and families.

Fifteen new species or varieties are reported and described for the first time.

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INTRODUCTION

Nature of the Study

The pursuit of knowledge rarely takes the inquisitive human being along a straight and unbranched path. Indeed it usually leads him to see an infinite number of ramifications which can be followed eternally if he does not deliberately shut his eyes and avoid, for the time being at least, most of the attractive byways which present themselves. During this study of algae in and around the state of Tennessee it has been difficult to ignore attractive problems relating to algal ecology, seasonal variation in species, life history of individual plants, and others. Regretfully, this had to be done and attention was restricted chiefly to systematic aspects of the flora.

Some attention was given to distribution according to broad regional zones which are determined by physiography. Also, some observations on specific ecological relations of species were made. The main objective, however, was taxonomic and accordingly the results of the study constitute a systematic treatment of the algae and is intended for use in the identification of species.

At this time in Tennessee such a manual for identification is demanded. The need is equally acute for those with a broad interest in algae who have access to hardly a single manual written in the English language, and those with special interests, such as physiologists, who need a reasonably accurate ready source for identifying the subjects of their investigations. It is hoped that this work will lead to more precise studies of particular groups of the algae, and encourage pursuits of the many ecological problems in the Tennessee flora.

In Tennessee, the present study has been preceded by some "check-lists" or studies of certain groups of algae. The first notable one of these was that of Eddy, 1930 on the plankton of Reelfoot Lake, followed by Lackey's report in 1942 on a river plankton study. Some references have been made in the literature to individual species collected in Tennessee both before and since these particular Tennessee studies. Smith, 1878 described a diatom from Knoxville, Schaeffer, 1918 described Jenningsia diatomophaga, which subsequently has not been verified, Drouet, 1939 and 1942 includes a few blue-green algae, and Phinney, 1946 studied a few Tennessee specimens of Cladophoraceae. Finally there are the studies by Schwartz, 1933 of Reelfoot Lake cryptogams and that of Wright, 1931, in his master's thesis at Peabody College, on the genera of algae in the Nashville Region.

The writer's first checklist was published in Silva & Sharp, 1944, followed by some additions (Silva, 1949), and a new species described in Prescott, Silva and Wade,

1949. A bibliography of previous publications pertaining not only to Tennessee, but the entire Southeast as well, can be found in Silva, 1948. The resumé on southeastern algal flora includes two which are in the nature of state floras; McInteer, 1930 and his subsequent reports on Kentucky, and Whitford, 1943, on North Carolina algae. Philson, 1939 has completed the only other recent generalized study in North and South Carolina, whereas studies have been made of special groups by Brown, 1930 (desmids), Strickland, 1942 (Virginia Oscillatoriaceae), Flint, 1947-8-9 (Batrachospermum chiefly), Tiffany, 1944 (Florida Oedogoniaceae), Salisbury, 1938 (Florida desmids), and Prescott and Scott, in a series of papers chiefly on desmids.

Character of the Tennessee Region

The territory hereinafter referred to as the "Tennessee Region" (Map 1) includes not only the entire state of Tennessee, which is drained partly by the Cumberland and Mississippi Rivers, but also the complete Tennessee River watershed, covering parts of Virginia, North Carolina, Georgia, Alabama, Mississippi and Kentucky. This territory is the heart of southeastern United States and is in the center of the deciduous forest expanse of Eastern North America. It stretches for five hundred miles, the western half of the distance between the Atlantic Ocean and the Mississippi River, and transects all the broad non-glaciated physiographic zones and prominent landscape features encountered in eastern United States except for the Piedmont. In regard to vegetation and soils, there are types included which are characteristic of regions much further north and south.

While it is not possible to select a single criterion for subdividing the area, certain sub-regions can be drawn arbitrarily, based on the more conspicuous natural differences. Thus, the ten subdivisions (Map 2), into which the area of this study are divided, are based on the physiographic provinces primarily, as presented in Fenneman, 1938, or the Geologic Map of Tennessee, revised by Pond, 1933.

The primarily physiographic sub-divisions are reinforced by the soil survey maps which coincide rather well with the physiographic regions. Maps such as that published by the Tennessee Valley Authority, 1949, on the soil associations of Tennessee do add divisions within the physiographic zones, and some of these are used in the delineation of the sub-divisions here. A good example of a soil sub-division is the Bewleyville-Baxter-Crider Association[1] in Montgomery and Robertson Counties which is in a position physiographically unseparated from the remainder of the lower plateau, or highland rims surrounding the Nashville Basin.

Terrestrial vegetation is a third contributor to the definition of the sub-divisions. It is a less useful factor

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1 See U. S. D. A. manuscript description of Soil Associations of Tennessee, 1949.

than the first two because almost all of the state is covered by what Shantz & Zon, 1924, characterized as the Chestnut-Chestnut Oak-Yellow Poplar Forest. Other names have been applied, but the evidence is clear that similar hardwood forests do cover most of the area (Map 3b). There are small sections which differ from the general fabric. The Spruce-Fir Forests form a head dress on the crests of the Appalachian Ridges in the eastern portion of the area, and Northern Hardwoods lie in the coves below. Also, a small tip of Shantz and Zon's Oak-Pine Forest does protrude up from Georgia into the Ridge and Valley Province of East Tennessee.

Because algae are primarily aquatic, it would seem that their distributional differences might be related to hydrologic differences within the area studied. Unfortunately, however, the well-marked areas present on a physiographic or soil map are absent from a hydrologic one. Only three ground water provinces are represented in the area, the Blue Ridge-Appalachian forming a strip along East Tennessee and Western North Carolina, the Paleozoic Province, including most of the eastern two-thirds of Tennessee, and the Atlantic Coastal Plain Province west of the lower Tennessee River Valley. This classification is according to Meinzer, 1923, and is included in Tolman, 1937.

Other criteria, such as rainfall and evaporation are vague. Livingston & Shreve, 1921 include maps which divide the area into only two land subdivisions. Still other criteria, such as those based on land form and usage which well may be more important than any of those ordinarily considered, have not been explored sufficiently to be employed.

At first glance the area of study is seen to be composed of three major watersheds (Map 1). The most conspicuous is the Tennessee River System which forms a large arc from the northeast, southwestward, then northwestward to the Ohio River near the Mississippi. Not only is its entire main thread impounded by dams, but there are eight major tributary dams, and several other minor ones. The Cumberland River forms a similar arc just inside the Tennessee arc, to the north of it. Finally, most of western Tennessee drains westward through smaller streams into the Mississippi.

A careful tabulation of the physical and chemical properties of the waters in streams of the entire area was published by Shoup, 1950, but there are only local T. V. A. studies of the standing waters (Map 3a), which have come within late years to be a conspicuous part of the Tennessee scene.

For a more accurate evaluation of the nature of the major areas, ten subdivisions are drawn here (Map 2). As stated above, the primary basis for these is physiography, with soil and vegetation considered to be of secondary importance. It must be stressed that the objective in listing these subdivisions is to establish a basis for a more accurate evaluation of the area, but not necessarily to imply that differences in algal flora are related positively to the differences on which subdivisions are based.

The subdivisions described below are listed from east to west.

1. Blue Ridge Province. Rugged mountains of crystalline, chiefly non-calcareous, rock cover the sub-region, and extend into the eastern bordering states of Virginia, North Carolina and Georgia. The soil in higher altitudes is an extension of the grey-brown podsol group from the north. Spruce-Fir Forests dominate the vegetation above altitudes of 4000 feet and Northern Hardwoods are found lower down, especially in coves and flats from two to four thousand feet elevation, while the lowest elevations exhibit the hardwood forest common to the entire region. Here the rainfall is highest, and evaporation and temperature lowest of anywhere in the entire Tennessee region. Springs are innumerable and streams are swift, rocky, and, in sections where the natural vegetation cover is retained, quite clear. Natural standing waters of any considerable extent are unknown, but Fontana and Hiwassee Dams form large, deep lakes at high altitudes, and there are some minor impoundments.

2. The Ridge and Valley Province or East Tennessee Valley. The alternating ridges and valleys of this region occupy most of eastern Tennessee between ridges of the Appalachians on the east and the Cumberland Plateau border on the west.

Outliers of the Plateau, Clinch and Powell Mountains, reach from Kentucky to a considerable distance into the heart of the region, as exceptionally large ridges. The soils are red-yellow podsolic type, mostly within a single association. The natural climax vegetation is the hardwood forest common to most of the region, with a little tongue of southerly pines extending into the lower parts of Hamilton, Bradley, and Polk Counties. The region is mesophytic and usually drought-free, rainfall, evaporation, and temperature conditions being intermediate between the Appalachian Region and those further west. Streams vary from brooks on the higher slopes of the mountains and ridges to slower and often very large ones, including the Tennessee River, in valleys. Springs from limestone fissures are rather frequent in many sections and solution work is responsible for several small sink hole lakes. Artificial lakes include six major T. V. A. impoundments and several lesser ones. The presence of ponds is related to local land usage and water supply.

3. The Cumberland Plateau Sub-Region. Its eastern escarpment lies in eastern Tennessee, but mainly it is within the middle third of the state. Its western edge drops off to form the eastern Highland Rim of the Nashville Basin in a north-south line through Pickett, Overton, Putnam, DeKalb, Warren, Coffee, Moore, and Franklin Counties. The sub-region must be further subdivided into:

a. The Plateau Proper, which has a steeper outer and a more flat inner part. The soils here are often referred to as Azonal lithosols, but this is correct only locally, since podsolic soils can also be found. Horizontally bedded sandstone with small streams are characteristic, but the deeper valleys contain larger streams, limestone soil, and farm ponds.

b. The Sequatchie Valley, which is strikingly entrenched in a narrow strip through Bledsoe, Sequatchie and Marion Counties. Its floor is similar to an eastern Tennessee ridge valley, but is even more fertile, with a red-yellow podsolic soil type the same as the valley fills referred to in the following section.

The natural vegetation of the entire area is the usual hardwood forest. Rainfall and evaporation result in somewhat less mesophytic conditions in the flat areas, but the valleys are quite green as are the valleys of eastern Tennessee. Natural standing waters, even farm ponds, are rare except in the fertile valleys.

4. The Highland Rim. This is the roughly circular low or dissected plateau which surrounds the Nashville Basin, extending from the Cumberland plateau on the east to the lower valley of the Tennessee River on the west. Physiographically this is a distinct region and a general poverty of vegetation and of Man is noticeable even to a casual observer. Nevertheless, there are important local variations from the over-all pattern, among them are:

a. Valley fills along the eastern side of the rim are of the same soil type as Sequatchie Valley, and are the most fertile in the state. Good drainage and adequate water supply also differentiate the region from most of the rim.

b. A tongue of northern soil extends from Kentucky into Montgomery and Robertson Counties, and includes some types assigned to the grey-brown podsolic group. A broad map showing this pattern is General Distribution of the Great Soil Groups, from the U. S. D. A. Yearbook of Agriculture, 1938. The area, which was treeless before cultivation, is an extension of the Kentucky barrens discussed by McInteer, 1938, but early farming attempts disturbed the ecological balance so that trees now cover most of it. Unusually pure limestone underlying the area and poor drainage are responsible for the soil type, however, not the prairie history.

The remainder of the region varies chiefly in the type and amount of drainage. Along northern and western arcs of the circle, it is often quite poor, and numerous catch basins can be found filled with shallow standing water. On the eastern side, where drainage is better, there are some artificial impoundments, such as Dale Hollow Lake in Clay County.

5. The Nashville Basin. The Basin is composed of an inner part centered in Rutherford County, and two concentric outer rings defined from the Maury-Mimosa-Stony Land, and the Baxter-Dellrose-Mimosa soil associations. The Basin is

ringed by Trousdale, Smith, Cannon, Coffee, Moore, Lincoln, Giles, Maury, Williamson, Davidson, Robertson and Sumner Counties, in the very center of the state of Tennessee. The forest here conforms to the general pattern with an interesting variation on flat limestone areas in the form of the extensive cedar (*Juniperus*) glades which are nowhere in the region better-developed. Rainfall and evaporation conditions are only slightly different from those in the Ridge and Valley Province, and there is a general resemblance in hydrologic conditions, although the streams are mostly of the valley type and the ridge pattern is replaced by a dendritic stream pattern. Sinkhole lakes do occur here, and extensive farming often makes use of ponds.

6. Eutaw-Tuscaloosa Sand and Gravel Sub-region. This is a small section in Hardin and Wayne Counties which extends up from equally poor lands in Alabama and Mississippi. Conditions are similar to those of the Cretaceous belt just west of the lower valley of the Tennessee River.

The western Tennessee subdivisions have certain features in common to distinguish them from those in the middle and eastern parts of the state. The area west of the Tennessee River consists of north-south banded, progressively younger zones which are shingled on the old Coastal Plain surface. The surface geologic formations are chiefly unconsolidated and, except near the Tennessee and Mississippi Rivers, are covered with a layer of Pleistocene loess which becomes fifty to one-hundred feet thick near the Mississippi. The vegetation, although containing some different elements, falls within the general hardwood pattern except for the river bottom forests. The streams are low-lying, shifty-bottomed, and form many sloughs and marshes. Hydrologically, the third ground water zone represented in the Tennessee area is located here. Although from a well driller's point of view, the water conditions are good, this is not true in respect to general vegetation. A combination of lower altitude, and slightly higher temperature and rate of evaporation, causes a frequent parched appearance in the higher lying lands, while the poor drainage maintains a saturated condition in the bottoms. Ponds are frequent landscape features, being used for stock, erosion control, or fish culture.

7. The Cretaceous Belt. This is the area just west of the Tennessee River which is covered by the Providence-Dulac-Ruston soil association.

8. The Eocene Belt. This is the broadest of the group, covering over half the width of western Tennessee. It is surfaced by the Grenada-Loring-Memphis soil association.

9. The Pleistocene Loess Belt. Actually this is the area where the loess is deepest. It lies between the Eocene Belt and the next zone, except that the Mississippi is reached at Memphis. Highly productive soils are found in the region where water relations are favorable.

10. The Recent Alluvial Area. This is the very low lying land along the Mississippi River and extending up its tributaries far eastward into western Tennessee. The Alluvial Sub-region corresponds rather well to the area in which the Cypress-Tupelo-Gum forest is best developed. This forest type also formerly extended up the Tennessee River into Alabama, but formation of T. V. A. lakes has largely inundated it.

In addition, a feature within the Alluvial area deserves special mention, Reelfoot Lake. This oddity resulted from an earthquake in the early Ninteenth Century and includes a bayou, swamps, and pond areas about eleven miles long and five to six miles wide. Although there are wide areas of open water the depth is astonishingly shallow, almost never over a man's head. Cypress trees may grow anywhere on the surface and bizarre cormorants and egrets perch or nest in their branches. The aquatic vegetations is that of a great over-grown pond--acres of Lemna, Nelumbo, Nymphaea, Nuphar, and immense quantities of Potamogeton, Cabomba, and algae, especially Hydrodictyon, Cladophora, Spirogyra, and Oedogonium. It is one of the most intriguing sites to be encountered in the Tennessee Region.

PROCEDURE

To date 2,400 collections have been made in the area. The first two hundred of these were made in 1941-2, largely from the Great Smoky Mountains but also including a few collections from the Knoxville area. Species identified from these early samplings are listed in Silva & Sharp, 1944. At first, most specimens were placed directly in vials of liquid preservative (6-3-1 mixture of water-alcohol-formalin), although living specimens were examined whenever possible.

When work was resumed in late 1946, collections numbered 300-730 were made. A large portion of these were from the Smokies, but several were added from the Knoxville area, the Cumberland Plateau in the vicinity of Falls Creek Falls, Washington County near Johnson City, and a scattering of samples from other areas contributed by Dr. A. J. Sharp. These collections have been preserved as exsiccatae rather than in liquid.

The final phase of the work began in the fall of 1947. Collections from the Smokies, the Knoxville area, and the Nashville area were made available by Dr. H. C. Bold, and Mr. Alfred Clebsch sent many of his more than 150 collections from the Clarksville area. The writer's efforts at this time were concentrated toward a compilation of the various phycological investigations published for the entire southeastern United States, and a comprehension of the species considered in them, so it was not until June of 1949 that intensive work was resumed.

During the summer of 1949 and the school year following, the advantages of an Atomic Energy Commission Pre-Doctoral Fellowship were enjoyed, which facilitated the investigation. The first field trip under this program was a long circuit through the Tennessee area: from Knoxville south to Chattanooga, west to Memphis, north to Martin and Reelfoot Lake, a ten day stay at Reelfoot Lake Biological Station, and then eastward by way of Clarksville, Nashville, Standing Stone State Park in Overton County, and Morgan County. A combination of collecting methods was employed during this time. Collections were made in four-dram vials. Field examination proved to be practical only in a limited sense, but freshly collected material was examined to a greater extent through the hospitality of Dr. Baker of the Reelfoot Lake Biological Station, Mr. Clebsch of Clarksville, and others. After preliminary examination, blue-green algae and red algae were dried on newspaper or filter paper, and most other algae preserved in 6-3-1 solution. Four shorter trips were carried out during the summer of 1949. In June there were trips to Cookeville in Putnam County, to Maury County, and a trip eastward through Jefferson and Greene Counties to reach the Archeozoic rock area around Flag Pond. In August there were two more trips. The first led south through the

Smokies into western North Carolina and northern Georgia to Tapoca, with a return by Hiwassee Dam and the Copperhill Basin of Polk County, Tennessee. The other was westward through the Guntersville Reservoir area of northern Alabama, then northward through Lincoln, Bedford, and Rutherford Counties to Lebanon, then west to Nashville. Here Dr. H. C. Bold served as an able and amiable guide in Davidson, Cheatham and Robertson Counties. The final collections before returning to Knoxville were made in Montgomery and Houston Counties with Mr. Alfred Clebsch of Clarksville.

A total of almost nine hundred samples were collected during the summer of 1949 plus an additional 150 from fall and winter collections including Clebsch's from Montgomery County, and those by Dr. T. F. Hall of T. V. A. from Colbert County, Alabama, as well as the writer's own from eastern Tennessee.

Active collection was resumed in March of 1950, in conjunction with an extended tour for conferences with specialists in various algal groups. Collections at this time were taken in a line from Knoxville to Memphis by way of Nashville and Clarksville, and, later, from Sumner County in northern Middle Tennessee. It was for this group of collections that the "field culture" was first employed. Samplings were placed in vials kept open to the air and upright in racks suitable for automobile transport. On arrival at Michigan State College the contents of the vials were transferred to cotton plugged 250 ml. Erlenmeyer flasks and about 150 ml. of water supplied and maintained. The water was either natural floodwater or soil extract of tap water, autoclaved and aerated. The imperfections of the method are obvious and numerous, but it does enable the development of Oedogonium and Vaucheria fruiting stages and the multiplication of many species not apparent in the fresh collection.

This method of maintaining field cultures was applied to an increased extent in the summer of 1950, but with a few modifications. Subculturing was sometimes successful in obtaining special individuals for added study. Some culturing on soil extract agar was attempted. For convenience, thirty and fifty ml. wide-mouth bottles were substituted for the flasks. Streptomycin (40 ppm) was used unsuccessfully in attempts to reduce bacterial decomposition during hot summer days. Petri plate cultures of mud and water, or whatever happened to be the substratum found, were also employed to some extent.

The final collections for the present writing were made during the summer of 1950, when two hundred samples were added. Another extended western trip was made from Knoxville northward to Caryville, westward across the northern border counties of Tennessee to Martin in western Tennessee, and Reelfoot Lake, then southwestward through Gibson, Madison, Herdeman, and McNairy Counties to enter Mississippi near Corinth, then eastward to the Tennessee River at Florence, Alabama, then east to the Tennessee River at the Guntersville Reservior near Scottsboro, Alabama, and generally following the river upstream to the point of departure. Other collections were added from Mr. Clebsch and the writer's East Tennessee trips.

The intention of the writer had been to collect from every county within the area, and to repeat collections within each of the natural zones during every season of the year. Only partial realization of this plan was possible, although 75 of the 96 counties of Tennessee and twelve neighboring counties are represented. The major natural areas are all represented by a number of collections. A few samplings were made a short distance outside the Tennessee region, but within the same natural areas.

The final treatment of most specimens collected during this study will be drying and preserving them in packets for distribution to the Herbaria of the University of Tennessee, and the Chicago Natural History Museum. Diatoms will be sent to the Academy of Natural Science of Philadelphia, and C. M. Palmer and L. H. Flint will receive duplicates of Lemaneaceae and Batrachospermaceae respectively.

GENERAL SUMMARY OF OBSERVATIONS

It was stated at the outset that the emphasis of this investigation has been on systematics, with the result that over eight hundred species representing two-hundred and thirty genera have benn studied. Limitations arising from the magnitude of the area surveyed and the time available have neccessitated far lesser effort in the field of ecology, so that no emphatic ecological conclusions can be offered. Nevertheless, in the course of work, certain generalities became apparent. These are stated below by way of summarizing the impressions derived from the survey.

Almost all the desmids herein reported were found by Irénée-Marie in the region of Montreal, and about eighty-five percent of the remaining algae, exclusive of the diatoms, are listed in Prescott, 1951, Algae of the Central Great Lakes Region. A similar correlation exists with the floral studies in North Carolina by Whitford, 1943 and in Kentucky by McInteer, 1930 etc. A direct comparison with these other studies is ratner difficult to make, since there have been differences in emphasis and in the use of scientific names by the various investigators.

It is felt that the precise nature of habitats is frequently independent of underlying geological strata, an observation which is in agreement with Brown, 1930. If the nature of the habitat can be independent, it seems wrong to refer to "limestone regions" or "crystalline rock regions" as though they were infallible determinants. Brown, quotes Ström, 1924-6 as a source of her "independent habitat" observation, but Ström is not neccessarily the originator of the principle. Rather, it is likely that the phenomenon simply has received little emphasis, although it has been known for some time. Related to the independence of the habitat from the geology of the area is the rather obvious dependence of the immediate habitat on the immediate edaphic factors. Lakes and ponds are intimately related to the surrounding land. It seems rather useless to speak of oligotrophy and eutrophy in the strict sense in an area where productivity is controlled by the previous year's water level, or the wash from bordering farm lands. Certainly, any index criteria of eutrophy based on the shape of the basin would not stand. Indeed, one is forced to disregard almost all of the index criteria supported by limnolgists, and to employ the empirical concept of "eutrophic" being synonymous with "productive" and "oligotrophic" with "non-productive", regardless of the reason for the degree of productivity.

For reasons mentioned above no new hypotheses are offered in relation to the subject of independence of aquatic habitats from their geologic base, or their dependence upon surrounding land. However, it is pertinent here to point out that the surrounding land and the history of the aquatic environments have been neglected in writings as causes for the nature of flora present. Desmids, for instance, are apparently developed best at a pH between 5.5 - 6.5 according to Irénée-Marie, 1939, and are classically supposed to be calciphobic. They are found in relative abundance for the region as a whole, however, not only in the crystalline rock zone of the Appalachians, but also in such places as near Lawrenceburg, where the bed rock contains considerable limestone, near Clarksville on old praire soil and in Obion County on loess. In the last two cases, the habitats were ponds on transported soil, not bedrock, and luxuriant plant growth covered the bottoms. In the latter case the ponds were artificially fertilized for fish production. The relation of surrounding land to fish production is discussed in Dendy, 1948, but this should be obvious enough to anyone who recalls the special flora of a barnyard pond. The primary land element affecting aquatic environments is land form which determines the grade of streams, the presence of running, still, or swampy water, and the availability of water for farm use. Secondarily, land use, which is partly dictated by land form, affects algal flora. For example, a pond formed from a mill dam will have a different flora in and around it from one which is formed from the same water on the same land, but which is stagnant, stable, and used as a watering place for stock, or from one which is merely located within a cultivated field.

It is suggested that land form and usage may partly account for the results obtained by McInteer, 1942 in relating algal distribution to soil regions of Kentucky. Unfortunately, there has been until now no subsequent study in Kentucky or Tennessee.

Likewise, a complete lack of comparable data on the algal flora of Tennessee soils prevents any comment on the two small studies of algae in Florida soils, Smith & Ellis, 1943, and Smith, 1944.

TAXONOMY

Plan of the Systematic Section

The system of classification employed below is substantially that developed by Pascher and his co-workers and followed by Smith, 1950 and Prescott, 1951. The classification of non-filamentous blue-green algae follows the results of Drouet and Daily's researches of the last decade. Placements of other genera follow Fritsch, 1935-45, or are assigned according to the writer's own opinion.

It will be seen that the broad groups of algae are given Divisional or Phylum status, and that Chrysophyta includes the Chrysophyceae, Bacillariophyceae, and Heterokonte, and Pyrrophyta includes the Dinophyceae and the Cryptophyceae. Within the families no attempt is made to follow a phylogenetic sequence, since the manual is meant to be used to locate categories conveniently, not to diagram phylogeny.

For most groups of algae the following information is included under each species:

The name and author. (References listed in bibliography, an "f" indicating that a figure is included in the reference.)

A short description of the species, which includes only such information as is neccessary for identification.

Comments on the species, either taxonomic, ecologic, or both.

Occurrence of the species in the Tennessee Region by county, where possible, listed from east to west. These reports are either previously published ones by other authors (see Nature of the Study) or by the writer, or else they are records being published for the first time. The collector, if other than the writer, is often indicated, as well as the collection number, if available, and the date of collection.

Initials indicating location of the species in other Southeastern States: V-Virginia, N-North Carolina, S-South Carolina, G-Georgia, F-Florida, K-Kentucky, A-Alabama, M-Mississippi, L-Louisiana.

The diatoms, however, are merely listed, and no species keys or descriptions are included since they are a highly specialized group requiring terminologies and lengthy description as well as carefully executed illustrations which could not be included in the present writing.

A key to genera precedes the systematic section proper, and there are species keys under each genus. Also there are pertinent, critical comments at any level of classification where they seem to be applicable. Illustrations are grouped on plates, and the reference to them is indicated under the species descriptions in the text.

Key to Genera

1. Plants macroscopic; large enough that the form or structure can be seen with the unaided eye.. 2
1. Plants microscopic, with structure not visible to unaided eye (may be seen as layers, cushions or spheres, sometimes floating, however)............. 13
   2. Upright "stems" bearing spine-like appendages in whorls.................... CHARACEAE 3
   2. Not upright "stems" bearing appendages in whorls.. 5
3. "Stem" and "leaves" corticate in most species (see discussion of cortication under genus heading), spirally twisted investing cells of oval oogonium (female organ) terminating in 5 crown cells, antheridia (globular male organ) below oogonia in the axils of the "stem" branches or "leaves"................... <u>Chara</u>
3. "Stem" and "leaves never corticated, spirally twisted investing cells of oogonium terminating in 10 cap or crown cells............. 4
   4. Antheridia on short pedicel among branches or at a forking of a branch, oospore (fertilized egg) compressed at maturity...... <u>Nitella</u>

4. Antheridia lateral to a branch at the node, beside the oogonium, oospore rounded at maturity.................. <u>Tolypella</u>

5. Plant body cartilaginous, branched or unbranched...................................... 6

5. Plant body not cartilaginous, may be gelatinous...................................... 9

6. Unbranched or branched only near base, arising as slender cylindrical bristles with rings of knobs at intervals.......... 7

6. Freely branched throughout...................... 8

7. Nodes formed by a continuous raised area encircling the bristle.................. <u>Lemanea</u>

7. Nodes formed by a circular series of protuberances, not a complete raised area... <u>Sacheria</u>

8. Cartilaginous condition complete, plant corticated except very near tips................................. <u>Tuomeya</u>

8. Cartilaginous only near base in response to extreme environmental conditions, ends gelatinous, beaded in appearance; plant consisting of an axis with bundles of branches at node-like intervals................ <u>Batrachospermum</u>

9. Terrestrial; colonies either spherical or irregularly shaped............................ 10

9. Aquatic plants.. 11

10. Shape globular or sac-like, thalli 1-3 mm in diameter, anchored to substrate by subterranean rhizoidal portion.............................. *Botrydium*

10. Larger spheres or irregularly lobed masses of a firm gelatinous texture, inclosing many filaments of bead-like cells............................ *Nostoc*

11. Gelatinous (if dried down, will stick to paper).. 12

11. Non-gelatinous, coarse, branched single filaments............................ *Compsopogon*, *Cladophora*, *Vaucheria*, or *Pithophora* (see key to smaller forms No. 13)

12. Color grass- or yellow-green, collapsing into amorphous mass when lifted from water (see key to smaller forms No. 13)...................... *Draparnaldia*

12. Color olive-green, blue-green, brown, purple, or rose colored etc., but not grass- or yellow-green; retaining some semblance of structure even when lifted from water........ *Batrachospermum*

13. Non-flagellated cells (frustules) with siliceous walls which are two-parted and

and decorated with etched lines or rows of dots, the sections (valves) fitting together in pill-box or capsule fashion; cells drum-shaped, cigar-shaped, wedge-shaped or rectangular.............................. 270

13. Flagellated or non-flagellated cells, without such siliceous walls......................... 14

14. Cells without chromoplasts, entire protoplast pigmented, generally blue-green in color, cell protoplasm inclosed by membrane and gelatinous sheaths rather than by a more or less rigid cell wall, the protoplast hardly collapsing, and readily resuming a normal appearance after ordinary drying; neither vegetative nor reproductive cells motile...... CYANOPHYTA 15

14. Cells possessing organized chromoplasts, color other than blue-green, motile or immotile, usually possessing a firm cellulose wall................................ 72

15. Plants unicellular or in families or colonies.. 16

15. Plants filamentous, solitary or aggregated, sometimes short cylindrical epiphytes, or epiphytic cushions with only a suggestion

of linear arrangement of cells toward the outer or upper portions of the thallus.............. 33

16. A small clump of cells with indistinct filamentous arrangement containing heterocysts (colorless cells usually with thick walls)................. 17

16. Plant different in form, heterocysts lacking.................................. 18

17. Cells over 10u in diameter. Stigonema (hormogones)

17. Cells under 10u in diameter... Nostoc (hormogones)

18. Intermingled with other plants or free, but not forming distinct epiphytic structures and without any suggestion of basal-distal polarity.. 19

18. Epiphytic and with some degree of basal-distal polarity........................... 30

19. Colony essentially flat, resulting from cell division in two planes at right angles... 20

19. Colony possessing depth resulting from division in three planes........................... 21

20. Cells arranged in rectilinear series.......... .... Merismopedia

20. Arrangement irregular, cells oval............... .... Microcrocis (Holopedium)

21. Cells spherical, compressed spherical, or very short oval, except when dividing........... 22

21. Cells cylindrical, definitely oval, or elliptic.................................... 28

22. Gelatinous sheath around individual cells or groups stratified......... <u>Gloeocapsa</u>

22. Stratified sheaths not present................. 23

23. Blue-green protoplasts enclosed in definite cell walls of Oocystis-like host (?) (see <u>Oocystis</u>).............. <u>Glaucocystis</u>

23. Not within Oocystis-like cells................. 24

24. Colonies spherical except before colony fragmentation........................... 25

24. Colonies irregularly shaped..................... 27

25. Cells distributed throughout the matrix, and containing pseudovacuoles (small refractive bodies).......................... .... <u>Diplocystis</u> (<u>Microcystis</u>)

25. Cells located only at periphery.................. 26

26. Cells at the ends of branched radiating stalks, cells lacking pseudovacuoles........................<u>Gomphosphaeria</u>

26. Cells not at the ends of radiating strands, cells normally with pseudovacuoles....................... <u>Coelosphaerium</u>

27. Planktonic or in shallow water, pseudo-

vacuoles always present, cells never retaining a paired arrangement after division.................... _Diplocystis_ (_Microcystis_)

27. Generally intermingled with other algae, pseudovacuoles absent, cells often retaining a paired arrangement after division..................... _Anacystis_ (_Aphanocapsa_)

    28. Protoplasm enclosed in definitely walled Oocystis-like cells....... _Glaucocystis_

    28. Not enclosed in Oocystis-like cells............ 29

29. Gelatinous sheath present, cells grouped in few or many........................ _Coccochloris_

29. No persistent gelatinous sheath, cells almost always single.................. _Synechococcus_

    30. Cushions of closely compressed cells........................... _Entophysalis_

    30. Erect epiphytes, may be crowded but still separate.......................... 31

31. Cylindrical structure often filament-like possessing 5-10 transverse septations........................... _Stichosiphon_

31. Plants shorter, cross partitioning to form only a few spores at the end of the filament.................................... 32

    32. Temporary gelatinous point present at tip........................... _Clastidium_

32. End rounded....... young stage of <u>Entophysalis</u>

33. Heterocysts present, or filaments tapered, or both.. 50

33. No heterocysts present, filaments not tapered.. 34

34. Filamentous structure vague or filaments attached at one end........................ 35

34. Filamentous structure definite, attached, if at all, only by incidental twining of median section of filament.. 39

35. Filaments long, attached at one end, many cells extremely long.............. <u>Loefgrenia</u>

35. Filaments very short, attached at one end, separated into short lengths; sometimes forming cushions of ill-defined structure containing more or less round cells.. 36

36. Cushions of closely compressed cells formed........................ <u>Entophysalis</u>

36. Erect epiphytes, may be crowded but still separate................................ 37

37. Cylindrical structure often filament-like, possessing 5-10 transverse septations.. <u>Stichosiphon</u>

37. Plants shorter, septating only to form a

few spores at the end.................................. 38

38. Temporary gelatinous tip present at apex............
.... Clastidium

38. Apex rounded.......... young stage of Entophysalis

39. Trichome (thread of cells) unbranched, single within sheath, though sheaths may be confluent........................... 40

39. Trichomes "falsely" branched (cell continuity extending laterally with break in continuity of main axis) or trichomes multiple within common sheath.. 48

40. Gelatinous sheath visible around trichomes......... 43

40. Gelatinous sheath generally not visible, colonial mass fragile, no adhesion between adjacent filaments.......................... 41

41. Filaments regularly spiraled...................... 42

41. Filaments not regularly spiraled. Oscillatoria

42. Septations visible only upon staining, if at all................................. Spirulina

42. Septations readily apparent........... Arthrospira

43. Chiefly terrestrial, arising in marked tufts made up of fused bundles of filaments with firm sheaths.. Symploca

43. Aquatic or terrestrial, if terrestrial not tufted.............................. 44

44. Sheaths thin, confluent to form fabric-like, usually tough mass....... Phormidium

44. Sheaths thick, hardly confluent................ 45

45. Filament about 35-40u broad with very short cells (length 1/3 of width), sometimes branching......................... Plectonema

45. Filaments various sizes, cells proportionally long or short, never branching............ 46

46. Sheaths cylindrical with relatively even surface................................ 47

46. Sheaths rough, irregular, sometimes coming to point at end of filament............. .... see Schizothrix

47. Sheaths thick, lamellose, colored; plants terrestrial.................. Porphyrosiphon

47. Sheaths usually not lamellose, plants aquatic................................ Lyngbya

48. Trichomes single within sheath, exhibiting false branching........... Plectonema

48. Trichomes generally multiple within sheath, false branching not apparent because of crowding of trichomes............... 49

49. One to several (3-5) trichomes within a common sheath, fascicle frequently branched in older specimens...................... Schizothrix

49. Many (more than 5) trichomes within a

common sheath, fascicle infrequently branched.............................. Microcoleus

50. Filaments clearly tapered from base toward apex.................................. 68

50. Filaments very slightly tapered................ 51

51. False or true branching frequent.................... 58

51. Branching none or exceedingly rare................. 52

52. Filaments relatively short, curved or sigmoid with heterocyst at end, youngest end often somewhat pointed............ .... Raphidiopsis

52. Filaments of indefinite length, end not pointed.................................... 53

53. Cells definitely discoid, much broader than long.................................. Nodularia

53. Cells not discoid................................. 54

54. Cells cylindrical, filaments with basal, cylindrical heterocyst, most of remainder of filament free from substrate.......................... Fremyella

54. Cells without cylindrical basal heterocyst, entire filament more or less prostrate on substrate if attached, or else completely free floating................. 55

55. Colony composed of more or less strongly bent or contorted trichomes surrounded by

a definite and firm gelatinous sheath...... Nostoc

55. Colony composed of straight or curved trichomes not surrounded by a firm and definite gelatinous sheath.......................... 56

56. Terrestrial, spores next to terminal heterocysts only............... Cylindrospermum

56. Usually aquatic, spores both adjacent to and remote from heterocysts, which are never exclusively terminal................. 57

57. Colony a floating raft-like bundle of straight, parallel filaments......... Aphanizomenon

57. Colony not a raft-like bundle, trichomes not straight or parallel................. Anabaena

58. Colonies with cushion-like base of more or less spherical compressed cells and upright filaments which may taper only very slightly............Amphithrix

58. Cushion-like bases if present, composed of definite filaments, both prostrate and upright.......................... 59

59. Branching of false type, or branches readily breaking off so that branching structure is not apparent........................... 60

59. Branching of true type (continuity of main axis maintained and branch arising

by cell division parallel to long axis............. 66

60. Colonies characteristically terrestrial cushions with much-branched prostrate filaments giving rise to many upright branches............... Hassallia

60. Dimorphic nature of colony not evident.. 61

61. Branches often in pairs, originating between heterocysts of the main trichomes. Scytonema

61. Branches generally single, originating just below heterocyst, branches sometimes forming short strands which become parallel with main filament......................... 62

62. Branching only in young filaments, older ones forming continuous series of thick walled spores............... Aulosira

62. No series of thick walled spores formed, spores rare or absent.................. 63

63. Trichomes growing side by side, parallel or entwined, resulting from broken branches within gelatinous sheath............... Desmonema

63. Parallel arrangement not apparent.................. 64

64. Filaments merely short curls or curved strands in broad gelatinous sheaths Diplocolon (likely a growth form of Scytonema)

64. Filaments long, straight or curved,

without broad laterally extended gelatinous sheaths.................................. 66

65. Branches frequent and permanent....... <u>Tolypothrix</u>

65. Branches quickly separating from parent filament, therefore plant usually observed as unbranched filament with basal heterocyst.................................... <u>Fremyella</u>

66. Terrestrial colony characteristically composed of prostrate filaments crowded with numerous upright branches.......... .... <u>Fischerella</u>

66. Such dimorphic colonies not apparent........... 67

67. Aquatic plants with uniseriate filaments........... .... <u>Hapalosiphon</u>

67. Aquatic or terrestrial plants with at least partly multiseriate filaments..... <u>Stigonema</u>

68. Cushion-like base of more or less spherical cells without filamentous organization......................... <u>Amphithrix</u>

68. No such base present under filaments........... 69

69. Trichomes single or seriately arranged within sheath, no apparent branching or definite colony form..................... <u>Calothrix</u>

69. Filaments arborescent in branching habit, or forming hemispherical or spherical colonies.. 70

70. Arborescent branching colony resulting from development of hormogonia (regenerating branches) within parent sheath, and protruding through the open end <u>Dichothrix</u>

70. Hemispherical or spherical colonies resulting from radial development of hormogonia.................................. 71

71. Spores next to basal heterocyst...... <u>Gloeotrichia</u>

71. No spores next to basal heterocyst...... <u>Rivularia</u>

72. Motile single cells or colonies composed of motile cells............................ 73

72. Non-motile solitary or colonial plants composed of non-motile cells..................... 137

73. Colonial... 74

73. Unicellular... 83

74. Colony a flattened or twisted plate............ 75

74. Colony not a flat nor twisted plate............ 76

75. Colony a flat tumbling rectangular plate without posterior and anterior differentiation..................................... <u>Gonium</u>

75. Colony a flattened, twisted horseshoe-shaped plate, colonial sheath rounded at the anterior end, lobed posteriorly <u>Platydorina</u>

76. Oval or pyriform cells compactly grouped with small ends apposed................. 77

76. Cells not radially arranged, gener-

ally at periphery of the gelatinous sheath, but sometimes compressed toward center.............................. 78

77. Colonies of few cells surrounded by definite gelatinous matrix containing imbedded granules (rare).................. Syncrypta

77. Colony often of many cells, without surrounding matrix being visible (common)..... Synura

78. Center of colony containing dichotomously branching gelatinous threads running to cells with unequal flagella................................. Uroglena

78. No dichotomously branching system present.. 79

79. A great number of cells (128 or more) present in each spherical or oval colony........... 80

79. Number of cells per colony 64 or less............... 81

80. Cells yellowish or brownish, flagella unequal in length, and cells not laterally connected with processes.. Uroglenopsis

80. Cells generally green, but see Volvox aureus with yellowish or golden color in which flagella are equal and with cells usually laterally connected. Volvox

81. Colony composed of two different sizes of cells (small vegetative and larger repro-

ductive cells)........................ __Pleodorina__

81. Colony composed of cells all the same size.. 82

82. Cells usually well separated, arranged in tiers............................ __Eudorina__

82. Cells usually appressed at center of colony, arrangement in tiers generally not evident...................... __Pandorina__

83. Rigid cells with definite transverse furrow circling half or all of cell, or with such a motile stage, one flagellum in transverse groove, other extending posteriorly from cell............................ 84

83. No such transverse furrow as above................ 91

84. Immotile (but may contain zoospores with the transverse groove differing greatly in form from immotile cell............. 85

84. Normally motile, containing no considerably different immotile stage............. 86

85. Immotile stage polygonal with thick, perhaps branched extensions at corners.. __Dinastridium__

85. Immotile stage unsymmetrically ovoid or elliptic with poles thickened or extended into horns........................... __Cystodinium__

86. Transverse groove extending halfway around cell......................... __Hemidinium__

86. Groove circling cell.............................. 87

87. No detectable structure of plates on surface........................... _Gymnodinium_

87. Surface of separate plates........................ 88

88. Cell markedly asymmetrical with 1 long anterior and 2 or 3 posterior horns............................ _Ceratium_

88. Asymmetry slight, no long protrusions at poles................................ 89

89. Plates indistinct with narrow, often indiscernible, sutures between.......... _Glenodinium_

89. Plates strongly marked, with wide sutures between.................................. 90

90. Single antapical (terminal, posterior) plate present...................... _Gonyaulax_

90. Twin antapical plates present...... _Peridinium_

91. Amoeboid with rhizopodal extensions................ 92

91. Not amoeboid.. 93

92. Spicule-like pseudopodia of twice body length present.............. _Rhizochrysis_

92. Pseudopodia slender but not spicule-like, of about body length, flagellated stages reported............. _Chrysamoeba_

93. Test (lorica, shell) present, that is, one which can remain after death or escape of the protoplast (test is often re-

sembled by firm gelatinous sheaths, but
these lack an enlarged flagellar opening)......... 94

93. No test present.............................. 95

94. Over 15u in diameter generally, if under 15u then chromoplasts green, not yellow-brown.............. _Trachelomonas_

94. Always less than 15u in diameter, chromoplasts yellow-brown...... _Chrysococcus_

95. Cells with chloroplasts and stigma, moving with worm-like motion but without flagellum.............................. _Euglena_

95. Cells not as above.............................. 96

96. Surface with faint plates (scales) bearing conspicuously long slender spicules........................ _Mallomonas_

96. Surface without surface plates or very long slender spicules................. 97

97. Four flagella present......................... 98

97. Less than four flagella present.................. 102

98. Body somewhat plastic, with or without posterior lobes, sometimes extruding pseudopodia............ _Collodictyon_

98. Body firm, without posterior lobes, or pseudopodia.......................... 99

99. Coarse granules covering oval gelatinous sheath around a smaller protoplast.... _Pedinopera_

99. Without granular sheath............................ 100

100. Anterior end with four rounded lobes........................ <u>Pyramimonas</u>

100. Anterior end without four lobes.............. 101

101. Cells somewhat compressed laterally.. <u>Platymonas</u>

101. Cells not compressed.................. <u>Carteria</u>

102. Cells with three flagella and Euglena-like eyespot, paramylum bodies, and metaboly (change in shape)....................... <u>Euglenomorpha</u>

102. One or two flagella only present............. 103

103. One flagellum present or second of unequal length.. 104

103. Two equal flagella present........................ 124

104. Cells colorless, scarcely metabolic, flattened quadrangular in cross section, with very short second flagellum; (rare).............. <u>Sphenomonas</u>

104. Without this combination of characters...................................... 105

105. Chromoplasts golden-yellow, yellow-brown or else rosy colored......................... 106

105. Chromoplasts some other color, or absent.. 109

106. One flagellum of almost twice body length......................... <u>Chromulina</u>

106. Two flagella, longer flagellum of no more than about body length.............. 107

107. Chromoplast definitely a rosy color... <u>Rhodomonas</u>

107. Chromoplast golden-brown................................ 108

108. Well developed broad longitudinal groove present.................... <u>Cryptomonas</u>

108. Longitudinal groove linear.... <u>Cryptochrysis</u>

109. Cells with chloroplasts (grass green chromoplasts), with eyespot (see <u>Trachelomonas</u> with masking brown color in test or shell)....................................... 110

109. Cells without chloroplasts, essentially colorless.. 115

110. Cells with some tendency to bend or change shape when moving................ 111

110. Cells rigid.................................. 112

111. Cells with two lateral chloroplasts, green to almost colorless, very slightly metabolic; (rare).................... <u>Monomastix</u>

111. Cells with other chloroplast arrangement; (common)................................ <u>Euglena</u>

112. Protoplast enclosed by variously shaped tests.................. <u>Trachelomonas</u>

112. No test present................................ 113

113. Cells fusiform, or rounded in cross section........................... <u>Lepocinclis</u>

113. Cells not symmetrically rounded in cross section.. 114

114. Cells strongly flattened, with dorsal ridge, or cell cup-shaped, surface with spiral or straight lines; containing numerous discoid chloroplasts; (common)................ <u>Phacus</u>

114. Cells only somewhat compressed, without ridges, folds, or surface ornamentation, with two laminate chloroplasts; (rare)............ <u>Cryptoglena</u>

115. One flagellum only.. 118

115. Two flagella, unequal in structure or behavior.. 116

116. One flagellum (the protruding one) very strong, the other (trailing) slender........... <u>Heteronema</u> - and <u>Peranema</u> (if the report of a second slender trailing flagellum here is correct)

116. Flagella not differing greatly in size but differing in behavior, one being more active and protruding............. 117

117. Conspicuous narrow gullet present on one side of cell......................... <u>Entosiphon</u>

117. No such gullet observable.............. <u>Anisonema</u>

118. Cells somewhat metabolic in movement......... 119

118. Cells rigid.............................. 122

119. Spindle or oval, somewhat metabolic, cells with excentric insertion of flagellum............................ Euglenopsis

119. Somewhat more metabolic, insertion of flagellum not excentric......................... 120

120. Base of flagellum bent, swollen slightly, pharyngeal rods may be detected................................ 121

120. Without granular swelling at base of flagellum or pharyngeal rods; (rare)............................... Astasia

121. Only two straight pharyngeal rods present; (very common).................... Peranema

121. Third, curved, pharyngeal rod, and ringed paramylum bodies present; (rare)................................ Jenningsia

122. Cell shape unsymmetrically ovoid Petalomonas

122. Cell shaped otherwise....................... 123

123. Cells usually curved or ridged with no swelling at base of flagellum.......... Menoidium

123. Cells straight, never ridged, flagellum turned and swollen at base............ Scytomonas

124. Surrounding gelatinous sheath, if present, of about the same shape as protoplast, except for apical

papillae and surface irregularities.......... 125

124. Surrounding gelatinous sheath differing from protoplast in shape.............. 131

125. Protoplast suspended within cell cavity by protoplasmic strands from wall, containing haematochrome.............. <u>Haematococcus</u>

125. Protoplast not suspended as above, without haematochrome.......................... 126

126. Cells fusiform, at least three times longer than broad.............. <u>Chlorogonium</u>

126. Cells not fusiform.......................... 127

127. Cells with two posterior lobes.......... <u>Furcilia</u>

127. Cells not lobed.................................. 128

128. Gelatinous covering with blunt, ridge-like irregular processes.... <u>Lobomonas</u>

128. Envelope, if any, smooth or merely irregular, but without protruding processes or ridges.......................... 129

129. Cells flattened anterior-posteriorly, end-view roughly hexagonal.......... <u>Heteromastix</u>

129. Cell not flattened so, nor angular................ 130

130. Single chloroplast occupying one side of cell leaving other side, which is often flat, hyaline, flagellum single; (rare)........ <u>Pedinomonas</u>

130. Chloroplast cup-shaped, its opening

anterior, two flagella of equal
length present; (common)...... <u>Chlamydomonas</u>

131. Two anterior lobes visible in broad side view, two chloroplasts present leaving colorless longitudinal area, very much flattened dorsi-ventrally, fusiform in shape in narrower side view.......... <u>Scherffelia</u>

131. Not anteriorly lobed, nor flattened to such a degree, without a hyaline axial area.. 132

132. Surface irregularly granular... <u>Thoracomonas</u>

132. Surface not granular.......................... 133

133. Gelatinous covering with marked wings, lobes, or appendages............................ 134

133. Without lobes or appendages....................... 135

134. Two or four wing-like or keel-like longitudinal appendages present.. <u>Pteromonas</u>

134. Lobes both wing-like and finger-like......................... <u>Wislouchiella</u>

135. Sheath distinctly wider than protoplast, at least in rear............................. 136

135. Oval or elliptic sheath only slightly larger than protoplast, very thin and close posteriorly, protoplast pyriform............ .... <u>Sphaerellopsis</u>

136. Division of two halves of gelatinous

covering often visible as circum-
ferential ridge or groove.......... <u>Phacotus</u>

136. Division in halves not apparent,
separate openings present for each
flagellum.................. <u>Dysmorphococcus</u>

137. Cells with bilateral symmetry, nearly
divided medianly to form two semicells
which are mirror images of one another,
or with cell contents equally divided............. 138

137. Cells neither constricted at mid-section,
nor dividing into mirror image semicells,
radially and bi-laterally symmetrical
forms included here................................ 152

138. Little or no equatorial sinus or
constriction present.......................... 139

138. Definite sinus or constriction................. 140

139. Straight, untapered cylindrical cells,
ends conical or rounded, length about
six times width........................... <u>Penium</u>

139. Cells tapered, poles narrowed or more or
less pointed, crescent-shaped or only
slightly curved......................... <u>Closterium</u>

140. Plants definitely filamentous in
structure..................................... 141

140. Cells solitary except for occasional
and temporary end-to-end adjoinment......... 143

141. Cells with deep, narrow, or wedge-shaped median constriction, apices of cells with two rod-like appendages which overlap adjacent cells.......................... Onychonema

141. Not deeply constricted, lacking rod-like appendages.. 142

142. Usually notched with narrow indentation at equator of cells, end view triangular or elliptic............ Desmidium

142. Lateral margin merely retuse or slightly concave, end view circular........................... Hyalotheca

143. Cells elongate and cylindrical or nearly so.. 144

143. Cells not long cylinders.......................... 145

144. Cells covered with short sharp spines, cells not constricted at center........................ Gonatozygon

144. Cells spineless, having at most short protuberances or undulations, cell constricted in midregion.. Pleurotanium

145. Cells with deep lobes, arms, spines, polar notches; in end view flattened or with lobes or protuberances......................... 146

145. Cells without deep lobes, arms, polar notches or any but minute spines; end

view oval, elliptic, or round but never essentially triangular or equilateral polygonal.............................. Cosmarium

146. Lobes very deep, cells essentially flat (except one case in which the lobes are twisted on the longitudinal axis).................... Micrasterias

146. Lobes shallower and/or cells not flat.. 147

147. Poles notched, retuse or concave........ Euastrum

147. Poles not notched or retuse........................... 148

148. Cells with long or short arms protruding from angles, cells triangular, or 4-8 rayed when seen in polar view....................... Staurastrum

148. Cells with no actual arms, although there may be strong spines.................... 149

149. Spines paired......................... Xanthidium

149. Spines not paired................................ 150

150. End view equilateral-polygonal, 3-4-8 angled or armed............ Staurastrum

150. End view compressed oval or angular.......... 151

151. Very short, heavy spines with three points, end view angular............. Xanthidium

151. Spines long, simple, end view oval or elliptic............................ Arthrodesmus

152. Dendritic colonies of essentially individual tests or unicells.................. 153

152. Colonies otherwise or cells solitary......... 154

153. Funnel-shaped tests inserted within one another to form branching colonies..... <u>Dinobryon</u>

153. Long, straight or bent, stipitate cylindrical cells, epiphytic on one another to form colony......................... <u>Ophiocytium</u>

154. Plants erect, sessile or stipitate, unicellular epiphytes, cell shape spherical or elongated......................... 155

154. Plants not erect unicellular epiphytes.................................... 158

155. Sessile globose epiphytes with very long protruding single setae, collared around base............................ <u>Chaetosphaeridium</u>

155. Not sessile, or not globose, or without long setae..................................... 156

156. A sessile test, variously shaped, but generally vase-like containing a protoplast with protruding thread-like pseudopodium, without starch.. <u>Lagynion</u>

156. Epiphytes not in test; sessile or stipitate................................ 157

157. Starch test positive, containing no oil bodies................................ <u>Characium</u>

157. Starch test negative, containing oil bodies.............................. *Characiopsis*
(Germlings of various zoospore-producing species often resemble these genera)

158. Cells united into a flat expanded thallus or forming a sessile epiphytic filament with setae.................... 159

158. Cells neither united into flat expanded thallus nor as a sessile epiphytic filament with setae.................... 161

159. Epiphytic filaments with one or more long setae per cell................. *Aphanochaete*

159. Flat expanded thallus of more or less laterally united filaments........................ 160

160. Some cells with long setae, branches laterally fused so that filamentous structure may be obscure........ *Coleochaete*

160. No setae present, cell arrangement often not easily discerned because of calcium incrustation, branched filamentous or irregular thalloid colony organization............ *Chlorotylium*

161. Plant body usually non-septate, elongated and lobed or branched.............................. 162

161. Plant body otherwise, or cells solitary........... 163

162. Fairly short saccate bodies with

lobes, branches, or angles, occasionally showing septation or containing motile or non-motile zoospores.......................... <u>Protosiphon</u>

162. Extended branched filaments which develop oogonia and antheridia.... <u>Vaucheria</u>

163. Cells attached end to end forming filaments.. 234

163. Cells attached otherwise or solitary............. 164

164. Cells commonly seen single except when reproducing, or merely clinging together but neither attached nor within common gelatinous matrix............. 165

164. Cells attached to each other or within common gelatinous matrix............. 184

165. Cells essentially spherical, oval, or polygonal, or approximately isodiametric......... 166

165. Cells elongated.................................. 222

166. Spherical, sessile epiphytic cells with single gelatinous seta, partly sheathed at base.......... <u>Chaetosphaeridium</u>

166. Not epiphytic................................. 167

167. Cell walls without appendages or conspicuous decorations, although they may be thickened and lamellose........................... 168

167. Walls with appendages or conspicuous

decorations.............................. 176

168. Large, over 20u in diameter, with
many discoid chloroplasts.................. 169

168. Smaller, without many discoid
chloroplasts.............................. 170

169. Cells spherical-shaped, walls not un-
evenly thickened; (frequent)........ Eremosphaera

169. Cells oval or sub-spherical, walls often
unevenly thickened; (rare)....... Excentrosphaera

170. Individual cells surrounded by
ridged, spindle-shaped, broad
gelatinous sheath.............. Desmatractum

170. Individual cells not surrounded by
such a sheath............................ 171

171. Sub-spherical to sub-cylindrical cells
with small discoid chloroplast, length
less than 5u...................... Nannochloris

171. Cells spherical............................ 172

172. Cells containing abundant haemato-
chrome which obscures cell struc-
ture........................ Haematococcus

172. Without abundant haematochrome.............. 173

173. Chloroplast circular with irregular
wavey edges, usually found as a consti-
tuent of lichens...................... Trebouxia

173. Not usually found in lichens, chloro-

plast cup-shaped or massive...................... 174

174. Zoospores as well as autospores produced, found in many soil samples, rarely in aquatic environment, generic status uncertain, and identification reliable only when life cycle is followed, mature cells over 10u in diameter........... *Chlorococcum*

174. Zoospores not produced, cells generally (but not altogether) less than 10u in diameter, generally aquatic............................ 175

175. Endozoic in Protozoa or small Metazoa............ .... *Zoochlorella*

175. Cells free living....................... *Chlorella*

176. Contents brown or golden brown, shape approximately hexangular, angles bearing short, heavy, sometimes forked spines............ *Dinastridium*

176. Contents green, shape not hexagonal nor with angles bearing spines in such a manner...................... 177

177. Cells spherical with thickened wall, decorated with reticulations, ridges or other projections. Some species included in this genus are open to question since

zygospores of other algae have been included, therefore the life cycle must be followed for certainty............... Trochiscia

177. Not as above.................................. 178

178. Cells spherical or oval, with long thin spines.................................. 179

178. Cells angular, the angles often extended to form arms.............................. 182

179. Cells spherical.............................. 180

179. Cells oval.................................. 181

180. Spines sheathed around base.. Acanthosphaera

180. Spines unsheathed at base........ Golenkinia

181. Spines not confined to poles, occurring on any part of surface................. Franceia

181. Spines only at poles................. Lagerheimia

182. Quadrangular or pyramidal shapes without spines or appendages on cell exterior although angles of cell itself may be somewhat extended.. Tetraedron

182. Spines present on exterior of cell........... 183

183. Each angle with single long stout spine Treubaria

183. Two or more bristle-like spines at angles............................ Polyedriopsis

184. Cells in linear series within a cylindrical sheath................ Geminella

184. Cells not end-to-end in linear

series.. 185

185. Sessile or attached macroscopic gelatinous colonies, cells arranged in four's and two's.............................. <u>Tetraspora</u>

185. Usually microscopic colonies, cells never arranged regularly in four's................ 186

186. Cells attached to each other directly or by appendages, but never end-to-end to form a filament........................... 187

186. Cells merely inclosed by common gelatinous matrix, not attached to one another................................ 196

187. Cylindrical cells attached by ends, three ends together to form continuous meshwork in shape of a hollow cylindrical net...............................<u>Hydrodictyon</u>

187. No such net formed............................. 188

188. Colony spherical or polygonal, with cells radiating from or distributed around a common center...................... 189

188. Cell arrangement other than spherical........ 191

189. Cells themselves essentially spherical (but with appendages), arranged around a hollow center......................... <u>Coelastrum</u>

189. Cells elongated, attached at a common center.. 190

190. Cells heart-shaped or pear-shaped and narrower toward center of colony, with two or more spines on the outer free wall............... <u>Sorastrum</u>

190. Cells narrow fusiform or cigar-shaped, without spines.................. <u>Actinastrum</u>

191. Cells oval, elliptic, or elongated fusiform arranged side by side on straight or curved axis....................... <u>Scenedesmus</u>

191. Cells not elongated, not arranged side by side.. 192

192. Irregular clumps, groups, even filaments of sub-spherical, angular or compressed cells................. <u>Protococcus</u>

192. Arrangement at least regular, flat........... 193

193. Several cells in radial arrangement, outer cells with lobed or at least undulate margin......................... <u>Pediastrum</u>

193. Only four cells, quadrately arranged.............. 194

194. Cells with deep median notch or indentation in outer margin........ <u>Pediastrum</u>

194. Cells without notch or indentation........... 195

195. Spines on outer faces of cells........ <u>Tetrastrum</u>

195. No spines present....................... <u>Crucigenia</u>

196. Cells with surface spines..................... 197

196. Cells with smooth surface..................... 200

197. Spines many times longer than cell diameter, one or few per cell.......................... 198

197. Spines much shorter, several to many............... 199

198. Cells in compound clumps, one to seven spines present per cell.. <u>Micractinium</u>

198. Cells in compound pyramids, single spine per cell.................... <u>Errerella</u>

199. Cells within gelatinous matrix, mother-cell wall persistent to some extent..... <u>Bohlinia</u>

199. Cells not within gelatinous matrix, mother-cell wall very persistent <u>Oocystis</u> (p. p.)

200. Cells elongated, reniform, cylindrical, oval, elliptic, fusiform, lunate, or sausage-shaped...................... 212

200. Cells spherical, broadly oval, or broadly ovoid.............................. 201

201. Cells red with haematochrome, or brown............ 202

201. Cells green or otherwise colored..................... 204

202. Brown- or brick-red, with stratified gelatinous sheath............ <u>Urococcus</u>

202. Red in green, or entirely red or red violet.................................. 203

203. Red in green, sheath often stratified............. <u>Euglena</u> (palmelloid stage)

203. Red or red-violet, in clumps or thin layer, cells surrounded by gelatinized

mother cell walls.................... Porphyridium

204. Cells oval very densely packed, often compressed to wedge-shaped, surrounded by characteristic brown or orange jelly.................. Botryococcus

204. Without densely packed cells or colored jelly.............................. 205

205. Several discoid yellow-green chloroplasts, with red oil spots, containing no starch.. Chlorobotrys

205. Chloroplast not disc-shaped, either single, cup-shaped or axial and radiating, or few and polygonal................................. 206

206. Cells within gelatinous matrix attached to branched, radiating strands of mother-cell wall material................................... Dictyosphaerium

206. Colony without radiating strands............... 207

207. Single central chloroplast with arms radiating out to parietal discs at the wall.................................... Asterococcus

207. Chloroplast or chloroplasts not as above.. 208

208. Cells with stratified sheaths.................. 209

208. Cells within homogeneous matrix, or held together only by ruptured

mother-cell walls.............................. 210

209. Cells sub-spherical or oval, dividing in two or four, not by autospores, flagellum traces in cell sheath may be visible, as may be also a prominent apical vacuole and an eyespot <u>Chlamydomonas</u> possibly, (identification is almost impossible for such material without culture studies)

209. Clearly distinguished only by absence of absence of flagellum trace in sheath. <u>Gloeocystis</u>

210. Cells always with single cup-shaped or massive chloroplast......................... 211

210. Older cells with polygonal chloroplasts, surrounded by broad gelatinous matrix............... <u>Planktosphaeria</u>

211. Cells within gelatinous sheath..... <u>Sphaerocystis</u>

211. Cells held together only by old non-gelatinized mother-cell wall............. <u>Westella</u>

212. Cells indefinitely retained within discernible mother-cell wall, which may be gelatinized.............................. 213

212. Cells merely grouped within gelatinized matrix.............................. 215

213. Mother-cell wall partially gelatinized and expanded, cells bent, usually asymmetrical or reniform................. <u>Nephrocytium</u>

213. Mother-cell wall not gelatinized.................. 214

214. Cell contents blue-green (because of inclosed protoplasts)....... Glaucocystis

214. Cells with green chloroplasts...... Oocystis

215. Cells lunate or crescent-shaped, or curved cylinders................................ 216

215. Cells straight, almost straight, or reniform..................................... 218

216. Cells sausage-shaped with characteristic orientation, two in the same plane, touching ends, two in a perpendicular plane and touching one end at junction of two apposed face-to-face cells; (even if this arrangement is not strictly kept, it is usually possible to identify the genus by the cell shape and tendency for cells to make contact at poles).......... .... Tetrallantos

216. No definite orientation unless parallel.................................. 217

217. Cells surrounded by gelatinous matrix, strongly curved, with concave margin more sharply curved and forming a narrow sinus.............................. Kirchneriella

217. Cells without surrounding matrix, curved

so that interior margin is curved about equal to the convex outer margin..... <u>Selenastrum</u>

218. Cells fusiform or elliptic with pointed poles.............................. 219

218. Cells oval or reniform......................... 220

219. Cells dividing transversely to longitudinal axis, long axes more or less parallel................................ <u>Elaktothrix</u>

219. Cells dividing parallel to long axis, so that they lie together in parallel placed bundles................................ <u>Quadrigula</u>

220. Cells dimorphic, reniform and oval, attached at the ends of radiating gelatinous strands........... <u>Dimorphococcus</u>

220. Cells all similar, oval to elliptic, embedded in gelatinous matrix................ 221

221. Cells small, less than 10u in length... <u>Coccomyxa</u>

221. Cells large, 10u or more in length... <u>Mesotaenium</u>

222. Protoplast with golden-brown chromoplasts, shape unsymmetrical, elliptic to lunate, motile stage a dinoflagellate......................... <u>Cystodinium</u>

222. Protoplast not golden-brown, nor unsymmetrically elliptic in shape............ 223

223. Paddlewheel-shaped chloroplast around longitudinal axis........................ <u>Netrium</u>

223. Chloroplast of different shapes.................... 224

224. Poles rounded or truncate, not ending in spines............................ 225

224. Poles pointed or terminating in spines............................... 229

225. Cell contents pale carrot-colored, sausage shaped with parallel sides, often strongly curving or coiled with rounded ends.............................. Ophiocytium

225. Not carrot-colored, nor with parallel sides, shaped otherwise...................... 226

226. Ends truncate, cells slightly curved............................... 227

226. Ends rounded, cells straight................. 228

227. Surface with longitudinal striae and cross girdles, chloroplast interrupted at center.............................. Closterium

227. Surface entirely smooth, chloroplast not interrupted at center................. Roya

228. Chloroplasts, 1-2 in each end, approaching shape of star.... Cylindrocystis

228. Chloroplasts not approaching star shape......................... Penium

229. Cylindrical, sausage-shaped, often strongly curving or coiled with rounded ends, short spines on one, or both ends.......... .... Ophiocytium

229. Not as above.................................. 230

230. Cells long needle-shaped.................... 231

230. Cells broader.................................. 232

231. Row of pyrenoids present in axial chloroplast............................ <u>Closteriopsis</u>

231. No such row of pyrenoids, cells not only straight, but also curved, or twisted about each other in bundles....... <u>Ankistrodesmus</u>

232. Yellow-green oval or cylindrical cells with very stout long spine at each end.................... <u>Centritractus</u>

232. Cells green, fusiform, straight, curved, or sigmoid........................ 233

233. Ends merely extended into thin sharp points.............................. <u>Ourococcus</u>

233. Ends produced into long, thin, bristle-like spines which are straight or curved and sometimes bifurcate............. <u>Schroederia</u>

234. Unbranched filaments........................ 235

234. Filaments branched.......................... 254

235. Filament multiseriate (toward the apex)........... .... <u>Schizomeris</u> (uniseriate filaments hardly distinguishable from <u>Ulothrix</u>)

235. No brick-work of component cells............... 236

236. Chloroplasts stellate....................... 237

236. Chloroplasts other than stellate............. 239

237. Cells elongate, chloroplasts double stellate, or at least organized around two centers.. 238

237. Cells disciform, with very large single chloroplast........................... <u>Schizogonium</u>

238. Chloroplasts occupying little of cells, purple cell sap sometimes present, when aquatic often developing long right-angled branches; (rare)........................... <u>Zygogonium</u>

238. Chloroplasts occupying much of cell, cell sap never purple, no long branches produced; (common)......... <u>Zygnema</u>

239. Chloroplasts spiral or straight elongated ribbons with aligned pyrenoids.................... 240

239. Chloroplasts other than elongated ribbons......... 242

240. Chloroplasts a rectangular plate, cells quite long................... <u>Mougeotia</u>

240. Chloroplasts either more than one or single and spiral......................... 241

241. Chloroplasts 1-3, straight or slightly twisted ribbons....................... <u>Sirogonium</u>

241. Chloroplasts 1-16, definitely spirally coiled ribbons.......................... <u>Spirogyra</u>

242. Oogamous, with conspicuously swollen

oogonia and oospores in filaments *Oedogonium*

242. Without swollen oogonia........................ 243

243. Cells very long, 15-60 times width containing several transverse cytoplasmic septa containing small chloroplasts arranged to form annular bands; oogamous, many ornamented spherical oospores with spiny walls within a cell............ *Sphaeroplea*

243. Cells without such transverse septa and oospores.................................. 244

244. Cells with reticulate chloroplast, cells generally 2-8 times the breadth.................................. 245

244. Cells with other than reticulate chloroplast, cell length rarely over three times the width.................. 246

245. Epiphytic on shells of turtles, (usually snapping turtles).................... *Basicladia* (actually branched near the base)

245. Not epiphytic on turtles, common, and usually floating in quiet or running waters............................ *Rhizoclonium*

246. Filaments composed of cylindrical or quadrate cells, lateral walls nearly or quite parallel..................... 247

246. Cells irregularly shaped, walls not

parallel; filamentous organization often lost in a "Palmella" stage.. Cylindrocapsa

247. Walls composed of H-shaped sections which adjoin in the midregion (as shown at ends or broken filaments), chloroplast discoid or vague and not easily definable.................. 248

247. Walls without H-shaped sections, chloroplast a parietal plate............................ 249

248. Chloroplasts yellow-green, small discoid, four to several per cell, no starch present.................. Tribonema

248. Chloroplast structure vague, starch present......................... Microspora

the ULOTHRIX complex 249-253

249. Cross wall formation delayed after protoplasts division, and each protoplast often surrounded by stratified material, two visible in each segment of filament.. Binuclearia

249. One protoplast in each cell, no stratified gelatinous material within cell.............. 250

250. Filaments tapered unevenly to sharp point, cell length 2½ or more times width........................... Uronema

250. End cells, if pointed, equally tapered, cell length twice width or less.. 251

The distinctions in 251-253 are traditional but it is open to question as to whether they should be made in practice

251. Firm hyaline sheath surrounding filament.......... .... Geminella

251. Filament lacking such a sheath.................. 252

252. Filament tenacious, chloroplast always containing pyrenoid................... 253

252. Filament often breaking into individual cells, chloroplasts never broad enough for ends to overlap, probably without pyrenoid...... Stichococcus

253. Filaments attached by holdfasts, chloroplast a complete or nearly complete parietal bond............................... Ulothrix

253. Filaments not attached by holdfasts, chloroplast usually a flat plate or folded over along one side only........ Hormidium

254. Elongated coenocytic filaments, septate only in formation of spores or sex organs............................... 255

254. Filaments regularly septate.................. 257

255. Plants parasitic, branching filements or dissociated cylindrical cells causing dark green spots on Jack-in-the-Pulpit leaves............................ Phyllosiphon

255. Plants free living................................ 256

256. Branching dichotomous, filaments sharply constricted at junctions of branches................. Dichotomosiphon

256. Branching unilateral, filaments not constricted at junctions of branches......... .... Vaucheria

257. Oogamous, some cells forming swollen oogonia containing an ornamentated oospore; cells with long setae............... Bulbochaete

257. Without such oogonia, oospores, or setae.......... 258

258. Epiphytic on turtles, (usually snapping turtles), branched only near base, with reticulate chloroplast and Rhizoclonium-like general appearance......................... Basicladia

258. Not epiphytic on turtles...................... 259

259. Branches drastically reduced in size from that of main filament............................ 269

259. Branches same size as main filament or gradually reducing in size......................... 260

260. Branches considerably tapering to pointed ends.............................. 261

260. Branches tapering but little, ends blunt.................................... 262

261. Large branches composed of a brick-work of cells, color of plant rosy or violet........... .... Compsopogon

261. All branches uniseriate........................... 263

262. Filaments in gelatinous colony which may be either spherical, flat, or elongated, and tattered...... Chaetophora

262. Filaments non-gelatinous, not clustered to form a definite colony............. .... Stigeoclonium

263. Conspicuous enlarged, dark, akinetes (vegetative spores) within filaments.. Pithophora

263. No such akinetes present........................ 264

264. First cross wall of branch frequently somewhat above junction.............. 265

264. First cross wall of branch generally at junction............................... 266

265. Cells only 4-5u broad, branching extensive and thallus rather bushy...... Microthamnion

265. Cells over 15u broad, branches of a single order, unicellular or multicellular, extending almost at right angles from

main axis or primary branch......... <u>Rhizoclonium</u>

266. Bushy branching, filament often becoming an obscure line-encrusted thallus, cells with ulotricoid chloroplasts.................... <u>Chlorotylium</u>

266. Branching infrequent, open, or glomerate only near apices, thalli not formed, chloroplast not ulotricoid........... 267

267. Plants terrestrial, often lichenized, frequently containing considerable haematochrome, chloroplasts parietal ribbons or several discoid ones........ <u>Trentepohlia</u>

267. Plants aquatic, without haematochrome, without such chloroplasts......................... 268

268. Cells under 20u broad, with reddish or greyish cast, producing clumps of round monospores............. <u>Audouinella</u> or juvenile (Chantransial) stages of <u>Lemanea</u> or <u>Batrachospermum</u>

268. Cells usually well over 20u broad, green, with Rhizoclonium-like chloroplasts, producing zoospores...... <u>Cladophora</u>

269. Plants green, cells with ulotricoid chloroplast, main axis a single series of large cells, side branches clumped, tapered to sharp ends.......................... <u>Draparnaldia</u>

269. Plants with some reddish cast, chloroplasts not ulotricoid, main axis a single filament or fascicle of small filaments, side branches made up of clusters of branches with bead-like or pyriform cells........................ Batrachospermum

270. Cells discoid, or cylindrical and capsule-shaped, with radially symetrical pattern of surface marking...................................... 271

270. Cells not discoid, but elongated, with surface ornamentation, if visible, bilaterally symetrical................. 274

271. Cells cylindrical, joined end-to-end in extended filaments...................... Melosira

271. Cells discoid, not in filaments................... 272

272. Surface pattern of circular view concentrically divided into two differing zones.................. Cyclotella

272. Surface pattern not divided, essentially continuous from center to margin.. 273

273. Surface pattern composed of discernibly radiate punctae.................... Stephanodiscus

273. Surface pattern not composed of radiately arranged punctae.................... Coscinodiscus

274. Apices or angles of tests with rather long spines or horns.......................... 275

274. Apices or angles without spines or horns... 276

275. Cylindric as usually observed, with single long sharp spine at each end.... Rhizosolenia

275. Rectangular as usually observed, with each angle produced into sometimes curved horn................................ Attheya

276. No raphe or groove present on surface in valve view.......................... 277

276. Raphe present, at least as partial groove... 283

277. Cells wedge-shaped, transversely septate internally................................ Meridion

277. Valves both longitudinally and transversely symmetrical................................ 278

278. Valves with longitudinal septation, generally occurring side by side in filaments of some length, valve view with broad center portion tapering toward knobbed ends....... Tabellaria

278. Valves lacking longitudinal septation... 279

279. Transverse internal septations present Odontidium

279. No internal septation present..................... 280

280. Cells arcuate in valve view, with bulge at center of inside curve.. __Ceratoneis__

280. Cells axis straight in valve view............ 281

281. Ends of valves broader than midsection, one end larger than the other....... __Asterionella__

281. Ends of valves not broader than midsection, both poles equal in width................ 282

282. Cells in bands, or in flat radiating colonies......................... __Fragilaria__

282. Cells generally solitary, but may be adjoined at one pole in irregularly radiating colonies............ __Synedra__

283. Valve view arcuate with transverse striae uninterrupted by a pseudoraphe (clear center line), a distinctive nodule present at each pole, and a raphe may be seen near the ends of the cell........... __Eunotia__

283. Raphe extending the length of one or both valves.................................. 284

284. True raphe in only one valve, the other with a clear center line or pseudoraphe............................ 285

284. True raphe present in both valves............ 286

285. Valve view generally somewhat elongated, girdle view showing longitudinal bending.......... .... __Achnanthes__

285. Valve view broadly elliptic, not bent longitudinally in valve view, clear area often present around margin of valve with raphe, usually found epiphytic on filamentous algae.......................... Cocconeis

286. Raphe in center line of valve view or displaced toward one side, but never at margin.............................. 287

286. Raphe displaced toward margin so that no part or only a small part of it is visible in valve view................. 297

287. Cells arcuate in valve view.......................... 288

287. Cells straight or sigmoid in valve view........... 289

288. Valves convex in girdle view........ Amphora

288. Valves flat in girdle view......... Cymbella

289. Cells straight and longitudinally asymmetrical in valve view................ Gomphonema

289. Cells longitudinally symmetrical or axis sigmoid.................................. 290

290. Cells axis in valve view sigmoid............ 291

290. Cells axis straight in valve view........... 292

291. Striae forming pattern in valve view parallel, perpendicular to central axis... Gyrosigma

291. Striae forming pattern in valve view diagonal to central axis............. Pleurosigma

292. Ornamentation of valve interrupted

by longitudinal line or clear area........... 293

292. Ornamentation of valve not interrupted....... 294

293. Striae easily seen as punctae............ Neidium

293. Striae scarcely discernible as punctae.. Caloneis

294. Elongated ridge containing raphae present in center line of valve. Vanhuerckia

294. No elongated ridge present................... 295

295. Nodule in center of valve face expanded laterally and free of ornamentation... Stauroneis

295. No laterally expanded, unornamented nodule present................................. 296

296. Striae seen as punctae............. Navicula

296. Striae window-like slots, not resolving into punctae............ Pinnularia

297. Valve view arcuate, at least one side convex, the other slightly concave or straight.. 298

297. Valve view not arcuate............................ 299

298. Valve view fairly broad, raphe visible toward center of face only as a V-shaped groove................ Epithemia

298. Valve view quite narrow, usually not seen in that position but in girdle or side view, raphe not present in V-shaped groove, center of valve bulged somewhat on the convex side,

ends sharply curved toward concave side.............................. <u>Rhopalodia</u>

299. Shape as generally seen elongated, (valve view) the extremities drawn into conical, pointed, or pointed and slightly knobbed poles... 300

299. Shape oval elliptic, or ellipsoid................. 301

300. Transverse section rhombic, keels containing raphes diagonally located to each other......................... <u>Nitzschia</u>

300. Transverse section rectangular, with keels opposite, that is, in a line along a side, not through the center of the test......................... <u>Hantzschia</u>

301. Both longitudinal and transverse septae present in cells, transverse septae appearing as uninterrupted ribs in valve view.................................... <u>Denticula</u>

301. Both septae not present, ribs, if present, broken at center line......................... 302

302. More or less conspicuous transverse costae on valve face, surface plane or spirally twisted................ <u>Surirella</u>

302. No transverse costae on valve face, surface bent or saddle-shaped.. <u>Cymatopleura</u>

CHLOROPHYTA

Chlorophyceae

Volvocales

Polyblepharidaceae

Although the motile unicellular organisms of the *Chlamydomonas* type (Chlamydomonadaceae) are considered to represent the nearest approach to a starting point for the evolution of the body types of algal plants, members of Polyblepharidaceae are more primitive in that they lack a definite cell wall. There is, however, some advancement in the Polyblepharidaceae beyond the *Chlamydomonas* prototype in respect to the variation of the cell shapes exhibited, the number of flagella present, and in the development of rhizopodal processes.

COLLODICTYON Carter 1865

Collodictyon triciliatum Carter. (Pascher f) Pl. 1, Figs. 1-3.

Cells variable in shape, generally larger at anterior end, which is usually truncate, whereas the posterior may be either truncate or with two lobes; colorless; four flagella of equal length present; two or three contractile vacuoles. L 20-70u. An amoeboid tendency is seen in the occasional protrusion of pseudopodia. Middle

Tenn.: Cumberland and Duck Rivers 1938-9.[1]

HETEROMASTIX Korshikov 1923

Heteromastix angulata Korsh. (Pascher f)(Smith f) Pl. 1, Fig. 4.

Distinctly angular or flattened from front to rear in broad side view; chloroplast deeply cup-shaped, sometimes containing small posterior eyespot; flagella of unequal length. Cells L 7-10u. The unequal flagella place the genus in an anomalous position among the motile green algae, which characteristically display two equal flagella. Davidson: concrete pools of Kelly's Kennels at Nashville, according to Dr. H. C. Bold in a letter dated 1 Nov. 1949 #1570. K.

PEDINOMONAS Korshikov

Pedinomonas minor Korsh. (Pascher f)(Smith f) Pl. 1, Figs. 5,6.

Shape in broad side view uniformly or asymmetrically ovoid; flatter side hyaline in asymmetrical cells; single chloroplast somewhat cup-shaped or massive, containing single pyrenoid; eyespot present; flagellum exceeding length of body slightly; palmelloid stages occur. L 4-5u. Davidson(?): Cumberland River 1938-9.[1]

PYRAMIMONAS Schmarda 1850

Pyramimonas tetrarhynchus Schmarda. (Pascher f)(Smith f)

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1 Reported in Lackey, 1942

Pl. 1, Figs. 7,8.

Cells obovoid, or occasionally hemispherical in side view, anterior with four rounded lobes, posterior broadly rounded; chloroplast cup-shaped with four anterior lobes, pyrenoid posterior; four flagella of equal length attached in anterior depression; two contractile vacuoles present near base of flagella. L 20-28u; W 12-18u. Knox: plankton from embayment of Ft. Loudon Lake at Blue Grass 23 June 1949 #1558.

Chlamydomonaceae

CARTERIA Diesing 1866

The motile cells of this genus are spherical, oval, or variously shaped, with or without anterior papillae. The chloroplast is usually cup-shaped, and may contain one or more pyrenoids and an eyespot. Groups of immotile cells surrounded by a gelatinous matrix form the palmelloid stage of the genus. The motile cells differ from Chlamydomonas only in possessing four equal flagella instead of two.

Pl. 1, Fig. 9.

The genus is probably of widespread distribution, but no species of it was identified during this study. Pascher, 1927 contains descriptions of over sixty species, and is a good source from which to seek identification of specimens.

CHLAMYDOMONAS Ehrenberg 1833

Cells of this genus are variously shaped but usually spherical, oval, or cylindric-oval. There is a firm cell membrane present, and often a conspicuous gelatinous envelope which is about the same shape as the protoplast. There are no definite lobes, and the only protrusions from the smooth surface are the apical papillae which occur in some species. A cup-shaped chloroplast is usually present, although other types are found, and a round or elongated eyespot may or may not be present. In motile state two flagella of equal length are present, but all trace of them usually disappears in the immotile phase. The immotile cells become surrounded by a gelatinous matrix, which may be homogeneous, or the cells may display individual sheaths. This "palmelloid" stage, as it is termed, is quite difficult to distinguish from Gloeocystis, in which the motile phase is transitory.

The genus is an enormous one in numbers of species, and it is common in water and soil almost to the point of ubiquity.

In addition to the taxonomic interest which it has drawn, Chlamydomonas has been a convenient subject for students of such diverse subjects as algal phylogeny, sexuality, morphology, and photosynthetic processes.

1. Cells with anterior papillae........................ 2
1. Cells lacking anterior papillae...................... 4
   2. Cell membrane conspicuously thickened
      at posterior end..... C. pseudopertyi Pasch.

2. Cell membrane not conspicuously thickened at posterior end........................ 3

3. Chloroplasts occupying most of cells, cells spherical or very broadly oval-shaped...................... C. nasuta Korsh.

3. Chloroplasts deeply cupped, leaving about anterior quarter of cells hyaline, cells distinctly oval, elliptic, or asymmentrically ovoid............. .... C. Ehrenbergii Gorosh.

4. Cells spherical, chloroplasts cup-shaped.................... C. globosum Snow

4. Cells elliptic or oval-shaped, chloroplasts plate-like. C. angelica Pasch.

1. Chlamydomonas angelica Pasch. (Pascher f)(Prescott 27 f)

A relatively small species; side view elliptic with obtuse ends; chloroplast single, transversely band-like, not filling cell, pyrenoid and eyespot not observed nor recorded as being present. L 7.5-11u; W 2-7u. Obion: Bayou du Chien at Biological Station 2 July 1949 #1151.

2. Chlamydomonas Ehrenbergii Gorosh. (Pascher f)

Side view distinctly oval to elliptic with a peaked, papillated anterior, one side often slightly concave; chloroplast cup-shaped leaving approximately anterior quarter of cell hyaline, two or more pyrenoids present; two contractile vacuoles in hyaline portion of cell. L 14-26u. Knox:

pool beside road near Strawberry Plains 30 June 1938 (Bold) #B-24e.[1]

3. Chlamydomonas globosa Snow. (Pascher f)(Prescott 27 f) Pl. 1, Fig. 10.

Shape globose or subglobose; chloroplast cup-shaped, almost filling cell, pyrenoid posterior; inconspicuous anterior eyespot present. Diameter of cells 5-10u. Obion: pond behind Mr. Hawkins' house on road on Walnut Log Road from Union City 1 July 1949 #1137.

4. Chlamydomonas nasuta Korsh. (Pascher f) Pl. 1, Fig. 11.

Cells spherical or broadly elliptic, with truncate thickening forming anterior papilla; chloroplast cup-shaped, filling most of cell, with large posterior pyrenoid; two anterior contractile vacuoles present; eyespot about median in position; two flagella about 1½ times length of body; cell surface described as covered with broad, dark striations. L 16-25u; W 12-17u. Knox: Chilowee Park Lake at outflow 18 June 1949 #831.

5. Chlamydomonas pseudopertyi Pasch. (Pascher f)(Prescott f)

Cells spherical or elliptic with rounded anterior papillae; chloroplast deeply cup-shaped but not extending to anterior end of cell, with posterior pyrenoid; two anterior contractile vacuoles present; eyespot median, fusiform; flagella slightly longer than body; cell membrane

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1. Reported in Silva, 1949

posteriorly thickened. Diameter of cells 12-17u. Knox: swampy pool beside road near Strawberry Plains 30 June 1938 (Bold)#B-24.[1]

CHLOROGONIUM Ehrenberg 1830

The fusiform cells distinguish the genus from others in the family. There are two equal flagella.

1. Slender spindle-shaped cells, 4-6u broad, two pyrenoids present. C. elongatum Dang.
1. Broader spindle-shaped cells, 11u broad, with single pyrenoid.. C. tetragamum Bohlin

1. Chlorogonium elongatum Dang. (Pascher f)(Smith f)

Slender spindle-shaped in side view; single plate-like chloroplast, two axial pyrenoids. L 20-45u; W 4-6u. Published illustrations, however, violate these proportions considerably. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

2. Chlorogonium tetragamum Bohlin. (Pascher f)(Smith f) Pl. 1, Fig. 12.

Broad spindle-shaped in side view; single plate-like chloroplast, one large pyrenoid. L about 33u; W about 11u. Sevier: roadside ditch near Greenbrier Cove 16 July 1939 (Bold)#H-33.[1]

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1 Reported in Silva, 1949
2 Reported in Lackey, 1942

FURCILIA Stokes 1890

The cells of this genus are laterally compressed, broader than long, with two posterior lobes in broad side view, whereas the end view is elliptic or oval in outline. The chloroplast is described as almost colorless, but if some of our identifications are correct, this is not necessarily the case and it may be quite definitely pigmented. The presence of an eyespot appears not to be of universal occurrence; when present it is recorded as lying somewhat back from the anterior margin. Two contractile vacuoles may be found at the base of the two flagella, which are equal in length and longer than the body.

1. Large posterior lobes which converge evenly into central portion of the cells........................ _F._ _lobosa_ Stokes
1. Small posterior lobes protruding rather abruptly from a rotund central portion........................ _F._ _rotunda_ Silva

1. _Furcilia_ _lobosa_ Stokes. (Pascher f)(Smith 33 f)

Colorless or lightly pigmented cell, rarely strongly green with massive chloroplast; rounded in broad side view, with two large posterior lobes, narrow side view obpyriform. L equal to W, 11-14u. Some Tennessee specimens (#2054) differed from the described forms not only in their heavy pigmentation, but also somewhat in proportions. Johnson:

squeeze from *Sphagnum* in bog near Mountain City 11 Aug. 1949 #1707 - Knox: among vegetation at margin of stagnant pond on Riverside Drive beyond Knoxville Waterworks 25 July 1949 #1586 - Cumberland: cultured from a drain into Ozone Creek at Ozone 16 March 1950 #2054. N.

2. *Furcilia rotunda* sp. nov. Pl. 1, Fig. 13.

Cells markedly laterally compressed, broad side view almost circular, with two small, sharply defined lobes at posterior end, narrow side view obpyriform, end view compressed oval; pigmentation light; two flagella of equal length, one and a quarter times length of body. L equal to W, 8u; T 4u.

Identification is particularly difficult in this group, since cells are motile, rare, and cannot be preserved to show details, but careful observations of specimens appearing in the Tennessee collections warrant description of a new species. Subsequent taxonomic investigation of additional specimens might lead to different conclusions regarding the form assigned to *F. rotunda*.

Knox: classroom material for Univ. Tenn. botany department 11 Aug. 1949 #1706.

LOBOMONAS Dangeard 1898

In this genus and some others of the family, the cell proper is surrounded by a firm gelatinous envelope which is different in shape from the protoplast. Here, the envelope surface protrudes in irregular, short, blunt processes.

Lobomonas rostrata Hazen. (Pascher f)(Smith f) Pl. 1, Figs. 14, 15.

Cells oval in side view; gelatinous envelope with characteristic blunt processes on surface; cup-shaped chloroplast common to family present, although pigmentation was very light in Tennessee specimen; two flagella of equal length, a little shorter than the cells in our specimens (but described originally as being length of the body). L 12u; W 8-10u.

The assignment of the Tennessee specimens here is tentative, but it seems reasonable since the characteristic blunt processes of the envelope are present, although somewhat ridge-like.

Overton: pond containing considerable number of aquatics at Timothy 15 July 1949 #1456 - Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] NK.

PLATYMONAS G. S. West 1916

Platymonas elliptica G. M. Smith. (Smith f) Pl. 1, Figs. 16,17.

Cells oval in side view with retuse anterior end, compressed oval shape in end view; chloroplast cup-shaped; quadriflagellate, flagella about as long as the body. L about 18u; W about 12u; T about 10u. This is the only species of the genus found in fresh water. Middle Tenn.:

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[1] Reported in Lackey, 1942

Duck River 1938-9.[1]

SCHERFFELIA Pascher 1927

Scherffelia phacus Pasch. (Fritsch I f)(Pascher f)(Smith f) Pl. 2, Figs. 1,2.

Cells strongly flattened and may be somewhat twisted on the longitudinal axis, shape of protoplast in side view ovoid; external gelatinous envelope extended into lateral wings or keels and two triangular forward projections; two flat chloroplasts present, one on either side of hyaline central region; eyespot anterior; two or three contractile vacuoles present; four equal flagella present. L 15u; W 9-12u. Middle Tenn.: Duck River 1938-9.[1]

SPHAERELLOPSIS Korshikov 1925

Sphaerellopsis fluviatile (Stein)Pasch. (Pascher f)(Smith f) Pl. 2, Fig. 3.

Cells ovoid while the sheath is elliptic. L 14-30u; W 10-20u. The genus is differentiated from Chlamydomonas by the consistent presence of a gelatinous sheath which differs from the shape of the cell proper, but lacks conspicuous lobes or projections. Middle Tenn.: Duck River 1938-9.[1]

Phacotaceae

DYSMORPHOCOCCUS Takeda 1916

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1 Reported in Lackey, 1942

Dysmorphococcus Fritschii Takeda. (Pascher f) Pl. 2, Fig. 4.

Cells ovoid, enclosed in much larger oval or ovoid calcified envelope with separate opening for each of the two flagella, slightly compressed laterally; chloroplast massive or cup-shaped, filling most of cell and containing a single median or posterior pyrenoid; elongated eyespot in median position. L 14-19u; W 10-14u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

PEDINOPERA Pascher 1927

Pedinopera granulosa Pasch. (Pascher f)(Smith f) Pl. 2, Figs. 5, 6.

Protoplast of cells subspherical in broad side view and normally pyriform in narrow side view; surrounded by broad circular envelope, anterior hastate with two rounded lobes, twisted on longitudinal axis in narrow side view; surface covered with coarse granules; chloroplast cup-shaped and filling most of protoplast; pyrenoids and eyespot not observed; four flagella equal to length of body. L 31u; W 29u; T 10u. Davidson(?): Cumberland River 1938-9.[1]

PHACOTUS Perty 1852

The most important taxonomic character of this genus unfortunately is difficult to discern. It is the pill-box structure of the two halves of the firm gelatinous envelope surrounding the protoplast. This pill-box structure is

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1 Reported in Lackey, 1942

readily observed only at times of division. Phacotus has a Chlamydomonas-like, cup-shaped chloroplast, and is surrounded by an almost test-like firm envelope which is oval or rounded in broad side view and elliptic in narrow side view and a pronounced lateral ridge may be present. The envelope is often colored, impregnated, or sculptured, and a layer of watery substance is stated to lie between the envelope and the protoplast.

1. Cells distinctly ovoid, elliptic, or obovoid in broad side view, surface rough...................... P. angustus Pasch.
1. Cells approximately round in broad side view.. 2
   2. Lateral ridge frequently well-developed, diameter 5-9u.................... .... P. subglobosus Pasch.
   2. Lateral ridge scarcely developed, diameter 13-20u P. lenticularis (Ehr.)Stein

1. Phacotus angustus Pasch. (Pascher f)

Outline of broad side view ovoid, elliptic, or obovoid; sheath uniformly thickened, if irregular. L 12-17u; W 8-13u. Maury: pool in brook near Laural Lake 24 Sept. 1939 (Bold)#B-112.[1]

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1 Reported in Silva, 1949

2. <u>Phacotus</u> <u>lenticularis</u> (Ehr.)Stein. (Pascher f)(Smith f)

Cells ovoid, enclosed in wide gelatinous envelope which is circular in broad side view, sometimes impregnated with lime; chloroplast cup-shaped with posterior pyrenoid; eye-spot anterior; contractile vacuoles anterior; flagella about equal to length of body. Diameter of envelope 13-20u.

Pascher includes <u>P.</u> <u>Lenderi</u> Chod. within this species because he considers the network of striations on its gelatinous wings not to be a constant character.

Campbell: plankton from Norris Lake 21 June 1938 (Bold)unnumbered[1] - Middle Tenn.: Duck River 1938-9[2] - Lake: plankton from deeper pools in Cranetown nesting area cypress swamp 5 July 1949 #1189. K.

3. <u>Phacotus</u> <u>subglobosus</u> Pasch. (Pascher f) Pl. 2, Figs. 9,10.

Cells spherical or broadly oval, enclosed by an envelope which is circular in broad side view, oval in narrow side view; surface smooth or sculptured with fine or coarse punctae; flagella usually long, up to 2½ times length of body. Diameter of envelope 5-9u; T 4-6u. Union: pond by road near Hickory Star Landing on Norris Lake 9 Aug. 1950 #2316.

PTEROMONAS Seligo 1887

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1 Reported in Silva, 1949
2 Reported in Lackey, 1942

The genus differs from other Phacotaceae by having a smooth outer surface. As illustrated in published figures the envelope projects laterally in a wing-like manner. In broad side view the outline of the envelope may be circular, oval, or rectangular.

1. Broad side view of envelope rectangular,
   corners produced into points........................ 2
1. Outline of envelope otherwise........................ 3
   2. Outline in broad side view irregu-
      lar or dentate..............................
      .... P. aculeata v. Lemmermannii Skuja
   2. Outline regular, lacking dentations........
      .... P. aculeata Lemm.
3. Outline of sheath truncate at anterior
   end and otherwise broadly rounded.............
   .... P. angulosa Lemm.
3. Outline in broad side view oval, rec-
   tangular or posterior caudate, but end
   view exhibits four variable lobes,
   cruciately arranged........ P. cruciata Playf.

1. Pteromonas aculeata Lemm. (Pascher f)(Smith) Pl. 2, Figs. 7,8.

Gelatinous envelope rectangular, margins entire, corners drawn into processes visible in broad side view, appearing in end view as a pair of lateral wings; chloroplast cup-shaped or massive; elongated eyespot and several pyrenoids described for the species. L 19-33u; W 18u. Lake: slough beside hwy Tenn.22 near Kentucky state line 5 July 1949 #1193.

2. Pteromonas aculeata v. Lemmermannii Skuja. (Smith f)

Differs from the typical species principally by the irregular or dentate margin of the gelatinous envelope in broad side view. Middle Tenn.: listed but no location given 1938-9.[1]

3. Pteromonas angulosa Lemm. (Pascher f)(Prescott 27 f) Pl. 2, Figs. 11,12.

Cell protoplast oval or narrowly ovoid in side view; envelope broadly circular with truncate anterior end in broad side, elliptic in narrow side view, wings seen in end view; chloroplast cup-shaped; eyespot anterior; two flagella about length of body. L 13-17u; W 9-20u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

4. Pteromonas cruciata Playf. (Pascher f)

Protoplast oval-shaped; envelope four-lobed, general outline in side view ovoid, rectangular, and lobed posteriorly, end view showing cruciately arranged lobes; surface irregular; chloroplast massively cup-shaped, pyrenoid posterior; eyespot round, posterior. L 29u; W 18u. Davidson(?): Cumberland River 1938-9.[1] K.

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1 Reported in Lackey, 1942

THORACOMONAS Korshikov 1925

Thoracomonas phacotoides G. M. Smith. (Smith f) Pl. 2, Figs. 13,14.

Envelope laterally compressed, oval-shaped in broad side view, ovoid in narrow side view; surface thick, verrucose; color sometimes deep brown from ferric hydroxide impregnation; two equal flagella inserted diagonally. L 12.5-17.5u; W 10-13u; T 6-8u. The coarsely granular surface is reminiscent of Pedinopera granulosa, which differs in having four flagella and being twisted in the anterior portion. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

WISLOUCHIELLA Skvortzow 1925

Wislouchiella planktonica Skvor. (Smith f) Pl. 2, Figs. 15,16.

Protoplast ovoid in side view; envelope broad, compressed, obovoid or obcordate in broad side view, finger-like projections visible in narrow side view and end view, two apical in position, four cruciately arranged near posterior end; chloroplast massively cup-shaped with single pyrenoid; eyespot anterior; flagella about length of body. L 25-30u; W 22-25u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

Volvocaceae

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1 Reported in Lackey, 1942

EUDORINA Ehrenberg 1832

This genus forms spherical or oval-shaped colonies composed of motile cells within a gelatinous envelope. The cells, numbering from 16 to 64 are arranged in tiers.

1. Colonies with mammillate protuberances
   at the posterior end.. E. unicocca G. M. Smith
1. Colonies smoothly rounded, without
   protuberances.................. E. elegans Ehr.

1. Eudorina elegans Ehr. (Pascher f)(Prescott f)(Smith f)
Pl. 3, Fig. 1.

Colony spherical or oval-shaped, evenly rounded; cells spherical; chloroplast massive or cup-shaped; two long, equal flagella. Colonies L 60-200u. Cells L 16-24u.

There is a considerable difference in size of cells and colonies, depending on the age and possibly upon environment. Male colonies may be found with the cells breaking up into small packets of antherozoids.

It should be remembered that E. elegans is an empirical species based on colony shape, and a number of species may be differentiated within the group if life history and physiology are taken into account.

This is undoubtedly the most common volvocacean in the region. At least twenty collections of the species were made, but only enough specific instances are listed here to indicate the general distribution.

Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1736 - Lincoln: among vegetation in stream by hwy U.S.241 19 Aug. 1949 #1775 - Davidson(?): Cumberland River 1938-9[1] - Cheatham: soil bottomed fish raising ponds on Little Marrowbone Creek Road 20 Aug. 1949 #1838-42-46 - Weakley: Dodd's farm pond just north of Martin 8 July 1949 #1257 - Obion - Lake: Reelfoot Lake 1929[2] - Obion: Bayou du Chien at Biological Station 2 July 1949 #1151. VNKL.

2. Eudorina unicocca G. M. Smith. (Prescott f)(Smith f)

Spherical or oval gelatinous colonies, with mammillate protuberances on posterior end; cells spherical; chloroplast massive or cup-shaped; two long, equal flagella. Colonies about L 30-50u; W about 20-30u. Diameter of cells about 5-10u. Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1738 - Cumberland: rain puddle in grass at front of New Salem Baptist Church along hwy U. S.70-N 16 March 1950 #2056 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1182.

GONIUM Mueller 1773

The biflagellate cells of this genus are inclosed by a firm gelatinous matrix, and they are arranged in flat rectangular plates. In locomotion, the colony tumbles in a manner so characteristic that it can be recognized even

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1 Reported in Lackey, 1942
2 Reported in Eddy, 1930

at low magnification.

1. Colonies of never more than four cells.................. *G. sociale* (Duj.)Warm.
1. Colonies generally of more than four cells, usually 16............................... 2
   2. Cells broadly ovoid or spherical, outline of colony essentially entire.................... *G. pectorale* Muell.
   2. Cells pyriform, outline of colony undulate.............. *G. formulosum* Pasch.

1. *Gonium formulosum* Pasch. (Pascher f)(Smith f) Pl. 3, Fig. 2.

Colonies flat, quadrangular, cells pyriform or ovoid, smaller end outward; chloroplast cup-shaped, with pyrenoid; eyespot present; two flagella equal. Cells L 10-25u; W 7-11u. In addition to the described distinguishing characters, it appears that the colony margin is also a useful one since it is undulate rather than straight, as is that of *G. pectorale* Muell. Knox: around roots in pond beside Ten Mile Creek at Farragut 23 July 1949 #1545.

2. *Gonium pectorale* Muell. (Pascher f)(Prescott f)(Smith f)

Colonies flat, quadrangular, cells broadly ovoid or oval; chloroplasts cup-shaped, with pyrenoid; eyespot present; two equal flagella. Cells L 5-14u; W 4-10u. The margins of the colony here are straight, contrasting with the wavey ones of G. formulosum. Knox: road rut pools at entrance to Island Home Park 20 July 1949 #1507 - plankton catch from Ft. Loudon Lake at Duncan's Dock 3 Sept. 1949 #1882 - Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] NGK.

3. Gonium sociale (Duj.)Warm. (Pascher f)(Prescott f) (Smith) Pl. 3, Fig. 3.

The forms of Gonium which never have more than four cells per colony are assigned this name. However, since the other species also do occur in four-celled colonies (Pascner, 1927), the basis of difference becomes too obscure to be easily judged without culturing and morphological study. The cell snape resembles that of G. formulosum, which has been recorded from the same site at the same time. Knox: around tree roots in pond beside Ten Mile Creek 23 July 1949 #1545 - Davidson(?): Cumberland River 1938-9[1] - Obion: pond beside Hawkins' house on road to Walnut Log from Union City 1 July 1949 #1139. NK.

PANDORINA Bory 1824

Pandorina morum Bory. (Pascher f)(Prescott f)(Smith f) Pl. 3, Fig. 4.

Colonies broadly oval-shaped, generally sixteen-celled; cells obovoid to spherical; chloroplasts cup-shaped, eyespot present; two equal flagella. Cells L equal to W, 9-17u. The layered arrangement of Eudorina is not found here, often

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1 Reported in Lackey, 1942

the cells are in a compact radial group. When the cells are well separated and approximately spherical, however, there is a close resemblance to Eudorina. Knox: stagnant pond on Riverside Drive east of Knoxville Waterworks 25 July 1949 #1586 - plankton from Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949 #1882 - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Cheatham: soil bottomed fish raising ponds on Little Marrowbone Creek Road 20 Aug. 1949 #1846 - Weakley: Dodd's farm pond just north of Martin 8 July 1949 #1257 - mud puddle on farm a few miles east of Dresden on hwy Tenn. 54 14 July 1949 #1334 - Obion: mud puddle near Marvin Hayes' fish tank 12 July 1949 #1321 - plankton from Reelfoot Lake at Samburg 12 July 1949 #1305 - Lake: plankton from water trough by Blue Basin 2 July 1949 #1150. VNSFK.

PLATYDORINA Kofoid 1899

Platydorina caudata Kofoid. (Pascher f)(Prescott f)(Smith f) Pl. 3, Fig. 5.

Colonies flat, horseshoe-shaped, twisted on the longitudinal axis, with three to five protuberances at the otherwise truncate posterior end; cells spherical to pyriform, 16-32 in a colony; cell structure similar to others of family. Cells L 10-15u. Colonies L 25-165u; W 21-145u. Knox: stagnant pond by Riverside Drive beyond Knoxville Waterworks 25 July 1949 #1586 - Middle Tenn.: Cumberland and Duck Rivers

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1 Reported in Lackey, 1942

1938-9[1] - Davidson: Radnor Lake summer 1949 according to data card of H. C. Bold 11 Oct. 1949 - culture from Radnor Lake at Vanderbilt University 17 March 1950 #2162. K.

PLOEDORINA Shaw 1894

Pleodorina californica Shaw. (Pascher f)(Prescott f)(Smith f) Pl. 3, Fig. 6.

Colonies spherical to broadly oval in outline, 32-128 motile cells embedded in periphery; cells differentiated distinctly in size between larger reproductive cells and smaller vegetative cells; about equal in number; cells spherical, otherwise similar to those of remainder of family. Diameter of cells 12-15u. Diameter of colonies up to 450u. The other described species, P. illinoisensis Kofoid, has only four vegetative cells. In #1378 certain colonies appeared to have about one quarter of the cells vegetative, indicating either that intermediates may exist, or that the colonies were abnormal. Claiborne: permanent pond north of Tazwell 26 June 1938 (Bold)unnumbered[2] - Davidson: culture at Vanderbilt University 17 March 1950 #2061 - Montgomery: pond at Tom Edwards' store on hwy U.S.79 west of Clarksville 14 July 1949 #1370 - Obion: pond in field two miles south of Midway 10 July 1949 #1288 - Lake: water trough beside Blue Basin of Reelfoot Lake 2 July 1949 #1150. K.

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1 Reported in Lackey, 1942
2 Reported in Silva, 1949

VOLVOX Linneaus 1758

The macroscopically visible spherical colonies of this genus are a most intriguing sight to the student of fresh water life. Such colonies are composed of up to several thousand spherical or ovoid cells peripherally arranged in a gelatinous envelope.

* species not in text

1. Individual cells connected by visible protoplasmic strands.............................. 2
1. Individual cells not connected by such strands..................................... 3
   2. Protoplasmic strands thick, cells appearing stellate from top view........... .... V. globator (L.)Ehr.*
   2. Protoplasmic strands thin, cells rounded from top view V. perglobator Powers
3. Individual cells sourrounded by distinct individual gelatinous sheaths........... .... V. tertius Meyer
3. Individual cells not surrounded by distinct sheaths............... V. aureus Ehr.

1. Volvox aureus Ehr. (Pascher f)(Prescott f)(Smith f)

Colonies large, visible to naked eye, containing up to 1000 cells; cells spherical; chloroplast massive; two equal flagella; not connected by visible protoplasmic strands.

Diameter of cells 5-8u. Diameter of colonies 500-850u. VNK.

2. Volvox perglobator Powers. (Pascher f)(Prescott f)(Smith)
Pl. 4, Figs. 4,5.

Colonies large, containing several thousand cells; cells pyriform, round from top view; chloroplast massive; two equal flagella; cells connected by visible protoplasmic strands; gelatinous sheaths of individual cells are not distinct from each other. Diameter of cells 3-8u. Diameter of colonies 1000-1500u. Pascher, 1927 comments that this species is probably synonymous with V. globator (L.)Ehr. Claiborne: permanent pond north of Tazwell 26 June 1938 (Bold)unnumbered.[1] N.

3. Volvox tertius Meyer. (Pascher f)(Prescott f)(Smith)
(Volvox mononae G. M. Smith)
Pl. 4, Figs. 1-3.

Colonies spherical or oval in outline, containing only a few hundred cells; individual cells spherical; two equal flagella; cells spherical, surrounded by individual gelatinous sheaths; cells not connected with visible protoplasmic strands. Diameter of cells 7-8u. Diameter of colonies 550-600u. Montgomery: marshy pond west of New Providence 14 July 1949 #1365 - Lake: slough beside hwy Tenn.22 near Kentucky state line 5 July 1949 #1191. NK.

Haematococcaceae

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1 Reported in Silva, 1949

HAEMATOCOCCUS C. A. Agardh 1828

Haematococcus lacustris (Girod.)Rostaf. (Smith f) Pl. 4, (Sphaerella lacustris (Girod.)Wittr. of Prescott f, Smith 33 f, etc.)

Figs. 6,7.

Cells solitary; in active state broadly oval or ovoid in side view, protoplast withdrawn from the wall and connected to it by cytoplasmic strands; two flagella about equal to length of body; cells characteristically colored red by haematochrome, with internal structure obscured. Motile cells L 10-60u; W 8-50u. Diameter of akinetes 30-60u. Akinetes of this organism frequently color the bottom of bird baths and such pools but not stock ponds which are colored by species of Euglena. Knox: bird bath at Beverly 7 July 1938 (Bold) unnumbered[1] - concrete fish pool at Chilowee Park Zoo 14 March 1950 #2043 - Davidson: small overflow lake near Radnor Lake 20 Aug. 1949 #1804 - Weakley: stock pond on county road near Mason Hall 8 July 1949 #1245. VNF.

Tetrasporales

Palmellaceae

The writer employs this family name while realizing unhappily that it is an invalid one, and he is yet to be convinced that Palmella, the type genus, even exists. To re-

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1 Reported in Silva, 1949

designate the family without the careful taxonomic study required, however, would not be the least helpful.

ASTEROCOCCUS Scherffel 1908

Asterococcus limneticus G. M. Smith. (Prescott f)(Smith f) Pl. 4, Fig. 8.

In common with other members of this family, several spherical cells (2-16) united within a gelatinous colony; characteristic cell structures are the centrally located (axial) chloroplast with arms radiating outward from a central pyrenoid to terminate at the wall in peripheral discs, this arrangement not easily detected under all conditions. L equal to W, 7.5-35u. Knox: fish pool at Ijams' place 11 July 1938 (Bold)unnumbered.[1]

GLOEOCYSTIS Naegeli 1849

Comments on the species of this genus are made with reservation since it is clear that no little confusion exists in their classification. Some described species are certainly developmental stages of algae belonging to other genera and #1705 presents justification for the assertion that Hormotila is indeed a stage of Gloeocystis species and is not worthy of generic status. Undoubtedly, too, many of the specimens labeled Gloeocystis are only palmelloid stages of Chlamydomonas. A careful study is needed even to determine the boundary, if any, between these two genera.

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1 Reported in Silva, 1949

1. Cells spherical except in division............
.... G. Grevillei (Berk.)Drou. & Dail.
1. Cells oval....... G. confluens (Kuetz.)Richt.

1. Gloeocystis confluens (Kuetz.)Richt. (Drouet & Habeeb) Pl. 4, Fig. 9.

The name is applied here to all of the oval-celled specimens surrounded by a gelatinous matrix. Cell size and condition of sheath are so variable, even within single colonies, that no attempt at finer differentiation is being made. Sevier: wet rocks beside trail near Newfound Gap (5500 ft.) a0 April 1947 #610[1] - Claiborne: permanent pond north of Tazwell 26 June 1938 (Bold)unnumbered[1] - Colbert (Ala.): on concrete in settling basin at Sheffield 15 Oct. 1949 (Hall)#1965 - Montgomery: field pond at Meriwether 18 March 1950 #2096 - Obion: foam on leeward side of Bayou du Chien near Biological Station 2 July 1949 #1154. F.

2. Gloeocystis Grevillei (Berk.)Drou. & Dail. (Drouet & Daily 48)

This species designation includes the spherical forms, which may be found solitary or in sizeable colonies with amorphous, stratified, gelatinous sheaths. Many specimens designated as G. gigas (Kueta.)Lag. would go here. Swain (N.C.): wet trailside rock (4500 ft.) Hughes Ridge along

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1 Reported in Silva, 1949

Bradley Fork trail 5 Sept. 1941 #120[1] - Davidson: cultured from collection at fishpool by greenhouse on Vanderbilt University campus 17 March 1950 #2060. VNFK.

SPHAEROCYSTIS Chodat 1897

Sphaerocystis Schroeteri Chod. (Prescott)(Smith f) Pl. 4, Fig. 10.

Colonies spherical, containing relatively few cells (up to 32, but generally 16 or less), arranged equidistant from each other within the common envelope; cells spherical; chloroplast cup-shaped, with single pyrenoid. Diameter 6-20u. Campbell: plankton from Norris Lake 26 June 1938 (Bold) unnumbered[2] - Montgomery: pond at Tom Edwards' store by hwy U.S.79 west of Clarksville 14 July 1949 #1371 - pond at corner of Dotsonville Road 9 Oct. 1949 #2031.

UROCOCCUS Kuetzing 1849

Urococcus Hookerianus Berk. & Hass. (Smith 33)

Cells spherical, contents granular with a very obscure structure which has not been determined satisfactorily, red color further obscuring the view; cells surrounded by a wide stratified gelatinous sheath. The status of the species and its genus is uncertain at this time since Dr. R. F. Thompson has found U. insignis (Hass.)Kuetz. to be a gloeodinoid stage of an organism which has a dinoflagellate type

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1 Reported in Silva & Sharp, 1944
2 Reported in Silva, 1949

of zoospore. Campbell: limestone pools of small stream entering Norris Lake below high water mark in Cove Creek inlet 12 April 1947 #632.[1]

Tetrasporaceae

In this family, cells capable of vegetative division are enclosed by a mucilage, so that the colony is a gelatinous mass, which attains macroscopic size in _Tetraspora_. In addition, frequently two hair-like processes are present on the outer cells of the colonies. The genera are distinctive. _Tetraspora_ is marked by cell arrangement in definite groups of four's (sometimes in two's) Pl. 5, Fig. 4, _Apiocystis_ by its pyriform colonies of microscopic size in which the cytoplasmic pseudocilia are more often observable than in _Tetraspora_, and _Schizochlamys_ by the remains of broken mother cell walls conspicuously present in the gelatinous matrix.

TETRASPORA Link 1809

1. Colonial mucilage tough, elongate, saccate............. _T. cylindrica_ (Wahlb.)Ag.
1. Colonial mucilage softer, not elongated............ 2
   2. Colonies an irregular mass................. .... _T. gelatinosa_ (Vauch.)Desv.
   2. Colonies flatter, more expanded, lobed, split.......... _T. lubrica_ (Roth)Ag.

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1 Reported in Silva, 1949

1. Tetraspora cylindrica (Wanlb.)Ag. (Lemmermann, Brunnthaler & Pascher f)(Smith f) Pl.5, Fig. 1.

Long cylindrical colonies tough and tenaceous, even when preserved, whereas other species have more irregular and less firm colonies. Sevier: attached to rocks in quiet river pool in Ramsey Prong (3250 ft.) 5 Sept. 1941 #144.[1] N.

2. Tetraspora gelatinosa (Vauch.)Desv. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith) Pl. 5, Fig. 2.

The irregular saccate colonies are softer than T. cylindrica and more lumpy than those of T. lubrica. Knox: Chilowee Park Lake at Knoxville 29 June 1938 (Bold)unnumbered[1] - Montgomery: farm pond by roadside near Ringgold mill beside hwy U.S.41 alt. 18 March 1950 #2083 - Henry: pool in piles of limey mud on west bank of Kentucky Lake near Paris Landing 19 March 1950 #2116. NFKL.

3. Tetraspora lubrica (Roth)Ag. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 5, Fig. 3.

The difference between this species and T. gelatinosa is not always clear but the typical colonies here are somewhat more expanded and split. It may be noted that #2048 had only paired cells, not groups of four. Knox: marshy roadside ditch just north of Knoxville by hwy U.S.25-W 15 March 1950 #2048 - Montgomery: in seepy gum-oak woods near Oakwood 18 March 1950 #2068 - Henry: drain ditch at Wallace

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1 Reported in Silva, 1949

Motor Court by hwy U.S.79 near Henry 19 March 1950 #2120. VNSK.

Coccomyxaceae

Members of this family were rarely encountered. They have in common with each other an elliptic or oval cell shape and a gelatinous colonial sheath of indefinite size and shape. The occurrence of vegetative division in the cells, and their inability to return directly to a mobile phase, sharply differentiates the group from the Tetrasporaceae.

COCCOMYXA Schmidle 1901

Coccomyxa dispar Schm. (Smith f) Pl. 4, Fig. 11.

Cells irregularly imbedded in gelatinous matrix; shape cylindrical oval to cylindric-elliptic in shape; chloroplast plate-like, typically covering only one side of the cell. L 6-10u. It should be noted that the saccoderm desmid, Mesotaenium macrococcum v. micrococcum (Kuetz.)West and West bears a rather strong resemblance to this species in casual observation, but is about twice its size. Sevier: spray-filled pool at falls (4150 ft.) Ramsey Cascade 4 Sept. 1941 #120.[1] N.

ELAKATOTHRIX Wille 1898

Elakatothrix viridis (Snow)Printz. (Prescott f)(Smith f)

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1 Reported in Silva and Sharp, 1944

Pl. 5, Fig. 5.

Cells fusiform, with sharp, pointed ends; cells grouped in small colonies imbedded in a gelatinous matrix. L 12-25u; W 6-21u. There is a resemblance to Quadrigula here, but the manner of cell division is quite different. Division occurs at right angles to the long axis in Elakatothrix, whereas in Quadrigula the autospores by which the cells reproduce result in bundles of daughter cells with their long axis parallel to the original mother cell axis. Shelby: goldfish pond at Memphis Zoo 19 March 1950 #2129.

NANNOCHLORIS Naumann 1919

Nannochloris bacillaris Naum. (Smith f) Pl. 4, Fig. 12.

Cells solitary, lacking the gelatinous matrix of Coccomyxa; shape oval or cylindric-oval; one or two small discoid chloroplasts. L 3-5u. It seems possible that it might be confused with the disjointed condition of Stichococcus bacillaris Naeg. N. bacillaris, however, has a small discoid chloroplast, which may not fill the cell. The difference is not easy to define in words. Knox: bird bath at Beverly 19 June 1938 (Bold)unnumbered.[1]

OUROCOCCUS Grobéty 1909

Ourococcus bicaudatus Grobéty. (Smith f) Pl. 5, Fig. 6.

Cells solitary, fusiform, with drawn-out seta-like poles which project straight or bend in the same or opposite di-

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1 Reported in Silva, 1949

rections; chloroplast parietal, with a single pyrenoid. This type of chloroplast as well as the greater width may be used to distinguish this species from Ankistrodesmus spp., which, furthermore, lack vegetative multiplication. L 10-35u; W 4-9u. Knox: plankton and shore debris from Ft. Loudon Lake embayment at Blue Grass 23 July 1949 #1558.

Ulotricales

Ulotricaceae

The definitions of this family virtually have been taken for granted by American phycologists since the time of Hazen. The taxonomy of the family is a source of utter frustration, however, to the independently minded observer. In spite of the immense credit which must be given to the Hazen treatment as a fine critical work, it is an injustice to his work to accept it as the last word on the family, particularly since his monograph is filled with statements of doubt and uncertainty.

Only in Smith, 1950 has there been some attempt to reorganize the family, especially in the transference to Hormidium of all of the species of Stichococcus except S. bacillaris Naeg. The writer's incomplete observations do not directly contradict this move, and he accepts them as a first step toward a neccessary clarification. It is felt that the existence of some of the species of Ulothrix, as well as some in Hormidium, and Stichococcus which appear in the literature would be difficult if not impossible to establish, even in a thorough study, which has not been attempted here.

Nevertheless, a few preliminary opinions have been formed and are offered in hope of arousing a critical approach to the study of the family in the future.

As far as the genera of the family are concerned, Schizomeris most certainly belongs here and there is little doubt that uniseriate strands of it have frequently been called Ulothrix spp. Binuclearia seems distinctive enough to stand as a good genus, but Ulothrix, Stichococcus, Uronema, Hormidium, and Geminella are by no means clearly defined. Radiofilum is not considered here, since it has not come under the writer's observation. The frequently published "key" characters separating the genera listed above on vegetative characters alone do not bear up under critical analyses.

Stichococcus and Hormidium, as now considered by Smith, do not form holdfasts, but this feature was not included in the original generic descriptions nor among those traditionally used to characterize them. The holdfast does seem to be a consistent character. The gelatinous sheath attributed to Ulothrix, is generally absent in specimens which seem to belong there and perhaps had better be dismissed as a diagnostic character. The sheath is used in the writer's concept of Geminella, however, which is based only on the materials of this study. Pointed filaments, used to differentiate *Uronema* exist as well on young *Ulothrix* strands. While it is true that the points on *Uronema* filaments are asymmetrical and the cells are proportionally longer, it is quite open to question as to whether the differences are of generic status. Certainly equivalent criteria are not considered in *Oedogonium*. As for the statement that *Uronema* occurs only as filaments of a few cells, it is incorrect, for much elongated filaments may be found. The lack of pyrenoids has been used to separate certain species of *Stichococcus* from *Gloeotilia* as represented in the Pascher handbook, (e.g.) but Smith, 1950 agrees closely with the observations made here in stating that only *S. bacillaris* lacks pyrenoids. Further observations should be made.

The trait of frequent separation of the cells of a filament into short lengths or into individual cells has been used to differentiate *Stichococcus* and *Ulothrix*, but this applies specifically to the 1950 concept of *Stichococcus*, not to all earlier ones. The final differentiating vegetative trait which remains is the shape of the chloroplast, which is described as filling most of the cell and circling more than half the circumference in *Ulothrix*, with a smaller chloroplast, circling less than half the cell in *Stichococcus*. The writer's conclusion from observation is that the same basic type of chloroplast is present in those Tennessee specimens belonging not only to both of the above genera but to *Hormidium* and *Uronema* in the same family as well.

The neat text book type of doubly folded chloroplast simply does not occur in all plants which seem to belong in *Ulothrix* on the basis of the holdfast and pointed terminal cells, yet there is a subtle difference between this chloroplast and that of the plant which would probably best be called *Hormidium subtile* (Kuetz.)Heering. This is amplified later in remarks under the species. As for the amount of the cell occupied by the chloroplast, there are probably valid differences, but it must be remembered that this trait varies with the age, and probably other conditions, of the cell.

There is now a tendency to look to the ontogeny of the plants for distinguishing criteria. Zoospore characters have been offered for diagnosis. *Ulothrix* is said to produce quadriflagellate zoospores, *Hormidium* biflagellate zoospores, and *Stichococcus* no zoospores, but sufficient data to support this contention are not available to the writer, although it may be correct.

The treatment of the family given below is a compromise and, as such, is only partly correct. Resisting the temptation to synonymize the genera, the course of perpetuating some errors was followed, as opposed to adding possible new ones in the absence of the monographic type of study actually needed for the family.

BINUCLEARIA Wittrock 1886

Binuclearia tatrana Wittr. (Prescott f)(Smith f) Pl. 5,

Fig. 7.

The filaments observed were attached, but details of the holdfast were obscured; filaments unbranched; cell length up to eight times width; cell often with two separate chloroplasts visible, the "binucleate" appearance caused by the delay in formation of a cross wall between newly separated protoplasts; the stratified gelatinous substance present between the end walls and the protoplast. Cells W 6-9u. #1749 is recorded as being 5u broad. Cherokee(N. C.): dripping cliff near Hiwassee Dam powerhouse 18 Aug. 1949 #1748 - Polk: sandy mud mottom stream near Ducktown by hwy U.S.64 14 Aug. 1949 #1749-50-53. N.

GEMINELLA Turpin 1828

A firm gelatinous sheath is the characteristic employed here to separate this genus from the others of the family, since the condition of separate cells lying longitudinally aligned within the sheath does not develop in the species included here. Other persistently filamentous species have been described for the genus, however. The chloroplast is of the same form as found in the remainder of the family.

The taxonomy of the genus is in an uncertain state, largely because of the relative infrequency of its occurrence and the lack of details revealed by exsiccatae. Therefore, after attempting to assign the Tennessee plants to the hazily described names, the writer has established a new species, realizing that further study may relegate it to syncnymy.

Geminella hormidioides sp. nov. Pl. 6, Fig. 5.

Filaments surrounded by firm, cylindrical, gelatinous sheaths; cells cylindric or considerably tumid; chloroplasts one per cell, plate-like, covering from half to almost all of the cell wall, the hyaline polar areas often being semi-circular-shaped, plate flat or folded on one, rarely on both sides; pyrenoid inconspicuous; one or two small, round shiny glycogen(?) bodies per cell; no indication of reproduction by zoospores observed. Cells L 6-8u; W 3-5u. Sheaths W about 12-15u. Knox: Chilowee Park Zoo fish pool attached or floating in masses 14 March 1950 #2043 - same site 21 July 1950 #2311.

HORMIDIUM Kuetzing 1843

As stated above in discussion on the family, Smith, 1950 is followed in the concept of the genus employed here. That is, the plants are unbranched filaments of indefinite length, the cells of which contain a plate-like chloroplast with a single pyrenoid. Biflagellate spores are produced, but holdfasts have not been recorded.

Of the four species listed here, the writer feels that only Hormidium subtile (Kuetz.)Heering is a satisfactory identification.

1. Hormidium flaccidum (Kuetz.)A. Br. (Hazen f)(Smith)
   (Stichococcus flaccidus (Kuetz.)Gay of Hazen etc.)

Filaments composed of tumid cells with thick walls, (according to Hazen's description). Cells ½-3 times as long as broad; W 5-14u. This is a most hazily characterized species. Knox: dried puddle on bare soil of field at Booth Kennels 18 March 1947 #529.[1]

2. Hormidium fluitans (Gay)Heering. (Hazen f)(Smith)
(Stichococcus fluitans Gay of Hazen etc.)

Filaments crisped and interwoven, constricted at cross walls, readily breaking up into separate cells; chloroplast large and opaque. Cells three times as long as broad; W 6.5-9u. Sevier: on mosses at Ramsey Cascade (4150 ft.) 18 July 1939 (Bold)#H-346.[1] V.

3. Hormidium rivulare Kuetz. (Hazen f)(Smith)
(Stichococcus rivularis (Kuetz.)Hazen of Hazen etc.)

Filaments constricted at cross walls, bent, with tendency to form rhizoidal outgrowths, not readily breaking up into individual cells; cells thick-walled. L 8-20u; W 8-11u. Sevier: on wet rock ledge beside Ramsey Cascade (4175 ft.) 28 Dec. 1946 #417.[1] F.

4. Hormidium subtile (Kuetz.)Heering. (Hazen f)(Prescott f)
(Stichococcus subtilis (Kuetz.)Klerck. of Hazen etc.)
(Smith f) Pl. 6, Fig. 6.

Filaments long, straight, with parallel sides; cells relatively thin-walled; chloroplast single, plate-like, covering from one-quarter to complete cell wall, flat or with single,

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1 Reported in Silva, 1949

rarely double fold; single pyrenoid present; biflagellate zoospores, but no holdfasts produced. Cells 1½-3 times longer than broad; W 5-7u.

To the critical observer, it must appear that the description of this species, as stated above, is a general one which might cover a multitude of Ulothrix-like filaments. It has been a general practice to employ this broad concept, however, and the writer wholeheartedly agrees that it is the best treatment of the species at the current state of knowledge. One disturbing aspect, however, is that those plants are included under this heading which occur in such different habitats as seep-covered mountain rocks and bare limestone soil. Therefore the "high mountain" type has been retained under Ulothrix variabilis, although they conform to the description of this species so well that the writer declines to attempt a statement of how they do differ. Madison(N.C.): rocks in road wet from constant rain and poor drainage at Cutshall's grocery by hwy N.C.212 near White Rock 25 June 1949 #937 - Sevier: set quartz rock (3500 ft.) Porters Creek in Greenbrier section 3 Sept. 1941 #158[1] - Blount: on stump by Charlie Meyers' barn in Cades Cove 19 June 1949 #876 - Jefferson: clear drain at base of Douglas Dam 22 July 1949 #1570 - Knox: flowing place in swampy area on Univ. Tenn farm 1 Aug. 1949 #1600 - drier

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1 Reported in Silva and Sharp, 1944

soil, same site and date #1603 - Putnam: recently exposed flat of Cookville reservoir 14 June 1949 #807 - Montgomery: damp soil under high porch of Alfred Clebsch' home on Gracey Ave. Clarksville 19 March 1950 #2111. VFT.

SCHIZOMERIS Kuetzing 1843

Schizomeris Leibleinii Kuetz. (Heering f)(Prescott f) (Smith f) Pl. 6, Figs. 1-3.

Young filaments unbranched, uniseriate; cells quadrate or length greater than width; chloroplast plate-like, often folded double in a manner similar to Ulothrix zonata (Webber & Mohr)Kuetz.; older filaments multiseriate in the apical region, forming a cylinder of polygonal brick-shaped or stone-shaped cells. Diameter of cells 10-30u. Adult cylinder W 100-150u. The uniseriate stages are easily mistaken for Ulothrix spp. Knox: attached to stick at margins of Ft. Loudon Lake at Blue Grass 23 July 1949 #1558-68 - on rocks in clear running stream by Riverside Drive east of Knoxville Waterworks 25 July 1949 #1584. NVSFKL.

STICHOCOCCUS Naegeli 1849

The concept of this genus which has been commonly held by American students since Hazen (1902) has been that of a group of plants in which the unbranched filaments lack holdfasts, and in which the plate-like parietal chloroplast of each cell circles less than half of it. In addition Stichococcus was described as having considerable tendency to break apart into short lengths or individual cells. Smith, 1950 confines the genus to those plants which, in addition to the above stated characters, lack pyrenoids, and zoospores. Consequently, most of the species are transferred to Hormidium.

Stichococcus bacillaris Naeg. (Hazen f)(Prescott f)(Smith f) Pl. 6, Fig. 4.

Cells short cylinders with rounded ends when separated, as they generally are, especially in culture; short filaments found under certain conditions, however; chloroplast plate-like, lacking a pyrenoid; zoospores apparently absent. L 4-8u; W 2.5-3.5u. Observations by the writer leave him in doubt as to the lack of both pyrenoids and zoospores. Preserved material from Tennessee gives evidence of exhibiting both, but inasmuch as the material was not living, final judgment is reserved. Madison: roadside slough west of Jackson 30 June 1949 #1112. VN.

ULOTHRIX Kuetzing 1833

The comments previously made under the family and under Hormidium and Stichococcus should be noted.

These unbranched filaments are of indefinite extent, and do not readily break up into individual cells. The filaments arise from quadriflagellate zoospores and may remain indefinitely attached by basal holdfasts. The cells are generally cylindrical, relatively short (none being described as more than twice as long as broad), and contain a chloroplast which almost fills the cell. The chloroplast is plate-like, doubly folded in the larger species (those over 10u broad, generally speaking) and variable in the smaller species, being plate-like or with single or double lateral folds. One or more pyrenoids are present. Reproduction is by quadriflagellate zoospores.

Considerable attention was given during this study to finding and culturing specimens of Ulothrix and its related genera, particularly of the smaller filaments, those under 10u broad. Some of the results have been interesting, although not as yet conclusive. The clearest indication which emerged is that there is some difference existing among the smaller ulotricaceous filaments, although whether the differences are the ones which earlier investigators such as Hazen had in mind, is difficult to state. Moreover, it should be understood that this study has been a limited one, and differences such as have been drawn between U. tenerrima Kuetz. and U. variabilis Kuetz. may not seem the same after study of a considerable amount of herbarium specimens and further observation of living material.

1. Cells 11-45u broad.................................. 2

1. Cells 10u or less broad............................. 4

   2. Cells 25-45u broad..........................

      .... U. zonata (Webber & Mohr)Kuetz.

   2. Cells less than 20u broad...................... 3

3. Cells 1-2 times as long as wide, 13-

   16u broad................... U. aequalis Kuetz.

3. Cells ½ times as long as wide, 11-20u broad.................... *U. tenuissima* Kuetz. .... including *U. oscillarina* Kuetz.

4. Chloroplasts yellowish-green, in culture often becoming distorted, torn, and spreading; cells often tumid, especially in older specimens; W 5-9.5u (Hazen 7.5-9u)............... .... *U. tenerrima* Kuetz.

4. Chloroplasts a clear grass-green, holding shape well in culture; cells rarely tumid; W 5-8u (Hazen 5-6u)................. *U. variabilis* Kuetz.

1. *Ulothrix aequalis* Kuetz. (Hazen f)(Prescott f)

Unbranched, elongated filaments; cells cylindric or tumid; chloroplast plate-like, folded on both sides, color bright green. Cells L 1-2 times width; W 13-16u. Davidson: on stones in brook near hwy U.S.70 at Kingston Springs 5 March 1939 (Bold)#B-3947.[1]

2. *Ulothrix tenerrima* Kuetz. (Hazen f)(Prescott f)(Smith) Pl. 6, Fig. 7.

Green floccose masses of filaments as described by Hazen under certain conditions (see #2298 below); unbranched, elongated, attached by basal holdfasts; cells cylindric or tumid; chloroplast plate-like sometimes forming double fold, but often with one fold or flat, tinge of yellow color in green. Cells quadrate to 1½ times longer than broad; W 5-9.5u (Hazen 5-6.5u). The chloroplast in some specimens is, as Hazen stated, "like a miniature specimen of Ulothrix zonata". Greene: drain outflows of Nolichucky Dam 25 June 1949 #915 - Jefferson: on rocks in swift outflow of Cherokee Dam 25 June 1949 #904 - Union: in drain between fish bait pools at Hickory Star Dock 22 July 1950 #2298 (an exceptionally good specimen) - Marion: wooden minnow trough at Harvan's near Sequatchie 28 June 1949 #994. VNK.

3. Ulothrix tenuissima Kuetz. (Hazen f)(Prescott) Pl. 6, Fig. 8.

Unbranching, elongated filaments; cells cylindric or tumid; chloroplast single, plate-like, folded on both sides. L half width or less; W 10-20u. The size limits stated here include the limits of U. oscillarina Kuetz. because of the writer's doubt that a statistically valid difference in measurements can be shown. Moreover, such plants as #2050 develop thick walls of the sort used to differentiate the brackish water species, U. flaccida (Dillw.)Thur. and it may be conjectured whether this species, too, is valid. Roane: boat bottom at Kingston Dock on Watts Bar Lake 16 March 1940 #2050 - Davidson: on stones in brook near hwy U.S.70 at Kingston springs 5 March 1950 #2052 - Davidson: on stones in brook near hwy U.S.70 at Kingston springs 5

March 1939 (Bold)#3947[1] - Sumner: on rocks in small stream by hwy U.S.31-E northeast of Gallatin 27 March 1950 #2198. VNK.

4. Ulothrix variabilis Kuetz. (Hazen f)(Prescott f)(Smith) Pl. 6, Fig. 9.

Unbranched, elongated filaments with some tendency to break up into shorter lengths, cells breaking apart and becoming slightly misshapen forms described as rhizoidal by Hazen and others; cells cylindrical; chloroplasts quite variable occupying either little or most of cells, folded singly, doubly, or flat, all variations frequently occurring in single filament. Cells described as ½-1½ times long as broad, but often much longer; W 5-8u.

This designation is a tentative one for the specimens, since it is felt that they belong with or close to Hormidium subtile Kuetz.)Heering.

Sevier: roadside drain at Clingman's Dome parking area on North Carolina state line 10 Sept. 1949 #1889 - Montgomery: in flume of Ringgold Mill 18 March 1950 #2084 - Henry: old typha pool in clay pit at Wallace Motor Court south of Henry by hwy U.S.79 19 March 1950 #2119 - Lake: slough at Reelfoot Lake Spillway 14 June 1950 #2269. VNK.

5. Ulothrix zonata (Webber & Mohr)Kuetz. (Hazen f)(Prescott f)

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1 Reported in Silva, 1949

Elongated filaments of cylindrical or slightly tumid cells; chloroplast a yellow-green, parietal ring-like band, several pyrenoids present. Cells L slightly shorter than quadrate to 1½ times width; W 25-45u. Uniseriate strands of Schizomeris Leibleinii Kuetz. are often mistaken for this species. Davidson(?): Cumberland River 1938-9.[1]

URONEMA Lagerheim 1887

The characters distinguishing this genus are the Ulothrix-like general appearance of the sessile unbranched filaments, with limited growth and an acuminate apical cell. The chloroplast is a flat or slightly folded plate, which covers two thirds or less of the cell. There are one to three pyrenoids.

Even after the writer had seen convincing specimens agreeing with the description of the genus, the doubt remains as to whether the differences between Uronema and Ulothrix justify the existence of separate genera. Uronema filaments are not of limited growth as they are described, rather they are of indefinite length, as are those of Ulothrix. Germlings of Ulothrix tenerrima Kuetz. (as employed here) come close to the qualifications described for Uronema, since they have distinctly pointed ends, and differentiation must rest on the uncertain characters of asymmetrically pointed tips and proportionately longer cells in

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1 Reported in Lackey, 1942

Uronema.

Uronema confervicola Lag. (Collins)(Smith) Pl. 5, Fig. 8.

Unbranched, attached filaments of cylindrical cells; chloroplasts plate-like, covering from half to three quarters of the cell length; apical cells asymmetrically pointed. L 2½-4 times width; W 5u. Attempts to separate this species from the other species of the genus U. elongatum Hogdetts are disappointing since such specimens as #1850 have the proportions (length 4-13 times the width) of U. elongatum but the size range of U. confervicola. Knox: in plankton from backwater of Ft. Loudon Lake at Knoxville Waterworks 25 July 1949 #1579 - on pilings same site, same date #1580- culture at Univ. Tenn. botanical laboratory 1 Aug. 1949 - Colbert(Ala.): on rocks in Pickwick Lake at Sheffield 2 Oct. 1949 (Hall)#1971 - Weakley: pond at H. D. Hager's farm east of Martin by hwy U.S.22 14 June 1950 #2246.

Microsporaceae

MICROSPORA Thuret 1850

The filaments of this genus are of indefinite length, and lack holdfasts. The cells are cylindric or tumid and contain reticulate chloroplasts. In most cases the chloroplasts are so obscured by numerous starch granules that the precise structure cannot be detected. The walls become impregnated with secondary deposits in such a manner that they separate at the middle part of the cells leaving H-shaped pieces, the cross wall of the cells being the cross piece of the "H". The "H" pieces, when present, are a fine mark of distinction from all other common genera except Tribonema but unfortunately young(?) plants of the smaller species fail to show them, even when treated with sodium hydroxide, and hence identification is rather difficult.

The genus has been subjected to a taxonomic study by Mrs. Grace Phinney, who, however, has not as yet published her conclusions. Nevertheless, the names employed by her and some of the specimens examined are familiar to this writer through the Cryptogamic Herbarium of the Chicago Natural History Museum, and through correspondence with Mrs. Phinney. Her treatment of the genus has neccessarily colored the reasoning employed in this study on Microspora, and the conclusions on nomenclatural priority from Mrs. Phinney's study are followed unquestioningly. One deviation here from her monographic study is the use of M. pachyderma (Wille)Lag. for the thick-walled forms about 7-9u broad.

The four other species found here are separated on size alone, and the difference between M. stagnorum (Kuetz.) Lag. and M. tennerrima (Kuetz.)Gay may not be as distinct as indicated here.

Tumidity and cell proportions do not appear to stand as bases for precise species differentiation.

1. Cells 22-33u broad..... M. amoena (Kuetz.)Lag.

1. Cells smaller.................................. 2
   2. Walls conspicuously thick, cells
      7-14u broad, sometimes tumid...............
      .... *M. pachyderma* (Wille)Lag.
   2. Walls relatively thin.......................... 3
3. Cells 11-20u broad......... *M. Wittrockii* Lag.
3. Cells 10u broad or smaller...................... 4
   4. Cells 7.5-9.5u broad.......................
      .... *M. stagnorum* (Kuetz.)Lag.
   4. Cells 5-7u broad.. *M. tenerrima* (Kuetz.)Gay

1. *Microspora amoena* (Kuetz.)Lag. (Hazen f)(Prescott f) (Smith) Pl. 7, Fig. 1.

This is the largest species. Cells L 1-2 times width; W 22-33u. Madison(N.C.): forming bunches in small clear rocky stream near Tenn. state line by hwy N.C.208 25 June 1949 #928 - Knox: on vegetable matter in roadside puddle southeast of Knoxville 19 March 1947 #532.[1] VN.

2. *Microspora pachyderma* (Wille)Lag. (Collins)(Prescott f) Pl. 7, Fig. 3.

These are the consistently thick-walled plants. Cell L 1-2 times width; W 7-14u. Sevier: trailside bank near Newfound Gap 10 Sept. 1949 #1892 - Marion: clinging to mint in stream at junction of hwys Tenn. 28 & 108 in Sequatchie

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1 Reported in Silva, 1949

Valley 28 June 1949 #1000 - Jackson(Ala.): embayment of Guntersville Lake north of Scottsboro at hwy U.S.72 bridge 17 June 1950 #2294 - Weakley: middle fork of Obion River northeast of Greenfield 23 June 1949 (Clebsch)#1906 - Gibson - Obion: bottom coating on Abe Shatz' farm east of Kenton 8 July 1949 #1238.

3. Microspora stagnorum (Kuetz.)Lag. (Hazen f)(Prescott f) (Smith)

Cells cylindric or rather tumid. Cells L 1-3 times width; W 7.5-9u. Cell proportions and tumidness vary according to age and habitat conditions. Sevier: gently flowing water below Charlie's Bunion 6 Sept, 1941 #161[1] - Morgan: rushing rocky stream by hwy U.S.27 south of Wartburg 15 July 1949 #1501 - Lauderdale(Ala.): pool near Cypress Creek at Florence 3 Oct. 1949 (Hall)#1962 - Lewis: catch basin in poorly drained, infertile soil of western Highland Rim country near Hohenwald 29 June #1067 - Henry: fairly large pond containing Juncus and Typha by hwy U.S.79 east of Paris 14 July 1949 #1349 - Obion: barnyard puddle beside Walnut Log Road from Union City 14 June 1950 #2249. NSGFKM.

4. Microspora tenerrima (Kuetz.)Gay. (Gay 1886 f)

The smallest forms of Microspora are placed here. Cells L 1-3 times width; W 5-7u. All of the identifications of

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1 Reported in Silva and Sharp, 1944

Tennessee plants are tentative. Lumpkin(Ga.): on pilings of artificial lake in Vogel State Park 14 Aug. 1949 #1735 - Greene: in drain outflows from Nolichucky Dam 25 June 1949 #915 - Knox: on rock below surface of water in quarry hole at Neubert's Springs 20 July 1949 #1534 - Montgomery: woods swamp by roadside south of Guthrie Kentucky on hwy Tenn. 11 18 March 1950 #2099 - Henry: pool in piles of limey mud on west bank of Kentucky Lake near Paris Landing 19 March 1950 #2116 - Weakley: barrel sunk in spring branch about four miles north of Gardner Station 8 July 1949 #1220 - Obion: shallow shore area on south side of Isom Lake 10 July 1949 #1269.

5. Microspora Wittrockii Lag. (Hazen f) Pl. 7, Fig. 2.
(including Microspora Willeana Lag.)

Belonging here are the medium-sized forms. Cells L 2/3 - 2½ times width; W 11-20u. Sevier: on rock with water trickling over it at base of Charlie's Bunion (4500 ft.) 6 Sept. 1941 #162[1] - Knox: on plants in Lakeside Lake, a sink-hole just south of Knoxville 20 July 1949 #1537 - Putnam: on drying rocks of spring north of hwy U.S.70-N near Caney Fork 14 June 1949 #822 - Wilson: creek running over shelving limestone of central basin west of Lebanon on hwy U.S.70-N 14 July 1949 #1415 - Benton: roadside bank south of Camden 10 May 1949 (Sharp)#1980 - Henry: pool in piles of limey

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1 Reported in Silva and Sharp, 1944

mud on west bank of Kentucky Lake near Paris Landing 16 March 1950 #2116.

Cylindrocapsaceae

CYLINDROCAPSA Reinsch 1867

Cylindrocapsa geminella Wolle. (Prescott f)(Smith f) Pl. 7, Fig. 4.

This species is so polymorphic that a considerable number of observations are neccessary before determinations can be made. On one hand, there are well-formed, uniseriate filaments composed of regular oblong cells within a thin gelatinous sheath. This was in a stable aquatic environment. When first observed these filaments were forming antherozoids and were multiseriate and unlike anything one would expect from most species descriptions. In a mud habitat, on the other hand, the filamentous organization was found to be obscured or completely lost, and only the morphology of the cells and the surrounding stratified gelatinous envelope indicated that it was the same as the filamentous plant. The chloroplasts are massive, with a single pyrenoid. L quadrate to about twice width; W up to about 20u. Knox: bottom coating on microcosm in Univ. Tenn. botanical laboratory 11 Aug. 1949 #1704 - culture at collector's home 27 Aug. 1949 #1865 - Roane: boat bottom at Kingston Boat Dock on Watts Bar Lake 16 March 1950 #2052 - Davidson: on Cladophora spp. in Hidden Lake 17 Sept. 1938 (Bold)#B-104[1] -

Henry: gravel pit east of Paris by hwy U.S.79 19 March 1950 #2118 - Shelby: goldfish pond at Memphis Zoological Gardens 20 March 1950 #2129. NK.

Chaetophoraceae

APHANOCHAETE A. Braun 1851

Aphanochaete repens A. Braun. (Prescott f)(Smith f) Pl. 7, Fig. 5.

Filaments branching, resupinate or creeping, epiphytic on filamentous algae, frequently on Pithophora, Cladophora, or Oedogonium spp.; setae borne singly on mature cells as much as 100u in length; cells tumid; chloroplast a parietal plate. L quadrate to about twice width; W 5-10u. Davidson: on Oedogonium spp. in small overflow lake near Radnor Lake 20 Aug. 1949 #1803 - fishpool by Vanderbilt University greenhouse 17 March 1950 #2060 - Montgomery: King & Queen Bluff on Cumberland River three miles southeast of Clarksville 24 Sept. 1949 (Clebsch)#1940 - Obion - Lake: epiphytic on Cladophora aegagropila Kuetz. at stump in Blue Basin of Reelfoot Lake 2 July 1949 #1159.

CHAETOPHORA Schrank 1789

This branched ulotricoid genus is characterized by a gradual reduction in size between the cells of the main filament and branches and the macroscopically recognizable gelatinous colonies which are spherical in all species except C. incrassata, which has flat, expanded, and branched colonies. Determination of species should not be attempted from juvenile plants, since the key characters do not develop until after a certain amount of growth. Size of the main branches is worthless as a character, so the branching habit is virtually the only criterion of differentiation. Branch form and arrangement are characters far more difficult to describe than to observe, especially in distinguishing species.

1. Colonies elongated, flat, branched............
 .... *C. incrassata* (Huds.)Hazen
1. Colonies spherical................................ 2
 2. Branches fascicled at summit, main
  branches 6-8u broad.............................. 3
 2. Branches not fascicles, main branches
  2-5.5u broad........... *C. attenuatum* Hazen
3. Branching loose, spreading branches
 with a sharp line of fasciculation,
 with shorter ultimate branches................
 .... *C. elegans* (Roth)Ag.
3. Branching compact, with a less sharp
 line of fasciculation, and longer
 ultimate branches.......... *C. pisciformis* Ag.

1. *Chaetophora attenuata* Hazen (Hazen f)(Prescott f)(Smith)

Colonies globose; erect and unfascicled branches, described as being smaller in width than those of the other species with globose colonies. Cells W 5-5.5u in the main filaments. Greene: swamp created by road building and choked with Typha, Juncus, Salix, and Carex and well fertilized, beside hwy Tenn.70 near N.C. state line 25 June 1949 #926. N.

2. Chaetophora elegans (Roth)Ag. (Hazen f)(Prescott f)(Smith)

Colonies globose; the best diagnostic characters being the combination of the loose branching fascicled toward the outside of the colony; possible added character the occurrence of the fasciculation in a sharply marked peripheral area, with the ultimate branches being short, although they may be further tapered into long setae. Cells W 8u in the main filaments. Knox: globular jelly masses among weeds in water at Carter's Mill 2 April 1947 #560[1] - Stewart: stream west of U. S. Grant's headquarters in marshy place by hwy U.S.79 19 March 1950 #2114 - Gibson - Obion: inlet to highest pond, fertilized for fish raising, on Abe Shatz' farm east of Kenton 8 July 1949 #1237 - Obion: roadside puddle near Trimble 8 July 1949 #1252. NK.

3. Chaetophora incrassata (Huds.)Hazen. (Hazen f)(Prescott f)(Smith f) Pl. 8, Fig. 1.

Colonies flat, much branched, tattered looking, yellow-green, bearing a superficial resemblance to Batrachospermum,

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1 Reported in Silva, 1949

but unlike any other alga; end cells tapering to long sharp point. Median cells L 2-6 times width; W 6-11u. Although only two collections of this species are recorded here, it is undoubtedly a farily common "spring sprout" in clear running or still water. It might be noted that in spring streams of Lousiana, C. incrassata occupies with a remarkable consistency the same habitats as Batrachospermum Boryanum Sir. and other Batrachospermum spp. Montgomery: Cunningham Lake, which is fed with a small stream, near Clarksville 30 April 1948 (Clebsch)Clebsch #7[1] - on rocks in Ringgold Creek at Peacher's Mill 18 March 1950 #2088.

4. Chaetophora pisiformis Ag. (Hazen f)(Prescott f)(Smith) Pl. 8, Fig. 2.

Colonies spherical; accepted diagnostic characters are the combination of compact branching with fascicled apices; added possible character is that the line of fasciculation between main branches and tufts is not marked as in C. elegans and the ultimate branches are longer, disregarding the setae to which many of them taper; size of the main branches, which is usually described as 6-7u in width (intermediate between C. elegans and C. attenuata) should not be assigned too much importance. Franklin: on sticks etc. in pond above Cowan 4 April 1949 (Sharp)#1989 - Montgomery: seepy stream in gum-oak woods near Oakwood 18 March 1950 #2066 -

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1 Reported in Silva, 1949

Benton: globular gelatinous masses floating in pond south of Birdsong Landing 10 May 1949 (Sharp)#1982 - Obion: in Nelumbo area of Reelfoot Lake near Samburg 12 July 1949 #1307.

CHLOROTYLIUM Kuetzing 1843

Chlorotylium cataractarum Kuetz. (Smith f) Pl. 8, Fig. 3.

Although the normal condition of the species is described as a dichotomous, much-branched filament, in which there is little or no reduction in size between orders of branching, only occasionally could doubtful signs of branching be found here; cells cylindric, tumid or irregular; chloroplast a parietal plate. Cells L one-several times width; W 8-14u. The identification of these specimens is made with reservations. They all came from irregular, lime-encrusted masses, in both running and standing waters. In all collections the plants were in a flat thalloid form, described as "palmelloid" but differing from the palmelloid form of Gloeocystis, Cylindrocapsa, or Chlamydomonas since little gelatinous matrix encloses the cells. Campbell: limestone pools below high water line at entrance of small stream to Cove Creek inlet of Norris Lake 12 April 1947 #632[1] - Giles: limestone creek 6 April 1949 (Sharp)#2006 - Lincoln: gelatinous green mass in roadside limestone creek 1 April 1949 (Sharp)#2007.

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1 Reported in Silva, 1949

DRAPARNALDIA Bory 1808

The large main filaments with fascicles of much smaller side branches characterize this genus rather definitely. However, the species are not perfectly distinct, Hazen traces a phylogenetic line of development among the species, and his line of reasoning deserves review. This is all the more appropriate since Hazen registered serious doubt at several points in the classification which he derived from his phylogenetic reasoning.

1. Definable axis running to summit of branch fascicles.................................. 2
1. No definable axis in branch fascicles.............. 3
   2. Fascicles erect, lanceolate, elongated............... D. plumosa (Vauch.)Ag.
   2. Fascicles spreading, with axis sometimes bent back on main filament.................. C. acuta (Ag.)Kuetz.
3. Cells of main filaments inflated, with narrow chloroplast.. D. glomerata (Vauch.)Ag.
3. Cells of main filaments cylindrical, chloroplast broad........ D. platyzonata Hazen

1. Draparnaldia acuta (Ag.)Kuetz. (Hazen f)(Prescott f) (Smith) Pl. 9, Figs. 1a,b.

This species and D. plumosa (Vauch.)Ag. have a discernible secondary main axis in their small lateral bunches of branches which diverge from the main axis of the plant; D. acuta is distinguished by the spreading habit of the branch bundles, the main axis of which may be ascending or almost doubled back on the main axis; parietal chloroplast about half as wide as the cell length; main axis cells are 50-90u broad. Knox: in clear, cold, moderately fast spring run-off in Fountain City Park 23 May 1946 unnumbered[1] - Montgomery: in seepy stream in gum-oak woods at Oakwood 17 March 1950 #2067-8 - marshy pools beside hwy Tenn.11 south of Guthrie Kentucky near state line 18 March 1950 #2102. NK.

2. Draparnaldia glomerata (Vauch.)Ag. (Hazen f)(Prescott f) (Smith f)

Distinguished from D. platyzonata, which also lacks a distinct axis in the bundles of branches, by its narrow chloroplasts; inflation of the main axis cells, contrasted with the cylindrical ones of the D. platyzonata, is probably a less reliable character. VNGK.

3. Draparnaldia platyzonata Hazen. (Hazen f)(Prescott f) (Smith)

A broad chloroplast is the chief distinction of this species; short cylindrical shape of the cells also given as a character; width of the main axis is about the same as that of D. acuta and others. Main filament cells L ½-2 times width; W 50-90u. Sevier: on large rocks in Ramsey

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1 Reported in Silva, 1949

Prong (1600 ft.) 24 Nov. 1946 #368.[1] N.

4. Draparnaldia plumosa (Vauch.)Ag. (Hazen f)(Prescott f) (Smith)

The combination of lanceolate or elongated branch-bundle outline and definite primary axis in the bundle distinguish this species from D. acuta, in which the bundle axis is bent back on the main axis and the other branches spread to form an oval outline; frequent constriction at cross walls of the main axis; chloroplast one-fourth to one-third as broad as length. Main filament cells L 1-3 times width; W 40-70u. Sevier: clear, soil bottomed pool of stream below Newfound Gap Highway (1700 ft.) 20 April 1947 #607[1] - Knox: attached to limestone in small clear stream near dolomite quarry beyond Island Home 10 Jan. 1948 (Iltis)unnumbered - Scott: rivulet over shaley rocks in burnt-over area along hwy Tenn. 52 13 June 1950 #2232. NVK.

MICROTHAMNION Naegeli 1849

Microthamnion Kuetzingianum Naeg. (Hazen f)(Prescott f) (Smith f) Pl. 8, Fig. 4.

Filaments densely branched, not reducing in size from order to order, ends rounded; cells cylindric; chloroplast, described as parietal and laminate, covered the entire visible wall area in the specimens observed, structure obscure; branches arising from the upper end of rather long propro-

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1 Reported in Silva and Sharp, 1944

tioned cells; no cell wall formed for some distance from the branching cell's origin. Cells L 2-4 times width; W 3-5u.

Branching of this type may also be seen in Rhizoclonium fontanum Kuetz. M. Kuetzingianum is distinguished from the other reported American species, M. strictissimum Rab. by its lack of a main axis within the branching system. This species has been quite elusive, and the collections which were made were poorly developed. Sevier: clinging rocks and humus in Porter's Prong (3500 ft.) 6 Sept. 1941 #159[1] - Obion: slough near Spillway 5 July 1949 #1185.

STIGEOCLONIUM Kuetzing 1843

These plants are branched, the branches being gradually reduced in size, with a long taper in the ultimate branches. The characteristic gelatinous colonies of Chaetophora are not formed but rather large non-gelatinous strands are found under favorable conditions. The cells are cylindric or tumid, with a plate-like chloroplast.

The key presented below is Hazen's, but under the respective species are comments derived from the writer's own experience with them, experience which does not altogether substantiate the earlier concepts.

1. Branching predominately opposite.................... 2
1. Branching predominately alternate.................... 3

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1 Reported in Silva and Sharp, 1944

2. Main filaments 14-16u broad, secondaries 6-7u, cells up to twice width in length, apices short-pointed............ .... _S._ _lubricum_ (Dillw.)Kuetz.

2. Main filaments 7-10u broad, lower cells three widths long, apices long-pointed or setiferous................ .... _S._ _tenue_ (Ag.)Kuetz.

3. Short caespitose filament tufts of filament....................................... 4

3. Elongated filaments frequent...................... 5

4. Main filaments 6-8u broad, tips short-pointed...... _S._ _namum_ (Dillw.)Kuetz.

4. Main filaments 7-9u broad, ends attenuate or setiferous.................. .... _S._ _aestivale_ (Hazen)Col.

5. Filament diameter 5-7u.................... .... _S._ _attenuatum_ (Hazen)Col.

5. Filament diameter 8-11u.................... .... _S._ _stagnatile_ (Hazen)Col.

1. _Stigeoclonium_ _attenuatum_ (Hazen)Col. (Hazen f)(Prescott (including _Stigeoclonium_ _stagnatile_ (Hazen)Col.) f)(Smith) Pl. 9, Fig. 3.

Both this species and _S._ _stagnatile_ were described as a result of the same investigation and in the same publication by Hazen. The plants are alternately branched, with elongated filaments. The key character given to separate them is size, 5-7u broad for S. attenuatum and 8-11u for S. stagnatile. Furthermore, the former is said to have a thin and broken chloroplast while that of the latter is not described and the illustration provides no distinction. The different growth habit described is of limited value, S. attenuatum having been found in extremely long strands, and S. stagnatile in floating masses.

In the collections from this region, there is no consistent set of characters to differentiate the two species. This is especially true when the plants are grown in the controlled environment of the laboratory. It seems preferable to consider all the specimens with elongated filaments and alternate branching under one name. The only deviation worth mentioning was #2285 which had unusually rich branching. In two cases plants identified as other species became S. stagnatile by growth, but in other cases plants in the size range of S. attenuatum were preserved immediately, not grown in the laboratory where their development could be observed.

Jefferson: base of Cherokee Dam on rocks in swift outflow water 25 June 1949 #904 - Roane: on bottom of boat at Kingston Boat Dock on Watts Bar Lake 16 March 1950 #2052 - Monroe: propeller of ferryboat on river at Sweetwater 7 July 1938 (Bold)unnumbered[1] - Sumner: on rocks in small

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1 Reported in Silva, 1949

stream in field northeast of Gallatin 27 March 1950 #2198 - Colbert(Ala.): rocky stream entering Wilson Lake near dam 16 June 1949 #2285. S.

2. Stigeoclonium lubricum (Dillw.)Kuetz. (Hazen f)(Prescott f)(Smith) Pl. 9, Fig. 2.

This is the common species of the genus displaying opposite branches, but well-developed plants are required to make determination certain; and distinguish this species from the other five opposite-branched species; ultimate branchlets short-pointed, more or less crowded; cell walls thick. Cell L 1-2 times width; W 11-30u.

The larger size and crowded branching are said to distinguish the species from the other common opposite branched species, but Hazen adds that "The best specimens of S. tenue reproduce S. lubricum in miniature". Although he clearly stated that the two were distinct and even grow in the same site, culture work might furnish convincing proof that they are identical.

It is asserted here that between S. lubricum and S. lubricum v. varians Hazen there is no consistent difference, since intermediate plants such as #1943 and #1957 do appear. Sevier: roadside drain (pH 4.5-5.0) beside Roaring Fork Road half mile from Gatlingburg 24 Nov. 1946 #348[1] - Knox: attached to mint roots in running stream east of Knoxville

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1 Reported in Silva, 1949

Waterworks 25 July 1949 #1583-4 - Lauderdale - Colbert (Ala.): running water near ice plant at Sheffield 5 Sept. 1949 (Hall) #1957 - Montgomery: ditch outside W. S. Austin's farm at junction of Foster's Cave Road and hwy U.S.79 18 March 1950 #2081. VGF.

3. Stigeoclonium nanum (Dillw.)Kuetz. (Hazen)(Prescott f) (Smith)

Plants described as short, predominantly alternate branching, caespitose filaments, with short-pointed ends; cells cylindric, tumid or irregular. L 1-2 times width; W 6-8u. This species was recorded in three or four cases, and, if the species had been preserved immediately, the species could have been written of with some assurance. Since some of them were allowed to grow in the laboratory, however, they developed similarity to other species - S. attenuatum, S. stagnatile, and S. lubricum. None maintained the short, caespitose filaments which designate S. nanum (with short pointed branch ends) and S. aestivale (Hazen)Col. (with attenuated or setiferous apices). There is no insistence here that these two species are without validity, particularly not without having seen the types, and only a limited amount of other material. It is suggested, however, that nature of the habitat may keep plants permanently in a short, caespitose condition, and that laboratory growth of typical specimens of these species under standard conditions is desirable.

Roane: on bottom of boat at Kingston Boat Dock on Watts Bar Lake 16 March 1950 #2052 (this developed into S. attenuatum-stagnatile) - Montgomery: rainwater lake in river bottom near Edmonson's Ferry on Cumberland River 31 Dec. 1949 (Clebsch)#2037(material preserved) - marshy pools in woods swamp south of Guthrie Kentucky near state line by hwy Tenn. 11 18 March 1950 #2101 (this was S. lubricum when collected, then formed spores, disintegrated, and finally the spores grew into fine examples of S. nanum).

4. Stigeoclonium stagnatile (Hazen)Col. (Hazen f)(Prescott f)(Smith)

See S. attenuatum (Hazen)Col.

5. Stigeoclonium tenue (Ag.)Kuetz. (Hazen f)(Prescott f)(Smith f)

Filaments with opposite branching; ultimate ends tapering or setiferous; lower cells cylindrical. L 1-2 times width; W 7-10u. The smaller size is used to separate it from S. lubricum, and the possible relation between the two is discussed under that species. Sevier: on submerged rocks in stream by Grassy Patch parking area 12 Aug. 1941 #39.[1]

Protococcaceae

PROTOCOCCUS Agardh 1824

Protococcus viridis Ag. (Prescott f)(Smith f) Pl. 10,

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1 Reported in Silva, 1949

Fig. 1.

Irregular clumps result from the usual grouping of the cells; cells globular, angular or cubical by mutual compression or incomplete separation, sometimes short filaments are formed, and cells growing in water are often quite spherical, as well as being much brighter in color than terrestrial cells; chloroplast a parietal plate not unlike that found in most of the rest of the Ulotricales, usually obscured and diffuse, without discernible structure. Diameter 8-20u. The species is quite common in the region, being best known as the scurfy green coating on tree bark (notably on the more moist side, hence the "moss" on the north side of trees.) Sevier: wet timber at upper Newfound Gap Road tunnel 13 Aug. 1949 #1711 - Grainger: bark of tree near Avondale Springs 5 May 1947 #591[1] - Knox: on cow excrement Univ. Tenn. Farm 30 Nov. 1947 (Iltis)unnumbered - Madison: wet wood below water faucet on West Tenn. Experiment Station Farm 30 June 1949 #1102-3. VNFK.

Coleochaetaceae

CHAETOSPHAERIDIUM Klebahn 1892

Chaetosphaeridium globosum (Nordst.)Kleb. (Prescott f) (Smith) Pl. 10, Fig. 2.

This is a most distinctive plant, easy to recognize as

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1 Reported in Silva, 1949

small epiphytic spheres with long setae which are enclosed by a sheath around the base; even if the seta is absent the erect sheath furnishes ample identification; chloroplast cup-shaped, containing single pyrenoid. Diameter of cells 12-18u. Davidson: on Oedogonium in concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1823 - Weakley: roadside marsh just west of Kenton by county road 8 July 1949 #1244.

COLEOCHAETE de Brébisson 1844

Filaments branching, but branches laterally united to form a flat or cushion-like thallus. Ulotricoid chloroplast common to other plants of the order quite evident, and there are long single setae on some of the cells. The setae are surrounded by a sheath at their bases.

1. Filamentous structure somewhat discernible, with incomplete lateral fusion of branches....... C. irregularis Prings.
1. Filamentous structure obscure, thallus a flat circular expanse............................. 2
   2. Cells 8-16u in diameter, thallus outline regular.......C. orbicularis Prings.
   2. Cells 25-45u in diameter, thallus outline irregular...........C. scutata Bréb.

1. Coleochaete irregularis Prings. (Collins)(Prescott) (Smith) Pl. 10, Fig. 6.

The cells are about the same size as those of C. orbicularis (Collins reports "up to 25u"), but there is comparatively little lateral union of the filaments and a most irregularly lobed colony is the result. Claiborne: permanent pond north of Tazwell 26 June 1938 (Bold)unnumbered[1].

2. Coleochaete orbicularis Prings. (Collins)(Prescott f) (Smith)

Thallus possessing smaller cells (10-20u in diameter) and more regular outline than C. scutata Bréb. This identification was obtained from the reliable records of H. C. Bold, but whether or not the species is distinct from C. scutata Bréb. is an open question. Both show more or less circular thalli formed by lateral fusion of filaments radiating and branching from the center. Both species produce thalli one cell thick, exhibit the ulotricacean chloroplast and have frequent setae with sheathed bases. Claiborne: permenent pond north of Tazwell 26 June 1938 (Bold)unnumbered.[1] FK.

3. Coleochaete scutata Bréb. (Collins)(Prescott f)(Smith f) Pl. 10, Fig. 5.

Flat thallus formed from lateral fusion of radiately branching filaments, outline irregular; cells irregularly polygonal, some with erect setae. Diameter of cells 25-45u. Its larger cells and irregular outline are used to distinguish it from C. orbicularis. This is the most fre-

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1 Reported in Silva, 1949

quently encountered species of the genus. Moore: rocks of spring branch at Cumberland Springs 29 June 1949 #1039 - Obion: on leaves of Potamogeton in Reelfoot Lake at Samburg 2 July 1949 #1165. Several other cases were observed, but not properly recorded. NVFK.

Trentepohliaceae

TRENTEPOHLIA Martius 1817

The branched filaments of this genus form mats or felty tufts on ledges, tree trunks or other terrestrial sites. The cells are cylindrical or slightly tumid, and contain chloroplasts, varying in shape from discoid to elongated ribbon-like, and often so much haematochrome is present as to obscure the internal cell structure completely.

Although only three Tennessee collections are listed here for the genus, it is fairly common, and might be found on any shelving rocky bluff which is slightly moist. Lichenization to form Coenogonium nigrum (Huds.)Zahlbr. is frequent. In this case the lichen is dark brown to black rather than the green or yellow-red of the fungus-free plant. Coenogonium nigrum is of special interest as a lichen because the alga alone dictates the form of the plant while the fungal component merely forms a sheath around it. In addition to the two species included here, a few others such as T. effusa (Kremp.)Har., T. odorata (Wiggers)Wittr., etc. are quite as likely to be encountered in the region.

1. Cells 8-30u broad, chloroplasts several, discoid.................. *T. aurea* (L.)Martius
1. Cells 4-10u broad, chloroplasts in bands.............. *T. abietina* (Flotow)Hansg.

1. *Trentepohlia abietina* (Flotow)Hansg. (Collins)(Heering) (Smith) Pl. 10, Fig. 3.

It only can be stated of the specimens considered here that they are within the described size range, and exhibit relatively long cells, considerably longer in proportion than those described for *T. aurea*. In addition, the cells contain about three slightly spiral band-like chloroplasts. The characters which we have been able to find to differentiate this species from *T. aurea* are rather vague, except for the size, and are of rather dubious value. However, these plants certainly differ from specimens collected in Mexico, which contain discoid chloroplasts and measure within the size and proportions of *T. aurea*. L about three times width; W 4-10u. Fentress: dry ledge by roadside near Pall Mall 15 July 1949 #1495 - Bell(Ky.): moist surface of huge boulder in Hemlock Gardens at Pine Mt. Recreation Area 10 June 1949 (Sharp)unnumbered. F.

2. *Trentepohlia aurea* (L.)Martius. (Collins)(Heering f) (Smith f) Pl. 10, Fig. 4.

A multitude of erect branches give the red, orange, or yellow patches of the alga a felty appearance, whereas microscopically the filaments are seen to be composed of cylindrical cells, the contents of which often show an obscure structure; chloroplasts several small disc-shaped. Cells L 1½-2 times width; W 10-30u. Sevier: wet, exposed rock (6000 ft.) Myrtle Point 4 Sept. 1941 #416.[1] VNS.

Schizogoniales

Schizogoniaceae

SCHIZOGONIUM Kuetzing 1843

Schizogonium murale Kuetz. (Collins)(Smith f) Pl. 11, Fig. 1.

Filaments are uniseriate and unbranched; cells tumid; chloroplast single, stellate, filling most of cell, containing single pyrenoid. Cells quadrate or shorter; W 10-15u. Reports of this species indicate an alpine and northern range. It is a terrestrial plant, and is found on wet rocks, or on earth or wood. Swain(N.C.): - Sevier(Tenn.): wet trailside rock (5500 ft.) on Appalachian Trail 7.9 miles east of Newfound Gap 6 Sept. 1941 #117.[1] VN.

Chlorococcales

Chlorococcaceae

ACANTHOSPHAERA Lemmermann 1899

Acanthosphaera Zachariasi Lemm. (Prescott f)(Smith f) Pl. 12, Fig. 1.

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1 Reported in Silva and Sharp, 1944

Cells spherical with a cup-shaped chloroplast, which usually appears to fill the cell; single pyrenoid; several scattered setae on surface, thick near the base and then abruptly taper and extend out in very slender needles to three or more times the diameter of the cell proper. Diameter of cells 10-14u. This may be a more common plankter than the few reports indicate. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

CHLOROCOCCUM Fries 1820

Chlorococcum humicola (Naeg.)Rab. (Prescott f)(Smith f) Pl. 12, Fig. 2.

Cells spherical; chloroplast may be cup-shaped but is usually diffuse and completely obscured with starch grains, one pyrenoid in young cells, more in older ones. Diameter up to 20u. Some cells are unsymmetrical and older cell walls are thicker than young ones, but stratified membranes have not been observed during this study. Reproduction by zoospores was not actually observed, but elongate, internally formed, cells were occasionally observed. The frequent means of multiplication was by eight, sixteen, or more autospores, (miniatures of the parent cell). The parent cell wall breaks and the daughter cells enlarge directly to form vegetative cells. Nothing observed was comparable with the palmelloid colony formation described in Smith, 1933 and else-

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1 Reported in Lackey, 1942

where, so entirely different organisms may have been under consideration. A great host of round or unsymetrically spheroid unicellular organisms can be labeled Chroococcum without any question in accord with the descriptions given. However, the skeptical observer eventually realizes that there are many algae of similar general description which a simple microscopic examination cannot differentiate. Only intensive culturing, and perhaps cytological study can furnish valid answers. Such a careful investigation is being conducted by Mr. Richard Starr at Vanderbilt University and the results are being awaited with eagerness.

At present, the writer's limited study is based on microscopical examination of field collections and cultures of soil, but does not include employment of unialgal culturing or the following of life cycles through altered conditions.

Among the many algae of the same general nature, there have been a few which agree with the description of C. humicolum best, and so are reported here. The agreement was purely a matter of the writer's judgment.

Sevier: wet rocks in Little River Gorge 4 Aug. 1949 #1645 - Knox: floating with other algae in stagnant pond east of Knoxville Waterworks 25 July 1949 #1587 - bottom coating of microcosm at Univ. Tenn. botanical laboratory 9 Aug. 1949 #1704 - Fentress: wet dripping sandstone rocks by roadside near Pall Mall on muddy ledge 15 July 1949 #1492 - Lauderdale(Ala.): farm near creek just above Joe Wheeler Dam by hwy U.S.72 17 June 1950 #2289. VNF.

TREBOUXIA de Puymaly 1924

Trebouxia Cladoniae (Chod.)G. M. Smith. (Smith f) Pl. 12, Fig. 3.

Cells spherical; chloroplast massive and axial with an irregular lobed margin, containing a single central pyrenoid; reproduction by autospores or zoospores. Diameter up to 12u. Although a single record is reported here, the same plant was found in twelve green alga lichens collected in different parts of the Tennessee region. Sevier: lichens along trailside on Mt. LeConte on Rainbow Falls trail 20 Aug. 1950 #2327 vicinity. N.

GOLENKINIA Chodat 1894

These spherical planktonic cells are actually solitary, but may adhere in small groups when their characteristic long setae become entangled. The chloroplast is cup-shaped.

1. Cells 15-16u in diameter, spines 16u long................. G. paucispina West & West
1. Cells 8-15u in diameter.................................. 2
   2. Spines 15-20u long.........................
      ..... G. radiata v. brevispina Tiff. & Ahl.
   2. Spines 25-45u long........ G. radiata Chod.

1. Golenkinia paucispina West & West. (Prescott f)(Smith f)

Cells are spherical with spines which are shorter than those of *G. radiata* and possibly thicker than those of *G. radiata* v. *brevispina*. The latter also usually has smaller cells; cell diameter 15-16u; spines 16u long. Middle Tenn.: Duck River 1938-9.[1]

2. *Golenkinia radiata* Chod. (Prescott f)(Smith f) Pl. 12, Fig. 4.

The diameter of the cell proper is 7-15u, and the setae are 25-45u long. The lack of thickened lower parts on the setae differentiate it from *Acanthosphaera Zachariasi* Lemm. Davidson(?): Cumberland River 1938-9[1] - concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1821 - Cheatham: soil bottomed fish raising pools on Little Marrowbone Creek Road 20 Aug. 1949 #1846.

3. *Golenkinia radiata* v. *brevispina* Tiff. & Ahl. (Tiffany and Ahlstrom f) Pl. 12, Fig. 5.

The variety has shorter spines than the typical form of the species. Diameter of cells 8-15u. Spines L 15-20u. Knox: pond at Mack's about five miles east of Knoxville on hwy U.S.11-E 19 June 1949 #857 - Obion: mud puddle near Marvin Hayes' fish tank 12 July 1949 #1321.

DESMATRACTUM W. & G. S. West 1902

Desmatractum bipyramidatum (Chod.)Pasch. (Smith f) Pl. 12, Fig. 6.

Cells spherical, containing a cup-shaped chloroplast;

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1 Reported in Lackey, 1942

surrounded by a broad, spindle-shaped gelatinous envelope which is a light brown color; envelope rosette-shaped in end view and has an equatorial ridge in side view along which it splits at cell division. Cells L 16-17.5u; W 6-7u. Davidson(?): Cumberland River 1938-9.[1]

Characiaceae

CHARACIUM A. Braun 1849

These unicellular sessile forms should always be compared with Characiopsis, and with the germlings of such plants as Ulothrix and Oedogonium whereas a positive starch test distinguishes the genus from the Charciopsis, only experience and observation can aid in determining whether one is dealing with Characium instead of a germling. The chloroplast is described as parietal, but appears as a flat plate including one or more pyrenoids.

1. Cells sessile or with exceedingly short stipe.. 2
1. Cells with discernible stipe........................... 3
   2. Linear-lanceolate shaped with unequal curvature to sides, very short stipe slightly flared at the base, length/width ratio about 3/1................ .... C. ensiforme Hermann

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1 Reported in Lackey, 1942

2. More linear, length/width ratio
about 4/1.............. C. ambiguum Hermann
3. Long slender stipe of length greater than
cell length, body of cell subspherical........
.... C. stipitatum (Bach)Wille
3. Stipe shorter, more robust........................ 4
4. Cell body extremely elongate with
parallel sides......... C. limneticum Lemm.
4. Cell body oval or elliptic...................... 5
5. Cell body broadly rounded oval, ovoid,
or elliptic..... C. Debaryanum (Reinsch)DeToni
5. Cells less broadly oval, lanceolate,
or elliptic.................................... 6
6. Apical end sharp-pointed................
.... C. Braunii Bruegger
6. Apical end blunt...... C. strictum A. Braun

1. Characium ambiguum Hermann. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith) Pl. 12, Fig. 7.

Cells linear-shaped with a sharp point and no stipe; sides unequally curved. Brunnthaler gives the size as 24-32u long and 4-8u broad, but some of the specimens considered here were smaller. #1311 which showed the expected proportions was 24u long, but #1165, which was somewhat thinner in proportion, was only 18-20u long. Obion: on Potamogeton in Reelfoot Lake at Samburg 12 July 1949 #1311 - Obion - Lake: on leaves of Potamogeton in Reelfoot Lake 2

July 1949 #1165 - Lake: in Cranetown nesting area in cypress swamp 5 July 1949 #1177.

2. Characium Braunii Bruegger. (Lemmermann, Brunnthaler & Pascher f) Pl. 12, Fig. 8.

Cells regularly ovate or lanceolate-shaped with a pointed distal end and definite short stipe which spreads at the base. L 25-35u; W 6.5-13u. This species has rather clear-cut characters compared with some others, and is not uncommon. Lincoln: roadside drain near Fayetteville 19 Aug. 1949 (Sharp)unnumbered - Montgomery: rainwater lake in river bottom near Edmondson's Ferry on Cumberland River 31 Dec. 1949 #2038 - Obion: slough at Spillway 14 June 1950 #2269.

3. Characium DeBaryanum (Reinsch)DeToni. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)

Cells broadly elliptic to ovoid with a rounded distal end; a comparatively thick stipe with a broadened base attaches the cells to crustaceans. L 33u; W 16-17u without stipe. Jefferson: roadside pool 24 June 1938 (Bold)unnumbered.[1]

4. Characium ensiforme Hermann. (Lemmermann, Brunnthaler & Pascher f)

The cells are linear-lanceolate in shape, with unequal curvature on the two sides. The stipe is so short that the cell appears to be sessile. Obion: roadside marsh just

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1 Reported in Silva, 1949

west of Kenton on county road 8 July 1949 #1244.

5. Characium limneticum Lemm. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith) Pl. 12, Fig. 10.

Cells are long and cylindrical with a long-pointed apex and stipe. (Had there been a slight spreading at the base of the stipe the proper classification then presumably would be C. gracilipes F. D. Lambert). Chloroplast single, parietal. L 25-83u; W 3-7u. This identity is tentative inasmuch as the plant was free rather than attached, as it usually is, to a crustacean such as Diaphanosoma. Yet, the appearance is distinctive enough to justify the designation. In #1147 evidently zoospore formation was beginning to occur and about four distinct chloroplasts were visible. Obion: floating mass in Bayou du Chien near Biological Station 2 July 1949 #1147. K.

6. Characium stipitatum (Bach)Wille. (Lemmermann, Brunnthaler & Pascher f)(Prescott f) Pl. 12, Fig. 9.

Cells spherical; attached by a long slender stipe. Diameter of cells 5-8u. Stipe L 10-16u. Davidson: on filamentous algae in quarry near Chocolate Shop on Franklin Road 20 Aug. 1949 #1818. K.

7. Characium strictum A. Braun. (Lemmermann, Brunnthaler & Pascher f)

Cells regularly linear-lanceolate or elliptic with a broadly rounded distal end and a very short stipe which spreads slightly as the base. L 23-30u; W 6-7u. Montgomery:

left bank of Cumberland River at Clarksville 1 Oct. 1949 #2022 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1176.

SCHROEDERIA Lemmermann 1899

Cells of this genus are solitary, and straight or curved-fusiform in shape. The sharp ends extend into long single setae.

1. Terminal spines simple. S. setigera (Schroed.)
1. One of terminal spines bifurcate, with the tips possibly recurved in anchor-like manner...... S. ancora G. M. Smith

1. Schroederia ancora G. M. Smith. (Smith f) Pl. 12, Fig. 12.

Cells fusiform, with long terminal spines, one unbranched, the other bifurcate; chloroplast plate-like. L (without spines) 16-29u; W 3-6u. Knox: culture at collector's home 17 Sept. 1949 #1898 - Obion: pond at Council's Grocery along hwy Tenn.28 toward Walnut Log from Union City 1 July 1949 #1142.

2. Schroederia setigera (Schroed.)Lemm. (Prescott f)(Smith f) Pl. 12, Fig. 11.

Cells fusiform, with long terminal spines, both spines simple, straight or bent. L (without spines) 22.5-52.5u; W 2.5-10u. Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] -

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1 Reported in Lackey, 1942

Obion: among floating mass in Bayou du Chien at Biological Station 2 July 1949 #1146 - south shore of Isom Lake 10 July 1949 #1270.

Protosiphonaceae

PROTOSIPHON Klebs 1896

Protosiphon botryoides (Kuetz.)Klebs. (Lemmermann, Brunnthaler & Pascher f)(Smith f) Pl. 11, Fig. 2.

The mature vegetative plants are elongate, bladder-like coenocytic structures with rather large vacuolar spaces (or at least uncolored portions). Plant bodies attaining size of L 1 mm.; W .4 mm. The elongated coenocyte may form cross walls, and a sort of filament of akinetes may result, and akinetes may subsequently germinate into elongated coenocytes or divide to form gametes. The gametes may not function as expected, however. Often they never develop motility, and simply act as vegetative spores, growing into vegetative plants without gametic fusion. This species was found in several soil samples which were cultured. Since it is highly polymorphic, stages of development are sometimes needed to make identification. Knox: on sticks in mixed stream and backwater of Ft. Loudon Lake below Knoxville 5 April 1947 #584[1] - on mud beside stream three miles east of Knoxville on hwy U.S.11-E 18 June 1949 #849 - laboratory

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1 Reported in Silva, 1949

culture from wet log at Worley's farm near Hampshire in Maury County 9 Aug. 1949 #1689 - Maury: phosphatic soil of western Highland Rim hill on Mr. Worley's farm near Hampshire 15 June 1949 #902. VN.

Hydrodictyaceae

HYDRODICTYON Roth 1800

Hydrodictyon reticulatum (L.)Lag. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 11, Figs. 3,4.

Individual cells are elongated cylinders containing a reticulate chloroplast; cells joined three together at each end to form a six-sided mesh and thus make up the colony; size of the colony depends on the age and growth conditions. Cells up to L 2mm.; W .4mm. Sometimes a daughter colony reticulum may be seen inside a large cell, having formed from zoospores which never escape in motile condition from the parent cell. Beyond doubt this is one of the most striking and intriguing algae in existence. The colonies may float in enormous mats. They occur in Reelfoot Lake and other stable, quiet waters, but the Reelfoot development is remarkable, covering the margins for miles in a mat so thick as to impede rowing. Davidson: quarry hole near Chocolate Shop on Franklin Road 20 Aug. 1949 #1816-8 - Maury: spring fed lake of Orphans' Home at Spring Hill 24 Sept. 1938 (Bold)#B-1176[1] - Obion: floating in Bayou du Chien near

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1 Reported in Silva, 1949

Biological Station 1 July 1949 #1147 - margins of Reelfoot Lake 14 June 1949 #2258. K.

PEDIASTRUM Meyen 1829

The angular cells of the plants in this genus remain attached side by side in a characteristic flat, usually circular, colony commonly referred to as a coenobe. Differences between species are based on the shape of the individual cells, chiefly the peripheral ones, and the arrangement of those within.

1. Outer wall of peripheral cells protruding into a single conical projection or spine.................................... 2
1. Outer wall of peripheral cells at least bilobate.................................... 3
    2. Inner cells compact in arrangement............... _P_. _simplex_ (Meyen)Lemm.
    2. Inner cells reticulately arranged................, _P_. _simplex_ v. _duodenarum_ (Bail.)Rab.
3. Notch between lobes of cells very wide and shallow (width at least twice depth........ _P_. _angulosum_ (Ehr.)Menegh.
3. Notch narrow and deeper in relation to width.................................... 4
    4. Notch between lobes very narrow and deep, incision with parallel sides................ _P_. _tetras_ (Ehr.)Ralfs

4. Notch wider, V-shaped margins
not parallel.................................. 5

5. Lobes bifurcate at apices into two
erect nipples............. *P. biradiatum* Meyen

5. Lobes not again divided............................ 6

6. Inner cells compactly arranged or
with only small diamond-shaped holes
at the corners.. *P. Boryanum* (Turp.)Menegh.

6. Inner cells exhibiting reticulate
arrangement................. *P. duplex* Meyen
.... and its varieties

1. *Pediastrum angulosum* (Ehr.)Menegh. (Lemmermann, Brunnthaler & Pascher f) Pl. 11, Fig. 5.

Coenobe unperforated; peripheral cells bilobed with a wide, shallow notch. Diameter of cells up to 50u. There are numerous forms of this species, some agreeing with none of the described varieties. Moreover, the species probably varies into *P. Boryanum* (Turp.)Menegh. Weakley: roadside marsh west of Martin by hwy Tenn.22 8 July 1949 #1211.

2. *Pediastrum biradiatum* Meyen. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith)

As considered here, this species includes *P. biradiatum* v. *emarginatum* A. Br. and does not seem distinguishable from it when a number of individuals are studied. Peripheral cells rather deeply bilobate, lobes being distinct in the inner cells as well. The lobes of each peripheral cell are further bifurcate to form two short terminal projections. Marginal cells were 10-20u in diameter in 16 celled colonies. Rabun(Ga.): plankton from pond near Clayton 9 Aug. 1949 #1725 - Blount: Laurel Lake near Kinzel Springs 4 Aug. 1949 #1456 - Montgomery: pond near Niagra Ave. Ft. Campbell Reservation 26 April 1950 (Clebsch)#2257 - Obion: among floating Potamogeton in Reelfoot Lake near Samburg 12 July 1949 #1311. NK.

3. Pediastrum Boryanum (Turp.)Menegh. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Coenobe unperforated; peripheral cells bilobate, the apices of the lobes extending into narrow process; surface punctate; number of cells in the coenobe varying from 4 to 128. Diameter of cells up to 40u. Knox: goldfish pond at Ijam's place 20 July 1949 #1509 - pond bottom in field by Ten Mile Creek at Farragut 20 July 1949 #1544 - goldfish pond at Knoxville Waterworks on Riverside Drive 25 July 1949 #1585 - Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1418 - Jackson(Ala.): embayment of Guntersville Lake near Scottsboro 18 Aug. 1949 #1782 - Davidson(?): Cumberland River 1938-9[1] - Davidson: quarry hole near Chocolate Shop on Franklin Road 20 Aug. 1949 #1816 - Cheatham: soil-bottomed fertilized fish raising pond on Little Marrowbone Creek Road 20 Aug. 1949 #1843 -

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1 Reported in Lackey, 1942

Obion: among grass in very shallow area at south end of Isom Lake 10 July 1949 #1266 - plankton in Reelfoot Lake at Samburg 12 July 1949 #1308 - In addition there are innumerable others occurring wherever there are quiet aquatic conditions for a short time. NGFK.

4. Pediastrum Boryanum v. longicorne Racib. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Variety differs from the typical only in the length of the appendages on the peripheral cells, being almost as long as the diameter of the cell proper. It would be interesting if the different gradations between the variety and species proper were subjected to statistical analysis. Blount: among floating plants in Laurel Lake near Kinzel Springs 4 Aug. 1949 #1660 - Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1421.

5. Pediastrum Boryanum v. perforatum Racib. (Lemmermann, Brunnthaler & Pascher f)

The appendages of this variety are shorter than typical ones of the species and there are small intercellular spaces at the angles of the interior cells. Here, as in v. longicorne Racib. statistical analyses of differences between this variety and the typical would be informative. Davidson: plankton in Valley Lake 20 Aug. 1949 #1815.

6. Pediastrum duplex Meyen. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith)

Cells reticulately arranged in colonies; peripheral cells with two more or less elongated conical lobes. Diameter of cells, disregarding appendage, 3-20u.

Numerous varieties are described for this species, which differs from P. Boryanum principally in the reticulate arrangement of the inner cells, rather than compact as in P. Boryanum.

Reported from southeastern United States are v. asperum A. Braun, v. clathratum (A. Braun)Lag., v. cohaerens Bohlin, which has been correctly raised to species level (see Prescott), v. cornutum Racib., v. gracillimum West & West, v. reticulatum Lag., and v. rotundatum Lucks.

Davidson: quarry near Chocolate Shop on Franklin Road 20 Aug. 1949 #1816-8 - Cheatham: plankton from fertilized fish ponds on Little Marrowbone Creek Road 20 Aug. 1949 #1841-2 - Obion: plankton from south end of Isom Lake 10 July 1949 #1282 (a variant) plankton from Reelfoot Lake at Samburg 12 July 1949 #1305 - margin of Reelfoot Lake among aquatics 14 June 1950 #2259 (v. rotundatum without the nipples figured by Smith, 1920) - Lake 2 July 1949 #1150 (v. gracillimum) - Obion: Reelfoot Lake 1928.[1] NSFK.

7. Pediastrum simplex (Meyen)Lemm. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith) Pl. 11, Fig. 6.

Cells compactly arranged in colonies, without intercell-

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1 Reported in Eddy, 1930

ular spaces; peripheral cells with single elongated conical or spine-like projection; walls are smooth or granulate. Diameter of cells, disregarding projections, 10-20u. There is no universal agreement on the application of this species name or the variety duodenarium (Bail.)Rab. The distinction in American practice (see Prescott, 1931 or Smith, 1933) seems to be based on whether the inner cells are reticulate or compact in arrangement. Both the species and the variety have a single projection on each outside cell, and the projection appears to vary in length somewhat and may or may not be produced into a hyaline horn. Knox: plankton from Tennessee River (Ft. Loudon Lake) at Island Home 20 July 1949 #1508 - Moore: mill pond at Cumberland Springs 29 June 1949 #1026 - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Cheatham: soil bottomed ponds fertilized for fish raising on Little Marrowbone Creek Road 20 Aug. 1949 #1838-42 - Obion:, plankton at Spillway bridge 10 July 1949 #1262 - plankton from Reelfoot Lake at Samburg 12 July 1949 #1308 - pond on Marvin Hayes' farm near Samburg 12 July 1949 #1320. SK.

8. Pediastrum simplex v. duodenarium (Bail.)Rab. (Prescott f)(Smith f)

The variety apparently differs from the typical in the reticulate arrangement of the inner cells. It may be ob-

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1 Reported in Lackey, 1942

served that this is also a distinction of P. duplex as distinguished from P. Boryanum. Knox: goldfish pond at Knoxville Waterworks on Riverside Drive 25 July 1949 #1588 - Cheatham: soil-bottomed fertilized fish raising ponds on Little Marrowbone Creek Road 20 Aug. 1949 #1845 - Lauderdale - Colbert(Ala.): plankton catch near Wilson Dam in Pickwick Lake 4 Sept. 1949 (Hall)#1942-4 - Lake: plankton from pools of Cranetown nesting area in cypress swamp 5 July 1949 #1188 (tapering as in Prescott, 1931, spine as in Smith, 1933) - Obion: plankton from Reelfoot Lake near Samburg 12 July 1949 #1305. SK.

9. Pediastrum tetras (Ehr.)Ralfs. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith)

Cells compactly arranged in coenobe, but inner cells show bilobate character; peripheral cells bilobate with narrow linear division, between lobes. Diameter of cells 8-16u. In spite of the name, coenobes of the species often contain 8 or 16 cells. Whereas the narrow division between the lobes is given as a key character, this is not uniform, and the species varies through many slightly different forms into P. biradiatum. Rabun(Ga.): pond near Clayton 13 Aug. 1949 #1725 - Overton: pond containing considerable number of aquatics at Timothy at Tom Edwards' store on hwy U.S.79 west of Clarksville 14 July 1949 #1371 - Lawrence: swamp (pH 5.5) near Lawrenceburg 29 June 1949 #1062 - Weakley: Mr. Bary's pond west of Martin along hwy Tenn.22 8 July 1949

#1208 - Obion: near shore at south end of Isom Lake 10 July 1949 #1268 - Obion - Lake: margins of Reelfoot Lake 14 June 1950 #2259. NSGFK.

SORASTRUM Kuetzing 1845

The colonies in this genus are composed of cells radiating from a core or center. The resulting overall outline is spherical, or at least polygonal, as opposed to the flat colonies of Pediastrum. Each individual cell is broadly expanded, with a gelatinous stalk at the base, which adjoins other stalks of the colony.

1. Inner stalks of cells relatively large, cells at least as long as broad............. S. americanum (Bohlin)Schm.
1. Inner stalks quite small, cells broader than long......... S. spinulosum Naeg.

1. Sorastrum americanum (Bohlin)Schm. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Cells radially attached by relatively large gelatinous stalks; cells as long as wide, somewhat heart-shaped in broad side view and flat or slightly tumid in narrow side view; two lateral spines on each of the lobes, arranged one over the other so that only two are visible in a broad side view. Cells L 8-15u; W 6-8u. 8-32 celled colonies reaching a diameter of 60u. Obion - Lake: margin of Reelfoot Lake 14 June 1950 #2259. N.

2. <u>Sorastrum</u> <u>spinulosum</u> Naeg. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith) Pl. 13, Fig. 1.

Distinguished from <u>S</u>. <u>americanum</u> by smallness of the gelatinous stalks; cells broader than long in broad side view, with an outline varying from cresent-shaped to broadly cordate; two laterally aligned spines on each lobe. Cells L 6-15u; W 12-18u. 8-32 cells in a colony. Knox: in goldfish pond at Univ. Tenn. botanical laboratory 1 Aug. 1949 #1605 - culture from collection in small stream at Westmoreland Heights gate 3 Aug. 1950 #2306 (possibly present here as a contaminant). FK.

Coelastraceae

COELASTRUM Naegeli 1849

The colonies here are hollow coenobes of spherical, cubical, or polygonal shape. The cells either adjoin directly, or are interconnected with pectic processes.

1. Cells spherical, adjoined without
   appendages.................. <u>C</u>. <u>microporum</u> Naeg.
1. Cells adjoined with interconnecting
   processes.. 2
   2. Cells 10-13 angled...... <u>C</u>. <u>cambricum</u> Arch.
   2. Cells with three outward facing
      truncate processes, cubical or polygonal
      colonies.................. <u>C</u>. <u>cubicum</u> Naeg.

1. Coelastrum cambricum Arch. (Lemmermann, Brunnthaler & Pascher f)(Prescott f) Pl. 13, Fig. 2.

Colonies spherical; cells polygonal in outline with short truncate projections on the outer margins; diameter of cells 9-12u. Jefferson: semipermanent pond on east side of Cherokee Dam 25 June 1949 #1208 - Knox: Chilowee Park Lake (pH 7.0, 28°C) at Knoxville 18 June 1949 #807 - Overton: pond with considerable number of aquatics at Timothy 15 July 1949 #1456 - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Wilson: pool of creek running over shelving limestone by hwy U.S.70-N about 8 miles west of Lebanon 14 July 1949 #1417 - Colbert(Ala.): Stenson Hollow of Wilson Lake 16 June 1950 #2279 - Cheatham: soil bottom ponds fertilized for fish raising on Little Marrowbone Creek Road 20 Aug. 1949 #1844 - Montgomery: marsh by hwy U.S.79 at Norfleet & Sons' grocery west of Clarksville 14 July 1949 #1376 - Weakley: Mr. Bary's pond (33°C) by hwy Tenn.22 west of Martin 8 July 1949 #1208 - pond at Ore Springs by hwy Tenn.54 east of Dresden 14 June 1950 #2244 - Obion: plankton from Reelfoot Lake at Samburg 12 July 1949 #1305. NFK.

2. Coelastrum cubicum Naeg. (Lemmermann, Brunnthaler & Pascher f) Pl. 13, Fig. 3.

Colonies cubical or polygonal; cells are round to hexangular with three stump-like projections on the outer free

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1 Reported in Lackey, 1942

face. Diameter of cells 8-20u. Shelby: goldfish pond at Memphis Zoological Gardens 19 March 1950 #2129.

3. Coelastrum microporum Naeg. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

The colonies of this species are spherical, as are the cells; cells lack surface projections. Diameter of cells 6-27u. Knox: Chilowee Park Lake 18 July 1949 #830 - on Crystotella (a bryozoan) stranded on exposed shoreline near Duncan's Dock on Ft. Loudon Lake 3 Sept. 1949 #1881 - Overton: pond containing considerable number of aquatics at Timothy 15 July 1949 #1456 - Middle Tenn.: Duck River 1938-9[1] - Weakley: Mr. Bary's pond by hwy Tenn.22 west of Martin 8 July 1949 #1208. FKM.

Oocystaceae

In this family, as in the Chlorococcaceae, the cells lack the capacity for vegetative multiplication. In addition the ability to produce zoospores, which is found in the Chlorococcaceae, is absent here. Reproduction is solely by autospores, small miniatures borne inside a reproducing cell. A frequent, though not universal, tendency among the genera of the family is the retention of daughter cells within the mother cell walls. Gelatinization of the mother cell walls may occur, or the cells may lie within a gelatin-

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1 Reported in Lackey, 1942

ous matrix.

The family is a varied one, containing about thirty genera, twenty-two of which are included here, and genus differentiation in the Oocystaceae is an involved problem. For example, Oocystis, as hitherto considered, includes no species with setae or spines, while Lagerheimia, which is comprised of setiferous species, is not characterized by the normal retention of daughter cells within the mother cell wall, although this does occur in some cases. Bohlinia, which was originally described as an Oocystis, does show the retention trait to some extent. However, its well-developed gelatinous matrix is present only in American collections (see Smith, 1933 and notes under Bohlinia below). No mention of a matrix is present in the original description, the type being illustrated with far longer spines than are present in what American writers have called Bohlinia.

ANKISTRODESMUS Corda 1838

These cells are needle-shaped, very narrowly sickle-shaped or lunate. Commonly they are clustered or grouped in bundles, but are not surrounded by a gelatinous sheath.

1. Cells straight, needle-shaped or only slightly curved or sigmoid, solitary or in loose, irregular bundles................. .... A. falcatus (Corda)Ralfs and varieties
1. Needle-shaped cells spirally wound around each other to form fascicles........... .... A. spiralis (Turn.)Lemm.

1. Ankistrodesmus falcatus (Corda)Ralf. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 13, Fig. 5.

In general, the cells are narrowly spindle-shaped to needle-shaped or sigmoid; chloroplast a single parietal plate, or it may be divided in two; both single cells and bundles are found in the species proper. L to about 150u; W 1-5u. There are at least seven varieties described for this species, of which two have been listed from southeastern United States: v. mirabilis (West & West)G. S. West and v. tumidus (West & West)G. S. West. Knox: around tree base in pond by Ten Mile Creek at Farragut 20 July 1949 #1545 - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Weakley: pond by hwy Tenn.54 east of Dresden 14 June 1950 #2244 - Obion: on mud of puddle at Walnut Log Lodge 2 July 1949 #1146 - near south shore of Isom Lake 10 July 1949 #1268 - around stumps in Reelfoot Lake at Samburg 12 June 1949 #1304. VNSGK.

2. Ankistrodesmus falcatus v. mirabilis (West & West)G. S. West. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)

This variety is distinguished by the rather uncertain qualifications of always being single, often sickle-shaped or sigmoid, and often with a two-parted chloroplast. The dimensions recorded do not differ materially from those of the typical. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] NK.

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1 Reported in Lackey, 1942

3. Ankistrodesmus falcatus v. tumidus (West & West)G. S. West. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)

This variety has a more broadly fusiform shape than the typical so that the outline is not unlike that of some Closterium spp. It occurs singly or in two's. L 61-73u; W 4.5u.

4. Ankistrodesmus spiralis (Turn.)Lemm. (Lemmermann, Brunnthaler & Pascher f)(Prescott f) Pl. 13, Fig. 4.

This species is characterized by its occurrence in a spirally wound bundle of needle-shaped cells. Cells L to about 50u; W about 2u. Anderson: fish raising pools below Norris Dam 26 June 1938 (Bold)unnumbered.[1]

BOTRYOCOCCUS Kuetzing 1849

Botryococcus Braunii Kuetz. (Prescott f)(Smith f) Pl. 13, Fig. 10.

The observations of Chodat, 1896 are being followed in placing this species in the Oocystaceae. Cells more or less spherical, except that the mutual compression of the cells causes most of them to be ovoid or wedge-shaped; cells bunched together in large numbers in characteristic irregular colonies, surrounded by a dense, wrinkled orange-brown jelly; old gelatinized mother cell walls are retained in the colony. Diameter of cells about 3-6u. Blount: among floating plants in Laurel Lake near Kinzel Springs 4 Aug. 1949

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1 Reported in Silva, 1949

#1660 - Jackson(Ala.): roadside ditch pond near Paint Rock 17 June 1949 #2291 - Montgomery: plankton from pond at Tom Edwards' store on hwy U.S.79 west of Clarksville 14 July 1949 #1376 - Lawrence: swamp (pH 5.0) with several aquatics near Lawrenceburg 29 June 1949 #1061 - Weakley: roadside marsh by hwy Tenn.22 west of Martin 8 July 1949 #1211 - pond of H. D. Hagar farm by hwy Tenn.22 east of Martin 14 June 1949 #2245 - Gibson - Obion: plankton from middle pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1242. VNFKL.

BOHLINIA Lemmermann 1899

Bohlinia echidna (Bohlin)Lemm. (Lemmermann, Brunnthaler & Pascher f)(Smith f) Pl. 13, Fig. 9.

Cells retained to some extent within mother cell walls; chloroplasts one to few, with a pyrenoid in each; cell wall with a number of short spines or bristles, which are more frequent near the poles. L (from Smith's figure) 10-20u; W 4-8u. L (Tennessee specimen) 6u; W 4u. This was one of the rare finds in the Tennessee collections. The plant collected is probably the same as figured by Smith, 1933, but whether these are the same as the plant which Bohlin described is open to question, since a gelatinous matrix is lacking in the European plant and the figure shows the surface bristles as being somewhat longer. Davidson: Radnor Lake at Brentwood 20 Aug. 1949 #1799.

CHLORELLA Beyerinck 1890

Chlorella cells are small, spherical or broadly oval, with cup-shaped chloroplasts. They are not imbedded in a gelatinous matrix, and quickly separate into individual cells after reproducing by autospores (internally formed miniatures of the parent cell) and not by zoospores as in *Chlorococcum*.

It is well to be unusually cautious when identifying species of *Chlorella*, because other algae, (*Chlorococcum*, e.g.), may appear very similar to forms which we understand to be *Chlorella*. Descriptions and published drawings really help very little, in the final analysis only the culturing of the plants can furnish reasonable identification.

1. Clearly distinct pyrenoid present in
   cell.................... *C. pyrenoidosa* Chick.
1. Pyrenoid not visible....... *C. vulgaris* Beyer.

1. *Chlorella pyrenoidosa* Chick. (Lemmermann, Brunnthaler & Pascher f) Pl. 13, Fig. 7.

Cells spherical; chloroplasts described as being parietal and hemispherical, but might be referred to as cup-shaped; distinct pyrenoid the principal difference between this species and *C. vulgaris* Beyer., but the cells are usually smaller as well. Diameter 3-5u. However, since *Chlorella* multiplies by autospores, which are miniature images of the parent cells, size is related to age and growing conditions. Knox: laboratory culture at Univ. Tenn. botanical laboratory from collection made at Mack's east of Knoxville by hwy U.S.11-E 9 Aug. 1949 #1692 - Scott: cultured from collections made at rivulet running over shaley rocks in burnt-over area 13 June 1950 #2232 - Lauderdale(Ala.): farm near creek crossing hwy U.S.72 above Wheeler Dam 17 June 1950 #2289.

2. Chlorella vulgaris Beyer. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith) Pl. 13, Fig. 6.

Cells spherical to broadly oval; walls thin; chloroplasts cup-shaped but usually seem to fill the cell, and no pyrenoid is discernible in it. Diameter 5-10u. Maury: on wier across Dry Fork at Mr. Worley's farm near Hampshire 15 June 1949 #893. NK.

ZOOCHLORELLA Brandt 1882 (included in Chlorella by many authors)

The cells, like Chlorella, are small spheres with parietal or massive chloroplasts. The endozoic habit identifies Zoochlorella immediately.

Zoochlorella parasitica Brandt. (Collins f)(Prescott f) (Smith) Pl. 13, Fig. 8.

The species is distinguished from the other reported from the United States by size, a diameter of 1.5-3u for this species in contrast to a diameter of 3-6u found in Z. conductrix Brandt. Greene: from rotifer in pool by river wier at Flag Pond 25 June 1949 #939 - Knox: from cilliate in pond by Ten Mile Creek at Farragut 23 July 1949 #1547. VNF.

CHODATELLA Lemmermann 1898

(Lagerheimia of Smith, 1933, Prescott, etc.)

The solitary cells of this genus all have a limited number of setae arranged at the poles, and never at the midsection. The shape of the cells is variable, being oval, elliptic, subcylindrical, or subspherical.

1. Cells compressed spherical, with only four spines crucistely arranged.. C. Chodatii (Bernard)Ley
1. Cells oval with more than four spines.............. 2
   2. Cell with four to ten spines, about 50u long, at each end... C. longiseta Lemm.
   2. Cell with two or three spines, about 30u long, at each end.... C. subsalsa Lemm.

1. Chodatella Chodatii Born. (Lemmermann, Brunnthaler & Pascher f)(Smith f)

This species has subspherical cells with four spines cruciately arranged. Diameter about 5-10u. Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Obion: plankton from Reelfoot Lake at Samburg 12 July 1949 #1305.

2. Chodatella longiseta Lemm. (Lemmermann, Brunnthaler & Pascher f)(Smith f)

Cells oval in outline; with 4-10 setae at each end. L up to 12u; W 5-8u. Setae are about 50u long. Middle Tenn.: Duck River 1938-9.[1] NK.

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1 Reported in Lackey, 1942

3. Chodatella subsalsa Lemm. (Lemmermann, Brunnthaler & Pascher f)(Smith f) Pl. 14, Fig. 6.

Shape oval, with 2-4 setae at each pole. Cells L to 12u; W 2.5-8u. Spines L about 30u. Possibly this species and C. longiseta should be considered varieties of the same plant. Gibson - Obion: middle pond, fertilized for fish raising, on Abe Shatz' farm east of Kenton 8 July 1949 #1242. NK.

CLOSTERIOPSIS Lemmermann 1899

Closteriopsis longissima Lemm. (Prescott f)(Smith Pl. 13, Fig. 13.

Cells needle-shaped, ends sharply pointed; chloroplast parietal ribbon, containing several pyrenoids. L to 550u; W to 7.5u.

At first glance this species would be called an Ankistrodesmus. The only good distinction between them is the presence of a linear series of several pyrenoids in Closteriopsis. The added character of larger size is sometimes given, but does not appear to be a valid one for separation at the genus level. C. longissima attains twice the size of Ankistrodesmus falcatus.

Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Weakley: Mr. Bary's pond by hwy U.S.22 west of Martin 8 July 1949 #1208. K.

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1 Reported in Lackey, 1942

DICTYOSPHAERIUM Naegeli 1849

Dictyosphaerium pulchellum Wood. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 13, Fig. 11.

Colonies of spherical or reniform cells imbedded in a gelatinous matrix and joined by strands from old mother cell walls; cells spherical; chloroplasts single, cup-shaped, containing single pyrenoid. Diameter 5-10u. Jefferson: semi-permanent pond east of Cherokee Dam 25 June 1949 #906b - Knox: planktom from Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949 #1882 - Moore: pools below dam at Cumberland Springs 29 June 1949 #1032. VNF.

DIMORPHOCOCCUS A. Braun 1855

Dimorphococcus lunatus A. Braun. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 13, Fig. 12.

Cells of this species are joined by branching strands of old mother cell walls. Cells markedly dimorphic, two in each of the groups of four being reniform to nearly cresent-shaped, the others oval. L 10-20u; W 3-10u.

The other species of the genus, D. cordatus Wolle, has bent cells which are more distinctly reniform or distinctly cordate, but its separation from D. lunatus has been questioned for a number of years without any new light being actually shed on the subject. Since a gelatinous matrix sometimes surrounds the cells, the only good distinction from Dictyosphaerium is the shape of the cells.

Davidson: lily pool on Vanderbilt University campus 12 Nov.

1938 (Bold)#B-154a[1] - Gibson - Obion: lower pond, fertilized for fish raising, on Abe Shatz' farm east of Kenton 8 July 1949 #1243 - Obion: around stumps in Reelfoot Lake at Samburg 12 July 1949 #1305. NFKL.

EREMOSPHAERA DeBary 1858

Eremosphaera viridis DeBary. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 14, Fig. 1.

Cells large, spherical, with a central nucleus and strands of protoplasm running to the periphery and enclosing many small oval chloroplasts. Diameter to 150u. Although never used for laboratory research, as far as the writer knows, it would appear to be a valuable addition to the stock of species already used. Unfortunately it is infrequent in occurrence, and not prolific in multiplication. Blount: squeeze from Chara and Potamogeton spp. in Laurel Lake near Kinzel Springs 4 Aug. 1949 #1661 - Henry: gravel pit by hwy U.S.79 east of Paris 19 March 1950 #2118 - Obion: among floating Potamogeton in Reelfoot Lake at Samburg 12 July 1949 #1311. VNSF.

EXCENTROSPHAERA G. T. Moore 1901

Excentrosphaera viridis G. T. Moore. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 14, Fig. 2.

Cells are irregularly globose; many chloroplasts, placed in a manner similar to those of Eremosphaera; walls may become thickened and stratified; reproduction is said to be by autospores which are released through a lateral pore, diameter of cells up to 55u. This identification is made with considerable hesitation. Wilson: creek running over shelving limestone of central basin, along hwy U.S.70-N eight miles west of Lebanon 14 July 1949 #1416-7. N.

FRANCEIA Lemmermann 1898

These cells are planktonic. They are oval in shape and the walls are furnished with several setae. Although frequently solitary, there is a tendency for several cells to adhere in small groups.

1. Slight swelling at base of each seta............... F. tuberculata G. M. Smith
1. No swellings present at base of the seta......... F. Droescheri (Lemm.)G. M. Smith

1. Franceia Droescheri (Lemm.)G. M. Smith. (Prescott f) (Smith f) Pl. 14, Fig. 3.

Cells oval; walls furnished with setae of two distinctly different lengths, lacking tubercles at bases; 2-4 parietal disc protoplasts. L (without setae) 9-16u; W 5-12u. Knox: on sides and bottome of goldfish pond at Knoxville Waterworks 25 July 1949 #1575.

2. Franceia tuberculata G. M. Smith. (Smith f)

Cells oval; walls with setae of about equal length, showing slight swellings at the base; chloroplasts two or more. Cells L 8.5-21.5u; W 5-12u. Setae L 7.5-32u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

KIRCHNERIELLA Schmidle 1893

Cells of the genus are characteristically sickle-, sausage- or horseshoe-shaped, and all except K. subsolitaris G. S. West are imbedded in a gelatinous matrix. Usually, there is a tendency for convex margins of the cells to be apposed.

Published descriptions attempt to separate K. lunaris from K. obesa on the basis of shape. In the former the ends are said to be sharp, whereas they are described as blunt in the latter, but it is felt that the two intergrade.

The gelatinous sheath is the chief difference between this genus and Selenastrum, which, in addition, has cells which are not so sharply bent.

1. Poles of cells equal in size and shape............. 2
1. Poles unequal in size and shape...............
   .... K. subsolitaris G. S. West
   2. Poles sharp-pointed.......................
      .... K. lunaris (Kirch.)Moeb.
   2. Poles blunt-pointed... K. obesa (West)Schm.

1. Kirchneriella lunaris (Kirch.)Moeb. (Lemmermann, Brunnthaler f)(Prescott f)(Smith f) Pl. 14, Fig. 5.

Cells lunate; single parietal chloroplast with pyrenoid present; sharp, similar ends distinguish the species. L 6-10u; W 3-5u. VNGFK.

2. Kirchneriella obesa (West)Schm. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)

Cells strongly curved; single parietal chloroplast with pyrenoid; species said to be distinguished from K. lunaris by its blunt ends and greater curvature, completing as much as three-quarters of a circle. L 6-9u; W 2-4.5u. Such forms as #906a indicate intergradation between the two. Jefferson: semi-permanent pond east of Cherokee Dam 25 June 1949 #906a-906 - Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]..VNK.

3. Kirchneriella subsolitaria G. S. West. (Lemmermann, Brunnthaler & Pascher f)(Prescott f) Pl. 14, Fig. 4.

Gelatinous sheath lacking; size and shape of the ends of the cells unequal, so that they are shaped somewhat like cashew kernel. L 8u; W 2-3u. However, in these collections #1881 does seem to have a gelatinous sheath, possibly the mother cell wall was misinterpreted. Knox: on Crystotella (a bryozoan) on very recently exposed shore of Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949 #1881.

NEPHROCYTIUM Naegeli 1849

In spite of the genus name, cells of the species of this genus are not necessarily reniform, being also oval-shaped. Their chief characteristic is that the daughter cells (autospores) are retained within the mother cell wall, as in Oocystis, but unlike Oocystis and other genera, the the mother cell wall is partly gelatinized.

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1 Reported in Lackey, 1942

1. Cells elongated reniform or sausage-shaped with slight curvature... N. Agardhianum Naeg.

1. Cells broadly oval or stoutly reniform............ N. ecdysiscepanum West & West

1. Nephrocytium Agardhianum Naeg. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Cells elongated reniform, within partly gelatinized mother cell wall. L 2-3 times width; W to 45u. Claiborne: permanent pond north of Tazwell 26 June 1938 (Bold)unnumbered[1] - Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1241. NK.

2. Nephrocytium ecdysiscepanum West & West. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 15, Fig. 1.

Cells described as broadly reniform or semicircular, but both West's and Smith's figures show broadly oval cells, similar to those observed in this study; two layers in the mother cell wall, an outer softer gelatinous one and an inner firm one. L 24-27u; W 13-17u. These cells are somewhat more plump than those of N. Agardhianum. Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1418.

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1 Reported in Silva, 1949

OOCYSTIS Naegeli 1845

Cells of this genus are oval or elliptic, single or in groups of from two to about sixteen retained within the partially gelatinized mother cell wall. Sometimes successively formed cell generations are included within a single mother cell wall. Differentiation from Nephrocytium is best made on the basis of the firm even sheath of Oocystis, rather than the wide gelatinous one of the other.

1. Short spines often decorating walls, persisting even on mother cell wall.. O. brevispina Silva
1. Cell walls without spines.............................. 2
   2. Cells papillate at the poles...................... 3
   2. Cells with smoothly rounded poles................. 4
3. Definite papillae on ends of citriform cells containing up to 8 chloroplasts... O. crassa Wittr.
3. Poles of cells merely thickened, cells elliptic in shape with only 2 or 3 chloroplasts................ O. lacustris Chod.
   4. Cell outline oval................................. 5
   4. Cell outline elliptic............................. 7
5. Outline broadly oval, 4 chloroplasts in cell......................... O. Borgei Snow
5. Outline narrowly oval, length twice the width or more................................. 6

6. Length about 2½ times width, ends broadly rounded, plants generally in open water or truly planktonic.......... .... O. *elliptica* W. West
6. Length about twice width, shape toward elliptic, plants inhabiting seeps................... O. *rupestris* Kirch.
7. Cell outline broadly elliptic, cell containing 4 chloroplasts.................. .... C. *lacustris* Chod.
7. Cell outline narrowly elliptic, length twice the width.............................. 8
8. Cell length 7-12u, cells containing 1-3 chloroplasts...... O. *parva* West & West
8. Length of cells over 15u, containing single chloroplast..... O. *rupestris* Kirch.

1. *Oocystis brevispina* sp. nov. (possibly identical with *Chodatella brevispina* Fritsch as in Lemmermann, Brunnthaler & Pascher f) Pl. 15, Fig. 2.

Cells broadly oval; 1-4 chloroplasts, and single pyrenoid in each chloroplast; surface of the cell wall evenly decorated with short spines about 2u long, daughter cells retained within the mother cell walls for some time; reproduction by autospores. L 16-20u; W 10-20u. Colony retained within old mother cell wall, 40u in diameter. With some uncertainty, it seems best to include the here described species in Oocystis, subject to revision. Knox: stagnant pond by Riverside Drive east of Knoxville Waterworks 25 July 1949 #1585 - goldfish pond at Knoxville Waterworks 25 July 1949 #1575.

2. Oocystis Borgei Snow. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Cells usually occur several in a group; cells broadly oval in shape, with very slight polar thickenings; 1-4 chloroplasts with one pyrenoid each. L 9-17u; W 9-13u. Jefferson: in rock bottomed, weedy outflow channel of spring near Cherokee Dam 25 June 1949 #908 - Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1420 - Cheatnam: soil bottomed ponds fertilized for fish raising on Little Marrowbone Creek Road 20 Aug. 1949 #1836 - Giles: in stranded pools of muddy creek at Pulaski 29 June 1949 #1153 - Obion: along south shore of Isom Lake 10 July 1949 #1269. VNFK.

3. Oocystis crassa Wittr. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 15, Fig. 4.

Cells usually occur several in a group; shape broadly citriform, elliptic with polar thickenings; as many as eight chloroplasts containing a single pyrenoid each. L 14-26u; W 10-20u. Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Obion: wet overflow around Sprout's Spring near

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1 Reported in Lackey, 1942

Samburg 10 July 1949 #1294. V.

4. <u>Oocystis</u> <u>elliptica</u> W. West. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)

Cells of this species occur several in a group; elongate elliptic in shape, about 2½ times longer than broad; no polar thickenings present; chloroplasts vague, numerous, and probably without pyrenoids. L 21-25u; W 11-15u. Knox: goldfish pool at Knoxville Waterworks 25 July 1949 #1575. NF.

5. <u>Oocystis</u> <u>lacustris</u> Chod. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Cells broadly elliptic; chloroplasts few (generally only 2), with 1 pyrenoid. L 16-28u; W 12-20u. This species is closest in its characters to <u>O</u>. <u>crassa</u>. #1186 seems to be somewhat broader in proportion than usually described for the species. Weakley: plankton from large spring hole about four miles north of Gardner Station 8 July 1949 #1221 - Obion: plankton from slough near Spillway 5 July 1949 #1186. FK.

6. <u>Oocystis</u> <u>parva</u> West & West. (Lemmermann, Brunnthaler & Pascher f)

Cells narrowly elliptic; chloroplasts one to three. L up to 12u; W up to 7u. This species is somewhat like <u>O</u>. <u>elliptica</u>, but the proportions are shorter, the over-all size is smaller, and the ends somewhat more pointed. Knox: pond at Mack's by hwy U.S.11-E about five miles east of Knoxville

18 June 1949 #856 - plankton from stagnant pond by Riverside Drive east of Knoxville Waterworks 25 July 1949 #1588 - Weakley: shallow roadside marsh by hwy Tenn.22 west of Martin 8 July 1949 #1211 - Obion: mud puddle beside Marvin Hayes' fish tank near Samburg 12 July 1949 #1321. K.

7. Oocystis rupestris Kirch. (Lemmermann, Brunnthaler & Pascher f) Pl. 15, Fig. 3.

Cells are not retained for long within the mother cell wall, thus often found solitary; shape elongated elliptic (not too different from O. elliptica). L 13-27u or more; W 6-12u. As understood here, this species is not a plankter as are many Oocystis species, but is found typically in waterfall pools, or where water is dripping over rocks. Sevier: in rock pools at Ramsey Cascade (4150 ft.) 18 July 1939 (Bold)unnumbered[1] - Morgan: wet cliff near Rugby 6 Aug. 1949 (Sharp)#1665.

PLANKTOSPHAERIA G. M. Smith 1918

Planktosphaeria gelatinosa G. M. Smith. (Prescott f)(Smith f) Pl. 15, Fig. 5.

Spherical cells, solitary or somewhat closely arranged in a gelatinous sheath; chloroplasts of the cells are single and cup-shaped when young, and several polygonal ones are present in mature cells. Diameter of cells up to 25u.

Continued observation makes one less sure of this

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1 Reported in Silva, 1949

species, since it has much in common with the *Chlorococcum*-like organisms. The possibility that zoospores may be produced by *Planktosphaeria* has not been explored beyond Smith's original statement of it in 1918.

Anderson: plankton from Norris Lake near Andersonville Dock 30 Aug. 1949 #1869 - Obion: plankton from Reelfoot Lake near Samburg 12 July 1949 #1305 - same, among *Potamogeton* #1311 - R. J. Latimer's big pond near Community Pride Church southeast of Union City 14 July 1949 #1329. K.

POLYEDRIOPSIS Schmidle 1899

Polyedriopsis spinosa Schm. (Prescott f)(Smith f) Pl. 14, Fig. 7.

Cells compressed polyhedral, or pyramidal, four to six-angled, with 4-6 delicate setae at each corner; chloroplast is parietal and contains a single pyrenoid. Cell diameter up to 20u. Setae L 30-40u. Davidson(?): Cumberland River 1938-9.[1]

QUADRIGULA Printz 1915

Quadrigula Chodatii (Tanner-Fullman)G. M. Smith. (Smith 20 f) Pl. 14, Fig. 8.

The cells are elongated-fusiform, tapering to sharp ends, longitudinally oriented within a gelatinous matrix so that the long axes of the cells lie more or less parallel; chloroplasts single, parietal and laterally notched in the

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1 Reported in Lackey, 1942

midregion; containing two pyrenoids. L 30-80u; W 3.5-7u. The plants considered here are the same as described by Smith in that they are straight or slightly curved, rather than the lunate shape described by Tanner-Fullman. It would be well if the type specimen could be re-examined. Hardeman: marshy area by hwy Tenn.18 at Madison County line 15 June 1950 #2247. NFK.

SELENASTRUM Reinsch 1867

All species of this genus have crescent-shaped cells which are clustered in small colonies. One species, S. bifidum Bennett is distinguished by its double-pointed ends, and the others are separated mostly on size. Since size is employed to separate the species, statistical studies would be helpful in deciding whether lines should be drawn between some of them.

1. Cells curved so that tips are 9u or less apart.............. S. minutum (Naeg.)Col.
1. Cell curvature less than above, distance between tips greater.......................... 2
   2. Cell arc 180° or less, breadth at center of cells 2.5u or less.................................... S. Westii G. M. Smith
   2. Cell arc at least 180°, breadth at center of cells over 2.5u.................... 3
3. Breadth of cells at center 4.5u................................. S. gracile Reinsch

3. Breadth of cells 5-8u... _S._ _Bibraianum_ Reinsch

1. _Selenastrum_ _Bibraianum_ Reinsch. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 15, Fig. 6.

Cells crescent-shaped, with pointed poles. L 16-23u; W 5-8u. These cells are thicker than those of _S._ _gracile_. Davidson: quarry hole near Chocolate Shop on Franklin Road 20 Aug. 1949 #1816. N.

2. _Selenastrum_ _gracile_ Reinsch. (Lemmermann, Brunnthaler (_Selenastrum_ _Bibraianum_ v. _gracile_ (Reinsch)Tiff. & Ahl.) & Pascher f)(Prescott f)(Smith f)

Cells crescent-shaped, with pointed poles. L 19-28u; W 4-5u. This species is thinner than _S._ _Bibraianum_. It is being retained as a species since its difference with _S._ _Bibraianum_ is no less than that between _S._ _Westii_ and _S._ _minutum_. Knox: on _Crystotella_ (a bryzoan) on recently exposed shore line of Ft. Loudon Lake near Concord 30 July, 1949 #1590 - Hamilton: pond of rainwater in field depression by hwy Tenn. 58 in northern part of county 28 June 1949 #976 - Middle Tenn.: Duck River 1938-9[1] - Cheatham: soil-bottomed ponds fertilized for fish raising on Little Marrowbone Creek Road 20 Aug. 1949 #1850 - Obion: plankton from Reelfoot Lake at Samburg 12 July 1949 #1305 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1178. VNFK.

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1 Reported in Lackey, 1942

3. Selenastrum minutum (Naeg.)Col. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith)

Cells crescent-shaped, with pointed poles. L 7-9u; W 2-3u. This is the small species of the genus. The cells are said to have less tendency to form aggregations than do the other species. Illustrations of this species are far from consistent in depicting the amount of cell curvature. Knox: in fishpool on Sanford Estate 7 July 1938 (Bold)unnumbered[1] - Colbert(Ala.): Wilson Lake at Town Creek 16 June 1950 #2287. SK.

4. Selenastrum Westii G. M. Smith. (Prescott f)(Smith f)

Cells arcuate, curved only to about half circular, rather than into a horseshoe, as is characteristic of the the other species; poles pointed. L 15-18u; W 1.5-2.5u. Cells of this species are even narrower than those of S. gracile.

Smith, 1920 observes that this species has been confused with Scenedesmus acuminatus (Lag.)Chod. which forms different sorts of colonies. The cells of Scenedesmus are side by side, although on a curved axis, rather than back to back, as is common in this genus. The difference is not always a distinct one, since a strong curvature of the Scenedesmus colonies brings the cells almost back to back, and many aggregations are irregular so that the arrangement is uncer-

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1 Reported in Silva, 1949

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Jefferson: semi-permanent pond east of Cherokee Dam 25 July 1949 #906a - Knox: on Crystotella (a bryozoan) on bank of Ft. Loudon Lake near Concord 30 July 1949 #1490. NK.

TETRAËDRON Kuetzing 1845

The cells in this genus are small polygonal shapes, with either quadrangular or triangular faces, and with or without spines at the angles. They are planktonic and solitary, and contain one or several chloroplasts.

1. Broadest face presented, generally quadrangular in outline.................... 2
1. Broadest face presented, triangular in outline.................................... 5
   2. Angles rounded, smooth; cell outline quadrangular with deeply concave margins... T. minimum (A. Braun)Hansg.
   2. Angles of cells considerably produced to form an H-shaped or cruciate outline.................................. 3
3. Extensions at the angles twice bifurcate, the ultimate branches ending in about three short spines...................
   .... T. gracile (Reinsch)Hansg.
3. Extensions at the angles not doubly bifurcate... 4
   4. Arms at the angles of about body

length. ending in about two short, sharp points, cell outline approximately H-shaped. _T._ _constrictum_ G. M. Smith

4. Arms at the angles shorter and stubbier, cell outline approximately cruciate.... _T._ _pusillum_ (Wall.)West & West

5. Angles of broad side view merely rounded; margins of cell in narrow side view forming a parallelogram 6-10u thick....... _T._ _minimum_ (A. Braun)Hansg.

5. Angles extended, knobbed, spined, or bifurcate.. 6

6. Extensions of the angles bifurcate, ending in about two short, sharp points................. _T._ _limneticum_ Borge

6. Angles without bifurcate extensions............ 7

7. Angles merely rounded or bluntly knobbed, pyramid-shaped or varying to a geometrically solid X.... T. _regulare_ Kuetz.

7. Angles of cells with spines.......................... 8

8. Cells pyramidal, so that any face view is triangular in outline.............. .... _T._ _regulare_ Kuetz.

8. Side view elliptic or oblanceolate......... .... _T._ _trigonum_ (Naeg.)Hansg. and _T._ _trigonum_ v. _gracile_ (Reinsch)DeToni

which has thinner proportions, longer end spines and more definitely concave sides than the species.

1. Tetraëdron constrictum G. M. Smith. (Prescott f)(Smith f)

Most conspicuous characteristic of this species is the H-shaped outline; at angles bearing two or more sharp points at their apices. Cells L 18-25u; W 5-8u; T 8u. Processes L 12-15u. Obion: among floating Potamogeton in Reelfoot Lake at Samburg 12 July 1949 #1311.

2. Tetraëdron gracile (Reinsch)Hansg. (Lemmermann, Brunnthaler & Pascher f)(Prescott f) Pl. 14, Fig. 9.

Cells rectangular and flattened, angles extended into twice branched arms which end in sharp points. Cells L equal to W, 15-30u; T 6-12u. Processes L 10-25u. Lake: pond by hwy Tenn.22 near Kentucky state line 5 July 1949 #1190. NK.

3. Tetraëdron limneticum Borge. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith)

Cells pyramidal, or at least with considerable depth, bifurcate angles terminating in two or more sharp points; face views three or four angled. Diameter up to 85u. Weakley: Mr. Bary's pond by hwy Tenn.22 west of Martin 8 July 1949 #1208.

4. Tetraëdron minimum (A. Braun)Hansg. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Cells are quadrangular or triangular in broad side view, with rounded angles. The narrow side view is more or less elliptic, or, as shown in Lemmermann, Brunnthaler & Pascher, parellelogram-shaped. Diameter of cells 6-10u; T 3-6u. There are three described forms or varieties based on length of spine, form of margin and wall smoothness. Jefferson: permanent farm pond at junction of hwy U.S.11-E and Cherokee Dam approach 25 July 1949 #910 - Knox: on Crystotella (a bryozoan) on shore of Ft. Loudon Lake near Concord 30 July 1949 #1590 - Davidson(?): Cumberland River 1938-9.[1] NK.

5. Tetraëdron pusillum (Wall.)West & West. (Lemmermann, Brunnthaler, & Pascher f)(Prescott f)

Cells in form of a Greek cross in broad side view, with each of the four arms extended into two (or 1-3) short points; side view elliptic, L equal to W, about 25u, thickness about 10u. Jefferson: semi-permanent pond east of Cherokee Dam 25 June 1949 #906a.

6. Tetraëdron regulare Kuetz. (Lemmermann, Brunnthaler, & Pascher f)(Prescott f) Pl. 14, Fig. 10.

Cells rather regular pyramids with considerable variation in the retuseness of the margins, form of angles and wall thickness; angles of the typical form bearing short spines, but there is considerable variation ranging from

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1 Reported in Lackey, 1942

stumps to long simple extensions, and bifurcations. Diameter 14-34u. Some forms are also differentiated by variety or form, and they are being retained under the species name of the typical, although each could as well be described as a distinct form of the typical. Union: pond near entrance road to Scout Camp 25 Aug. 1950 #2338 - Weakley: roadside marsh by hwy Tenn.22 west of Martin 8 July 1949 #1208 (a variant with blunt corners) - Obion: among vegetation in Bayou du Chien near Biological Station 2 July 1949 #1165 - sharper ends than #1208 - plankton from south end of Isom Lake 10 July 1949 #1265-8 - Lake: pond by hwy Tenn.78 near Kentucky state line 5 July 1949 #1190 (a variant which cannot be placed). NFKL.

7. Tetraëdron trigonum (Naeg.)Hansg. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)

These cells are triangular in broad side view with concave or straight sides and a long spine at each angle. Diameter 20-30u. Spines L 5-10u. Weakley: roadside pond by hwy Tenn.22 west of Martin 8 July 1949 #1208. NK.

8. Tetraëdron trigonum v. gracile (Reinsch)DeToni. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Cells somewhat narrower than those of the typical with more concave edges in broad side view, and, in the specimens considered here, with longer spines at the angles; narrow side view in the Tennessee specimens narrowly lanceolate, but is generally described as flattened. Diameter

25-50u; T 6-10u. Weakley: marsh beside hwy U.S.22 8 July 1949 #1211 - Lake: plankton from slough near Tiptonville 5 July 1949 #1187. NK.

TREUBARIA Bernard 1908

Although triangular in outline, cells of this genus are pyramidal. There are three or four strong gelatinous spines at the angles, three or four times the cell diameter in length.

1. Sides of spines sub-parallel, with
   flattened, sword-like apices..................
   .... *T. crassispina* G. M. Smith
1. Sides of spines tapering gradually to
   a point............. *T. tripendiculata* Bernard

1. *Treubaria crassispina* G. M. Smith. (Smith f)

Cells pyramidal; spines at the angles with sub-parallel sides and sword-like points differentiate the species; Diameter (without spines) 12-15u; Spines 3-4 times diameter of the cell. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] N.

2. *Treubaria tripendiculata* Bernard. (Smith f) Pl. 15, Fig. 7.

Cells pyramidal; gradually tapering spines at the angles as opposed to the sword-like ones of *T. crassispina*. Des-

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1 Reported in Lackey, 1942

cribed dimensions of cells are Diameter 6.5-10u. Spines 15-20u. However, the specimens observed were uniformly large, 12u in diameter for the cell proper and 40u including the spines. This is within the size range of T. crassispina. Davidson: Valley Lake near Nashville 20 Aug. 1949 #1814 - Obion: mud puddle near Marvin Hayes' fish tank near Samburg 12 July 1949 #1321 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1186.

TROCHISCIA Kuetzing 1845

Most reports of Trochiscia must be treated with some skepticism, since a number of zygospores and aplanospores of other algae have somewhat similar physical characteristics which could lead to their being identified as Trochiscia, if they are not isolated, and their life cycle followed. Trochiscia is described as solitary, spherical, and unicellular, containing a cup-shaped or massive chloroplast and having a thick, highly ornamented cell wall.

1. Wall ornamentation of stumpy, wart-like projections.......... T. papillosa Kuetz.
1. Wall ornamentation consisting of reticulations enclosing hexagonal areas.......... T. reticularis (Reinsch)Hansg.

1. Trochiscia papillosa Kuetz. (Lemmermann, Brunnthaler & Pascher)

The description given is: "Cells spherical, 8-23(mostly

13-18)u in diameter. Cell wall rather thick, with stumpy wart-like projections covering it". Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

2. Trochiscia reticularis (Reinsch.)Hansg. (Prescott f) (Smith) Pl. 15, Fig. 8.

Cells spherical with thick reticulate wall, the reticulations enclosing hexagonal areas. Diameter to about 40u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

WESTELLA de Wildemann 1897

These plants are to be compared with Dictyosphaerium and other colonial forms with spherical cells surrounded by a gelatinous envelope. The best distinction for the genus is that the cells have a definite tendency to remain together in groups of four, possibly with an old mother cell wall partly surrounding them.

Westella botryoides (W. West)DeWild. (Prescott f)(Smith f) Pl. 15, Fig. 9.

Cells spherical, quadrately grouped (whereas in the other reported American species, W. linearis G. M. Smith, they are in linear series of four); within gelatinous matrix. Diameter 3.5-8u. Knox: plankton sample from Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949 #1882 - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Obion: among roots etc. at edge of Bayou du Chien near Biological Station

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1 Reported in Lackey, 1942

2 July 1949 #1161. NK.

Scenedesmaceae

ACTINASTRUM Lagerheim 1882

The species of this genus are characterized by colonies of 4-16 elongated cells radiating from a common center. The two species comprising this genus differ primarily in the shape or proportion of the cells. The exact definition of the species, however, is confused when the descriptions and illustration of more than one author are considered. Smith (1933) describes A. Hantzschii Lag. as having cells which are twice as broad at the middle as at the ends, whereas A. gracilimum G. M. Smith is less than twice as broad at the ends. The illustrations used by Smith (l.c.) are not very helpful. The figures shown in Lemmermann, Brunnthaler & Pascher for A. Hantzschii are quite different from Smith's, depicting a longer proportioned cell, which tapers gradually to the free or outer pole and more abruptly toward the inner pole. The outer poles is often almost pointed, a character used to differentiate Actinastrum Hantzschii v. fluviatile Schroed. Plainly the two authorities are not dealing with identical cell types under the same name. Although not attempting to clarify the matter, the writer is cognizant that in this study two distinct forms have appeared, the short-celled form with truncated end cells is assigned to A. Hantzschii Lag. and the forms with elongated cells which taper abruptly toward the inner pole and gradually to a somewhat fine point at the outer pole are referred to as *A. gracilimum*, but it should be understood that this is done solely as an expedient.

1. *Actinastrum gracilimum* G. M. Smith. (Prescott f)(Smith f) Pl. 16, Fig. 1.

In the original concept this species contains colonies in which the cells are less than twice as broad at the middle as at the ends. L 14-21u; W 2-3u. The particular cells found in this study tapered unevenly, a gradual taper ending in a point at the free end, and more abruptly tapering to a truncate pole at the adjoined or inner apex. Knox: water cress squeeze from shallow pond at Carter's Mill 2 Aug. 1949 #1617 - Jackson(Ala.): shallow embayments of Guntersville Lake above Scottsboro 19 Aug. 1949 #1791 - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Davidson: Valley Lake near Nashville 20 Aug. 1949 #1814 - Weakley: Dodd's farm pond just north of Martin 8 July 1949 #1257 - Obion: among *Potamogeton* in pond on J. M. Evrett's farm near Glass 8 July 1949 #1255 - among *Potamogeton* in Reelfoot Lake at Samburg 12 July 1949 #1311. K.

2. *Actinastrum Hantzschii* Lag. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 16, Fig. 2.

The cells of this species are distinguished by being

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1 Reported in Lackey, 1942

twice as broad in the center as at the ends, ends quite truncate. L 10-26u; W 3-6u. Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Cheatham: pond beside hwy Tenn.49 about three miles northeast of Ashland City 20 Aug. 1949 #1848. K.

CRUCIGENIA Morren 1830

Both this genus and Tetrastrum are characterized by the grouping of four cells into a flat quadrately-arranged coenobe. Crucigenia is said to have more of a tendency to form extended compound coenobes, than does Tetrastrum.

1. Hemispherical cells arranged about a square central space, with their straight faces inward... C. Lauterbornii Schm.
1. Cells unequally broad cuneate-shaped bounding only a small diamond-shaped center space.................................... 2
    2. V-shaped notch present at poles of longer axis of colony, apexes of cells bounding axial notch pointed or nipple-ended.. C. apiculata (Lemm.)Schm.
    2. Colonies without V-shaped notch at poles of longer colony axis, outer cell angles evenly rounded.................
    .... C. quadrata Morren

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1 Reported in Lackey, 1942

1. Crucigenia apiculata (Lemm.)Schm. (Prescott f)(Smith)
(Tetrastrum apiculata (Lemm.)Schm.)
Pl. 16, Fig. 4.

Four quadrately arranged cells, outline of cells approximately ninety degree sectors, mutually compressed on their inner surfaces, with a small diamond-shaped space in the center of the colony, outer cell faces rounded; short sharp projections on cell angles at ends of the longer, and possibly the shorter axis of the colony. Cells L 5-10u; W 3-7u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

2. Crucigenia Lauterbornii Schm. (Prescott f)(Smith 20 f)
Pl. 16, Fig. 5.

Cells hemispherical with their flat faces apposed so as to form a quadrate colony with a large square space in the center. Cells L 8-15u; W 4.5u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

3. Crucigenia quadrata Morren. (Lemmermann, Brunnthaler & Pascher f)(Smith f)

Cells approximately ninety degree sectors flattened by mutual compression on their inner surface and rounded on their outer; no appendages or projections on the outer free walls. Cells L 3-7u; W 2.5-6u. Knox: Chilowee Park Lake (pH 7.0 26°C) 18 June 1949 #830 - culture at collector's home 17 Sept. 1949 #1898. K.

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1 Reported in Lackey, 1942

4. Crucigenia tetras (?) No trace of the author or application of this name has been discovered yet. It is suggested that possibly Pediastrum tetras (Ehr.)Ralfs is the name intended for this record. Davidson(?): Cumberland River 1938-9.[1]

ERRERELLA Conrad 1913

Errerella Bornheimiensis Conrad. (Lemmermann, Brunnthaler & Pascher f)(Smith f) Pl. 15, Fig. 10.

The colonies of this species are quite distinctive in that they are composed of compounded pyramids each of which is made up of spherical cells arranged by fours in small simple pyramids. Cells having single, very long setae on their outer faces. Diameter of Tennessee cells about 5u. Setae L 40u. Lemmermann, Brunnthaler & Pascher give slightly larger measurements. Diameter of cells 6-7u. Setae 50-90u. Obion: plankton from Reelfoot Lake at Samburg 12 July 1949 #1305. K.

MICRACTINIUM Fresenius 1858

Micractinium pusillum Fres. (Prescott f)(Smith f) Pl. 15, Fig. 11.

Cells spherical, with one or more very large setae protruding from surface, clinging together in pyramidal colonies. Diameter of cells 3-7u. Setae L 20-35u. This species has much in common with Errerella Bornheimiensis Conrad, from

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1 Reported in Lackey, 1942

which it is distinguished by its lack of a definitely formed, pyramidal colonial structure and by the frequent presence of two or more setae on each cell instead of a single one.
Knox: pond at Mack's by hwy U.S.11-E about five miles east of Knoxville 18 June 1949 #857b - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Obion: among floating mass in Bayou du Chien near Biological Station 2 July 1949 #1146 - plankton from Reelfoot Lake at Samburg 12 July 1949 #1305 - Lake: slough beside hwy Tenn.78 near Kentucky state line 5 July 1949 #1192. NK.

SCENEDESMUS Meyen 1829

This genus contains a large number of frequently encountered species, some of which show considerable variability. It is also a much-studied genus with many carefully described species.

The coenobe of *Scenedesmus* is a flat or curved plate of elongated cells placed side by side with their long axes parallel. Sometimes two series of cells are found, with the cells of the two series end to end or else alternating. In certain cases, such as *S. acuminatus* (Lag.)Chod. the plate colony is so curved that it is difficult to recognize that the cells are side by side.

1. Cell walls plain and smooth without
   ridges, teeth or spines on surface................. 2

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1 Reported in Lackey, 1942

1. Cell walls not plain and smooth.................... 8

2. Cells oval or cylindric-oval in shape........... 3

2. Cells elliptic, elongated elliptic, or lunate in shape............................. 6

3. Colony flat, cells in one row................. .... *S. bijuga* (Turp.)Lag. .... for varieties see..... 4

3. Colony axis an arc, cells in one or in two rows....................................... 5

4. Cells alternating with one another to form two rows rather than in a single row as is found in the typical,. *S. bijuga* v. *alternans* (Reinsch)Borge

4. Cells in an extremely long series, (8-16 cells) in a twisted or spiral plane......... *S. bijuga* v. *flexuosus* Lemm.

5. Colony containing single series of cells...................... *S. arcuatus* Lemm.

5. Colony containing double series of cells.. *S. arcuatus* v. *platydiscus* G. M. Smith

6. Plane of colony curved or twisted, cells elongated lunate in shape........... .... *S. acuminatus* (Lag.)Chod.

6. Plane of colony straight, colony flat....................................... 7

7. Cells either straight, or with outer

cells curved, the convex margins toward the inner straight cells, tips of cells considerably extended, longer than the body of the cell....................
.... S. dimorphus (Turp.)Kuetz.

7. Cells straight or curved as above, but somewhat shorter proportioned, with only acute rather than acuminate tips, the tips shorter than the body of the cell........ S. obliquus (Turp.)Kuetz.

8. Cells oval or cylindric-oval in outline.................................... 9

8. Cells elliptic in outline...................... 19

9. Apex of each cell with one to three short, sharp spines or teeth....................... 10

9. Apices without teeth, if spines, then spines are as long as cell width................. 11

10. Axis as seen in end view of cells wavey............... S. denticulatus Lag.

10. Axis as seen from cell ends straight.....
...... S. denticulatus v. linearis Hansg.

11. Poles of outer cells with a single spine...................................... 12

11. Spines located at poles, and elsewhere on walls..................................... 16

12. Two or more longitudinal ridges

present along inner surface of
cells, often visible only at ends
or rather obscurely along entire
length..... _S._ _armatus_ (Chod.)G. M. Smith

12. No ridges present, cells L 18-
23u.......... _S._ _quadricauda_ (Turp.)Bréb.
.... for varieties see..... 13

13. Cells longer, 27-36u or more.................
.... _S._ _quadricauda_ v. _maxima_ West & West

13. Cells smaller, less than 25u long.................. 14

14. Cells cylindric-oval, proportions
longer than typical, length over
three times width........................
.... _S._ _quadricauda_ v. _Westii_ G. M. Smith

14. Cells oval, less than three times
longer than broad............................. 15

15. Spines comparatively longer than in
other variants, being about equal to
the length of the cells...... _S._ _quadricauda_
v. _longispina_ (Chod.)G. M. Smith

15. Spines comparatively shorter than in
other variants, being half the usual
cell length or less........... _S._ _quadricauda_
v. _quadrispina_ (Chod.)G. M. Smith

16. Interpolar spines present on end
cells, polar spines present on

end cells, polar spines present
on interior cells........................
.... *S. abundans* (Kirch.)Chod.
.... for varieties see..... 17

16\. Interpolar spines not present
on end cells.............................. 18

17\. Cells roundly oval, spines short,
about cell width in length or less,
cells possibly shorter (5-8u) than
those of both the typical (7-12u)
and the variety *longicaudatus* (8-
11u) *S. abundans* v. *brevicaudatus* G. M. Smith

17\. Cells oval, apical spines about
equal to the cell in length (7-
9u). *S. abundans* v. *longicaudatus* G. M. Smith

18\. Linear series of two to eight
cells in colony, any of which
may exhibit one or two spines
at either end or lack them..............
.... *S. longus* Meyen

18\. Interior cells of colony gener-
ally with a spine only at one
end. *S. longus* v. *Naegelii* (Bréb.)G. M. Smith

19\. End cells with long polar spines,
cells lacking longitudinal ridges...........
.... *S. opoliensis* Richt.

19. End cells without spines, all cells with longitudinal ridges........................ .... *S. acutiformis* Schroed.

1. *Scenedesmus abundans* (Kirch.)Chod. (Prescott f)(Smith f) Pl. 16, Fig. 8.

Flat colony of oblong cells with bluntly rounded poles, any of which may bear one or more spines equal to or shorter than the cell in length. L 7-12u; W 4-7u. Knox: culture in Univ. Tenn. botanical laboratory 1 Aug. 1949 #1604 - marshy pool by hwy U.S.25-W just north of Knoxville 15 March 1950 #2047 - Colbert(Ala.): Stenson Hollow, an embayment of Wilson Lake 16 June 1950 #2279 - Obion: in *Nelumbo* area of Reelfoot Lake at Samburg 12 July 1949 #1306 - Lake: plankton from trough at west side of Blue Basin 2 July 1949 #1150. NK.

2. *Scenedesmus abundans* v. *brevicaudatus* G. M. Smith (Smith 20 f)

Differentiated from the typical by more oval-shaped cells and short spines. The smaller recorded size may be a valid character too. Cell size is generally given as L 5-8u; W 2.5-5u. Spines 1.5-3.5u long. Specimens observed, however, were a micron or two larger in both dimensions. Lauderdale(Ala.): pool near cypress creek at Florence 3 Oct. 1949 (Hall)#1962 - Obion: among floating *Potamogeton* in Reelfoot Lake at Samburg 12 July 1949 #1311. K.

3. Scenedesmus abundans v. longicaudatus G. M. Smith. (Prescott f)(Smith 20 f)

Smaller than the typical, with the spines longer in proportion. Cells L 7-9u; W 3-6u. Spines 6-10u. K.

4. Scenedesmus acuminatus (Lag.)Chod. (Lemmermann, Brunnthaler & Pascher f) Pl. 16, Fig. 7.

Cells lunate with long extended poles tapered to a fine point; the axis of the coenobe is so strongly curved that the cells seem to be bunched. L (between cell tips) 30-40u; W 3-7u. This species departs furthest from the strict definition of the genus. Selenastrum Westii G. M. Smith should be compared. Greene: Nolichucky Dam, probably in lake behind dam 25 June 1949 #977 - Jefferson: permanent pond near junction of hwy U.S.11-E and approach road to Cherokee Dam 25 June 1949 #910 - Knox: on Crystotella (a bryozoan) on shore of Ft. Loudon Lake near Concord 30 July 1949 #1590. NFK.

5. Scenedesmus acutiformis Schroed. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith 20 f) Pl. 16, Fig. 9.

Cells fusiform, with a median longitudinal ridge extending from one pole to the other. Only one median ridge on each cell can be seen in face view, but the end cells may have more than two ridges; colonies flat. L 16-20u; W 5-8u. Knox: marsh beside hwy U.S.25-W just north of Knoxville 15 March 1950 #2047. FK.

6. Scenedesmus arcuatus Lemm. (Lemmermann, Brunnthaler &

Pašcher f)(Prescott f)(Smith 20 f) Pl. 16, Fig. 15.

Cells oblong or elliptic-oblong with bluntly rounded ends; colonies having one or two series of cells in the plate, which may be bent so far as to form a semicircle. L 9-17u; W 3-9u.

As originally described, the species has two series of cells, but curved colonies with but one series do exist, and these presumably belong here rather than with S. bijugatus (Turp.)Lag. It may be noted that the occurrence of the double series is not considered of specific value in the case of the fusiform species, S. obliquus (Turp.)Kuetz. for instance.

Knox: on Crystotella (a bryozoan) on shore of Ft. Loudon Lake near Concord 30 July 1949 #1590. VK.

7. Scenedesmus arcuatus v. platydiscus G. M. Smith. (Prescott f)(Smith 20 f) Pl. 16, Fig. 14.

This variety is distinguished from the typical by its flat rather than curved colonies with two series of cells. Cells L 8-17u; W 4.5-7.5u. Knox: on Crystotella (a bryozoan) on bank of Ft. Loudon Lake near Concord 30 July 1949 #1590. K.

8. Scenedesmus armatus (Chod.)G. M. Smith (Prescott f) (Smith f)

Cells oblong-elliptic with bluntly rounded poles, cells may alternate in position slightly in the flat colony; end cells bear a long seta at each pole; all cells may show longitudinal ridges of the same nature as those of the spineless S. acutiformis but they may be altogether indistinct or visible only at the poles. L 16-22u; W 5-8u. Blount: pond near Charlie Meyers' house in Cades Cove 19 June 1949 #877 - Jefferson: permanent farm pond near junction of hwy U.S.11-E and Cherokee Dam approach road 25 June 1949 #910 - Knox: plankton from Chilowee Park Lake (pH 7.0 26°C) 18 June 1949 #830 - on Crystotella (a bryozoan) on recently exposed shore of Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949 #1881 - Hamilton: winter pond of long duration in field depression by hwy Tenn.58 in northern part of county 28 June 1949 #977 - Putnam: stranded pools of Caney Fork at hwy U.S.70-N bridge 14 June 1949 #821 - Davidson: concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1825 (a very large variant) - fish pool by greenhouse on Vanderbilt University campus 17 March 1950 #2060 - Montgomery: pond at Tom Edwards' store by hwy U.S.79 west of Clarksville 14 July 1949 #1371 - Obion: near south shore of Isom Lake 10 July 1949 #1268. NSK.

9. Scenedesmus bijuga (Turp.)Lag. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Cells oblong-elliptic with no appendages or protrusions, arranged as a flat plate in a single series; cell size is given as L 7-18u; W 4-7u; but the variability exceeds these figures. This is the commonest and most characterless species of the genus. Lumpkin(Ga.): artificial lake in Vogel State

Park 14 Aug. 1949 #1735 - Knox: in goldfish pool at Knoxville Waterworks 25 July 1949 #1575 - on Crystotella (a bryozoan) on shore of Ft. Loudon Lake at Concord 30 July 1949 #1590 - around tree roots in pond by Ten Mile Creek at Farragut 23 July 1949 #1545 - Overton: pond containing considerable number of aquatic plants at Timothy 15 July 1949 #1456 - Lauderdale(Ala.): pool near Cypress Creek at Florence 30 Oct. 1949 (Hall)#1962 - Colbert(Ala.): shallow embayment of Wilson Lake near dam 16 June 1949 #2285 (colonies composed of 8 cells) - Montgomery: pond at Tom Edwards' store by hwy U.S. 79 west of Clarksville 14 July 1949 #1371 - Gibson - Obion: middle pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1240. VNSGFK.

10. Scenedesmus bijuga v. alternans (Reinsch)Borge. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith 20 f)

This variety differs from the typical by the decidedly alternate arrangement of the cells, usually eight in number. L 6-15u; W 4-8u. Colbert - Lauderdale(Ala.): coating on concrete below Wilson Dam 4 Sept. 1949 (Hall)#1947. NK.

11. Scenedesmus bijuga v. flexuosus Lemm. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)

The colonies of this variety are in a single series and are somewhat longer (8-16 cells) than in most of the other variations of the species; cells themselves similar to the typical but the axis of the colony is twisted or sigmoid in a manner quite different from the flat colonies of the typical and its other varieties. L 12-17u; W 5-8u. Knox: on Crystotella (a bryozoan) on shore of Ft. Loudon Lake near Concord 30 July 1949 #1590 - Colbert(Ala.): embayment of Wilson Lake near dam 15 June 1949 #2285.

12. Scenedesmus denticulatus Lag. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith 20 f) Pl. 16, Fig. 10.

Cells oval-shaped, with 1-3 short teeth at the apices of each cell; colony irregularly aligned when seen in end view. L 7-15u; W 5-11u. The cells may become somewhat swollen, angular, and peculiarly shaped however, as may those of S. obliquus (Turp.)Kuetz. etc. Knox: on Crystotella (a bryozoan) on bank of Ft. Loudon Lake near Concord 30 July #1590 - Wilson: creek running over shelving limestone of Nashville basin eight miles west of Lebanon 14 July 1949 #1417. K.

13. Scenedesmus denticulatus v. linearis Hansg. Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

The variety is distinguished from the typical only in having the cells always in a flat plane, as shown in end view. L 10-15u; W 2.5-5u. The distinction seems to be a weak one, but may have been established by pure culture studies. Jefferson: permanent pond at junction of hwy U.S. 11-E and Cherokee Dam approach road 25 June 1949 #910.

14. Scenedesmus dimorphus (Turp.)Kuetz. (Prescott f)(Smith) Pl. 16, Fig. 11.

Cells fusiform with long attenuated poles, without spines or ridges; colony flat. L 18-23u; W 2.5-5u.

The description of varieties is not at all on the same basis as that used in other species, such as S. bijugus. The following structural varieties are met among a large number of specimens:

Typical expression - center cells straight or curved slightly outward, outer cells curved considerably outward, even lunate or sickle-shaped.

Orthocellular variety - all cells with straight axis, all four cells in a single series.

Diorthocellular form - four cells arranged in two series with cells alternating.

The difference between this species and S. obliquus (Turp.)Kuetz. is not convincing. Illustrations show considerable differences between the two which are not apparent in the actual specimens. If the name S. dimorphus is reserved only for the forms with long proportions with rather long attenuated poles, the situation is clarified somewhat. It must be remembered, however, that S. dimorphus may have all its cells entirely straight, and S. obliquus may be just as dimorphic as the other species ever is.

Knox: on Crystotella (a bryozoan) on recently exposed shore of Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949 #1881 - Campbell: Cove Lake at junction of hwys U.S.25-W and Tenn. 63 13 June 1950 #2229 - Hamilton: winter pond of long duration in field by hwy. Tenn.58 in northern part of county 28

June 1949 #977 - Davidson: concrete pools of Kelly's Kennels near Nashville 20 Aug. 1949 #1825 - Cheatham: soil-bottomed ponds fertilized for fish raising on Little Marrowbone Creek Road 20 Aug. 1949 #1838 - Lauderdale(Ala.): pool near Cypress Creek at Florence 3 Oct. 1949 (Hall)#1962 - Montgomery: stock pond at junction of hwy U.S.79 and Foster's Creek Road west of Clarksville 18 March 1950 #2079 - Obion: among grass in shallow area of Isom Lake 10 July 1949 #1266 - Lake: plankton from trough on west side of Blue Basin 2 July 1949 #1150. NFK.

15. Scenedesmus longus Meyen. (Prescott f)(Smith 20 f)

Cells oval-shaped, in single series of 2-8 cells, any of which may show one or two spines on either end or may be without them. Cells L 8-11u; W 4-5u. FK.

16. Scenedesmus longus v. Naegelii (Bréb.)G. M. Smith. (Prescott f)(Smith 20 f)

Cells of this variety are generally in colonies of eight, the outer cells with spines at both poles and the inner cells with a spine at only one pole. Cells L 18-33u; W 6.5-11u. Knox: plankton from Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949 #1882 - Hamilton: winter pond of long duration in field by hwy Tenn.58 in northern part of county 28 June 1949 #977.

17. Scenedesmus obliquus (Turp.)Kuetz. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 16, Fig. 12.

Cells fusiform, generally shorter in proportion than those of S. obliquus, with more abruptly tapering ends. Outer cells of a colony of four straight or curve outward. L 10-21u; W 3-9u.

In this species, as in S. dimorphus, if indeed there really are two species, the different expressions have not been segregated as described varieties or forms. Among the expressions are:

Orthocellular form - the typical and usually figured type, with straight or slightly crescent-shaped outer cells.

Dimorphic variety - intergrades from the above to colonies with sharply curved outer cells.

Duodimorphic form - like the above, but in two series with the cells alternating.

Orthoalternate variety - four cells alternating.

From the accumulation of field observations it seems likely that variation occurs in combinations of:

a. straight or dimorphic cells (outside cells outwardly curved)

b. single or double series of cells

c. straight or irregularly alternate arrangement of cells.

Pure culture studies might result in other conclusions.

The discussion referring to this species under S. dimorphus should be noted.

Knox: on Crystotella (a bryozoan) on shore of Ft. Loudon Lake near Concord 30 July 1949 #1590 - on Crystotella on shore of Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949

#1882 - culture in Univ. Tenn. botanical laboratory 2 Aug. 1949 #1604 - Lauderdale(Ala.): pool by Cypress Creek at Florence 3 Oct. 1949 (Hall)#1962 - Colbert(Ala.): Stenson Hollow embayment of Wilson Lake 16 June 1950 #2279 - Montgomery: plankton from pond at Tom Edwards' store by hwy U.S. 79 west of Clarksville 14 July 1949 #1371 - woods swamp by hwy Tenn.11 very near Kentucky state line 18 March 1950 #2099 - Lake: plankton from trough at west side of Blue Basin 2 July 1949 #1150. NSGFK.

18. Scenedesmus opoliensis Richt. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 16, Fig. 13.

Cells fusiform with a long spine at either end of the outside cells of the colony (generally four-celled). Cells L 12-28u; W 5-8u. Occasionally, as in #1257, there may be an extra spine on the end cells. The combination of spines and fusiform cells identifies the species immediately. Blount: plankton from pond nearest Charlie Meyers' house in Cades Cove 19 June 1949 #877 - Knox: on Crystotella (a bryozoan) on shore of Ft. Loudon Lake near Concord 30 July 1949 #1590 - Montgomery: spring pond in Spring Creek bottom pasture ten miles northeast of Clarksville 1 Sept. 1949 (Clebsch)#1925 - Obion: plankton taken at Spillway bridge 10 July 1949 #1262. NK.

19. Scenedesmus quadricauda (Turp.)Bréb. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Cells oblong or oval with broadly rounded poles; flat plate colonies of four cells; outside cells have one spine at each pole. Cells L 11-16u; W 3.5-6u. Spines L 10-12u.

Knox: on Crystotella (a bryozoan) on shore of Ft. Loudon Lake near Concord 30 July 1949 #1590 - on Crystotella on recently exposed shore of Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949 #1881 - Campbell: Cove Lake at junction of hwys U.S.25-W and Tenn.63 13 June 1950 #2229 - Cheatham: soil-bottomed fish raising ponds on Little Marrowbone Creek Road 20 Aug. 1949 #1842 - Obion: Reelfoot Lake 1929[1] - There were numerous other collections which were not recorded, since the species is most common and almost universally distributed. VNFK.

20. Scenedesmus quadricauda v. longispina (Chod.)G. M. Smith. (Prescott f)(Smith f)

This variety is distinguished from the typical by the length of the spines, which are as long as the cell, whereas those of the typical are about 2/3 of the cell in length and those of v. quadrispina (Chod.)G. M. Smith are 1/2 the cell length, or less. Cells L 8-11u; W 3.5-5u. Blount: plankton from pond nearest Charlie Meyers' house in Cades Cove 19 June 1949 #877 - Davidson: concrete pools at Kelly's Kennels 20 Aug. 1949 - fish pool by Vanderbilt University greenhouse 17 March 1950 #2060 - Weakley: pond at Ore Springs by hwy Tenn.54 east of Dresden 14 June 1950 #2244. K.

21. Scenedesmus quadricauda v. maxima West & West. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)

These cells are king-sized replicas of those of the species. The Pascher handbook treatment includes it within the

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1 Reported in Eddy, 1930

variation of the typical, but American practice recognizes it as a separate entity. Statistical analysis of many measurements might settle the question. Cells L 27-36u; W 9-11.5u. Spines 12-16u. Davidson: concrete pools at Kelly's Kennels 20 Aug. 1949 #1824 - Cheatham: soil-bottomed fish raising ponds on Little Marrowbone Creek Road 20 Aug. 1949 #1838. N.

22. Scenedesmus quadricauda v. quadrispina (Chod.)G. M. Smith. (Prescott f)(Smith f)

Length of spines are about half that of the cell, or less, being shorter than those of the other varieties of the species. Cells L 8.5-15u; W 3.5-8u. Knox: pond at Mack's by hwy U.S.11-E about five miles east of Knoxville 18 June 1949 #906a - goldfish pool at Knoxville Waterworks 25 July 1949 #1575. FK.

23. Scenedesmus quadricauda v. Westii G. M. Smith. (Prescott f)(Smith 20 f)

These cells differ from those of the typical plants in proportion, being somewhat narrower, spines very slender and strongly recurved. Cells L 16-22u; W 4.5-8u. Blount: plankton from pond nearest Charlie Meyers' house in Cades Cove 19 June 1949 #877. N.

TETRALLANTOS Teiling 1916

Tetrallantos Lagerheimii Teil. (Prescott f)(Smith f) Pl. 16, Fig. 3.

Cells arcuate, the diagnostic character being the peculiar orientation of the cells; two lie in the same plane with their tips apposed and their concave side outward, the other two in the group of four are perpendicular to the apposed cells with one end touching the two apposed cells at their junctions; a broad gelatinous sheath surrounding the four-celled colony, which may be compounded to form a colony of eight or sixteen cells, the daughter colonies remaining attached to each other by remains of the old mother cell wall. Cells L (tip to tip) 6.8u; W 2u. Even if the colonial arrangement as described above is not strictly kept, the tendency of the cells to touch ends and appose concave sides are good characters to aid identification. The tiny cells of this species resemble link sausages, and certain small colonies of Selenastrum minutum (Naeg.)Col. or Kirchneriella spp. The surrounding gelatinous sheath of this genus may help distinguish it from the former. Knox: on Crystotella (a bryozoan) on recently exposed shore of Ft. Loudon Lake near Duncan's Dock 3 Sept. 1949 #1881 - Union: pond by Boy Scout Camp approach road 25 Aug. 1950 #2338 - Davidson(?): Cumberland River 1938-9[1] - Montgomery: large marsh by Norfleet & Sons grocery by hwy U.S.79 west of Clarksville 14 July 1949 #1376 - Obion: Nelumbo area in Reelfoot Lake near Samburg 12 July 1949 #1306. NF.

TETRASTRUM Chodat 1895

The cells of this genus exhibit the same quadrate arrangement found in Crucigenia, but the two differ in that Tetrastrum rarely exhibits compound colonies. In addition,

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1 Reported in Lackey, 1942

all of the species of Tetrastrum considered here only, have setae, whereas those of Crucigenia listed here lack them.

1. Two unequally long spines on outer surface of cells.................................
.... *T. heterocanthum* (Nordst.)Chod.
1. Five rather short, equal spines on outer surface of cells..........................
.... *T. staurogeniaeforme* (Schroed.)Lemm.

1. *Tetrastrum heterocanthum* (Nordst.)Chod. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f)

Colonies of four quadrately arranged cells; cells are flat on their inner surface and straight or emarginate on the outer; two setae differing greatly in length present on each cell. Diameter of cells 4-8u. Middle Tenn.: Duck River 1938-9.[1]

2. *Tetrastrum staurogeniaeforme* (Schroed.)Lemm. (Lemmermann, Brunnthaler & Pascher f)(Prescott f)(Smith f) Pl. 16, Fig. 6.

Colonies of four quadrately arranged cells; cells flat on inner surface, and convex on the outer; five rather short setae of about equal length present. Diameter of cells 5-6u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] NF.

Oedogoniales

Oedogoniaceae

BULBOCHAETE Agardh 1817

Although twenty-eight species of the genus have been reported previously from southeastern United States, the fortunes of collecting failed to being forth a single specimen in reproductive condition proper for identification during this study. Pl. 17, Fig. 1.

Tiffany, 1937 & 1944 are the best references for the species likely to be encountered in the region surveyed.

OEDOGONIUM Link 1820

Oedogonium is filamentous, attached (at least when young) by a basal hold-fast cell. The plants attain indefinite length by repeated division of all cells but the basal one. The cells are of various lengths and the sides may be parallel, (or nearly so), undulate, nodose, or capitellate. They contain a reticulate, cylindrical chloroplast. An excellent vegetative character which often can be used for identification of the genus is the presence of overlapping collars or caps of old cell wall around the forward end of some of the cells. The reproductive characters, which are common to members of the order, are unique. Certain cells, often enlarged ones, act as oogonia, and come to contain a single large egg. Antherozoids, with a ring of cilia-like flagella round one end, are produced in antheridia. The antheridia may be located in the same filament with the oogonia, and are recognizable as a series of very short cells. In such case the species are said to be monoecious. In other cases, antheridia are found in filaments separate from, but more or less similar to the one bearing the oogonia, in this case the species is dioecious and macrandrous. Otherwise, the filament which bears the antheridia may be a very short one which is epiphytic upon the female filament, often quite near or upon the oogonia (nannandrous spp.). Sometimes these dwarf males are epiphytic on the cells subtending the mature oogonia, special cells, sometimes inflated, and referred to as suffultory cells. The antherozoid enters the oogonium through either a pore or split in the wall, in the latter case the oogonia are said to have lids. The zygotes resulting from the fertilization of the eggs develop into oospores, the walls of which may be smooth or variously ornamented. One additional morphological character is helpful in making species identification, in the case of dioecious species. Motile, multiciliate androspores are produced in androsporangia, which are recognized as short cells within the filaments. Androsporangia may occur in the same filaments with the oogonia (gynandrosporus) or in separate filaments (idioandrosporous). The androspores develop into male filaments.

This genus is exceeded only by <u>Spirogyra</u> among filamentous algae in frequency of occurrence and abundance of plant growth found in the region of study. It far exceeds <u>Spirogyra</u> in number of species listed here because fruiting material is more frequently found and hence easier to identify. Furthermore, <u>Oedogonium</u> can be grown easily in the laboratory, and induced to fruit so that many sterile specimens eventually can be identified, whereas <u>Spirogyra</u> species are much more difficult to grow to a reproductive and identifiable state.

<u>Oedogonium</u> is such a large genus that a satisfactory appraisal of it in Tennessee would be a full time task. Fortunately, the monographs of Tiffany, (1930, 1937), provide a ready reference for species identification, but, even they may not provide all the information needed for study of a localized flora, and the observant microscopist will encounter many variants not included in the descriptions.

The starred species below are included in the key but not in the text because although they frequently have been reported in southeastern United States, they have not appeared in the Tennessee collections.

1. Vegetative cells subhexagonal or subelliptic in shape............ <u>O</u>. <u>Reinschii</u> Roy*
1. Vegetative cells cylindrical, undulate, or capitellate................................ 2
    2. Vegetative cells undulate or nodulose.......... <u>O</u>. <u>undulatum</u> (Bréb.)A. Braun*
    2. Vegetative cells not undulate or nodulose...................................... 3
3. Vegetative cells distinctly capitellate............ 4
3. Vegetative cells cylindrical........................ 8

4. Monoecious plants, vegetative cells 6-9u broad.. O. capitellatum Wittr.*

4. Dioecious plant, cells 9u or broader.................................... 5

5. Female vegetative cells 9-12u, oogonia 29-33u................ O. Howardii G. S. West*

5. Female vegetative cells variable in diameter, oogonia over 25u broad................... 6

6. Oospore oval to globose............. .... O. latiusculum Tiff.*

6. Oospore depressed globose...................... 7

7. Gynandrosporous, oogonia 34-39u x 36-40u................ O. Areschougii Wittr.*

7. Idioandrosporous, oogonia 29-36u x 26-40u.................. O. subplenum Tiff.

8. Vegetative cells, at least of female plants, 6u or less broad............... 9

8. Vegetative cells, at least of female plants, over 5u broad (if 5-6u follow both dichotomies)................ 11

9. Oospore constricted in the midregion......... O. pusillum Kirch.

9. Oospore not constricted at the equator........... 10

10. Oospore globose......................... .... O. sphaerico-inconspicuum Silva

10. Oospore depressed globose................

.... *O. inconspicuum* Hirn.

11. Oogonium opening with a pore.................... 12

11. Oogonium opening with a lid..................... 43

    12. Pore median..................................... 13

    12. Pore above or below median...................... 24

13. Spore wall smooth................................ 14

13. Spore wall decorated in some manner.............. 20

    14. Oospore sexangular-elliptic..............

    .... *O. sexangulare* Cleve

    14. Oospore not sexangular.......................... 15

15. Plants monoecious (as indicated by antheridia in same filament with oogonia).. 16

15. Plants dioecious (as implied by lack of antheridia in same filament with oogonia).. 17

    16. Diameter of oogonia 32-38u..............

    .... *O. laeve* Wittr.

    16. Diameter of oogonia 18-26u..............

    .... *O. vulgare* (Wittr.)Tiff.

17. Oogonium diameter 22-30u, vegetative cells 8-10u.............. *O. rufescens* Wittr.*

17. Oogonium over 30u broad, vegetative cells of various diameters...................... 18

    18. Oogonia 49-52u broad.................

    .... *O. flavescens* (Hass.)Wittr.

18. Oogonia 30-39u broad........................ 19

19. Plants with dwarf males, oospore not filling oogonium, vegetative cells 13-15u broad............... *O. Braunii* Kuetz.*

19. Male filaments large, oospore filling oogonium, vegetative cells 9-16u............ .... *O. sociale* Wittr.*

20. Oospore wall spiney........................... 21

20. Oospore wall spirally ribbed, oogonium 50-60u in diameter.............. .... *O. illinoisensis* Trans.*

21. Vegetative cells 17-30u broad................... 22

21. Vegetative cells under 17u broad.................. 23

22. Oogonia diameter 36-38u................. .... *O. subglobosum* (Wittr.)Tiff.

22. Oogonia diameter 38-50u *O. hystrix* Wittr.*

23. Vegetative cells 9-14u, male plants large.................... *O. suecicum* Wittr.*

23. Vegetative cells 12-16u broad, male plants dwarf................. *O. pungens* Hirn

24. Pore above center (supramedian) but usually not near top of oogonia........... 25

24. Pore superior, near top of oogonia............ 28

25. Vegetative cells 7-12u broad................. .... *O. Franklinianum* Wittr.

25. Vegetative cells over 12u broad.................. 26

26. Usually monoecious, pore varying to superior, cell width 12-16u................................ *O. varians* Wittr. & Lund

26. Always dioecious, pore consistently supramedian in position for a single filament, female vegetative cell 16u wide or over.................................... 27

27. Female vegetative cell 18-30u, oogonia 48-70u broad...... *O. cardiacum* (Hass.)Wittr.

27. Female vegetative cell 16-28u in diameter, oogonium 30-45u broad.. *O. Lemmermannii* Tiff.

28. Oospore wall smooth.............................. 29

28. Oospore wall ornamented in some manner.................................... 37

29. Vegetative cell 15-23u broad, dwarf male plants present; suffultory cell enlarged, spores approaching a quadrate shape..... *O. Borisianum* (LeClerc)Wittr.*

29. Oogonia without swollen suffultory cells, spores not at all quadrate.................. 30

30. Vegetative cells mostly less than 20u broad.................................... 31

30. Vegetative cells mostly over 20u broad.................................... 36

31. Vegetative cells 10-15u broad, oospore

subovoid to subglobose, dwarf male
plants present........... O. multisporum Wood

31. No dwarf male present.............................. 32

32. Diameter of oogonia generally
36u or smaller.............................. 33

32. Diameter of oogonia over 36u.................. 35

33. Vegetative cells 15-18u broad................
.... O. intermedium Wittr.

33. Vegetative cells 14u or less in
diameter.. 34

34. Oogonia and oospore obovoid,
oogonia diameter 28-31u.. O. Hirnii Gutw.

34. Oogonia and oospore globose,
oogonia diameter 30-37u..................
.... O. globosum Nordst.

35. Oospore diameter 42-47u, cells within
the filament differing greatly in
size.................. O. upsaliense Wittr.

35. Oospore diameter 35-43u, cells within
the filament of about the same size..........
.... O. Richterianum Lemm.

36. Vegetative filaments over 40u
broad....................................... 37

36. Vegetative filaments less than
40u broad.................................. 38

37. Oospore subglobose or elliptic in

shape.................... *O. Kurzii* Zeller

37. Oospore ovoid in shape....................

.... *O. Kurzii* v. *ovoidum* Silva

38. Plants monoecious....... *O. Oryzae* Wittr.

38. Plants dioecious........................... 39

39. Plants macrandrous, that is, with large male plants.. *O. angustatum* (Hirn)Tiff.

39. Plants nannandrous, with dwarf males.............. 40

40. Length of vegetative cells 1-3 times width............................. 41

40. Length of vegetative cells 3-6 times width............................. 42

41. Oogonia 39-54u broad........ *O. crassiusculum* v. *arechavaletae* (Wittr.)Hirn

41. Oogonia 55-60u broad.....................

. *O. crassiusculum* v. *cataractum* (Wolle)Tiff.

42. Gynandrosporous (see genus explanation).............. *O. crassiusculum**

42. Idioandrosporous (see genus explanation).........................

O. idioandrosporum (Nordst. & Wittr.)Tiff.

43. Oospore wall ribbed.......................... 44

43. Oospore wall ornamented otherwise................. 46

44. Ribs smooth, entire...................

.... *O. Boscii* (LeClerc)Wittr.

44. Ribs crenate.............................. 45

45. Spores oval, crenations or ribs distinct........... O. crenulatocostatum Wittr.

45. Spores cylindrical-ovate, ribs only slightly crenate........ O. crenulatocostatum v. cylindricum (Hirn)Tiff.

46. Oospore wall reticulate.................. .... O. dictyosporum Wittr.

46. Oospore wall ornamented otherwise............. 47

47. Oospore walls echinate, oogonium 29-34u broad.................. O. armigerum Hirn

47. Oospore walls otherwise ornamented............... 48

48. Oospore walls scrobiculate............... .... O. argenteum Hirn

48. Oospore walls pitted, pits arranged in longitudinal rows.................. 49

49. Oospore 60-75u broad, pits not arranged in transverse rows.................... .... O. concatenatum (Hass.)Wittr.

49. Oospore 48-56u broad, pits arranged in transverse rows...................... .... O. rectangulare (Rich.)Tiff.

50. Division of oogonium median................. 51

50. Division of oogonium superior............... 55

51. Oogonia 20-30u broad......................... 52

51. Oogonia over 30u broad....................... 53

52. Plants monoecious, inner spore

wall brown, oogonia 23-29u broad.................. *O. Gunnii* Wittr.

52. Plants dioecious with dwarf males, without brown inner spore wall, oogonia 21-26u broad............... .... *O. Rothii* Prings.

53. Plants monoecious, vegetative cells 7-10u, oogonia 30-35u broad................ .... *O. acmandrium* (Elfv.)Hirn

53. Plants dioecious, female vegetative filaments over 9u broad........................... 54

54. Female vegetative filaments 9-12u, oogonia 29-33u broad.................... .... *O. Howardii* G. S. West*

54. Female vegetative filaments 10-17u, oogonia 33-40u broad...*O. pratense* Trans.

55. Oospores oblong-elliptic or elliptic-ovoid.................................. 56

55. Oospores globose, subglobose or sub-ovoid globose.......................... 57

56. Plants monoecious.................... .... *O. gracilimum* (Wittr.)Tiff.*

56. Plants dioecious..................... .... *O. epiphyticum* Trans. & Tiff.*

57. Plants monoecious, oospores globose or subglobose............................ 58

57. Plants dioecious, oospores globose................ 59

58. Oospores not filling oogonia.............
... *O. Pringsheimii* v. *Nordstedtii* Wittr.

58. Oospores nearly filling oogonia..........
.... *O. Pringsheimii* Cramer

59. Dwarf males present.............................. 60

59. Dwarf males not present.......................... 63

60. Suffultory cell enlarged................
.... *O. hians* Nordst & Hirn

60. Suffultory cell not enlarged................. 61

61. Vegetative cells 2-3 diameters long..........
.... *O. Hohenackeri* (Wittr.)Tiff.

61. Vegetative cells 2½-6 diameters long............. 62

62. Vegetative cells 15-20u broad,
oogonia 43-54u long *O. macrandrium* Wittr.

62. Vegetative cells 10-16u broad,
oogonia 33-45u long....................
.... *O. macrandrium* v. *aemulens* Hirn

63. Oospores not filling oogonia, oogonia
37-45u broad........ *O. crispum* (Hess.)Wittr.*

63. Oospores filling oogonia, oogonia
30-38u broad................................
.... *O. crispum* v. *hawaiense* Nordst.

1. *Oedogonium acmandrium* (Elfv.)Hirn. (Tiffany f)

Monoecious; oogonia 1-2, depressed-globose, operculate, division median and narrow; oospore depressed globose or subglobose, filling oogonium, wall smooth.

veg. cell	L 30-80u	W 7-10u
oogonium	28-38	30-35
oospore	25-29	28-33
antheridium	10-15	8-10

Henry: old Typha pool in clay pit at Wallace Tourist Court south of Henry by hwy U.S.79 19 March #2119.

2. Oedogonium angustum (Hirn)Tiff. (Prescott f)(Tiffany 37 f)
(Oedogonium grande v. angustum Hirn of Tiffany, 1930)

Dioecious; oogonia 1-4, subovoid, pore superior; oospore similar in shape to oogonium and nearly filling it, wall smooth.

female veg. cell	L 70-330u	W 19-30u
male veg. cell	80-225	19-25
oogonium	62-110	42-52
oospore	60- 89	40-50

White: pig pond by hwy U.S.70 16 March 1949 #2059 - Montgomery: clinging to stick in huge spring near Peacher's Mill 18 March 1950 #2093. AM.

3. Oedogonium argenteum Hirn (Tiffany f)

Dioecious; oogonium 1, obovoid-globose, pore superior, rarely supramedian, oospore ovoid to globose, outer wall layer scrobiculate.

female veg. cell	L 80-160u	W 20-28u
male veg. cell	70-160	20-22
oogonium	48- 62	44-52

oospore	L 44-50u	W 43-48u
antheridium	8	22

Knox: pond at Mack's by hwy U.S.11-E about five miles east of Knoxville 18 June 1949 #906. F.

4. Oedogonium armigerum Hirn. (Tiffany f) Pl. 17, Fig. 3.

Dioecious; oogonium 1, subglobose, pore superior; oospore globose, nearly filling oogonium, wall outer layer echinate; dwarf male curved, on suffultory cell.

female veg. cell	L 36-100u	W 9-13u
oogonium	30- 40	29-38
oospore	26- 29	26-30
dwarf male, lower cell	20- 24	7- 8
dwarf male, upper cell	21- 30	5- 6
antheridium	7- 8	5- 6

Shelby: Joe Priestly's aquarium 814 Adams St. Memphis 20 March 1950 #2131. F.

5. Oedogonium Boscii (LeClerc)Wittr. (Prescott f)(Tiffany f)

Dioecious; oogonium 1-2, oblong-elliptic, pore superior; oospore elliptic, not nearly filling oogonium longitudinally, wall outer and middle layers with 27-35 rarely anastomosing longitudinal ribs.

female veg. cell	L 45-135u	W 14-23u
male veg. cell	52-108	13-18
oogonium	75-110	39-51
oospore	56- 70	36-43
antheridium	6- 16	13-14

Knox: culture at collector's home 27 Aug. 1949 #1865.

6. Oedogonium cardiacum (Hass.)Wittr. (Prescott f)(Tiffany f) Pl. 17, Fig. 2.

Dioecious; oogonium usually 1, subglobose to subcordiform-globose, pore supramedian; oospore globose, not filling oogonium, wall smooth.

female veg. cell	L 60-200u	W 18-30u
male veg. cell	45-170	15-25
oogonium	58- 78	48-70
oospore	42- 60	42-60
antheridium	10- 14	15-21

Moore: cultured from collection in sulfur spring runoff at Cumberland Springs 29 June 1949 #1019. L.

7. Oedogonium crassiusculum v. arechavaletae (Wittr.)Hirn. (Tiffany f)

Dioecious and idioandrosporous; oogonium 1-2, globose obovoid or subglobose, pore superior; oospore elliptic-globose or globose, not filling oogonium; dwarf male almost erect, on or near suffultory cell. The variety differs from the species by having a generally smaller, rounder oospore.

female veg. cell	L 32-110u	W 21-35u
oogonium	42- 65	39-54
oospore	40- 57	37-52
antheridium	10- 16	9-14
dwarf male	40- 57	14-16

Montgomery: farm pond by hwy U.S.41 alt. near Ringgold 18 March 1949 #2082. K.

8. <u>Oedogonium</u> <u>crassiusculum</u> v. <u>cataractum</u> (Wolle)Tiff. (Tiffany f)

veg. cells	L 42-112u	W 28-38u
oogonium	60- 75	55-60
oospore	50- 60	50-55
dwarf male	65	10

Putnam: shore of Cookeville Reservoir 14 June 1949 #807 Montgomery: farm pond by hwy U.S.41 alt. near Ringgold 18 March 1949 #2082 (wall double normal thickness).

9. <u>Oedogonium</u> <u>crenulatocostatum</u> Wittr. (Prescott f)(Tiffany f)

Dioecious; oogonia 1-6, obovoid to subelliptic, pore superior; oospore same form, nearly filling oogonium, outer spore wall smooth, median spore wall with 14-20 longitudinal ribs, crenulate and sometimes anastomosing.

female veg. cell	L 25-125u	W 10-18u
male veg. cell	32- 80	9-13
oogonium	40- 65	30-36
oospore	37- 55	28-34
antheridium	9- 14	9-12

Grainger: Buffalo Springs Game Farm 26 June 1938 (Bold)#B-14a & b[1] - Knox: pond at Mack's by hwy U.S.11-E about five miles east of Knoxville 18 June 1949 #906 - Moore: pools below dam at Cumberland Springs 29 June 1949 #1032. VNK.

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1 Reported in Silva, 1949

10. <u>Oedogonium</u> <u>crenulatocostatum</u> v. <u>cylindricum</u> (Hirn)Tiff. (Tiffany f) Pl. 17, Fig. 4.

Oogonium and oospore cylindric; oblong or more rarely elliptic or obovoid-elliptic; ribs of oospore scarcely crenate according to Tiffany, but considerably so here. The cylindric-shaped oogonium and oospore differentiate the variety.

veg. cell	L 44-150u	W 11-16u
oogonium	42- 81	30-36
oospore	40- 65	27-34

Greene: swamp created by road building and containing <u>Typha</u>, <u>Juncus</u>, <u>Salix</u> and <u>Carex</u> by hwy Tenn.70 near North Carolina state line 25 June 1949 #923.

11. <u>Oedogonium</u> <u>crispum</u> v. <u>hawaiense</u> Nordst. (Tiffany f)

Monoecious; oogonium usually single, subobovoid-globose to pyriform-globose, operculate, division superior; oospore globose or subglobose, not filling oogonium; terminal vegetative cell mucronate or short setiferous. The smaller spore differentiates this variety from the typical.

veg. cells	L 20-64u	W 10-16u
oogonium	31-38	30-38
oospore	27-33	27-32
antheridium	6- 8	8-11

Lumpkin(Ga.): attached to vegetation in artificial lake at Vogel State Park 14 Aug. 1949 #1737. F.

12. Oedogonium dictyosporum Wittr. (Tiffany f)

Monoecious; oogonium 1-2, obovoid-globose with superior pore; oospore globose to elliptic-globose, usually not filling oogonium, outer wall layer reticulate.

veg. cell	L 25-95u	W 11-16u
oogonium	38-46	33-40
oospore	30-40	28-38
antheridium	5-10	8-13

Humphries: stream north of Waverly by hwy Tenn.13 21 Aug. 1949 #1865.

13. Oedogonium Franklinianum Wittr. (Tiffany f)

Dioecious; oogonium 1, subglobose with supramedian to nearly superior pore; oospore globose, almost filling oogonium, wall smooth.

female veg. cell	L 30-95u	W 8-12u
male veg. cell	25-90	8-10
oogonium	29-41	26-31
oospore	24-30	24-30
antheridium	5- 7	8- 9

Obion - Lake: margins of Reelfoot Lake among aquatics 14 June 1949 #2256. FK.

14. Oedogonium globosum Nordst. (Tiffany f)

Monoecious; oogonium 1, globose or subglobose, pore superior; oospore globose, filling oogonium, wall smooth; terminal cell of filament setiferous.

veg. cell	L 40-95u	W 10-14u
oogonium	32-46	32-40
oospore	28-37	30-37
antheridium	4- 8	9-12

Jefferson: pond at junction of hwy U.S.11-E and Cherokee Dam approach road 25 June 1949 #911.

15. Oedogonium Gunnii Wittr. (Prescott f)(Tiffany f)

Monoecious; oogonium 1-4, subdepressed or subglobose, operculate, division median and narrow, but distinct; oospore same shape as oogonium and filling it, wall smooth, outer layer thick hyaline, inner brown.

veg. cells	L 30-85u	W 6- 9u
oogonium	19-29	23-29
oospore	17-23	22-27
antheridium	12	12

Knox: backwater of Ft. Loudon Lake at Blue Grass 23 July 1949 #1568. FA.

16. Oedogonium hians Nordst. & Hirn. (Prescott f)(Tiffany f) Pl. 17, Fig. 5.

Dioecious; oogonia 1-2, subovoid or globose, operculate, division superior; oospore globose, filling oogonium, wall smooth, thick, often lamellose; suffultory cell tumid, curved dwarf male epiphytic upon it.

veg. cell	L 37-145u	W 9-15u
oogonium	45- 60	37-43
oospore	33- 40	33-40

dwarf male stipe	L 32-35u	W 7- 9u
antheridium	5- 6	7- 8

Alcorn(Miss.): Crystal Lake near Corinth 16 June 1950 #2278. K.

17. Oedogonium Hirnii Gutw. (Prescott f)(Tiffany f)

Monoecious; oogonium 1, subglobose or subovoid, with superior pore; oospore globose, not filling oogonium, wall smooth; vegetative cells sometimes slightly capitellate.

veg. cell	L 28-80u	W 8-13u
oogonium	32-39	32-37
oospore	28-31	28-31
antheridium	4- 9	8-11

Cocke: in ditch near Cosby 17 July 1939 (Bold)#H-366.[1] K.

18. Oedogonium Hohenackerii Wittr. (Tiffany 44 f)

(Oedogonium macrandrium v. Hohenackerii (Wittr.)Tiff.)

Dioecious; oogonia 1-4, globose-ovoid, operculate, division superior; oospore globose, not completely filling oogonium; dwarf male on or near oogonium, stipe curved.

veg. cell	L 24-45u	W 12-15u
oogonium	30-35	29-33
oospore	28-31	27-31
dwarf male stipe	18-24	9-14
antheridium	5- 8	5- 6

Montgomery: clinging to stem in huge spring near Peacher's Mill 18 March 1950 #2093. N.

19. Oedogonium idioandrosporum (Nordst. & Wittr.)Tiff.

(Oedogonium crassiusculum v. idioandrosporum Nordst. & Wittr.)

(Tiffany 37 f)

Dioecious; oogonia 1-3, globose-obovoid to globose, pore superior; oospore elliptic-globose, ovoid, angular-globose (rarely globose), nearly filling oogonium, wall smooth, thick.

female veg. cell	L 65-200u	W 25-36u
oogonium	57- 90	48-59
oospore	50- 66	42-57
dwarf male stipe	60- 70	14-16

Knox: floating in Ft. Loudon Lake near Duncan's Dock 30 July 1950 #2300. NKM.

20. Oedogonium inconspicuum Hirn. (Tiffany f)

Dioecious; oogonia 1-4, depressed or subpyriform-globose, operculate, division median, narrow; oospore depressed globose, rarely ovoid, filling the inflated part of the oogonium, wall smooth.

veg. cell	L 20-34u	W 3- 5u
oogonium	13-18	13-23
oospore	8-12	12-17

The cells of #2118 are longer than the dimensions given above. Henry: gravel pit east of Paris by hwy U.S.79 19 March 1950 #2118 - Obion - Lake: margins of Reelfoot Lake 16 June 1949 #2259. F.

21. Oedogonium intermedium Wittr. (Prescott f)(Tiffany f)

Monoecious; oogonium 1, obovoid to obovoid-globose, pore superior; oospore globose or obovoid-globose, filling oogonium or nearly so, wall smooth and thick.

veg. cell	L 45-80u	W 15-18u
oogonium	34-45	31-37
oospore	33-41	30-36
antheridium	5-10	14-16

Knox: stream fed marshy area by hwy U.S.25-W just north of Knoxville 7 Aug. 1949 #2313 - Weakley: pond and marsh at Greenfield 30 June 1949 #1118. **SFKAM.**

22. <u>Oedogonium</u> <u>Kurzii</u> v. <u>ovoidum</u> var. nov. Pl. 18, Fig. 1.

Monoecious; oogonium single, ovoid or subelliptic, pore superior; oospore usually ovoid, wall smooth; antheridia hypogonous or scattered. Differs from the typical primarily in the ovoid shape of the oospores.

veg. cell	L 90-250u	W 44-52u
oogonium	111-130	70-95
oospore	80-100	67-90
antheridium	6- 16	44-52

Montgomery: large marsh by Norfleet & Sons grocery by hwy U.S.79 west of Clarksville 14 July 1949 #1376.

23. <u>Oedogonium</u> <u>laeve</u> Wittr. (Prescott f)(Tiffany f)

Monoecious; oogonium single, depressed-globose, pore median; oospore depressed-globose, filling oogonium, wall smooth.

veg. cell	L 20-70u	W 10-14u
oogonium	24-30	32-38
oospore	23-26	30-35
antheridium	9-13	9-10

Davidson: May 1949 (Bold)#1941.

24. Oedogonium Lemmermannii Tiff. (Tiffany 37 f)

(Oedogonium cardiacum v. minus Lemm. of Tiffany 30 f)

Dioecious; oogonium 1, subglobose, pore supramedian to nearly superior; oospore globose, not filling oogonium, wall smooth.

female veg. cell	L 25–75u	W 16–28u
male veg. cell	25–75	14–23
oogonium	35–50	30–45
oospore	28–40	28–42
antheridium	5– 6	12–15

Obion: shallow south shore of Isom Lake 10 July 1949 #1267. K.

25. Oedogonium macrandrium Wittr. (Tiffany f)

Dioecious; oogonia 1-4, globose-ovoid, operculate, division superior; oospore globose, rarely ovoid-globose, not completely filling oogonium, wall smooth; terminal cell of filament may be shortly apiculate; dwarf male on or near oogonium, stipe quite curved, sometimes 2-3 celled.

female veg. cell	L 45–100u	W 15–20u
oogonium	43– 54	36–42
oospore	33– 39	31–37
dwarf male stipe	24– 33	12–13
antheridium	7– 10	9–10

Knox: culture at collector's home 16 Aug. 1949 #1765. N.

26. Oedogonium macrandrium v. aemulens Hirn. (Tiffany f)

The variety is smaller than the typical. The oogonia are in series of 2-9.

veg. cell	L 22-90u	W 10-16u
oogonium	33-45	28-42
oospore	26-36	26-36
dwarf male stipe	20-25	9-12
antheridium	7-10	6- 9

Montgomery: clinging to stick in huge spring near Peacher's Mill 18 March 1949 #2093. KM.

27. Oedogonium multisporum Wood. (Tiffany f)

Dioecious; oogonia 1-3; subovoid or subglobose, pore superior; oospore globose, nearly filling oogonium, wall smooth; dwarf male a little curved or nearly erect, near or on oogonium.

veg. cell	L 10-30u	W 10-15u
oogonium	27-33	24-35
oospore	24-30	27-30
dwarf male stipe	26-30	10-11
antheridium	7- 9	7- 9

Knox: culture at collector's home 27 Aug. 1949 #1865 - Gibson: slough beside hwy U.S.45 south of Greenfield 16 June 1950 #2270.

28. Oedogonium Oryzae Wittr. (Tiffany f)

Monoecious; oogonia 1-2, scarcely tumid, subovoid or subcylindric, pore superior; oospore same form as oogonium, nearly filling it, or sometimes enlarging it, wall smooth; terminal cell of filament acuminate.

veg. cell	L 36-120u	W 24-39u
oogonium (upper series)	65- 95	45-55
oogonium (lower series)	45- 57	43-53
oospore	44- 80	41-51

Davidson: May 1949 (Bold)#1941. NM.

29. Oedogonium pratense Trans. (Prescott f)(Tiffany f)

Dioecious; oogonium 1-2, subdepressed-globose or broadly pyriform, operculate, division median, narrow but distinct; oospore depressed-globose or subglobose, filling or nearly filling oogonium, wall smooth.

female veg. cell	L 25-95u	W 10-17u
male veg. cell	32-82	8-15
oogonium	35-50	33-40
oospore	28-35	32-38
antheridium	13-18	10-14

Sumner: cultured from collection on rocks in small stream by hwy U.S.31-E northeast of Gallatin 27 March 1950 #2198. AM.

30. Oedogonium Pringsheimii Cramer. (Prescott f)(Tiffany f)

Dioecious; oogonia 1-6, subovoid-globose, operculate, division superior; oospore globose, nearly filling oogonium; antheridia in series up to ten, alternating frequently with vegetative cells.

female veg. cell	L 28-100u	W 14-20u
male veg. cell	24- 64	12-16
oogonium	36- 46	35-43

oospore	L 30-37u	W 30-37u
antheridium	6- 9	10-15

Obion: margins of Reelfoot Lake among aquatics 14 June 1950 #2256. FK.

31. <u>Oedogonium</u> <u>Pringsheimii</u> v. <u>Nordstedtii</u> Wittr. (Prescott f)(Tiffany 30 f)

Dioecious; oogonia 1-2, subovoid-globose, operculate, division superior; oospore globose, not filling oogonium.

female veg. cell	L 20-76u	W 10-26u
male veg. cell	18-68	9-15
oogonium	36-45	28-39
oospore	26-34	27-34
antheridium	8- 9	9-12

#1567 varies down to 9u broad for the female filaments and 28u broad for the oospores. Knox: on rocks in Ft. Loudon Lake embayment at Blue Grass 23 July 1949 #1559 - marshy backwater #1567 - Montgomery: field pond at Meriwether 18 March 1949 #2096. NK.

32. <u>Oedogonium</u> <u>pungens</u> Hirn. (Prescott f)(Tiffany f)

Dioecious; oogonium 1, subdepressed-globose to subglobose, pore median or supramedian; oospore subglobose almost filling oogonium, outer wall echinate; dwarf male a little curved, on suffultory cell.

veg. cell	L 50-128u	W 12-16u
oogonium	40- 50	40-48
oospore (with spines)	35- 43	37-44

dwarf male stipe	L 20-30u	W 9-12u
antheridium	6-15	6-12

Knox: culture at collector's home 27 Aug. 1949 #1865 - Montgomery: field pond at Meriwether 18 March.1950 #2097. NS.

33. Oedogonium pusillum Kirch. (Prescott f)(Tiffany f)

Monoecious; oogonium 1-2, subbiconic-elliptic or subbiconic-globose; seen from above, circular, margin even; operculate, division wide (up to 2.5u); oospore elliptic or globose, generally constricted at equator, not quite filling oogonium, wall smooth.

veg. cell	L 10-60u	W 3- 6u
oogonium	15-25	14-16
oospore	13-15	11-13
antheridium	5- 6	3- 4

Knox: culture at collector's home 27 Aug. 1949 #1865. F.

34. Oedogonium rectangulare (Rich)Tiff. (Tiffany 34 f)

(Oedogonium concatenatum v. rectangulare Rich of Tiffany 30 f)

Dioecious; oogonium 1-6, subovoid or quadrangular-elliptic, pore superior; oospore quadrangular-elliptic, membrane thick, middle layer of spore wall with pits in longitudinal rows and about 15 transverse rows; the suffultory cell swollen. The pitted oospore and swollen suffultory cells form good distinctions for the species.

veg. cells	L 75-400u	W 32-36u
suffultory cell	88-155	50

oogonium	L 76-105	W 56
oospore	67- 95	48-56

Gibson - Obion: middle pond fertilized for fish raising on Abe Shatz' farm 8 July 1949 #1235.

35. Oedogonium Richterianum Lemm. (Tiffany f)

Monoecious; oogonia 1-2, obovoid or subelliptic, pore superior; oospore subovoid or subelliptic (rarely globose-elliptic), filling or not filling oogonium, wall smooth.

veg. cell	L 36-126u	W 12-21u
oogonium	48-74	36-48
oospore	43-59	35-43
antheridium	6-10	12-15

Knox: culture at collector's home 27 Aug. 1949 #1865.

36. Oedogonium Rothii Prings. (Tiffany f)

Dioecious; oogonia 1-3, subdepressed-globose, operculate, division median, narrow; oospore depressed-globose, almost filling oogonium, wall smooth.

veg. cell	L 20-76u	W 6-10u
oogonium	16-27	20-27
oospore	14-20	17-25
dwarf male	11-12	4

Shelby: Joe Priestly's aquarium 814 Adams St. Memphis 19 March 1950 #2130 - monkey moat at Memphis Zoological Gardens 19 March 1950 #2131. F.

37. Oedogonium sexangulare Cleve. (Prescott f)(Tiffany f)

Dioecious; oogonium 1-2, sexangular-elliptic, pore a little above median; oospore same form as oogonium and nearly filling it, wall smooth; dwarf male on suffultory cell, slightly curved, with 2-3 curved stipe cells.

veg. cell	L 30-110u	W 9-16u
oogonium	33-39	29-33
oospore	31-36	27-31
dwarf male stipe	21-30	7- 9
antheridium	9-12	6- 7

Henry: pond north of Paris near Kentucky state line by hwy Tenn.54 14 June 1950 #2243. NSFKML.

38. Oedogonium sphaerico-inconspicuum sp. nov. Pl. 17, Fig. 6.

Dioecious; oogonia 1-2, spherical for inflated portion, operculate, division median, of medium width; oospore spherical, filling inflated part of oogonium, wall smooth.

veg. cell	L 15-35u	W 3-5u
oogonium	14-16	14-16
oospore	13-15	13-15

Quite possibly additional observations might neccessitate the reassignment of this plant to O. inconspicuum Hirn, but for the present it is separated on the basis of the consistently spherical oospores and wider division of the operculum. Obion - Lake: Reelfoot Lake around Nix Towhead 15 June 1950 #2263.

39. Oedogonium subglobosum (Wittr.)Tiff. (Tiffany 34 f)

(Oedogonium hystrix v. subglobosum Wittr. of Tiffany f)

Dioecious; oogonium single, elliptic, pore median; oospore elliptic, nearly filling oogonium, outer wall echinate.

female veg. cell	L 30-120u	W 17-28u
oogonium	45-65	38-48
oospore	43-55	37-46
dwarf male stipe	22-25	10-11
antheridium	9-14	6-8?

Obion: Reelfoot Lake margins around Nix Towhead 16 June 1949 #2263.

40. Oedogonium subplenum Tiff. (Tiffany 37 f)

(Oedogonium Areschougii v. americanum Tiff. of Tiffany, 1930)

Dioecious; oogonia 1-3 subdepressed or depressed-pyriform-globose, operculate, division median, wide; oospore globose, rarely subdepressed-globose, not completely filling oogonium longitudinally, wall smooth; vegetative cells capitellate; dwarf male obovoid, unicellular, on oogonium.

veg. cell	L 35-75u	W 8-13u
oogonium	36-40	34-39
oospore	22-25	22-26
androsporangium	10-12	9-10
antheridium	13-15	6- 7

#2198 differs from the description of the variety in that its oospore does fill the oogonium completely. Sumner: rocks of small stream by hwy U.S.31-E north of Gallatin 27 March 1950 #2198.

41. <u>Oedogonium</u> <u>upsaliense</u> Wittr. (Tiffany f)

Monoecious; oogonium 1, obovoid or suboblong-elliptic, pore superior; oospore same shape as and filling oogonium, wall smooth; antheridium, oogonium, and vegetative cell alternating; vegetative cells varying greatly in size in the same filament.

veg. cell	L 55-160u	W 13-20u
oogonium	66-100	45-50
oospore	60- 75	42-47
antheridium	7- 10	15-18

Greene: marsh formed by road building by hwy Tenn.70 near North Carolina state line 25 June 1949 #923.

42. <u>Oedogonium</u> <u>varians</u> Wittr. & Lund. (Prescott f)(Tiffany f)

Monoecious, or sometimes dioecious; oogonium 1, rarely more, depressed or subdepressed-pyriform-globose, pore supramedian or nearly superior; oospore globose, not filling oogonium, wall smooth, antheridia in long series up to nine.

veg. cell	L 35-144u	W 12-16u
oogonium	34-55	34-50
oospore	30-41	30-41
antheridium	5- 7	11-15

Davidson: fishpool by greenhouse on Vanderbilt University campus 17 March 1950 #2160 - Henry: ditch drain from small marsh by Wallace Motor Court south of Henry by hwy U.S.79 19 March 1950 #2120.

43. Oedogonium vulgare (Wittr.)Tiff. (Tiffany 37 f)

(Oedogonium cryptoporum v. vulgare Wittr. of Tiffany 30 f)

Monoecious; oogonia 1-5, subdepressed-obovoid-globose, pore median; oospore subdepressed-globose filling oogonium, wall smooth.

veg. cell	L 15-48u	W 5- 8u
oogonium	18-26	18-25
oospore	15-19	16-23
antheridium	9-12	5- 7

#2093 differs from the typical in that the oospore does not fill the oogonium longitudinally, but this is true also for a form illustrated by Tiffany, 1930. Montgomery: clinging to stem in huge spring near Peacher's mill 18 March 1950 #2093.

Cladophorales

Cladophoraceae

BASICLADIA Hoffmann and Tilden 1930

Basicladia Chelonum (Col.)Hoff. & Tild. (Prescott f)(Smith f) Pl. 18, Fig. 2.

Filaments of Cladophora-like cells, branched only near the base, or rarely at right angles in the upper portions; cells near the base are very long, 10 diameters or more, plants growing conspicuously on shells of the snapping turtle, although rarely they may be found on others, (#2040 e.g., which came from what the collector listed as a dry-land terrapin). Filaments W 35-50u. Those of B. crassa Hoff. & Tild. are over 50u broad. Differences between the two species, which grow intermingled, are convincingly reported by Hamilton, 1948. Knox: from turtle in pond near Kimberlin Heights 22 June 1939 (Bold)unnumbered[1] - Sumner: land terrapin shell near Mitchellville 7 March 1950 (Shanks)#2040 - Obion: snapping turtle's back in Bayou du Chien near Biological Station 2 July 1949 #1144 - snapping turtle's shell in Marvin Hayes' Fish House at Samburg 12 July 1949 #1314.

CLADOPHORA Kuetzing 1843

The fresh water representatives of this genus form macroscopically large, sometimes coarse tufts of branching filaments composed of long, often multinucleate, cells. The chloroplast is characteristically a reticulate cylinder, but may dissociate to form a network of small discoid chloroplasts. Reproduction is by zoospores and isogametes and all plants begin life attached, some remaining permanently so.

The species concepts employed here are those of Phinney, 1945, which the writer has found somewhat more employable than earlier definitions of Collins, et al.

1. Lake or still water species, with apical ends of the cells often enlarged somewhat, filaments appear

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1 Reported in Silva, 1949

dichotomous or trichotomous in branching due to displacement of lateral branches....... .... *C. aegagropila* Kuetz.

1. Mainly running water species, without conspicuous or frequent enlargement of the apical ends of cells, branching distinctly lateral.................................. 2
   2. Branches ascending, forming fairly acute angles with main filament, successive branches gradually reduced in size, sometimes forming glomerate fascicles *C. glomerata* (L.)Kuetz.
   2. Branches at wide angles from main filaments, never forming fascicles......... .... *C. crispata* (Roth)Kuetz.

1 *Cladophora aegagropila* Kuetz. (Phinney) Pl. 18, Fig. 4.

Plants considerably branched and bushy in form, (although it has not been found in the region rolled into *Cladophora* "balls") ultimate branches not differing greatly in size from main ones, cells of any branches may be swollen at the apical end or at middle. Profuse branching, often appearing to be dichotomous or trichotomous by displacement, further dilineates the species. W 50-90u.

This is the common still-water *Cladophora*, and it may be found in considerable quantity along the T. V. A. chain of lakes, in Reelfoot, or numerous small lakes.

Colbert(Ala.): around summer cottage dock on Wilson Dam embayment 16 June 1950 #2280 - Obion: slough at Spillway 15 June 1950 - #2269 - Obion - Lake: margins of Reelfoot Lake 14 June 1950 #2254 - around Nix Towhead 15 June 1950 #2266.

2. Cladophora crispata (Roth)Kuetz. (Collins)(Phinney)(Prescott f) Pl. 18, Fig. 5.

Branches diverging at conspicuously wide angles, giving the impression of dichotomy, no glomerate fascicles formed; cells generally cylindrical. W 50u or more. This species is a running water form. Campbell: limestone pools at entrance of small stream to Norris Lake in Cove Creek Inlet 12 April 1947 #628[1] - Smith: on limestone in fairly fast stream by hwy U.S.70-N five miles west of South Carthage 16 March 1950 #2058 - Montgomery: puddle from seep in old city quarry of Clarksville near Collins Bridge over Red River 5 Nov. 1949 (Clebsch)#2032 - Shelby: attached to float in Mississippi River at Memphis docks 30 June 1949 #1081. VFKL.

3. Cladophora glomerata (L.)Kuetz. (Collins)(Phinney)(Prescott f) Pl. 18, Fig. 6.

Branches with narrower angles than C. crispata and a tendency for the reduction in size by successive branching, the ultimate branches being the narrowest; fascicles sometimes formed; cells cylindrical. W 50u or more. This species

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1 Reported in Silva, 1949

is a running water form.

In the sense used here this name includes most of what has been identified as C. callicoma Kuetz., C. Kuetzingiana Grun., and C. uberrima Lambert. Intergradations between all the forms described as these species are apparent when a considerable number of specimens are examined.

Tennessee: location and date unspecified[1] - Jefferson: on rocks in swift outflow (53°) of Cherokee Dam 25 June 1949 #905 - Knox: clinging to limestone rubble in moderately sized valley stream, Love's Creek, near hwy U.S.11-E east of Knoxville 14 March 1950 #2041 - Davidson: rocky stream in ravine on Little Marrowbone Creek Road north of Nashville 20 Aug. 1949 #1827 - Montgomery: ravine east of Greenwood Cemetery at edge of small stream 17 Dec. 1949 (Clebsch) #2036. VK.

PITHOPHORA Wittrock 1877

The branches formed in this genus are almost at right angles to the main filaments, and there seems to be a tendency for the first cross walls in a branch to form some distance above its junction.

This sort of division does occur in Rhizoclonium fontanum Kuetz., however. The notable character of the genus is the presence of conspicuous akinetes which occupy various cells (sometimes alternating with vegetative cells) and

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1 Reported in Phinney, 1945

which have been used as a basis for species distinctions.

1. Branches of three orders, cell length up to about six times the width.................................... P. oedogonia (Mont.)Wittr.

1. Branches almost always of a single order only, cells often so long that the plants may seem to be completely coenocytic................. P. kewensis Wittr.

1. Pithophora kewensis Wittr. (Heering 21 f)(Smith) Pl. 19, Fig. 3.

The chief differentiating character ascribed to this species is the single order of branching. An additional characteristic employed here is the extremely long cell which may be more than ten times the width, so long at times that a siphonaceous condition is approached. It is quite possible that this name is properly applied to the sterile material on which the Florida report of Wolle is based, as well as Cladophora pithophoroides Phinney (1945).

Dr. Phinney feels that the long-celled condition intergrades imperceptibly into ordinary P. oedogonia (Mont.) Wittr., and it well may be that additional observations will lead the writer to the same opinion.

Campbell: Cove Lake at junction of hwys U.S.25-W and Tenn. 63 13 June 1950 #2229 - Davidson: Valley Lake near Nashville 20 Aug. 1949 #1810-1 - Colbert - Lauderdale(Ala.): attached to concrete of Wilson Dam 4 Sept. 1949 (Hall)#1947 - Montgomery: above and below lock B on Cumberland River 23 Sept. 1949 (Clebsch)#1934-9 - pond at corner of Dotsonville Road 9 Oct. 1949 (Clebsch)#2028. NF.

2. Pithophora oedogonia (Mont.)Wittr. (Collins)(Phinney) (Prescott f)(Smith f) Pl. 19, Fig. 4.

As differentiated in the traditional system of classification this species has consistently cask-shaped, intercalary akinetes about 230 x 115u in size, the filament width being about 70u. As understood here P. oedogonia includes those specimens from about 70-110u broad, with three orders of branching and a cell length never more than six times the width. The akinetes are variously shaped, spherical, cylindrical, barrel-shaped, branched, but never consistently hexagonal, as are those of the other species reported from southeastern United State, P. Roettleri (Roth)Wittr. Knox: aquarium at Univ. Tenn. botanical laboratory 16 May 1947 #692[1] - Montgomery: woods pond east of Shady Grove 3 Sept. 1949 #1910 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1176-81 - Shelby: Joe Priestly's aquarium 814 Adams St. Memphis 30 June 1949 #1082. VF.

RHIZOCLONIUM Kuetzing 1843

This genus contains both unbranched and branched filamentous forms. However, a transition of branched forms may

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1 Reported in Silva, 1949

be observed through short unicellular side stumps to multicellular branches of indefinite length. The branching is almost at right angles, and the first cross wall of the branches are formed away from the junction. These two characters distinguish the genus from Cladophora spp. In addition, if one accepts the genus categories as they are now established, the branched Rhizoclonium spp. are far smaller than the least Cladophora. The chloroplast, although variable in appearance, is identical with that of Cladophora, a reticulate plate or a pattern of small chloroplasts.

1. Filaments branched to some extent, from unicellular stumps to multicellular branches of indefinite length, cell 17-25u broad.. R. fontanum Kuetz.
1. Filaments unbranched.................................... 2
   2. Cells from about 17-80u broad.............
      .... R. hieroglyphicum (Ag.)Kuetz.
      possibly including R. hieroglyphicum v. macromeres Wittr. with thicker walls
   2. Cells over 200u broad... R. giganteum Silva

1. Rhizoclonium fontanum Kuetz. (Collins)(Prescott f) Pl. 18, Fig. 3.

Branching filamentous with long cells; chloroplasts reticulate or broken; branches of one order arising from the middle of cells, more or less at right angles to the parent filament and cross walls are laid down some distance from it, or, in the case of short-pointed branches, no wall is laid down at all, varying from mere stumps to pluricellular elongated branches. W 18-25u.

This species is distinguishable from the other two included here by its branching. Perhaps such a separation is untenable, but there are consistently branched plants and consistently unbranched ones.

Tennessee: location and date unspecified[1] - Davidson: fish pool by greenhouse on Vanderbilt University campus 17 March 1950 #2060 - Colbert(Ala.): embayment of Wilson Lake 16 June 1950 #2282 - Obion - Lake: Reelfoot Lake around Nix Towhead 15 June 1950 #2263. V.

2. *Rhizoclonium giganteum* sp. nov. Pl. 19, Fig. 2.

Unbranched filaments of cylindrical cells; chloroplast reticulate as is characteristic for the genus; cells cylindrical, 1½-3 diameters long, cells 240-280u broad. In dried condition the filaments tend to have a kinky appearance which is not so noticeable in fresh specimens. The type specimens differ from *R. hieroglyphicum* (Ag.)Kuetz. by their enormous size, the largest recorded for a uniseriate filament in strictly fresh water. The largest *R. hieroglyphicum* encountered in this study was about 80u broad. Cheatham: in rocky limestone creek near Turnbull

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1 Reported in Phinney, 1945

Creek between Cragie Hope and Kingston Springs 21 July 1950 (Sharp)#2308.

3. Rhizoclonium hieroglyphicum (Ag.)Kuetz. (Collins)(Prescott f)(Smith) Pl. 19, Fig. 1.

Unbranched filaments of long cells; chloroplast reticulate or broken; cells W 20-80u. This name is being used in the "catch-all" sense for the consistently unbranched Rhizoclonium specimens except for the huge ones over 200u broad. Varieties Hosfordii (Hazen)Col. and macromeres Wittr. cannot be differentiated on a basis of size, although cell wall thickness may be a valid differentiating character in the case of the last mentioned. Moreover, the large specimens are within the size range of what is described as Rhizoclonium Hookeri Kuetz., but that species is said to be frequently branched. Tennessee: unspecified location and date[1] - Knox: in old filled lily pond at Ijams' place 20 July 1949 #1512 - forming extensive mats along waterline of Ft. Loudon Lake near Concord 27 Aug. 1949 #1866 - Putnam: stranded pool of Caney Creek at hwy U.S.70-N bridge pier 14 June 1949 #818 - artificially channeled stream near hwy U.S. 70-N bridge 14 June 1949 #823 - Jackson(Ala.): Guntersville Lake at hwy U.S.72 bridge north of Scottsboro 17 Aug. 1950 #2293 - Moore: stream by spring at Cumberland Springs 29 June 1949 #1039 - Davidson: concrete pools of Kelly's Kennels

1 Reported in Phinney, 1945

at Nashville 20 Aug. 1949 #1822 - Colbert(Ala.): cold water spring at Tuscumbia 4 Oct. 1949 (Hall)#1954 - Montgomery: bank of Cumberland River at Clarksville 1 Nov. 1949 (Clebsch) #2022-3 - rainwater lake in river bottom near Edmonson's Ferry 31 Dec. 1949 (Clebsch)#2038 - Obion - Lake: margins of Reelfoot Lake 15 June 1950 #2269. There were numerous additional collections of the species, but only enough are listed to indicate that it may be found throughout the region, from mountains to the Mississippi, in sufficiently aerated waters. NFK.

4. Rhizoclonium hieroglyphicum v. macromeres Wittr. (Collins) (Prescott)

This is described by Collins as having cells 20-30u broad, and 5-12 diameters long, but Phinney refers to it as a thicker-walled form of the typical. Tennessee: unspecified location and date.[1]

Sphaeropleales

Sphaeropleaceae

SPHAEROPLEA Agardh 1824

Sphaeroplea annulina (Roth)Ag. (Heering 21 f)(Smith f) Pl. 19, Fig. 5.

Long cylindrical cells united into unbranched filaments, recognizable in vegetative condition because of the numerous

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1 Reported in Phinney, 1945

septations of cytoplasm with vacuoles between them, giving a sort of ladder effect in the cell; end walls are unevenly thickened, side walls relatively thin. Cells L 250-1400u; W 27-72u.

Peculiar reproductive characteristics set the species off from the other green algae. After repeated multiplication has produced many nuclei in the gametangial cells, each nucleus is surrounded by a separate protoplast, and becomes an egg in some cells and an antherozoid in others. After introduction of sperms through a lateral pore of the gametangium, the eggs are fertilized and become oospores with thick papillose walls. Delayed germination leaves the oospores in the oogonium long enough to be of value in identification. Germlings of this species are characteristically sharp-pointed at both ends.

#1999 was a single strand among Vaucheria spp. The papillae on the oospores were longer than any figured or observed from available herbarium specimens, but may be within the normal variation of the species.
Montgomery: ditch by Daniel St. Clarksville 4 April 1949 (Clebsch)#1999.

Siphonales

Dichotomosiphonaceae

DICHOTOMOSIPHON Ernst 1902

Dichotomosiphon tuberosus (A. Braun)Ernst. (Prescott f)

(Smith f) Pl. 20, Figs. 3,4.

Coenocytic filaments, without cross walls, dichotomously branched and constricted at the branches immediately identify this species, which usually grows deep under water in clear lakes; sexual reproduction oogamous as in Vaucheria, the oogonia are large and spherical, terminal on recurved branches, the antheridia tubular, borne on terminal branches alongside the oogonial branches, antherozoids released through a terminal pore. Filaments W 40-125u. Blount: Montvale Springs Lake 30 June 1931 (Bold)unnumbered.[1] A thorough search of the same site in August, 1950 unfortunately failed to rediscover this plant in its only known locality in the region. GL.

PHYLLOSIPHON Kuehn 1878

Phyllosiphon Arisari Kuehn. (Prescott f)(Smith f) Pl. 20, Figs. 1,2.

Coenocytic, dark green, filaments; intercellular in leaves of higher plants, branching dichotomously or irregularly, frequently occurring as a series of oblong aplanospores only; appearing macroscopically as very dark green wrinkled or creased patches on leaves. Filaments W 23-35u. Aplanospores L 5u; W 2.5u. This alga is a mild parasite on Jack-in-the-pulpit, and although reported only a single time from southeastern United States, is probably common enough, since it was found on the first collection of Arisaema ex-

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1 Reported in Silva, 1949

amined. Knox: on _Arisaema triphylla_ (L.)Schott on lake bank beside hwy U.S.411 bridge at Univ. Tenn. farm 12 June 1950 #2355. F.

Zygnematales

This order includes those green algae in which gametes exhibit an amoeboid tendency, the protoplasmic contents of gametangial cells flowing into other cells or into a common tube formed between cells, there to fuse with similar contents of another cell. The chloroplast, which is relatively large and usually axial, also is a rather good identifying character of the group. Of the three families in the order, the Zygnemataceae are entirely filamentous, whereas the Mesotaeniaceae and Desmidiaceae are largely unicellular. There are a few distinctly filamentous genera among the desmids, however, and the family distinctions are not sharp.

Zygnemataceae

MOUGEOTIA Agardh 1824

Unbranched filaments of cells with a flat axial chloroplast containing a single line or series or scattering of a few pyrenoids are characteristic for the genus, the cells often being proportionately rather long. A slight twisting in some forms implies a possible linkage with _Spirogyra_, a genus much larger in number of species, and one far more common than _Mougeotia_.

1. Species reproducing by zygospores (rarely aplanospores also present) 2
1. Species reproducing by aplanospores (zygospores rare or unknown) 7
   2. Sporangia not extending into gametangia 3
   2. Sporangia extending into both gametangia 6
3. Zygospores globose, subglobose, ovoid, or elliptic, longer axis parallel with conjugation tube 4
3. Zygospores with longer axis at right angles to conjugation tubes 5
   4. Diameter of vegetative cells less than 12u, spores asymmetrically elliptic, outer oogonial wall a thick pectic layer....... M. tubifera Tiff.
   4. Diameter of vegetative cells 24-40u, spores symmetrical, oogonial walls not pectic...................................... M. genuflexa (Dillw.)Ag.
5. Vegetative cells 18-21u, median spore wall shallow scrobiculate M. operculata Trans.
5. Vegetative cells less than 16u broad, median spore wall punctate.................................... M. depressa (Hass.)Wittr.

6. Vegetative cells 14-21u broad, spore wall smooth, zygospores quadrate with rounded corners, over 50u in diameter. M. capucina (Bory)Ag.

6. Vegetative cells 5-7u, spore wall minutely verrucose, sides concavely quadrate........ M. gracilima (Hass.)Wittr.

7. Diameter of vegetative cells 4-5u............. .... M. tenerrima G. S. West

7. Diameter of vegetative cells 6-9u............. .... M. ventricosa (Wittr.)Col.

1. Mougeotia capucina (Bory)Ag. (Czurda f)(Transeau)

Vegetative cells L 75-200u; W 14-21u, sporangium attached to four cells; spore quadrate with rounded corners and concave sides, walls smooth. Spores W 60-100u. NFA.

2. Mougeotia depressa (Hass.)Wittr. (Czurda f)(Transeau)

Vegetative cells L 35-135u; W 7-12u. Sporangium suspended between two filaments; spore elliptic, middle wall punctate. Spores L 20-32u; W 12-14u. NF.

3. Mougeotia genuflexa (Dillw.)Ag. (Czurda f)(Transeau)
Vegetative filaments frequently with knee-like bends L 70-200u; W 25-38u. Sporangium attached to two cells, not interrupting filamentous continuity; conjugation in tube between cells of separate filaments, or adjacent cells of the same filament; spore oval to spherical, wall smooth. Spores W 30-40u. GFL.

4. <u>Mougeotia</u> <u>gracilima</u> (Hass.)Wittr. (Czurda f)(Transeau) Pl. 22, Fig. 1.

Vegetative cells L 40-150u; W 5-7u. Zygospore case attached to four cells, spore four-angled with concave sides, rounded corners, median wall minutely verrucose. Spores W 20-25u. Cherokee(N.C.): dripping cliff near Hiwassee Dam powerhouse 14 Aug. 1949 #1748.

5. <u>Mougeotia</u> <u>operculata</u> Trans. (Transeau)

Vegetative cells L 60-285u; W 18-21u. Sporangia between two undivided gametangia; zygospore compressed spheroid, with prominent equatorial ridge, median wall shallowly scrobiculate, pale yellow. NF.

6. <u>Mougeotia</u> <u>tenerrima</u> G. S. West. (Czurda f)(Transeau)

Vegetative cells 4-5u. Aplanospores ovoid or elliptic. Spores L 24-25u; W 12-13u (in descriptions), Tennessee specimens L 25-30u; W 16-20u. Polk: coating on dripping rocks by hwy U.S.64 near Ocoee Dam #3 14 Aug. 1949 #1758 - Knox: culture at collector's home 16 Aug. 1949 #1765.

7. <u>Mougeotia</u> <u>tubifera</u> Tiff. (Transeau)

Vegetative cells L 90-400u; W 9-10u. Aplanospores asymmetrically ovoid, bulged on one side, walls smooth. Spores L 33-45u; W 27-30u. Peculiar characteristics of this species are the unusual length and the frequent twisting of the conjugation tubes. NF.

8. <u>Mougeotia</u> <u>ventricosa</u> (Wittr.)Col. (Czurda f)(Transeau) Pl. 22, Figs. 2,3.

Vegetative cells L 30-150u; W 5-9u. Aplanospores elliptic with smooth walls. L 16-29u; W 12-21u. Actually, #1761 only approximates this species, since the filaments are slightly too large (10u) and the median wall of the aplanospore is more yellow-brown than the grey-brown as originally described. Polk: coating on dripping rock by hwy U.S.64 14 Aug. 1949 #1761.

SIROGONIUM Kuetzing 1843

Sirogonium sticticum Kuetz. (Smith f)(Transeau) Pl. 23, Fig. 5.

Filaments of cylindrical cells, unbranched; chloroplasts 3 or 4 nearly straignt or slightly twisted ribbons, containing pyrenoids which appear similar to those of Spirogyra. Vegetative cell L 60-250u; W 38-62u. Conjugation by juxtaposition of cells without conjugation tubes; zygospores elliptic or cylindric-elliptic, somewhat variable in length, averaging about 1½ times the width, median wall brown. Zygospore L 60-100u; W 40-60u.

The line between this and some Spirogyra spp. in which the chloroplast barely turns, is not well drawn, but the complete lack of conjugation tubes provides a clear distinction.

Montgomery: farm pond by hwy U.S.41 alt. near Ringgold 18 March 1950 #2082 - clinging to stem in huge spring near Peacher's Mill 18 March 1950 #2093 - ditch pond by hwy Tenn. 13 near Kentucky state line 18 March 1950 #2104. FK.

SPIROGYRA Link 1820

This genus is one of the most easily recognizable among all algae because of the unmistakable spiral and ribbon-like chloroplasts containing several pyrenoids in a single series. The number of chloroplasts may vary from 1 to 6 (or more) according to species. Second to the diatoms, <u>Spirogyra</u> is the great algal pioneer in aquatic environments. Transeau includes over 250 species in his forthcoming monograph and no doubt many more will be found in studies of local floras. Only <u>Oedogonium</u>, among filamentous algae, compares with it in utter prolificness.

Unfortunately <u>Spirogyra</u> species do not grow and sporulate as freely in the laboratory as does <u>Oedogonium</u> so that far fewer are reported here, but <u>Spirogyra</u> is the more common genus of the two in Tennessee.

1. End walls of vegetative cells plane................ 2
1. End walls of vegetative cells replicate........... 22
    2. Tubes formed by projections from
        both gametangia................................ 3
    2. Tubes formed almost completely by
        male gametangia............ <u>S.</u> <u>liana</u> Trans.
3. Cells with one chloroplast......................... 4
3. Cells with more than one chloroplast................ 9
    4. Spores uniform in shape......................... 5
    4. Spores distinctly polymorphic.............
    .... <u>S.</u> <u>pratensis</u> Trans.

5. Spores elliptic in outline........................ 6

5. Spores ovoid or cylindric-ovoid.................... 7

6. Sporangia cylindric or merely inflated by enclosed spores, vegetative filaments 18-26u broad.................................. *S. communis* (Hass.)Kuetz.

6. Sporangia definitely inflated on both sides, vegetative cells 17-20u broad.................. *S. pratensis* Trans.

7. Vegetative cell diameter usually less than 40u broad.............................. 8

7. Vegetative cell diameter 40-50u................................. *S. porticalis* (Muell.)Cleve

8. Zygospore diameter less than 30u, chloroplast relatively narrow, spores 1½ times as long as broad........................... *S. pseudojuergensii* Silva

8. Zygospore diameter 28-38u, chloroplast broad, spores twice as long as broad......... *S. longata* (Vauch.)Kuetz.

9. Median spore wall smooth............................ 10

9. Median spore wall not smooth, wrinkled and pitted................ *S. fluviatilis* Hilse

10. Fertile cells cylindric or enlarged by the spores.................................. 11

10. Fertile cells inflated................................. *S. neglecta* (Hass.)Kuetz.

11. Spores elliptic or cylindric-elliptic............ 12
11. Spores ovoid or cylindric-ovoid................... 18
    12. Vegetative cells usually less than 45u broad.......................... 13
    12. Vegetative cells usually over 45u broad.......................... 15
13. Cells with 3 (sometimes 2) chloroplasts, making 1½ turns, cells 40-44u broad.......... .... S. *Fuelleborne1* Schm.
13. Cells with 2 (3) chloroplasts, making 2½-3½ turns, cells 41u or less broad............... 14
    14. Cells with 2 chloroplasts, making 1½-3½ turns, cells 35-38u broad.......... .... S. *microspora* Jao
    14. Cells with 2-3 chloroplasts, making 2½-3½ turns, cells 36-41u broad....... S. *rivularis* (Hass.)Rab.
15. Vegetative cells 45-60u broad..................... 16
15. Vegetative cells over 60u broad................... 17
    16. Vegetative cells less than 48u broad.................... S. *hyalina* Cleve
    16. Vegetative cells 48-54u broad............ .... S. *columbiana* Czurda
17. Vegetative cells 60-80u broad................ .... S. *nitida* (Dillw.)Link
17. Vegetative cells 120u or more broad...........

.... *S. ellipsospora* Trans.

18. Vegetative cells less than 60u broad.. 19

18. Vegetative cells more than 60u broad.. 20

19. Spores 34-48 x 48-54u......................... .... *S. triplicata* (Col.)Trans.

19. Spores 54-64 x 75-100u......................... .... *S. neglecta* (Hass.)Kuetz.

20. Vegetative cells usually less than 75u broad.................................... 21

20. Vegetative cells usually over 75u broad.......... *S. jugalis* (Fl. Dan.)Kuetz.

21. Cells with 3 chloroplasts, vegetative cells 55-67u broad.. *S. neglecta* (Hass.)Kuetz.

21. Cells with 4 (3) chloroplasts, vegetative cells 60-78u, spores usually elliptic.............. *S. nitida* (Dillw.)Link

22. Conjugation tubes formed more or less equally by both gametangia................ 23

22. Conjugation tube mostly from male gametangium .... *S. Spreeiana* Rab.

23. Fertile cells cylindric or enlarged by spores.. 24

23. Fertile cells inflated................................ 26

24. Zygospores elliptic................................ 25

24. Zygospores ovoid........ _S. Weberi_ Kuetz.
25. Spores 22-26(32) x 51-103u....... _S. arta_ Jao
25. Spores 30-36 x 55-110u, some fertile cells inflated............. _S. Spreeiana_ Rab.
26. Vegetative cells usually 11-13u broad, median spore wall finely punctate........ _S. rugosa_ (Trans.)Czurda
26. Vegetative cells 15-24u broad.................. 27
27. Vegetative cells 18-24u broad, usually over 150u long, conjugation tubes variable, male generally longer............................... _S. Spreeiana_ Rab.
27. Vegetative cells 15-20u broad, usually less than 150u long, conjugation tubes very short, equal.................................... _S. inflata_ (Vauch.)Rab.

1. _Spirogyra columbiana_ Czurda. (Czurda f)(Transeau)

Vegetative cells L 70-110u; W 48-54u, end walls plane; usually three chloroplasts, occasionally one or two; conjugation tubes formed equally by both gametangia, fertile cells not swollen; zygospores elliptic, middle layer of wall with visible longitudinal seam, L 90-100u; W 50-70u. Chester: edges of artificial lake at Chickasaw State Park 16 June 1950 #2273.

2. _Spirogyra communis_ (Hass.)Kuetz. (Czurda f)(Prescott f) (Transeau)

Vegetative cells L 50-250u; W 18-26u, end walls plane;

one chloroplast making 1½-4 turns; conjugation tubes from both gametangia, fertile cells cylindric; zygospores elliptic. L 40-70u; W 19-26u. NK.

3. Spirogyra denticulata Trans. (Transeau)

Vegetative cells L 160-400u; W 44-56u, end walls plane; one chloroplast making 3-6 turns; conjugation tubes from both participating cells; spores ovoid, inner layer of outer wall scrobiculate. L 76-130u; W 45-60u. Rutherford: floating in calcareous pool near hwy U.S.70 17 May 1939 (Bold)#2937.[1] M.

4. Spirogyra ellipsospora Trans. (Prescott f)(Transeau)

Vegetative cells L 125-500u; W 120-150u, end walls plane; chloroplasts three to eight with ½-5 turns; conjugation tubes projecting from both gametangia, fertile cells cylindric; zygospores elliptic or cylindric-elliptic, wall smooth, L 160-235u; W 100-140u. Montgomery: large marsh by hwy U.S.79 at Norfleet & Sons grocery west of Clarksville 14 July 1949 #1376. K.

5. Spirogyra fluviatilis Hilse. (Czurda f)(Prescott f) (Transeau) Pl. 23, Figs. 3,4.

Vegetative cells L 70-250u; W 35-45u, end walls plane; four chloroplasts making 1½-4 turns; conjugation tubes from both gametangia, fertile cells swollen, fusiform; zygospores ovoid; median spore wall wrinkled and irregularly pitted (Prescott's description, and true of #1613), L 70-110u; W

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1 Reported in Silva, 1949

54-65u. Knox: on muddy board in pond at Carter's Mill 2 Aug. 1949 #1613. F.

6. Spirogyra Fuelleborne1 Schm. (Prescott f)(Transeau)

Vegetative cells L 120-200u; W 40-44u, end walls plane; three chloroplasts making about 1½ turns; conjugation tubes from both gametangia, fertile cells cylindric; zygospore elliptic, wall smooth, L 66u; W 38u. Weakley: roadside marsh by hwy Tenn. 22 west of Martin 8 July 1949 #1211.

7. Spirogyra hyalina Cleve. (Transeau)

Vegetative cells L 80-100u; W 44u, end walls plane; four (2-4) chloroplasts making about 1½ turns; conjugation tubes from both gametangia, fertile cells cylindric; zygospore ovoid, wall smooth, L 60u; W 40u. Montgomery: cultured from collection in stream near Foster's Cave #2 18 March 1950 #2276.

8. Spirogyra inflata (Vauch.)Rab. (Prescott f)(Transeau)

Vegetative cells L 50-150u; W 15-20u, end walls replicate; one chloroplast making 3-8 turns; conjugation tubes very short, from both gametangia, fertile cells greatly inflated, fusiform; zygospore elliptic, wall smooth, L 60-70u; W 35-45u. VN.

9. Spirogyra jugalis (Fl. Dan.)Kuetz. (Collins)(Prescott f) (Transeau)

Vegetative cells L 100-150u; W 90-100u, end walls plane; three or four chloroplasts making 1-2 turns; conjugation tubes from both gametangia, fertile cells cylindric, zygospores elliptic or cylindric-elliptic, L 125-150u; W 87-108u. Obion - Lake: margins of Reelfoot Lake 15 June 1950 #2259.

10. Spirogyra longata (Vauch.)Kuetz. (Czurda f)(Prescott f)(Transeau)

Vegetative cells L 60-300u; W 28-38u, end walls plane; one chloroplast with 2-5 turns; conjugation tubes from both gametangia, fertile cells cylindric; zygospores broadly oval or elongate oval, bright yellow, L 60-80u; W 28-38u. VNK.

11. Spirogyra microspora Jao. (Jao f)(Transeau)

Vegetative cells L 64-131u; W 35-38u, end walls plane; two chloroplasts, broad with large pyrenoids, making 1½-3½ turns; conjugation lateral (scalariform in Tennessee specimens) with equal projections from both gametangia, fertile cells cylindric; zygospores elliptic, wall smooth, L 35-60u; W 26-36u. Shelby: pond at junction of Gerber Road and hwy U.S.64 30 June 1949 #1094.

12. Spirogyra neglecta (Hass.)Kuetz. (Czurda f)(Transeau)

Vegetative cells L 120-300u; W 55-67u, end walls plane; three chloroplasts making 1½-2½ turns; conjugation tubes from both gametangia, fertile cells slightly inflated; zygospores broadly ovoid, wall smooth, yellow. Spores L 70-100u; W 55-65u. Chester: artificial lake at Chickasaw State Park 16 June 1950 #2273 - Obion - Lake: Reelfoot Lake around Nix Towhead 15 June 1950 #2264. SK.

13. Spirogyra nitida (Dillw.)Link. (Borge & Pascher f) (Prescott f)(Transeau)

Vegetative cells L 100-300u; W 60-70u, end walls plane; chloroplasts three to five, straight or with ½-1½ turns; conjugation tubes from both gametangia, fertile cells cylindrical; zygospores elliptic with pointed ends, walls smooth, L 90-150u; W 60-85u.

14. Spirogyra porticalis (Muell.)Cleve. (Prescott f)(Transeau)

Vegetative cells L 80-250u; W 39-50u, end walls plane; chloroplast one making 3-4 turns; conjugations tubes very short but formed by both gametangia; fertile cells slightly or not at all inflated; zygospores oval or broadly oval, yellow, L 60-100u; W 42-50u. FK.

15. Spirogyra pratensis Trans. (Prescott f)(Transeau)

Vegetative cells L 80-100u or longer; W 17-20u, end walls plane; chloroplasts one (or two), making 1-8 turns; conjugation tubes from both gametangia, fertile cells inflated; zygospores elliptic to subcylindric-oval, walls smooth, L 50-70u; W 24-36u. FK.

16. Spirogyra pseudojuergensii Silva. (Prescott, Silva & Wade f)

Vegetative cells L 70-150u; W 24-30u, end walls plane; one chloroplast making 2-4 turns; conjugation tubes from both gametangia, fertile cells cylindric; zygospores broadly ovoid, walls smooth, L 50u; W 28u. Knox: slowly flowing but well aerated stream through limestone country near Island Home (1000 ft.) April 1947 unnumbered.[1]

17. <u>Spirogyra</u> <u>rivularis</u> (Hass.)Rab. (Borge & Pascher) (Prescott f)(Transeau)

Vegetative cells L 100-300u; W 36-41u, end walls plane; chloroplasts two or three with 2½-3½ turns; conjugation tubes from both gametangia, fertile cells scarcely swollen; zygospore elliptic, L 80-100u; W 40-55u. FK.

18. <u>Spirogyra</u> <u>Spreeiana</u> Rab. (Czurda f)(Prescott f)(Transeau) Pl. 23, Figs. 1,2.

Vegetative cells L 150-400u; W 18-24u, end walls replicate; chloroplast one, making 1½-4 turns; conjugation scalariform, tubes variable, male generally longer, fertile cells expanded by spore or fusiformly inflated; zygospore elliptic, L 55-110u; W 30-36u. Davidson: pool near Glen Echo Lake 19 Feb. 1939 (Bold)#B-3935.[2] K.

19. <u>Spirogyra</u> <u>triplicata</u> (Col.)Trans. (Prescott f)(Transeau)

Vegetative cells L 80-160u; W 34-48u, end walls plane; chloroplasts three, making 1-2 turns; conjugation tubes from both gametangia, fertile cells cylindric; zygospores oval to subglobose, L 48-54u; W 34-48u. K.

20. <u>Spirogyra</u> <u>Weberi</u> Kuetz. (Czurda f)(Prescott f)(Transeau)

Vegetative cells L 80-300u; W 19-30u, end walls replicate; chloroplast one, making 3-6½ turns; conjugation tubes

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1 Reported in Prescott, Silva & Wade, 1949
2 Reported in Silva, 1949

from both gametangia, fertile cells slightly or not at all swollen; zygospores oval, smooth walled, L 30-60u; W 21-32u. NK.

ZYGNEMA Agardh 1824

The two star-shaped chloroplasts with a pyrenoid in the center of each constitute an unmistakable identifying character of this genus, although the chloroplast shape occasionally may be obscured because they so nearly fill the cell. The nearest approach to this type of chloroplast is in the rather rare genus Zygogonium, in which the chloroplast lacks the radial aspect of the Zygnema stars. Also Zygogonium may have the chloroplasts arranged in dumbbell-shaped fashion as in some Zygnema spp.

1. Filaments exhibiting zygospores, sometimes aplanospores, filaments 26-32u broad.................. Z. insigne (Hass.)Kuetz.
1. Filaments exhibiting aplanospores, zygospores infrequent or absent....................... 2
   2. Vegetative cells 16-21u broad............... .... Z. spontaneum Nordst.
   2. Vegetative cells 44-54u broad............... .... Z. sterile Trans.

1. Zygnema insigne (Hass.)Kuetz. (Czurda f)(Prescott f) (Transeau) Pl. 22, Fig. 4.

Vegetative cells L 30-60u; W 26-32u; conjugation lateral;

zygospore wall smooth, in unaltered fertile cell, spherical or oval, W 27-30u. Lewis: catch basin in infertile rolling country perhaps representing fragmentary plateau near Hohenwald 29 June 1949 #1072. V.

2. Zygnema spontaneum Nordst. (Transeau)

Vegetative cells L 30-40u; W 16-21u; aplanospores yellow-brown scarcely inflating cells, broadly oval W 20-25u. Davidson: May 1949 (Bold)#1941.

3. Zygnema sterile Trans. (Prescott f)(Transeau)

Vegetative cells L 22-59u; W 44-54u, walls quite thick; filaments often surrounded by firm pectic sheath; cell contents rather dense so that chloroplast structure is often indiscernible; thick walled aplanospores fill cells. Montgomery: pool in rock by Ringgold Mill 18 March 1950 #2086 - Henry: gravel pit by hwy U.S.79 east of Paris 19 March 1950 #2117. N.

ZYGOGONIUM Kuetzing 1843

Zygogonium ericetorum Kuetz. (Prescott f)(Smith f) Pl. 22, Fig. 5.

Vegetative cells L 15-100u; W 14-24u, often more or less swollen; in wet subaerial or dripping habitats long unicellular or pluricellular branches develop; chloroplasts two, comparatively small, cushion-like, each with a pyrenoid, with a small nucleus between them; zygospores rarely produced, spherical, oval, or short cylindrical, formed laterally between filaments, cut off from gametangia. Filaments W 15-

20u. Sevier: in frozen puddle on Sugarlands Mt. trail near Mt. Collins 7 Dec. 1946 #456[1] - Polk: on dripping rocks by hwy U.S.64 by Ocoee River below Ocoee Dam #3 14 Aug. 1949 #1760. VNF.

Mesotaeniaceae

Although their chloroplasts are quite similar, this family differs from the Zygnemataceae most conspicuously in its unicellular rather than filamentous habit. At the same time these "saccoderm desmids" differ from the Desmidiaceae or "placoderm desmids" in several respects, the most noteworthy of which is growth throughout the entire new cell after division, rather than regeneration of a new semicell from each of the old semicells. During sexual reproduction conjugation tubes are present in the Mesotaenaceae, but not in the Desmidiaceae.

CYLINDROCYSTIS Meneghini 1838

This genus of saccoderm desmids contains species with straight cylindrical cells and rounded poles. Of the two species included here C. americana West & West has sides constricted at the midregion, (an unusual character in the saccoderm desmids) and C. Brebissonii Menegh. has parallel sides.

1. Cylindrocystis americana West & West. (Irénée-Marie f)

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1 Reported in Silva, 1949

(Nordstedt)(Prescott I) Pl. 24, Fig. 1.

Cells cylindric, slightly constricted at midregion, round in end view; chloroplasts rounded in end view. L 40-60u. May be confused with shorter specimens of Penium minutum (Ralfs)Delp. in which, however, there is an elongated chloroplast. The size range observed may indicate v. minor Cush., but in absence of proof that there is an actual size difference between the typical (described as 60u long) and the variety, (described as 44u long) the variety is not separated here. Sevier: roadside drain on Clingman's Dome 10 Sept. 1949 #1889 - Cumberland: rather swift stream at Ozone 16 March 1950 #2053. F.

2. Cylindrocystis Brebissonii Menegh. (Irénée-Marie f) (Nordstedt)(Prescott I)

Cells cylindric, unconstricted at midregion, round in end view; chloroplasts stellate. L 40-60u; W 14-19u. Cumberland: rain puddle in grass in front of New Salem Baptist Church by hwy U.S.70-N 16 March 1950 #2056. NSGFK.

GONATOZYGON DeBary 1856

Gonatozygon aculeatum Hasting. (Irénée-Marie f)(Nordstedt) (Prescott I)(Smith f) Pl. 24, Fig. 2.

Cells elongate-cylindric, sometimes undulate near the truncate poles; median cell wall with many sharp spines. L 125-300u; W 12-20u. NSGF.

MESOTAENIUM Naegeli 1849

1. Mesotaenium macrococcum (Kuetz.)Roy. (Nordstedt)(Pres-

cott I) Pl. 24, Fig. 3.

Cells oval or cylindric-oval in outline; terrestrial, embedded in jelly; chloroplast laminate, (compare with the stellate ones of Cylindrocystis). L 22-38u; W 11-20u. Knox: on wet Thuidium at Carter's farm (1100 ft.) Oct. date 1947 (Iltis)#700.[1]

2. Mesotaenium macrococcum v. micrococcum (Kuetz.)West & West. (Prescott I)

Smaller than the typical. L 10-26u; W 5-14u. The variety is larger than Coccomyxa dispar Schm. with which it should be compared. Morgan: wet cliff near Rugby 6 Aug. 1949 (Sharp)#1666 - Rhea: wet cliff in Richland Creek Gorge above Dayton 25 Sept. 1949 (Sharp)#1987. K.

NETRIUM Naegeli 1849

The shape of cells in this genus varies from fusiform to almost cylindric. The length is at least three times the width, and there is no median constriction. The chloroplast is paddle wheel-shaped, composed of longitudinal plates radiating around the central axis.

1. Cells with sides parallel for most of their length, that is, somewhat cylindric-shaped.................................. 2
1. Cells elliptic or fusiform......................... 3

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1 Reported in Silva, 1949

2. Cells cylindric with conical
ends.......... N. interruptum (Bréb.)Luetk.
2. Cells cylindric with rounded
ends N. oblongum v. cylindricum West & West
3. Cell ends tapered to rather sharp
points... N. digitus v. Naegelii (Bréb.)Krieg.
3. Cell ends truncate N. oblongum (DeBary)Luetk.

1. Netrium digitus v. Naegelii (Bréb.)Krieg. (Irénée-Marie)
(Netrium Naegelii (Bréb.)West & West)
(Nordstedt)(Prescott I) Pl. 24, Fig. 7.

Cells elliptic, with sharp poles; chloroplast paddle-wheel type typical for genus. L 115-190u; W 25-46u.

Although this name is used here to represent the elliptic cells with sharp ends, such cells are labeled Netrium Naegelii by Irénée-Marie and other sources except Krieger. However, Krieger's N. digitus v. Naegelii is not this sort of cell, and the elliptic cells with sharply rounded poles are included within the variation of the typical which generally has more blunt ends. Obviously, not only is a different usage being made of the names by various authors, but there is an incomplete knowledge of the variation encountered in the plants themselves.

Giles: stagnant pool by muddy stream at Pulaski 29 June 1949 #1054 - Gibson - Obion: bottom coating on highest pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1238. FKL.

2. Netrium interruptum (Bréb.)Luetk. (Irénée-Marie f)(Nordstedt)(Prescott I) Pl. 24, Fig. 5.

Cells elongated cylindric, occasionally constricted slightly at center, conical or rounded conical poles; chloroplasts interrupted in the center of the semicells as well as in the midregion of the cells. L 200-320u; W 37-64u. Obion: near south shore of Isom Lake 10 July 1949 #1270. NSGFKA.

3. Netrium oblongum (DeBary)Luetk. (Irénée-Marie f)(Nordstedt)(Prescott f)

Cells described as oblong-cylindric, but illustrated in shapes varying from naviculoid to elliptic. L 75-140u; W 29-44u. Actually the differentiation between this species and N. digitus and its varieties varies according to the investigator, and is of somewhat uncertain status. Cherokee (N.C.): dripping cliff near Hiwassee Dam powerhouse 14 Aug. 1949 #1748 - Polk: sandy mud bottom by hwy U.S.64 near Ducktown 14 Aug. 1949 #1749 - on dripping rocks by hwy U.S.64 below Ocoee Dam #3 14 Aug. 1949 #1760 - Chester: margins of artificial lake in Chickasaw State Park 16 June 1950 #2273. NFL.

4. Netrium oblongum v. cylindricum West & West. (Irénée-Marie f)(Prescott I)

Cells shaped perfectly cylindric with rounded poles L 60-80u; W 17-21u. Montgomery: woods pond east of Shady Grove 3 Sept. 1949 #1910.

ROYA W. and G. S. West 1896

Roya obtusa v. montana Gutw. (Nordstedt)(Prescott I)(Smith f) Pl. 24, Fig. 6.

Cells cylindric, slightly attenuated toward truncate poles, axis straight or slightly arcuate; chloroplast axial, notched at mid-section on concave side, with series of 4-6 aligned pyrenoids. L (16)35-81(93)u; W 4.5-7.5u. Sevier: pools at Ramsey Cascade (4150 ft.) 18 July 1939 (Bold)H-61.[1]

Desmidiaceae

These plants are also known as the "placoderm desmids". They are unicellular or filamentous. Their conspicuous characteristic in division is the separation of the cells at the midregion, with a complete regeneration of a new semicell from each half of the old cell.

ARTHRODESMUS Ehrenberg 1838

Members of this genus all have compressed cells, constricted in the midregion to form semicells as are most desmid genera. The semicells are variously shaped with surfaces that are either entirely smooth or finely punctate. The only prominent ornaments are a few spines, occurring singly at the angles of the semicells, and never found in pairs, as in Xanthidium.

Arthrodesmus incus v. extensus Anders. (Irénée-Marie f) (Nordstedt)(Prescott I) Pl. 25, Fig. 9.

Cells hourglass-shaped with a semi-circular equatorial sinus; spines one at each polar angle, slightly diverging, long, straight. L 20-34u; W 15-22u; Is 5-8.5u. Unfortunately, only this single representative of the entire genus appeared during this study. Gibson - Obion: plankton from lower pond, fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1243. NGKM.

CLOSTERIUM Nitzsch 1817

This is a large genus and representatives are frequently found. Most species have arcuate cells but in some they are cylindrical, the shape varying from almost straight to a curvature of 180°. The cells are unconstricted at the mid-section and are always attenuated to some extent toward the poles. The chloroplasts may be plane axial plates, but are usually conspicuously longitudinally ridged, and contain aligned or scattered pyrenoids. The cell wall may be smooth or longitudinally striated.

A distinctive feature of the genus, sometimes used as a diagnostic character for species distinction, is the clear apical cytoplasmic area in which grains of gypsum are contained in a vacuole.

1. Cells with one or more girdles between older and younger semicells 2
1. Cells without girdles between semicells 17
   2. Exterior margin curved at least 100° 3
   2. Exterior margin curved less than 100° 4
3. Apices of cells obliquely truncate,

nose-like.................... *C. Dianae* Ehr.

3. Apices of cells not obliquely truncate.................... *C. Cynthia* DeNot.

4. Cell walls smooth................................ 5

4. Cell walls striate................................ 8

5. Cells longer than 60u (456-680u)..............
.... *C. lunula* (Muell.)Nitzsch

5. Cells less than 60u long (between apices).. 6

6. Cells over 20u long............................ 7

6. Cells less than 20u long.................
.... *C. macilentum* Bréb.

7. Apices more or less truncate.................
.... *C. didymotocum* Corda

7. Apices of cells acute........................
.... *C. acerosum* (Schrank)Ehr.

8. Apices of cells slightly recurved.........
.... *C. turgidum* Ehr.

8. Apices of cells not recurved................... 9

9. Cells less than 20u long (between apices).. 10

9. Cells over 20u long............................ 11

10. Cell shape lunate, tapering considerably to poles... *C. intermedium* Ralfs

10. Cell shape cylindrical scarcely attenuated toward the poles. *C. ulna* Focke

11. Striae 15 or more on cell surface.................. 12
11. Less than 15 striae on surface.................... 15
    12. Interior margin of cells convex
        at midregion............ *C. Ralfsii* Bréb.
    12. Interior margin of cells not
        convex at midregion...................... 13
13. Apices sharply pointed.....................
    .... *C. acerosum* (Schrank)Ehr.
        and *C. acerosum* v. *elongatum* Bréb.
    (see No. 7 of key)
13. Apices not sharply pointed........................ 14
    14. Cell wall at apex possessing a
        thickening which protrudes in-
        ward slightly....... *C. didymotocum* Corda
    14. Cell wall without such thickening
        at the poles.......... *C. striolatum* Ehr.
15. Striae 11-15 on visible cell surface.........
    .... *C. striolatum* Ehr.
15. Striae 10 or fewer on visible cell
    surface.. 16
    16. Sides of cells essentially par-
        allel, cells cylindrical................
        ...... *C. angustatum* v. *clavatum* Hastings
    16. Sides of cells tapering toward
        poles.............. *C. intermedium* Ralfs
17. Exterior cell margin curved over 100°............ 18

17. Exterior cell margin curved less than 100°.................................... 28

18. Cells over 20u broad.............................. 19

18. Cells under 20u broad.............................. 22

19. Pyrenoids in single median line.................... 20

19. Pyrenoids scattered over the chloroplast................ *C. Ehrenbergii* Menegh.

20. Cells 188-420u long, 30-68u wide, curvature 100-130°...................... .... *C. moniliferum* (Bory)Ehr.

20. Cell proportions narrower than the approximately L/W ratio of 6/1 of *C. moniliferum* (Bory)Ehr............... 21

21. Apices obliquely truncate, curvature 107-130°.................... *C. Dianae* Ehr.

21. Apices not obliquely truncate, curvature 124-190°........... *C. Leibleinii* Kuetz.

22. Cell length over 140u........................... 23

22. Cell length 140u or less........................ 26

23. Apices obliquely truncate..... *C. Dianae* Ehr.

23. Apices not obliquely truncate..................... 24

24. Interior cell margin convex at mid-section......... *C. Leibleinii* Kuetz.

24. Interior cell margin not convex................ 25

25. Apices sharp or roundly pointed............. .... *C. parvulum* Naeg.

25. Apices rounded..............................
..........*C. Cynthia* v. *Jenneri* (Ralfs)Krieg.

26. Cells 50-87u long........ *C. Venus* Kuetz.

26. Cells 96-170u long..... *C. parvulum* Naeg.

27. Axis curved for most or all of length, at least less than 2/3 of mid-section is straight.............................. 28

27. Axis straight for 2/3 of mid-section.............. 40

28. Cells broader than 25u at midregion........... 29

28. Cells narrower than 25u at midregion.......... 37

29. Cell walls smooth.............................. 30

29. Cell walls striate............................. 33

30. Cells broader than 100u at midregion.................................. 31

30. Cells narrower than 100u at midregion.................................. 32

31. Pyrenoids scattered through chloroplast................ *C. Ehrenbergii* Menegh.

31. Pyrenoids in single median row................
.... *C. lunula* (Muell.)Nitzsch

32. Apices sharply pointed........................
.... *C. acerosum* (Schrank)Ehr. and
C. acerosum v. *elongatum* Bréb.
(see No. 7 of key)

32. Apices rounded.... *C. Ehrenbergii* Menegh.

33. Ends of cells slightly recurved..............

.... *C. turgidum* Ehr.

33. Ends of cells not recurved........................ 34

34. Striae 20 or fewer present on visible cell surface.... *C. lineatum* Ehr.

34. More than 20 striae present on visible cell surface........................ 35

35. Interior margin of cells convex in the midregion..... *C. Ralfsii* v. *immane* Cush.

35. Interior margin of cell not at all or only very slightly convex........................ 36

36. Apices sharply attenuated................
.... *C. acerosum* (Schrank)Ehr.
and *C. acerosum* v. *elongatum* Bréb.
(see No. 7 of key)

36. Apices gradually attenuated.............
.... *C. lineatum* Ehr.

37. Cell length over 400u........................ 38

37. Cell length less than 400u........................ 39

38. Length/width ratio at least 20/1, long attenuated to small rounded apices............... *C. praelongum* Bréb.

38. Length/width ratio lower than 20/1, apices sharply pointed............
.... *C. acerosum* (Schrank)Ehr.
and *C. acerosum* v. *elongatum* Bréb.
(see No. 7 of key)

39. Cell length less than 225u. C. tumidum Johns.

39. Length 225-400u.... C. acerosum (Schrank)Ehr.

40. Cells over 25u wide at midregion..........
.... C. lunula (Muell.)Nitzsch

40. Cells less than 25u wide...................... 41

41. Cells gradually attenuated toward
the apices.................................. 42

41. Cells hardly attenuated to obtuse
apices...................................... 43

42. Width at center of cells 6.5-9u..........
.... C. pronum Bréb.

42. Width at center of cells 12-17u..........
.... C. strigosum Bréb.

43. Cells 69-130u long, 4.5-5.5u broad..........
.......C. gracile v. tenue (Lemm.)West & West

43. Cells larger................................ 44

44. Cells 200-250u long, 4.5-6.5u broad......
.. C. gracile v. intermedium Irénée-Marie

44. Cells 130-206u long, over 6u broad.......
.... C. gracile Bréb.

1. Closterium acerosum (Schrank)Ehr. (Irénée-Marie f)(Prescott I)

Cells clavate in shape with sharply pointed poles, curvature slight, about 10°; chloroplast longitudinally folded, with a linear series of 10-20 pyrenoids. L/W ratio 10-15/1. L 288-480u; W 19-53u. Knox: loose coating on marble pebbles in spring at Fountain City Park 23 March 1947 #549[1] - Cumberland: swift stream at Ozone 16 March 1949 #2053 - Weakley: Mr. Bary's pond by hwy Tenn.22 west of Martin 8 July 1949 #1207 - Obion: slough near Spillway 5 July 1949 #1185. VNSGFKML.

2. Closterium acerosum v. elongatum Bréb. (Irénée-Marie f) (Prescott I)

This variety is distinguished from the typical by its more elongate form and frequently by more pronounced wall striations. L/W ratio would seem to be 10-20/1. L 500-790u; W 29-42u. The over-all lengths recorded are greater than those of the typical. However, available data on length and width are not convincing in establishing that there is a justifiable differentiation between the two. Smith: pond from small, dammed spring just east of South Carthage 16 March 1950 #2057 - Davidson: Valley Lake near Nashville 20 Aug. 1949 #1814 - fishpool by Vanderbilt University greenhouse 17 March 1950 #2060 - Shelby: pond at corner of Gerber Road and hwy U.S.64 30 June 1949 #1090. VKAM.

3. Closterium angustum v. clavatum Hastings. (Irénée-Marie f) (Nordstedt)(Prescott I)

Cells elongated cylindric with slight curvature, ends truncate; wall with fine surface ridges which appear as clear striae that are parallel or somewhat spiral toward the

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1 Reported in Silva, 1949

ends of the cells. L 355-510u; W 21-34u; C 26-51°. This variety is distinguished from the typical only by its size. For the typical, Closterium angustatum Kuetz., L 240-515u; W 16-28u; C 26-51°. Lumpkin(Ga.): artificial lake of Vogel State Park 14 Aug. 1949 #1733.

4. Closterium Cynthia DeNot. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells lunate, tapering to sharp poles; wall brown, with longitudinal striae and transverse girdles. L 73-170u; W 11-48u; C 120-146°. The species is most easily distinguished from C. parvulum Naeg. by its striate surface, and from C. Venus Kuetz. by having less curvature. Obion: among grass on south shore of Isom Lake 10 July 1949 #1268. NKM.

5. Closterium Cynthia v. Jenneri (Ralfs)Krieg. (Nordstedt)
(Closterium Jenneri Ralfs of Irénée-Marie f)
(Prescott I)

The variety is distinguished from the typical by greater curvature, and generally smaller size; as in the latter, a single granule is present in each terminal vacuole. L 40-135u; W 6-14u; C 140-175°. Obion: south shore of Isom Lake 10 July 1949 #1268. N.

6. Closterium Dianae Ehr. (Irénée-Marie f)(Nordstedt) (Prescott I) Pl. 25, Fig. 1.

The species belongs to the group with more or less straight middle portions, and curved apices; considered to be different from C. Leibleinii Kuetz. by having girdle bands at the mid-section of the cell, although Irénée-Marie mentions having observed tham in that species; in addition C. Diane is generally reported as larger. L 103-380u; W 16-36u; C 112-130°. Montgomery: pond on hwy U.S.79 six miles northeast of Clarksville 11 Oct. 1949 (Clebsch)#1926. NGFKM.

7. Closterium didymotocum Corda. (Irénée-Marie f)(Nordstedt) (Prescott f)

Cells cylindric-arcuate tapering more or less to truncate ends; one or more girdle bands present; specimens observed with distinct longitudinal striae; wall colored deep brown. L 295-640u; W 25-56u; C 27-56°. The species is far more common than the three records given below indicate, because its appearances in other collections were not recorded. Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1736 - Polk: in spring water of ditch by hwy U.S.64 below Ocoee Dam #3 14 Aug. 1949 #1762 - Gibson - Obion: bottom coating on highest pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1238. VNFK.

8. Closterium Ehrenbergii Menegh. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells with a short, more or less straight, midregion, apices sharply curving; no girdle bands usually visible; chloroplast showing four or five ridges with several pyrenoids scattered through it. L 285-720u; W 60-145u; C 92-135°. The size and robust proportions differentiate the species. Overton: pond containing a considerable number of aquatics at Timothy 15 July 1949 #1456 - Davidson: fishpool by greenhouse on Vanderbilt University campus 17 March 1950 #2060 - Montgomery: fish pond in yard of Alfred Clebsch's neighbor, Clarksville 19 March 1950 #2113 - Gibson: slough beside hwy U.S.45 south of Greenfield 15 June 1950 #2270 - Obion: in Nelumbo area of Reelfoot Lake near Samburg 12 July 1949 #1306 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1177-82. GFK.

9. Closterium gracile Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells extremely elongate and slender, with parallel sides for 2/3 of length and curving slightly at the sharply pointed apices. L 130-206u; W 3.5-6u. VNFKA.

10. Closterium gracile v. intermedium Irénée-Marie. (Irénée-Marie f)

The variety is distinguished only by its intermediate size from the typical and from v. elongatum West & West. L 200-250u; W 4.5-6.5u. Obion - Lake: margins of Reelfoot Lake 14 June 1950 #2255.

11. Closterium gracile v. tenue (Lemm.)West & West. (Irénée-Marie f)(Prescott I)

The variety differs from the typical only in size, being smaller. L 69-130u; W 4.5-5.5u. Obion: near south shore of Isom Lake 10 July 1949 #1268.

12. Closterium intermedium Ralfs. (Irénée-Marie f)(Nordstedt)

(Prescott I)

Cells elongate-clavate, slightly curved, tapering evenly to blunt apices; girdle bands and rather fine longitudinal striae present; wall deep yellow to yellow-brown; terminal vacuoles usually containing a single, large granule. L 200-465u; W 16-28u; C 36-56°. Greene: at wier across river at Flag Pond 25 June 1949 #940 - Sevier: roadside pool near Newfound Gap 10 Sept. 1949 #1893 - Lumpkin(Ga.): in artificial lake at Vogel State Park 14 Aug. 1949 #1733 - Knox: among tree roots in pond by Ten Mile Creek at Farragut 23 July 1949 #1548 - Gibson - Obion: bottom coating on highest pond on Abe Shatz' farm east of Kenton 8 July 1949 #1238 - Obion - Lake: margins of Reelfoot Lake 14 June 1950 #2255. VNKM.

13. Closterium lanceolatum Kuetz. (Irénée-Marie f)(Nordstedt)(Prescott I)

Cells arcuate, slightly curved, tapering to rather sharp apices; chloroplast ridged, containing a row of 6-7 pyrenoids in each semicell. L 235-500u; W 37-72u; C 30-55°. Distinguished from C. acerosum by broader proportions. Union(Ga.): backwater of Nottely Lake by hwy U.S.129 14 Aug. 1949 #1739 - Todd(Ky.): ditch pond beside hwy U.S.79 west of Guthrie and quite near Tennessee state line 11 Oct. 1949 #1923. VGFKM.

14. Closterium Leibleinii Kuetz. (Irénée-Marie f)(Nordstedt)(Prescott I) Pl. 25, Fig. 2.

This is another of the group with a more or less uncurved center portion, the apices being sharply curved; five pyrenoids aligned in the chloroplast in each semicell. L 107-250u; W 17-42u; C 124-190°. Lumpkin(Ga.): backwater of artificial lake at Vogel State Park 14 June 1949 #1737 - Knox: well splashed rocks below old dam spillway at Neubert's Springs 20 July 1949 #1527 - reservoir at Neubert's Springs 20 July 1949 #1529 - on twigs in quiet waters of pond at Carter's Mill 2 Aug. 1949 #1612 - Montgomery: pond at Tom Edwards' store by hwy U.S.79 14 July 1949 #1371 - Hardeman: slough or marsh beside hwy Tenn.18 14 June 1950 #2272. VNSGFKL.

15. Closterium lineatum Ehr. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells elongate-arcuate, slightly curved, striate, tapering to narrow but blunt apices, slightly tumid in the middle on the concave surface; row of about eight pyrenoids in the chloroplast in each semicell. L 400-760u; W 16-40u. #1376 is a trifle smaller than the dimensions given above, but not enough to be of significance. Lumpkin(Ga.): artificial lake at Vogel State Park 14 Aug. 1949 #1733 - plankton #1738 - Montgomery: large pond at Oakwood 17 Sept. 1949 (Clebsch) #1928 - large marsh by hwy U.S.79 at Norfleet & Sons grocery 14 July 1949 #1376. VNKM.

16. Closterium lunula (Muell.)Nitzsch. (Irénée-Marie f) (Nordstedt)(Prescott I)

Cells arcuate, slightly curved, tapering evenly to narrow blunt ends; several pyrenoids scattered over 8-10 chloroplast folds. L 465-680u; W 71-116u. The large size, scattered pyrenoids, and slight curvature set this species off from others. Blount: pond nearest Charlie Meyers' house in Cades Cove 19 June 1949 #877 - Campbell: Cove Lake at junction of hwys U.S.25-W and Tenn.63 13 June 1950 #2230 - Cumberland: rain puddle in grass in front of New Salem Baptist Church by hwy U.S.70-N 16 March 1950 #2056 - Weakley: Mr. Bary's pond by hwy Tenn.22 west of Martin 8 July 1949 #1207-8 - Gibson - Obion: lower end of middle pond, fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1240. VNSGFK.

17. Closterium macilentum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells almost straight, cylindric in center portion, slightly bent only from girdle bands located in median portion of semicells, tapering to blunt ends; surface smooth; row of 8-10 pyrenoids in the single chloroplast. L 264-722u; W 11-20u. Shelby: pond at corner of Gerber Road and hwy U.S.64 30 June 1949 #1090. KM.

18. Closterium moniliferum (Bory)Ehr. (Irénée-Marie f) (Nordstedt)(Prescott I)

Cells arcuate, with perhaps a very short straight center portion, curved, tapering to narrow blunt apices; pyrenoids in a single row. L 188-420u; W 30-68u; C 100-130°. Knox: culture in Univ. Tenn. botanical laboratory 1 Aug. 1949 #1604 - Anderson: in branch two miles below Norris Dam

26 June 1939 (Bold) #B-12[1] - Montgomery: rock coating in Ringgold Creek at Scout Camp 18 March 1950 #2088 - Obion: Bayou du Chien at Biological Station 2 July 1949 #1151-63 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1177. VNSGFKAL.

19. Closterium parvulum Naeg. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells new moon-shaped, evenly curved from center to pointed apices; row of pyrenoids present in each semicell. L 96-170u; W 7.5-14.5u; C 100-140°. Distinguished from C. Diane by the lack of a more or less straight center portion and its smaller size. Rabun(Ga.): plankton from pond by hwy U.S.23 near Clayton 13 Aug. 1949 #1725 - Knox: around tree base in pond at Ten Mile Creek at Farragut 23 July 1949 #1545. VGFKL.

20. Closterium praelongum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells extremely elongated-arcuate, slightly curved in an even arc, tapering to blunt pointed apices; row of about ten pyrenoids in each semicell. L 520-846u; W 11.5-24u. Obion - Lake: plankton from Blue Basin 12 July 1949 #1324.

21. Closterium pronum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells extremely elongated, a straight, narrow ellipse

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1 Reported in Silva, 1949

for most of length, but the sharp apices curve slightly. L 320-400u; W 6.5-9u. The large size and the elliptic, rather than cylindric, center portion distinguish the species from most of the other thin ones. Weakley: Mr. Bary's pond by hwy Tenn.22 west of Martin 8 July 1949 #1207. F.

22. Closterium Ralfsii v. immane Cush. (Irénée-Marie f) (Prescott I)

Cells clavate, slightly curved, tapered to small blunt ends, bulged slightly in center, wall finely striate. L 455-806u; W 60-75u; C 45-55°. Madison(N.C.): roadside pool of short duration near Cutshall's grocery by hwy N.C.212 25 June 1949 #1894 - Shelby: puddles in drain from pond at corner of Gerber Road and hwy U.S.64 30 June 1949 #1092. NS.

23. Closterium strigosum Breb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells narrowly elliptic for about 2/3 of length, bending sharply outward at the apices and tapering to sharp points; row of pyrenoids in each semicell. L 230-358u; W 12-17u. Gibson: slough by hwy U.S.45-E south of Greenfield 14 June 1950 #2270 - Obion - Lake: plankton from Blue Basin 13 July 1949 #1324. K.

24. Closterium tumidum Johns. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells arcuate, slightly curved, tapering to fairly sharp apices, the middle slightly tumid on the concave side; single granule in each terminal vacuole. L 59-139u; W 5-20u.

Knox: Lakeside lake about five miles south of Knoxville by hwy Tenn.71 20 July 1949 #1540 - Cumberland: rain puddle in grass in front of New Salem Baptist Church by hwy U.S.70-N 16 March 1950 #2056. NSK.

25. Closterium turgidum Ehr. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells elongated arcuate, slightly curved, tapering gradually to blunt apices, longitudinal striae and transverse girdle bands present. L 650-791u; W 50-75u; C 47-55°. Hardeman: slough or marsh by hwy U.S.45-E at Madison County line 14 June 1950 #2272. VFK.

26. Closterium ulna Focke. (Irénée-Marie f)(Nordstedt) (Prescott I) Pl. 25, Fig. 3.

Cells narrow, elongated cylinders, slightly curved, truncated or rounded ends; longitudinal striae and transverse girdle bands on surface; terminal vacuoles containing a large granule. L 220-500u; W 11-22u; C 15-34°. The striae of this species are different from the ridges of C. angustatum, and the color here, if any, is yellow rather than the reddish color which appears in C. angustatum. Lumpkin (Ga.): among vegetation and pilings in artificial lake at Vogel State Park 14 Aug. 1949 #1734-7. NSKAM.

27. Closterium Venus Kuetz. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells regularly lunate, often making a neat semicircle, tapering to sharp apices. L 50-87u; W 7-10.5u; C150-180°.

The species is distinguished from C. parvulum and larger species by its small size, and from C. Cynthia by the smooth and usually colorless wall. Davidson: Hidden Lake 17 Sept. 1938 (Bold)#B-103.[1]

COSMARIUM Corda 1834

The cells of this genus are variable in shape, but are never deeply or sharply lobed, and never decorated with spines other than minute ones, although they may display many sorts of granules. Although many species are compressed when seen from end or side view, they are not distinctly flattened, being oval or elliptic in end view (sometimes spherical). Their length is never more than about three times the width, most species being shorter. The equatorial sinuses are narrow or broad, shallow or deep.

The genus is a common one which may occur in almost any aquatic environment in the Tennessee Region, and even on several wet terrestrial sites. Whereas the number of species reported is the largest among the desmid genera listed here, it represents only a casual sampling of those which could be identified if time and space permitted.

* species not included in text

1. Cell surface smooth, punctate, or scrobiculate....................................... 2

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1 Reported in Silva, 1949

1. Cell surface with some manner of granules, generally in a pattern, the margin frequently dentate or crenate.................... 29
   2. Apical view of cell circular....................... 3
   2. Apical view of cell not circular................... 5
3. Semicells almost cylindrical in face view..................... C. _cucurbitum_ Bréb.
3. Semicells not cylindric in face view................. 4
   4. Semicells obovate-circular in face view........... C. _viride_ (Corda)Josh.
   4. Semicells tapering toward poles and rounded at apices...... C. _attenuatum_ Bréb.
5. Semicells approaching semi-circular in face view.................................... 6
5. Semicells not semi-circular in face view.. 7
   6. Cell length and width nearly equal......... .... C. _circulare_ Reinsch
   6. Cells longer than broad................. .... C. _pachydermum_ Lund.
7. Semicells transversely elliptic or reniform.. 8
7. Semicells not transversely elliptic nor reniform, shaped otherwise........................ 11
   8. Sinus round at apex and continued narrow toward exterior.......................... 9

8. Sinus gradually opening from
   apex to exterior..... *C. bioculatum* Bréb.

9. Cells as broad as long.... *C. phaseolus* Bréb.
   and *C. phaseolus* f. *minor* Boldt

9. Cells longer than broad.............................. 10

10. Apical view of cells revealing
    slight facial protuberances..............
    .... *C. tumidum* Lund.

10. Apical view of cells without
    such protuberances... *C. bioculatum* Bréb.

11. Semicells rectangular in shape with
    the upper lateral angles sometimes
    beveled, margin undulate....................
    .... *C. rectangulare* Reinsch

11. Semicells not rectangular in shape................ 12

12. Semicells pyramidal with poles
    truncate or rounded........................... 13

12. Semicells polygonal........................... 22

13. Margins crenate or undulate....................... 14

13. Margins of cells neither crenate nor
    undulate.. 16

14. Margins of cells showing about
    three rows of crenations in face
    view................. *C. obtusatum* Schm.

14. Margins of cells not showing
    three rows of crenations..................... 15

15. Margins of cells only undulate...............
.... _C. impressulum_ Elfv.

15. Margins crenate or acutely undulate........................ _C. Reinschii_ Arch.

16. Margins of cells concave or retuse.. 17

16. Margins of cells convex or rarely straight.............................. 18

17. Cells over 40u in length, center protuberence broad and extending most of semicell length.......................
.... _C. Nymannianum_ Groenb.

17. Cells about 20u in length, protuberance merely a small knob...................
...... _C. Miedzyrzecense_ v. _monomazum_ Groenb.

18. Semicells pyramidal-semi-circular........
.... _C. subtumidum_ Nordst.

18. Semicells pyramidal-trapezoidal................19

19. Cells less than 1/4 longer than broad............ 20

19. Cells more than 1/3 longer than broad............ 21

20. Cell surface punctate, lower lateral angles of semicells rounded............. _C. galeritum_ Nordst.

20. Cell surface very finely punctate, lower lateral angles sharp...............
... _C. angulare_ v. _canadense_ Irénée-Marie

21. Cells 60u or more broad. C. pyramidatum Bréb.

21. Cells less than 60u broad....................
.... C. pseudopyramidatum Lund.

22. Semicells transversely hexagonal-
elliptic in shape................................. 23

22. Semicells not so shaped.......................... 26

23. Semicells with one or more facial
protuberances..................................... 24

23. Semicells without facial protu-
berances.. 25

24. Single protuberance present on
face........... C. polygonum (Naeg.)Arch.

24. Two small laterally aligned pro-
tuberances present.... C. angulare Johns.

25. Semicell apex broad, straight or
convex.................... C. angulosum Bréb.

25. Semicell apex narrow, straight or
retuse...... C. repandum f. minor West & West

26. Semicells with 7 or 8 rounded
angles.............. C. impressulum Elfv.

26. Semicells with less than eight
angles.. 27

27. One or two sides of semicells re-
tuse, others convex............................... 28

27. All sides of semicells convex or
straight.. 29

28. Apical margin of semicells generally the retuse one, apical view a smoothly rounded ellipse..........
.... *C. repandum* Nordst.
and *C. repandum f. minor* West & West

28. Upper lateral margins usually the retuse ones, apical view revealing single facial projections................
.... *C. polygonum* (Naeg.)Arch.

29. Apical view of cells circular, rows of large granules present. *C. Portianum* Arch.

29. Apical view of cells not circular................. 30

30. Semicells somewhat semi-circular or semi-elliptic shaped in face view....................................... 31

30. Semicells neither semi-circular nor semi-elliptic in shape.................... 36

31. Apical view of cells elliptic with squarely truncate ends, protuberances at corners and midregion of face, range of double granules placed inside margin, face view of semicell hemispherical, margin crenate................
.... *C. monomazum* Lund.

31. Cells otherwise.................................. 32

32. Sinus narrow and straight.................... 33

32. Sinus open and semicircular at
apex.. 35

33. Semicell face with a rectilinear
series of granules in midregion only.............. 34

33. Semicell face covered with diagonally
arranged granules...............................
.... <u>C. margaritatum</u> (Lund.)Roy & Biss.
and <u>C. margaritatum</u> f. <u>minor</u> Boldt

34. Semicell face with four series
of central granules.....................
.... <u>C. norvegicum</u> Stroem.

34. Semicell face with six or seven
series of granules visible...............
.... <u>C. costatum</u> Nordst.

35. Facial granules in seven or eight
longitudinal series of 4-5 large
granules, L 31-37u..... <u>C. orthostichum</u> Lund.*

35. Facial granules in six longitudinal
series of 3-4 granules each, L 21-
25u.......... <u>C. orthostichum</u> v. <u>pumilum</u> Lund.

36. Semicells inverted truncate...............
.... <u>C. biretum</u> Bréb.

36. Semicell shaped otherwise.................... 37

37. Semicells elliptic or reniform.................... 38

37. Semicells pyramidal, rectangular or
hexangular.. 45

38. Semicells reniform. 39

38. Semicells elliptic. 43

39. About twelve broad undulations in the margins of semicell. . . . . *C. subcrenatum* Hantzsch

39. Margins of semicells not undulate, but dentate or granulose. 40

40. Sinus broadly enlarged at apex, wedge-shaped. 41

40. Sinus enlarged at apex but not wedge-shaped. 42

41. Apical view of cells oval or oval-elliptic. *C. reniforme* Ralfs

41. Apical view oblong-oval, with compressed sides. . . . . *C. reniforme* v. *compressum* Nordst.

42. Semicells with straight, slightly rostrate apices with large submarginal punctae, face punctate toward lateral margins. . *C. ornatum* Ralfs

42. Semicells with slightly rounded but not rostrate apices, without conspicuous submarginal punctae, and with regular rows of granular ornamentation extending to center. . . . . *C. punctulatum* Bréb.

43. Cell face ornamentation with four transverse series of large granules.......... .... *C. orthostichum* Lund. and *C. orthostichum* v. *pumilum* Lund.

43. Six or more rows of smaller granules present on cell face.............................. 44

44. Apex of sinus acute... *C. Portianum* Arch.

44. Apex of sinus semicircular............... ...... *C. Portianum* v. *nephroideum* Wittr.

45. Semicells pyramidal............................. 46

45. Semicells approaching rectangular in shape with upper lateral angles broadly rounded... *C. margaritatum* (Lund.)Roy & Biss. and *C. margaritatum* f. *minor* (Boldt)West & West

46. Cells as long as wide to ¼ longer.............. 47

46. Cells longer than 1¼ times width.............. 53

47. Semicells with truncate and rostrate apices...................... *C. Turpinii* Bréb.

47. Semicells with straight or slightly rounded, but not rostrate, apices................. 48

48. Semicell face with a discernible central protuberance visible in side or apical view......................... 49

48. Semicell face without central protuberance........ *C. punctulatum* Bréb.

49. Cells less than 20u long (between tips)........... 50

49. Cells 20u or more long........................... 51

50. Center protuberance ornamented with single granule...................................... *C. humile* (Gay)Nordst.

50. Center protuberance ornamented with one large and three small granules................. *C. Blytti* Wille

51. Semicell margins undulate, 4-5 undulations on sides..... *C. subcrenatum* Hantzsch

51. Semicell margins crenate, 6-8 crenations on side.................................... 52

52. Cells less than 30u broad.................................... *C. norvegicum* Stroem.

52. Cells more than 35u broad................... *C. formulosum* Hoff. and *C. formulosum* .... v. *Nathorstii* (Boldt) West & West

53. Semicell margins crenate........................ 54

53. Semicell margins smooth, smoothly undulate or dentate............................ 55

54. Cells less than 50u broad................................. *C. subspeciosum* Nordst.

54. Cells broader than 50u........................... *C. speciosum* v. *validus* Nordst.

55. Cells longer than 150u. *C. denticulatum* Borge and *C. denticulatum* f. *Borgei* Irénée-Marie

55. Cells less than 150u long *C. Botrytis* Menegh.

1. Cosmarium angulare Johns. (Irénée-Marie f)(Nordstedt) (Prescott I)

Semicells hexangular to octangular, with sharp basal angles and two slight mid-facial projections especially visible in end view. L 30-32u; W 20-30u; Is 6-10u; T 12-16u. Knox: fishpool at Chilowee Park Zoo 14 March 1950 #2043 - Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1418 - Montgomery: pond on Dotsonville Road near Clarksville 9 Oct. 1949 (Clebsch)#2024 (in strings) - field pond at Meriwether 18 March 1950 #2096. L.

2. Cosmarium angulare v. canadense Irénée-Marie. (Irénée-Marie f)

Differs from the typical by the broader proportions, and lack of center protuberances, and the basal angles of the variety are rounder. L 25-27u; W 28-30u; Is 7.5-8u. Montgomery: large pond at Oakwood 17 Sept. 1949 #1929.

3. Cosmarium angulosum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Semicells roundly hexangular in shape, approaching hemispherical; total cell length slightly greater than width. L 15-18u; W 13.5-18u; Is 3-6u; T 7.5-9.5u. Moore: pools below mill dam at Cumberland Springs 29 June 1949 #1032 - Robertson: wet marshy woods with prominent Liquidambar and Alisma spp. a mile south of Cedar Hill 20 Aug. 1949 #1857. VFKL.

4. Cosmarium attenuatum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I) Pl. 26, Fig. 1.

Over-all cell shape fusiform with very shallow sinuses; cross section circular. L 60-87u; W 20-30u; Is 17.5-25u. Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1421.

5. Cosmarium bioculatum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

The semicells are oblong-oval to hemispherical; the cell incised at the equator by deep funneling sinus; end view elliptic; side view of semicells circular. L equal to W, 15-30u; Is 4.5-11u; T 6-19u. Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1736 - Polk: sandy mud bottomed stream near Ducktown by hwy U.S.64 14 April 1949 #1749 - Montgomery: large pond at Oakwood 17 Sept. 1949 (Clebsch)#1928-9. GK.

6. Cosmarium biretum Bréb. (Nordstedt)(Prescott I) Pl. 26, Fig. 2.

Over-all proportions of the cells quadrate, with the broadest portion at the poles, the semicells being inverted trapezoid in shape with rounded polar angles; polar margins are rather concave in one collection (#1324), but are usually described as straight or slightly convex; sinuses fairly deep and linear; coarse granules cover the surface; end view elliptic in Tennessee specimens, but often figured with facial protuberances. L 44-52u; W 40-44(52)u; Is 16-20u; T 18-22u.

Obion - Lake: plankton from Blue Basin of Reelfoot Lake 13 July 1949 #1324. K.

7. Cosmarium Blytti Wille. (Irénée-Marie f)(Nordstedt) (Prescott I)

Semicells hemispherical-trapezoid with crenate margins and a row of intramarginal granules, with a large facial granule near the isthmus. L 10-19u; W 7-16u; Is 3-5.5u; T 6-11u. Davidson: concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1825. FAM.

8. Cosmarium Botrytis Menegh. (Irénée-Marie f)(Nordstedt) (Prescott I)

Overall L/W ratio of cell previously reported as 1¼/1, but is found here as about 1 1/3-1; semicells hemispherical, flattened at the apex, rounded at sinus angles; covered with numerous papillae, about 25-30u around the perimeter of a semicell. L 60-111u; W 44-85u; Is 13-26u; T 33-40u. NF.

9. Cosmarium circulare Reinsch. (Irénée-Marie f)(Nordstedt) (including Cosmarium Baileyii Wolle) (Prescott I) Pl. 26, Fig. 4.

Cell outline circular, almost perfectly so; each semicell a hemisphere in face view; narrow side view almost circular; end view elliptic with rounded ends; cell surface finely punctate; sinus deep and narrowly linear to narrowly wedge-shaped. L 47-95u; W 39-90u; Is 15u; T 22-39u. Knox: Chilowee Park Lake 15 July 1938 (Bold)unnumbered. VFK.

10. Cosmarium costatum Nordst. (Krieger f)(Nordstedt)

(Prescott I)

Cells 1/5 to 1/4 longer than broad; over-all cell outline cylindric-oval or hexagonal; sinus narrow and deep; lower lateral angles of semicells rectangular; about 12-15 crenations around margins of semicell; crenations entire near base, emarginate around upper margins of semicell; face exhibiting granules in a concentric group at the center and paired granules in concentric series between center of semicell and margin; side view of semicells bulbous, inflated near base; mid-facial and marginal groups of granules present; apical view generally truncate elliptic. L 27-57.5u; W 25-39.5u; Is 10.5-21.5u; T 15-29u. Bount: Montvale Springs 1925.[1] N.

11. Cosmarium cucurbitum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Over-all shape of cell a cylinder with rounded ends; the sinuses being only shallow depressions; apical view circular. L 29-50u; W 15-25u; Is 14-21u. The over-all shape differs from that of C. attenuatum Bréb. which is fusiform and from that of C. viride (Corda) Josh. both of which have shallow sinuses. Cherokee: dripping cliff near Hiwassee Dam Powerhouse 14 Aug. 1949 #1749. FKAM.

12. Cosmarium denticulatum f. Borgei Irénée-Marie. (Irénée-Marie f)

Over-all cell outline oval with slightly flattened ends,

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1 Reported in Brown, 1930

median incision deep, forming a narrow sinus; about three rows of minute teeth visible around the perimeter, approximately thirty-five in each semicell for each row. L 168-208u; W 95-128u; Is 35-44u. C. denticulatum Borge is a variable species. Irénée-Marie has designated two forms, but a number of others could be described, if one wished to do so. Rabun(Ga.): plankton from pond by hwy U.S.23 near Clayton 13 Aug. 1949 #1725 - Hardeman: slough or marsh beside hwy U.S.45-E at Madison county line 15 June 1949 #2272.

13. Cosmarium formulosum Hoff. (Nordstedt)(Prescott I)

Semicells trapezoid or hemispherical in shape; lower lateral angles rounded somewhat; margins crenate, 6-7 crenations on sides, three at ends according to West & West; face surface with concentric rows of granules toward margin; center of face with 5-7 vertical lines of granules; sinus linear with broader base. Gibson - Obion: plankton from upper pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1243. G.

14. Cosmarium formulosum v. Nathorstii (Boldt)West & West. (Irénée-Marie f)(Nordstedt)(Prescott I)

Smaller in size and broader in proportion than the species. L 44-54u; W 42-52u; Is 11-16u; T 23-24u. Polk: in spring water by hwy U.S.64 below Ocoee Dam #3 14 Aug. 1949 #1762 - Weakley: large spring about four miles north of Gardner Station 8 July 1949 #1221.

15. Cosmarium galeritum Nordst. (Irénée-Marie f)(Nordstedt)

(Prescott I)

Over-all cell outline broadly elliptic; semicells flattened hemispherical with lower lateral angles rounded; surface punctate. L 51-60u; W 42-50u; Is 15-18u; T 23-27u. Knox: Lakeside Lake by hwy Tenn.71 about five miles south of Knoxville 15 March 1950 #2050. N.

16. Cosmarium humile (Gay)Nordst. (Irénée-Marie f)(Nordstedt)(Prescott I)

Length only slightly exceeding width; semicells trapezoid in shape, the margins crenate, with a single intramarginal row of granules visible in face view; a single granule near the center of each semicell. L 11-15.5u; W 10-16u; Is 4-5u; T 7.5-8.5u. Distinguished from C. Blytti Wille by being more angular, having rounded rather than pointed granules, and having a single central granule instead of four. Montgomery: pond on Dotsonville Road near Clarksville 9 Oct. 1949 #2024. F.

17. Cosmarium impressulum Elfv. (Irénée-Marie f)(Nordstedt)(Prescott I)

Over-all cell shape irregularly polygonal; semicells with a rounded perimeter of about eight small straight edges or undulations. L 20-36u; W 14.5-26u; Is 3.5-9u; T 8.5-14u. Lawrence: swamp containing several aquatics near Lawrenceburg 29 June 1949 #1062. GFK.

18. Cosmarium margaritatum (Lund.)Roy & Biss. (Irénée-Marie f)(Nordstedt)(Prescott I)

Over-all cell shape transversely broadly oval with a very slight rounding at the lower lateral angles of the semicells; poles rather flat; surface ornamented with many relatively large granules aligned in diagonal rows with small punctations hexagonally arranged about them; about thirty granules at the margin of the semicell. L 60-105u; W 56-82u; Is 19-31u; T 36-38u. Todd(Ky.): ditch pond by hwy U.S.79 near Tennessee state line 11 Sept. 1949 #1921 - Obion: pond on Hawkins' farm on road to Walnut Log from Union City 1 July 1949 #1135. VGFKM.

19. Cosmarium margaritatum f. minor (Boldt)West & West. (Irenee-Marie f)(Nordstedt)(Prescott I)

Distinguished from the typical only by the size, but the recorded dimensions approach each other and even coincide. L 44-62u; W 38-51u; Is 12.5-16u; T 25-41u. Blount: among aquatics in Laurel Lake near Kinzel Springs 4 Aug. 1949 #1660. K.

20. Cosmarium Meidzyrzecense v. mononazum Groenb. (Prescott I) Pl. 26, Fig. 3.

Outline of semicells trapezoid, transversely constricted midway to the poles; single small protuberance present in center of semicell face. L 18-21u; W 12u; Is 4-5u; T 6-7u. Tennessee: summer, 1949. M.

21. Cosmarium monomazum Lund. (Nordstedt)(Prescott I)

Cells only slightly longer than wide; outline transversely oval; sinus narrow and deep with the lower lateral angles rounded but angular, apices almost flat; margins of cells with about sixteen slightly emarginate granules, two rows of paired granules visible in side or apical view, at corners of cell. L 38u; W 34u; Is 11.5u; T 22u. Polk: sandy mud bottomed stream by hwy U.S.64 near Ducktown 14 1949 #1749.

22. Cosmarium norvegicum Stroem. (Irénée-Marie f)(Prescott I)

Cells broadly oval to subspherical; margins with about 11 crenations and four or five rows of intramarginal punctations; four straight rows of punctations in the center of each semicell. L 24-28u; W 20-27u; Is 6-8u; T 11u. Rabun (Ga.): plankton from pond by hwy U.S.23 near Clayton 13 Aug. 1949 #1725.

23. Cosmarium Nymannianum Groeno. (Irénée-Marie f)(Nordstedt)(Prescott I)

Semicells roughly trapezoidal in shape with sides and end somewhat concave; there is a wide longitudinal ridge in the center of each semicell and a single granule. L 42-54u; W 20-42u; Is 7.5-11u; T 20-26u. Tennessee: summer, 1950. G.

24. Cosmarium obtusatum Schm. (Irénée-Marie f)(Nordstedt)(Prescott I)

Semicells trapezoid, sides slightly concave with about 7-9 undulations on each side, opposite the undulations are one or two other marginal rows of granules; surface minutely punctate. L 44-60u; W 37-52u; Is 13-18u; T 20.5-27u. Lincoln: ponds on farm by hwy U.S.241 near Fayetteville 19 Aug. 1949 #1795 - Wilson: pond by hwy Tenn.10 south of Lebanon 20 Aug. 1949 #1797-8 - Colbert(Ala.): concrete tank at Nitrate Plant #1 near Sheffield 16 Oct. 1949 (Hall)#1969 - Davidson: fishpool by Vanderbilt University greenhouse 17 March 1950 #2061 - Obion: Sprout's Spring near Samburg 12 July 1949 #1293. VK.

25. Cosmarium ornatum Ralfs. (Irénée-Marie f)(Nordstedt) (Prescott I)

Over-all cell shape approximately square; the semicells approximately oblong, but highly ornamented with more or less circular groups of granules in the middle of the face, ends, and sides of the semicells. L 29-41u; W 32-42u; Is 9.5-13u; T 21-24u. Rabun(Ga.): plankton from pond by U.S. 23 near Clayton 13 Aug. 1949 #1725. SFKA.

26. Cosmarium orthostichum v. pumilum Lund. (Irénée-Marie f) (Nordstedt)(Prescott I)

Over-all cell shape broadly oval; semicells flattened hemispherical, ornamented with four transverse rows of about 8 large granules. L 21-25u; W 20-21.5u; Is 5-8u; T 12.5-14u. Montgomery: large marsh by hwy U.S.79 at Norfleet & Sons Grocery west of Clarksville 14 July 1949 #1376. FML.

27. Cosmarium pachydermum Lund. (Irénée-Marie f)(Nordstedt) (Prescott I)

Over-all shape broadly oval; semicells hemispherical and rounded at the lower lateral angles; cell wall markedly thick with a coarsely punctate surface. L 78-117u; W 60-87u; Is 29-40u; T 48-59u. Wall 2.5-3.5u. Montgomery: large pond at Oakwood 17 Sept. 1949 #1928. VFKM.

28. Cosmarium phaseolus f. minor Boldt. (Irénée-Marie f) (Nordstedt)(Prescott I)

Semicells compressed hemispherical with slightly rounded lower lateral angles; surface punctate, thickened in center of cell face. L 20-25u; W 18-24u; Is 4.5-7u; T 11-15u. Shape same as C. subtumidum, which lacks the facial thickenings, and similar to C. tumidum which has oblong-oval or reniform semicells. Shelby: goldfish pond in Memphis Zoological Gardens 20 March, 1949 #2129. K.

29. Cosmarium polygonum (Naeg.)Arch. (Nordstedt)(Prescott I)

Semicells irregularly hexagonal in shape, flattened laterally; uppermost lateral margins often concave; sinus linear or narrowly wedge-shaped; prominent knob in center of semicell visible in end or side view. L 15-21u; W 14-18.5u; Is 3-7u; T 10-12.5u. #1825 is somewhat different than generally figured, but measurements and descriptions seem not to exclude it from the species. Davidson: concrete pools of Kelly's Kennels at Nashville 26 Aug. 1949 #1825.

30. Cosmarium Portianum Arch. (Irénée-Marie f)(Nordstedt) (Prescott I)

Over-all shape dumbbell-like; semicells ornamented with 10-12 rows of large granules; the wide sinus is variable. L 26.5-40u; W 19-30u; Is 8-13u; T 15-24u. Rabun(Ga.):

plankton from pond by hwy U.S.23 near Clayton 13 Aug. 1949 #1725 - Union: pond by road near Hickory Star Landing 9 Aug. 1950 #2316 - Montgomery: woods pond east of Shady Grove 3 Sept. 1949 #2270 - Lawrence: swamp containing several aquatics by hwy U.S.64 near Lawrenceburg 29 June 1949 #1062 - Madison: slough by hwy U.S.45-E south of Gibson county line 14 June 1950 #2870. NSGFKAM.

31. Cosmarium Portianum v. nephroideum Wittr. (Irénée-Marie f)(Nordstedt)(Prescott I)

Distinguished from the typical by the smaller size and less rounded lower lateral angles of the semicells. L 25-31u; W 22-27u; Is 7-10u; T 12-16u. Knox: plankton from shallow water in old concrete reservoir at Neubert's Springs 20 July 1949 #1527. F.

32. Cosmarium pseudopyramidatum Lund. (Irénée-Marie f) (Nordstedt)(Prescott I)

Semicells more or less truncate pyramids, slightly rounded at lower lateral angles; surface punctate. L 43-65u; W 25-40u; Is 7.5-14u; T 9-15u.

Cosmarium pseudopyramidatum v. lentiferum Taylor (Irénée-Marie f) has been distinguished by the thickened region in the center of each semicell face, but, as Irénée-Marie observes, all cells of the species are thickened to some extent, so the variety is not employed here as a valid entity. Furthermore, in this variable group there are many cells smaller than the stated limits.

Madison(Ala.): embayment of Guntersville Lake above Scottsboro 19 Aug. 1949 #1784 - Pickett: margins of Dale Hollow Dam Lake at hwy Tenn.42 bridge 15 July 1949 #1482 - Montgomery: pond by hwy U.S.79 about six miles northeast of Clarksville 11 Oct. 1949 #1926 - Gibson - Obion: bottom coating in highest pond fertilized for fish raising on Abe Shatz' farm east of Kenton 9 July 1949 #1238 - Obion: squeeze from aquatics near Biological Station 2 July 1949 #1153. FA.

33. Cosmarium punctulatum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Over-all shape broadly oval; semicells flattened hemispherical in face view with rounded lower lateral angles; surface covered by granules which are a trifle larger in the very center, about 24 are at the perimeter. L 24-40u; W 24-38u; Is 7.5-12u; T 17-19u. The smallest length and width found recorded for this species was L 28u; W 27u so #1762 was smaller than usual, with shallower sinuses. Polk: spring water of ditch beside hwy U.S.64 near Ocoee Dam #3 14 Aug. 1949 #1762 - Roane: Miss Littleton's lily pool at Kingston 8 July 1938 (Bold)unnumbered.[1]

34. Cosmarium pyramidatum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Semicells truncate pyramids with rather sharp lower

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1 Reported in Silva, 1949

lateral angles, slightly convex sides; and straight or slightly concave poles; surface finely scrobiculate. L 58-100u; W 41-63u; Is 13.5-20u; T 26.5-36u. The clearest difference between this species and C. pseudopyramidatum Lund. is the single pyrenoid (per semicell) in the chloroplast of C. pseudopyramidatum, whereas there are two in C. pyramidatum. Colbert(Ala.): concrete tank at Nitrate Plant #1 near Sheffield 16 Oct. 1949 (Hall)#1969. NGFKM.

35. Cosmarium rectangulum Reinsch. (Nordstedt)(Prescott I) Pl. 26, Fig. 5.

Cells only slightly longer than broad, over-all shape rectangular with beveled upper lateral angles; sinuses linear and rather deep; margins undulate, described as four at the ends and three at the semicell sides, but Tennessee specimens showed only two lateral undulations; apical view a compressed rectangle with rounded poles. L 28.5-32u; W 27.5-28u; Is 9-13u; T 10u. Tennessee: culture of material collected in summer of 1949, preserved 7 March 1950 #2222.

36. Cosmarium Reinschii Arch. (Nordstedt)(Prescott I)

Cells about 1/5 longer than broad; semicells trapezoid in shape; sinus narrow and deep; lower lateral angles of semicells rounded, ends quite straight and sides described as having four acute undulations. The size recorded by West & West is L 36-37u; W 27.5-30u; Is 7-8u, but in the Tennessee specimens, L 28u; W 24u; Is 6u. #1211 differed from the descriptions in that there are actually rounded crenations on the margins. Weakley: marsh beside hwy Tenn.22 west of Martin at Mr. Bary's 8 July 1949 #1211.

37. Cosmarium reniforme (Ralfs.)Arch. (Irénée-Marie f) (Nordstedt)(Prescott I)

Semicells reniform in shape; surface covered with a diagonal pattern of punctations, about 25-30 at the perimeter. L 44-67u; W 36-60u; Is 13-20u; T 24-29u. Blount: coating on limestone rubble dam in Laurel Lake near Kinzel Springs 4 Aug. 1949 #1651 - Knox: pond on old Maryville Pike near Knoxville City limits 30 June 1931 (Bold)unnumbered[1] - Montgomery: ditch by hwy U.S.79 and Foster's Cave Road at W. D. Austin's farm 18 March 1950 #2082. FKML.

38. Cosmarium reniforme v. compressum Nordst. (Nordstedt) (Prescott I)

Differentiated from the typical best in apical view which is oblong-oval with flat margins rather than oval-elliptic. L 46-64u; W 47-56u; Is 13-18u; T 24-28u. Blount: Montvale Springs 1925.[2]

39. Cosmarium repandum f. minor West & West. (Irénée-Marie f)(Nordstedt)(Prescott I)

Semicells hexagonal or octagonal; sinuses very narrow and deep. L 15-22u; W 14-20u; Is 4-8u. The L/W ratio is almost 1/1 rather than the 4.6/4 or 5/4 found in published

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1 Reported in Silva, 1949
2 Reported in Brown, 1930

descriptions, so the identification may be faulty. Montgomery: large pond at Oakwood 17 Oct. 1949 (Clebsch)#1929 - Lawrence: swamp (pH 5.0) containing several aquatics by hwy U.S.64 near Lawrenceburg 29 June 1949 #1062.

40. *Cosmarium subcrenatum* Hantzsch. (Irénée-Marie f)(Nordstedt)(Prescott I)

Over-all shape broadly oval, equatorial angles nearly square; sinuses narrow and deep; perimeter undulate, 4-5 undulations on each side and 3 or 4 at the somewhat truncate poles, one or two granules are opposite each undulation; 4-5 rows of 2-6 granules in the midregion. L 20-37u; W 18u; Is 7-16u; T 12-20u. One specimen observed was only 20u in length and width rather than the recorded minimum of 23u long. Lumpkin(Ga.): in artificial lake at Vogel State Park 14 Aug. 1949 #1735 - Knox: culture at collector's home 16 Aug. 1949 #1766 - Obion: pond behind Hawkins' house on road to Walnut Log from Union City 1 July 1949 #1137. K.

41. *Cosmarium subspeciosum* Nordst. (Irénée-Marie f)(Nordstedt)(Prescott I)

Semicells hemispherical with flattened poles and sharp lower lateral angles; sinus narrow; margins with angular crenations, about eighteen at semicell perimeter; center of face with five or six series of granules. L 33-50u; W 26.5-36u; Is 11.5-16u; T 17.5-26u. Gibson - Obion: bottom coating in highest pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1238.

42. Cosmarium subspeciosum v. validus Nordst. (Irénée-Marie f)(Nordstedt)(Prescott I)

Distinguished from the typical by larger size and the slightly greater number of rows of granules (seven or eight) in the midregion of the face. L 68-85u; W 47-62u; Is 17.5-22u; T 33-39u. #1964 was 64u wide, thus having broader proportions than generally recorded. Lauderdale(Ala.): from Podostemon spp. in swift water of Cypress Creek at Florence 2 Oct. 1949 (Hall)#1964.

43. Cosmarium subtumidum Nordst. (Irénée-Marie f)(Nordstedt)(Prescott I)

Semicells hemispherical with slightly flattened poles, equatorial angles somewhat rounded; surface finely punctate. L 30-40u; W 24-34u; Is 7.5-10u; T 14.5-17u. Montvale Springs 1925.[1] FKM.

44. Cosmarium tumidum Lund. (Irénée-Marie f)(Nordstedt)(Prescott I)

Semicells oblong-oval or slightly reniform, surface punctate; slight thickening present at center of face. L 31-37u; W 23-35u; Is 6.5-8u; T 17-23u. #2096 was broader than recorded, 35u instead of 32u. The species has much in common with C. phaseolus f. minor Boldt, the semicells of which are less rounded at the lower lateral angles, and C. subtumidum Nordst. which is shaped about as C. tumidum

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1 Reported in Brown, 1930

and lacks the facial thickenings. Montgomery: pond at corner of Dotsonville Road 9 Oct. 1949 (Clebsch)#2026 - field pond at Meriwether 18 March 1950 #2096.

45. Cosmarium Turpinii Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Semicells trapezoid with rounded lower lateral angles; surface decorated with granules, about forty at the perimeter, and two adjoining circular patterns made up of concentric rings of granules in the midregion of the semicell face. L 32.5u; W 49.5u; Is 14.5u; T 30u are the measurements as described, but most reports record larger cells L 60-77u; W 56-67u; Is 14-20u; T 34-38u. Montgomery: field pond at Meriwether 18 March 1950 #2096. VKL.

46. Cosmarium viride (Corda)Josh. (Nordstedt)(Prescott I) Pl. 26, Fig. 6.

Cells about 1 3/4 times longer than broad; sinus a shallow obtuse depression; semicells obovate-circular; apical view circular; cell surface punctate. L 41-55u; W 20-33u; Is 14-24u. The species should be compared with C. cucurbitum Bréb. which also has a very shallow sinus. Morgan: wet cliff near Rugby 6 Aug. 1949 (Sharp)#1665. V.

DESMIDIUM Agardh 1825

The cells of this genus are arranged in definite filaments rather than in incidental series as formed by Cosmarium and other unicellular genera. Most of the species are triangular in apical view.

1. Apical view of cells elliptic or
citriform......... *D. Grevillii* (Kuetz.)DeBary
1. Apical view triangular or oblong.................. 2
   2. Cells adjoined only at corners,
   which are considerably protruded
   out from the center section of
   the cell.................................... 3
   2. Cells apparently adjoined along
   entire apical surfaces..... *D. Swartzii* Ag.
3. Lateral margins straight or slightly
concave, end view triangular..................
.... *D. Baileyii* (Ralfs)Nordst.
3. Lateral margins lobed, sinuses narrow,
fairly deep................. *D. aptogonum* Bréb.
which is triangular in apical view and
D. aptogonum v. *Ehrenbergii* Kuetz. which
is oblong.

1. *Desmidium aptogonum* Bréb. (Irénée-Marie f)(Nordstedt) (Smith f)

Cells almost twice as wide as long; apical margins cleft with very narrow, fairly deep sinuses; apical angles slightly extended adjoining the processes of adjacent cells; cross section triangular except in v. *Ehrenbergii* Kuetz. which has an oblong shape. Lawrence: swamp (pH 5.0) containing several aquatics by hwy U.S.64 near Lawrenceburg 29 June 1949 #1062. VNSGFM.

2. Desmidium Baileyii (Ralfs)Nordst. (Irénée-Marie f)
(including Desmidium Baileyii v. minor Allorge & Allorge)
(Nordstedt)(Prescott I)

Lateral edges of cells straight or slightly concave; apical angles extended so that adjacent cells join only by these processes; cross section triangular. L 15-26u; W 19-28u. The variety is included with the species here since no evidence is found for a consistent difference in size between it and the typical. Roane: Miss Littleton's lily pool at Kingston 9 July 1939 (Bold)unnumbered[1] - Shelby: Joe Priestly's aquarium in Memphis 20 March 1950 #2131. vnSGrKA.

3. Desmidium Grevilii (Kuetz.)DeBary. (Irénée-Marie f)
(Nordstedt)(Prescott I)(Smith f)

Cell length 1/3 to 1/2 of width; lateral margins straight, undulate, notched or with distinct linear sinus; a polar thickening forming a pad between adjoining cells; polar view elliptic with short polar pad-like thickenings at the angles. L 20-46u; W 43-63u; Is 25-42u. Hamilton: winter pond of long duration in cultivated field by hwy Tenn.58 in northern part of the county 28 June 1949 #990 - Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1421-30-31 - pond containing considerable number of aquatic plants at Timothy 15 July 1949 #1456 - Madison(Ala.): reservoir of Guntersville Lake at hwy U.S.72 northeast of Scotts-

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1 Reported in Silva, 1949

boro 18 Aug. 1949 #1784 - Wilson: creek running over shelving limestone of central basin by hwy U.S.70-N eight miles west of Lebanon 14 July 1949 #1417 - Montgomery: marshy pond with considerable vegetation at New Providence 14 July 1949 #1364-5-9 - woods pond east of Shady Grove 3 Sept. 1949 (Clebsch) #1911 - field pond at Meriwether 18 March 1950 #2096 - Henry: fairly large pond with Typha and Juncus spp. by hwy U.S.79 northeast of Paris 14 July 1949 #1348. NSGFM.

4. Desmidium Swartzii Ag. (Irénée-Marie f)(Nordstedt) (Prescott I) Pl. 25, Fig. 6.

Cells about twice as wide as long; margins on sides cordately lobed, the lobes sharply pointed in the typical, rounded in v. amblyodon (Itz.)Rab.; cells adjoined flat against each other rather than adjoining at angles by thickenings; apical view triangular. L 20-46u; W 43-63u; Is 25-40u. Blount: on rocks in Montvale Springs Lake 18 Aug. 1950 #2323 - Montgomery: hog pond with Salix etc. just north of Hazelwood 18 March 1950 #2095. VNSGFKAML.

EUASTRUM Ehrenberg 1832

This genus and Cosmarium approach each other in cell shape, although for most species the distinction is clear enough. The emarginate or sinoid polar lobe is the most prominent character here, but the deep linear equatorial sinus, compression of the cells and almost universal presence of facial protuberances aid in differentiation of the genus.

1. Apical incision narrow, well marked................ 2
1. Apical lobe merely retuse or emarginate............ 6
   2. Margins with spines or points.................... 3
   2. Margins without spines or points................. 5
3. Cells 45u or less in length......................... 4
3. Cells over 45u in length.. *E. lapponicum* Schm.
   4. L 37.5-41u; W 27-28u... *E. abruptum* Nordst.
   4. L 22-28u; W 17-20u..........................
   .... *E. abruptum* f. *minor* West & West
5. Apical lobe capitate........ *E. pinnatum* Ralfs
5. Apical lobe not capitate..... *E. aboense* Elfv.
   6. Apical lobe enlarged toward summit............... 7
   6. Apical lobe not enlarged toward
   summit.. 8
7. Cells less than 20u broad at basal
   lobes......................... *E. gemmatum* Bréb.
7. Cells over 20u broad at basal lobes...........
   .... *E. verrucosum* Ehr.
   8. Three bulbous elevations on face
   of cell................. *E. tribulbosum* Silva
   8. Without three bulbous elevations
   on face.............. *E. binale* (Turp.)Ehr.

1. *Euastrum aboense* Elfv. (Irénée-Marie f)(Prescott I)

Semicell outline truncate pyramidal with definite linear apical notch, two equal lateral lobes are separated by equal undulations; three surface protuberances are present, one near isthmus, other two within the margin of the upper lateral lobules; five rows of pits present on the semicell face. L 48-65u; W 31-42u; Is 8-13u; T 24-25u. Knox: culture at collector's home 16 Aug. 1949 #1766.

2. Euastrum abruptum Nordst. (Irénée-Marie f)(Nordstedt) (Prescott I)

Semicells trapezoid-shaped, almost square, basal lobes rectangular, lobule on lateral margin merely a swelling with two or three short blunt spines, angles of polar lobe extended into spine-like processes; center of face with three granules forming a circle on the median swelling. L 37.5-41u; W 27-28u; Is 7-9u. Obion: Reelfoot Lake near Samburg 12 July 1949 #1304. FL.

3. Euastrum abruptum f. minus West & West. (Irénée-Marie f) (Nordstedt)(Prescott I)

Smaller than the typical. L 22-28u; W 17-20u; Is 4.5-5.5u. F.

4. Euastrum binale (Turp.)Kuetz. (Irénée-Marie f)(Nordstedt) (Prescott I) Pl. 26, Fig. 8.

Semicells trapezoid in shape, apical notch wide and shallow, lateral lobes almost equal to polar lobes; polar lobes with a short lateral spine; center of face with a round, raised protuberance. L 15-30u; W 12.5-21u; Is 3.5-5u; T 9-13u. Montgomery: pond at corner of Dotsonville Road 9 Nov. 1949 #2026. NFKM.

5. Euastrum gemmatum Bréb. (Irénée-Marie f)(Nordstedt)

(Prescott I)

Semicells essentially inverted T-shaped with scarcely any apical notch; face ornamented with three circular groups of granules; entire surface coarsely scrobiculate. L 40-70u; W 38-47u; Is 10-15u; T 20-30u. Rabun(Ga.): plankton from pond by hwy U.S.23 near Clayton 13 Aug. 1949 #1725 - Lawrence: swamp containing a considerable number of aquatic plants by hwy U.S.64 near Lawrenceburg 29 July 1939 #1062. VGFKAM.

6. Euastrum lapponicum Schm. (Irénée-Marie f)(Nordstedt) (Prescott I)

Semicells approximately square in outline, apical notch rather narrow and visibly prominent; two lateral lobes equal, with shallow undulation between; polar lobes rectangular, with small short spikes on the lateral angles; spines often on the other lobes as well; face with intra-marginal granules opposite lobes and a considerable protuberance in cell center giving the side view a bulbous appearance. L 35-40u; W 27-29u; Is 6-8u; T 18-19u. #1763 is a form approximating that in Prescott & Scott, 1945, but the proportions seem different from those given, although they approximate those of the illustration. L 35u; W 20u. Polk: embayment of Ocoee Dam Lake #1 by hwy U.S.64 14 Aug. 1949 #1763. M.

7. Euastrum oblongum (Grev.)Ralfs. (Irénée-Marie f)(Nordstedt)(Prescott I)

Semicells conical with rectangularly truncate apex and shallow, narrow apical notch; two lateral lobes present; lower lateral sinus broad, upper sinus narrow; surface punctate. L 125-205u; W 63-107u; Is 19-31u. Claiborne: permanent pond north of Tazewell 26 June 1938 (Bold)unnumbered.[1] VNFKML.

8. Euastrum pinnatum Ralfs. (Irénée-Marie f)(Nordstedt) (Prescott I) Pl. 26, Fig. 7.

Semicells a rounded cone, apical notch linear and pronounced; two lateral lobes, lower divided with very shallow invagination between two round lobules, upper lateral margin more deeply retuse, upper lateral lobe rectangular; cell surface with five or more protuberances, three along sinus of cell and two above, perhaps others in the upper lateral lobes. L 93-156u; W 44-80u; Is 16-24u; T 35-50u. Madison: reservoir of Guntersville Lake above Scottsboro near hwy U.S.72 crossing 19 Aug. 1949 #1784. NGFKML.

9. Euastrum tribulbosum sp. nov. Pl. 26, Fig. 9.

Semicell outline truncate pyramidal with fairly narrow apex, lateral and apical margins of face view concave; equatorial sinuses linear and fairly deep; basal angles of semicells rounded; face raised in three bulbous protuberances, two equatorial and the third toward the apex; side view of semicell bulbous, with bulges visible and tapering

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1 Reported in Silva, 1949

to a truncate apex; end view complicated, but generally elliptic in outline. L 60u; W 40u; Is 10u; T 20u.

This newly described species is nearest E. crassicolle Lund. which, however, is far smaller and has poles with broader proportions. The three bulbous protuberances, however, are identical in form and prominence.
Gibson - Obion: bottom coating in upper pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1836.

10. Euastrum verrucosum Ehr. (Irénée-Marie f)(Nordstedt) (Prescott I)

Semicells trapezoid, apical notch wide and shallow, two lateral lobes on each side; lower lateral sinus wide and shallow, upper narrower, deeper, all lobes surmounted by groups of granules; face of cells with three concentrically arranged rows of granule groups just above the sinus, center group being largest; entire surface covered with very small granules. L 88-114u; W 68-108u; Is 17-22u; T 42-55u. Montgomery: woods pond east of Shady Grove 3 Sept. 1949 (Clebsch)#1910.

HYALOTHECA Ehrenberg 1841

In this genus the cylindrical cells, which are generally constricted to some extent at the center, are joined end-to-end to form a filament of indefinite length. Hyalotheca and Gymnozyga approach each other in character, although as typically described, the cells of Gymnozyga are broadest in the midregion, with narrower sinuses.

1. Two rings of granules present at each
   end of cell............ H. mucosa (Dillw.)Ehr.
1. No rings of granules present........................ 2
   2. Cells about twice as long as broad.........
      .... H. neglecta Racib.
   2. Cells as broad or broader than
      long............ H. dissiliens (Smith)Bréb.

1. Hyalotheca dissiliens (Smith)Bréb. (Irénée-Marie f) (Nordstedt)(Prescott I) Pl. 25, Fig. 7.

Filaments composed of nearly cylindrical cells which are usually wider than long with sides very slightly undulate. L 10-33u; W 10-39u. Lumpkin(Ga.): on pilings in artificial lake at Vogel State Park 14 Aug. 1949 #1735 - Warren: McMinnville 7 Feb. 1938 (Miss Mason in Bold's records)unnumbered[1] - Moore: spring at sulfur well at Cumberland Springs 29 June 1949 #1019 - Lawrence: swamp containing several aquatics by hwy U.S.64 near Lawrenceburg 29 June 1949 #1062 - Montgomery: woods pond east of Shady Grove 3 Sept. 1949 #1910. VNSGFKM.

2. Hyalotheca mucosa (Dillw.)Ehr. (Irénée-Marie f)(Nordstedt)(Prescott I)

Filaments of cylindrical cells, lateral margins parallel;

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1 Reported in Silva, 1949

two rows of granules around each end. L 14-26u; W 16-22u. Knox: Lakeside Pond (Lake) Sevierville Pike (about 5 miles south of Knoxville) 11 June 1938 (Bold)unnumbered[1] - Moore: pools below mill dam at Cumberland Springs 29 June 1949 #1032. NSGFKM.

3. Hyalotheca neglecta Racib. (Irénée-Marie f)(Nordstedt) (Prescott I)

Filaments of cylindrical cells, more than twice as long as wide, lateral margins with only a shallow notch or undulation. L 26-42u; W 11-18.5u. It is at this species that the line between Gymnozyga and Hyalotheca becomes indistinguishable, since some cells do show a slight median bulge, and some show a narrow notch, both of which are characters which would definitely belong to Gymnozyga, if they were accentuated. Macon(N.C.): in spring tub at Gay, near Franklin by hwy U.S.23 13 Aug. 1949 #1722. NFM.

MICRASTERIAS Agardh 1827

Distinctly separated from other genera, Micrasterias has very thin and very flat cells,[2] the semicells of which are deeply and sharply lobed in face view. These are always either three or five principal lobes per semicell.

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1 Reported in Silva, 1949

2 Micrasterias muricata (Bail.)Ralfs is radially symmetrical, but clearly is related to the genus because of other characteristics.

1. Overall outline vaguely rectangular, with three ranks of laterally projecting conical appendages on each semicell margin in place of the usual lobes. These projections are disposed almost radially *M. muricata* (Bail.)Ralfs
1. Cell essentially flat.............................. 2
   2. Polar lobe apex 1/3 of semicell perimeter or more broad, convex................. 3
   2. Polar lobe apex less than 1/3 of semicell perimeter broad, concave............... 4
3. Lateral lobes shallowly bifurcate ending in short double points................. .... *M. truncata* (Corda)Bréb.
3. Lateral lobes bifurcate, with linear sinuses, ending in long, sharp double points *M. truncata* v. *semiradiata* (Naeg.)Cleve
   4. Ultimate lobes terminating in blunt apices without points................ .... *M. denticulata* Bréb.
   4. Ultimate lobe terminating with some sort of points............................ 5
5. Three small points often present on ultimate lobes, principal lateral and apical lobe sinuses about equal and fairly broad, facial spines only at

base of apical lobe sinuses and at apical margin....... *M. americana* (Ehr.)Ralfs

5. Lobes consistently ending in two points.................................... 6

6. Apical lobe raised as a pedestal leaving a very large sinus between it and lateral lobes.................... 7

6. Apical lobe separated from lateral lobes only by linear sinus.................... 8

7. Apices with four appendages, two directed away from the plane of the cell, sinuses often bordered with a row of small spines.... *M. Mahabuleshwarensis* v. *dichotoma* G. M. Smith

7. Apical lobes with only the two lateral angles extended, these in the plane of the cell........... *M. radiata* Hass. and *M. radiata* v. *gracilima* G. M. Smith and *M. radiata* v. *simplex* G. M. Smith

8. Upper lateral lobes bifurcate to form two lobes, each subdivided to form eight ultimate lobules, lower lateral lobes ending in four ultimate lobules........................... *M. rotata* (Grev.)Ralfs

8. Only five principal lobes per

semicell apparent............................ 9

9. Over-all outline octangular, length 118-156u................ *M. papillifera* Bréb.

9. Over-all outline broadly oval, length 150u or more....................................... 10

10. Several rows of spines on face of cell more or less radiating from cell center.......................... .... *M. apiculata* (Ehr.)Menegh.

10. Few facial spines, present only at base of sinuses....................... *M. apiculata* v. *fimbriata* (Ralfs)Nordst.

1. *Micrasterias americana* (Ehr.)Ralfs. (Irénée-Marie f) (Nordstedt)(Prescott I) Pl. 27, fig. 1.

Over-all cell outline broadly oval; semicells with five principal lobes; all except apical or center lobe bifurcate with sinuses about half as deep as the principal ones, which are very deep; apical lobe wedge-shaped with four lobes extending out from it in two planes; all lobes with small spikes at the ends; pairs of small protuberances present at base of upper sinuses and at top of apical lobe. L 120-160u; W 100-145u; Is 17-29u. Warren: McMinnville 2 Jan. 1938 (Miss Mason in Bold's records)unnumbered[1] - Moore: rain

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1 Reported in Silva, 1949

barrel (pH 5.0) on Tolley farm south of Lynchburg 29 June 1949 #1012 - Davidson: fish pool by Vanderbilt University greenhouse 17 March 1950 #2060 - Lawrence: swamp containing several aquatics by hwy U.S.64 near Lawrenceburg 23 June 1949 #1062 - Weakley: marsh by hwy Tenn.22 west of Martin 8 July 1949 #1211. VNSGFKL.

2. Micrasterias apiculata (Ehr.)Menegh. (Irénée-Marie f) (Nordstedt)(Prescott I)

Over-all outline broadly oval, apical notch a broad "V"; two principal side lobes bifurcate or doubly bifurcate into secondary lobes with successively shallower sinuses, all lobes ending in two or more short sharp spines; face surface with rows of short spines tending to be aligned along the sinuses. L 150-294u; W 120-250u; Is 21-56u. Warren: McMinnville 2 Jan 1938 (Miss Mason in Bold's records)unnumbered.[1]

3. Micrasterias apiculata v. fimbriata (Ralfs)Nordst. (Irénée-Marie f)(Nordstedt)(Prescott I)

Differs from the typical principally in lacking most of the facial spines; angles of the apical lobes extend into double spines and two more are visible along the margin of the apical notch. L 210-293u; W 200-252u; Is 25-40u. Polk: spring water in ditch by hwy U.S.64 near Ocoee Dam #3 14 Aug. 1949 #1762. GFA.

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1 Reported in Silva, 1949

4. Micrasterias denticulata Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Over-all outline a broad oval; apical notches generally figured as narrow but distinct. In the Tennessee specimen they are a broad "V", the same shape as shown in one of the illustrations in West & West; sinuses all very narrow; five principal sinuses per semicell (two lateral lobes on each side margin), all lateral lobules usually twice bifurcate to form smaller lobes with blunt ends; cell surface smooth or slightly punctate. L 205-350u; W 177-300u; Is 23-40u. Knox: Lyons View Creek at Lyons View 28 June 1949 #1895. NSGFKAM.

5. Micrasterias Mahabuleshwarensis v. dichotoma G. M. Smith. (Irénée-Marie f)(Prescott I)

Semicells vaguely trapezoid in shape, with three principal lobes for each semicell, the lower ones bifurcate once and sometimes twice, lobes ending in two or three blunt spines; apical lobe angles extending into arm-like projections and two additional ones at the edge of the wide apical notch set at different angles to the plane of the cell; lateral sinuses very broad and deep; face surface with several rows of short, sharp spines which tend to follow the margins to some extent. L 134-170u; W 125-160u; Is 19-30u. The variety differs from the typical only in the presence of secondary dichotomies in the lateral lobes.

The general description of M. americana (Ehr.)Ralfs agrees with this variety rather closely since only the proportions of secondary lobes differ. It has been pointed out by Prescott and Scott, 1942 that there are enough intergradations present that they should be considered a single species.

Madison(N.C.): roadside spring hole near junction of hwys N.C.208 & 212 25 June 1949 #932 - Montgomery: field pond at Meriwether 19 March 1950 #2096.

6. Micrasterias muricata (Bail.)Ralfs. (Irénée-Marie f) (Nordstedt)(Prescott I) Pl. 27, Fig. 2.

Over-all cell outline vaguely rectangular, with three ranks of elongated conical appendages in place of the usual lobes; the appendages are laterally directed and are more or less radially arranged; surface smooth or finely punctate. L 105-224u; W 80-208u; Is 16.5-25u.

As has been frequently observed, this species does not resemble others of the genus and is included partly because of the lack of a more suitable position.

Henry: fairly large pond with Typha and Juncus spp. by hwy U.S.79 northeast of Paris 14 July 1949 #1349. FML.

7. Micrasterias papillifera Bréb. (Irénée-Marie f)(Nordstedt)(Prescott I)

Over-all shape octangular to broadly oval, apical notch a broad "V"; semicells with three principal lobes, the lateral ones twice bifurcate and ending in small lobes with small spines at the angles; all sinuses linear; face with rows of short, sharp spines along principal sinuses;

surface finely punctate. L 119-156u; W 109-148u; Is 15-22u. Madison(N.C.): roadside pool of some duration by hwy N.C. 212 near Cutshall's grocery 25 June 1949 #1994. VGFK.

8. Micrasterias radiata Hass. (Irénée-Marie f)(Nordstedt) (Prescott I) Pl. 27, Fig. 3.

Over-all outline of cells broadly oval with flattened poles; apical notches broad and shallow, the angles of the apical lobe extended into arms ending in two small spines; semicells with three principal lobes, lateral lobes twice bifurcate with rather long lobe arms, ultimately ending in double small spines. L 123-197u; W 113-186u; Is 17-30u. All intergradations exist not only between the forms of this species, but also between the typical and M. Crux-melitensis (Ehr.)Hass. The described differences are based on the proportions of the lobes, and presence of secondary bifurcations. Blount: upper end of Montvale Springs Lake 18 Aug. 1950 #2324 - Henry: pond with Cyperus spp. etc. by hwy Tenn. 54 quite near Kentucky state line 14 June 1950 #2255. VNSGFKML.

9. Micrasterias radiata v. gracilima G. M. Smith. (Irénée-Marie f)(Prescott I)

The variety is defined by having narrower divisions of the lobes than the typical, with which, however, it intergrades. Moore: plankton in mill pond at Cumberland Springs 29 June 1949 #1035. FML.

10. _Micrasterias_ _radiata_ v. _simplex_ G. M. Smith. (Irénée-
(_Micrasterias_ _furcata_ v. _simplex_ Wolle of Nordstedt and of Prescott papers)
Marie f)

This variety has the thinner form of v. _gracilima_, but is defined by the lack of secondary dichotomies in the lateral lobes. Such differences are not constant. Overton: well vegetated pond at Timothy 15 July 1949 #1456 - Montgomery: marsh pond just west of New Providence 14 July 1949 #1365.

11. _Micrasterias_ _rotata_ (Grev.)Ralfs. (Irénée-Marie f) (Nordstedt)(Prescott I)

Over-all outline of cells broadly ovate; apical notch a broad "V" shape, angles of apical lobe ending in two short sharp spines; semicells with five principal lobes, lower lateral lobes twice bifurcate, upper lateral lobes thrice bifurcate, first bifurcation rather deep; all sinuses narrow and principal sinuses very deep; all lobes generally ending in points; surface finely punctate. L 205-366u; W 190-305u; Is 28-40u. Moore: spring at sulfur well of Cumberland Springs 29 June 1949 #1019. VNSGFKM.

12. _Micrasterias_ _truncata_ (Corda)Bréb. (Irénée-Marie f) (Nordstedt)(Prescott I)

Over-all outline essentially broad barrel-shaped, apical notches not present, polar margins straight or even slightly convex, and very broad with bifurcate lateral angles;

semicells with five principal lobes, lateral lobes shallowly bifurcate and tipped with two double spines; only deep sinuses of semicells separating the apical lobe from the higher lateral lobes; surface of face punctate. L 70-110u; W 60-122u; Is 15-21u. Blount: upper end of Montvale Springs Lake 18 Aug. 1950 #2324 - Roane: Miss Littleton's lily pool at Kingston 11 July 1938 (Bold)unnumbered.[1] VNGFKAM.

13. Micrasterias truncata v. semiradiata (Naeg.)Cleve. (Irénée-Marie f)(Nordstedt)(Prescott I)

Distinguished from the typical by slightly deeper sinuses and longer spines on the ends of the lobes, and also by a more rounded shape. L 94-98u; W 96-105u; Is 14-16u. This is only one of many varieties described for this species, and probably many more could be found. #2027 has much longer spines than are usually figured. Montgomery: marsh pond just west of New Providence 14 July 1949 #1365 - pond at corner of Dotsonville Road 9 Oct. 1949 #2027. L.

ONYCHONEMA Wallich 1860

The filaments of this genus are composed of somewhat Cosmarium-like or Arthrodesmus-like cells with deep median sinuses and transversely elliptic or hemispherical semicells. The characteristic features of the genus, however, are the two relatively long finger-like processes located at the apices of the cells. The processes are on alternate sides

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1 Reported in Silva, 1949

of the cells and involve with those of adjacent cells.

1. Semicells cylindric-oval in shape, the lateral margins usually coming to a point or short spine........................ 2
1. Semicells hemispherical to roundly-oval in shape, margins without points or spines...... _O. filiforme_ (Ehr.)Roy & Biss.
   2. Points short, acute........................
      .... _O. laeve_ v. _micranthum_ Nordst.
   2. Points longer, acuminate.. _O. laeve_ Nordst.

1. _Onychonema filiforme_ (Ehr.)Roy & Biss. (Irénée-Marie f) (Nordstedt)(Prescott I)

Filaments of approximately quadrate cells with a deep sinus; semicells cylindric-oval, apices with two projections fitting under and over adjoining cells. L 8.5-13.5u; W 8.5-17u; Is 3.5-6u. Overton: pond containing a number of aquatic plants at Timothy 15 July 1949 #1456. SGFKM.

2. _Onychonema laeve_ Nordst. (Nordstedt)(Prescott I) Pl. 25, Fig. 8.

Filaments of approximately quadrate cells with a deep sinus; semicells cylindric-oval with lateral angles extended into points. L 16-19u; W 20.5-25u (46u with points). Todd (Ky.): ditch pond by hwy U.S.79 quite near Tennessee state line 11 Sept. 1949 (Clebsch)#1921 - Montgomery: pond on Dotsonville Road 9 Oct. 1949 #2024. SGFK.

3. Onychonema laeve v. micracanthum Nordst. (Irénée-Marie f) (Nordstedt)(Prescott I)

The variety is differentiated from the typical by the very short lateral points. L 15-16u; W 18-21u; Is 3.5-4u. Actually there is considerable variation in the spine length, even in a single filament, some angles having no marginal spines, some with short spines, (typical of the variety), whereas the longer spines are characteristic of the typical. Overton: large shallow lake containing many aquatic plants, one mile northwest of Livingston 15 July 1949 #1465. NGF.

PENIUM de Brébisson 1844

The cells here are approximately cylindrical with rounded or conical poles, and with a slight constriction in the midregion. The discussion under Pleurotaenium should be noted.

1. Cells tapering slightly to conical poles; cell surface ornamentated with anastomosing rows of granules.................. .... P. margaritaceum (Ehr.)Bréb.
1. Cells not tapering to the poles, poles rounded; cell surface ornamented with longitudinal striae..................... .... P. spirostriolatum Barker

1. Penium margaritaceum (Ehr.)Bréb. (Irénée-Marie f)(Nordstedt)(Prescott I)

Cell shape cylindrical to almost fusiform with only a suggestion of a constriction at midregion; surface yellow-brown, ornamented with anastomosing rows of granules. L 73-130u; W 12.5-26u. Jefferson: roadside pool 26 June 1938 (Bold)unnumbered[1] - Union: pond by road near Hickory Star Landing 9 Aug. 1950 #2316 - Cumberland: rain puddle in front of New Salem Baptist Church by hwy U.S.70-N 16 March 1950 #2056 - Gibson - Obion: stick in middle pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1235. VNFKML.

2. Penium spirostriolatum Barker. (Irénée-Marie f)(Nordstedt)(Prescott I) Pl. 24, Fig. 4.

Cells a long, straight cylinder with rounded poles and a slight constriction at midregion; surface with 8-15 striae which may be straight or somewhat spiralled, some anastomosing. L 123-400u; W 14-34u. Jefferson: permanent pond at junction of hwy U.S.11-E and Cherokee Dam approach road 25 June 1949 #910. NGFK.

PLEUROTAENIUM Naegeli 1849

Some species in this genus have characteristics in common with Penium. In fact, Pleurotaenium minutum (Ralfs) Delponte has been repeatedly shifted to Penium and back again according to different authors. This is understandable because this species combines the general cell shape

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1 Reported in Silva, 1949

and proportions of a Pleurotaenium with Penium-like internal organization.

The generic criteria are:

relative length of cell to width, not a strong character by which to separate a genus, Pleurotaenium having cells six or more times longer than wide;

equatorial constriction, common to the Pleurotaenium species but also present in Penium spirostriolatum Barker and possibly even in Penium margaritaceum (Ehr.)Bréb.;

equatorial girdle band, present in both genera;

truncate poles, true for most Pleurotaenium species, but uncertain in some forms such as P. minutum;

swelling at base of semicells, which, like the form of the poles, fails to catagorize P. minutum.

1. Constriction at midregion slight,
   no swelling at base of semicells,
   apices of cells somewhat rounded...............
   .... P. minutum (Ralfs)Delponte
1. Constriction at midregion distinct,
   semicells slightly swollen at base;
   apices of cells truncate.......................... 2
   2. Poles of cells plain, smooth...................... 3
   2. Poles of cells with crown of
      tubercles..... P. Ehrenbergii (Bréb.)DeBary
3. Cells over 40u broad at base of semi-
   cells.............. P. maximum (Reinsch)Lund.

3. Cells less than 40u broad. 4
    4. Two swellings at each semicell base. 5
    4. Single swelling at each semicell base. 6
5. L 240-650u; W 18-35u. . . . . P. Ehrenbergii (Bréb.)DeBary
5. L 525-660u; W 23-30u. . . . . P. Ehrenbergii v. elongatum W. West (described as being more narrowly proportioned than the typical)
    6. L 340-620u; W 25-40u. . . . . P. trabeculum (Ehr.)Naeg.
    6. L 212-408u; W 18.5-24u. . . . . P. trabeculum v. rectum W. West (described as being more narrowly proportioned than the typical)

1. Pleurotaenium Ehrenbergii (Bréb.)DeBary. (Irénée-Marie f) (Nordstedt)(Prescott I)

Cells elongated cylindrical, tapering slightly to truncate apices which are decorated with a circle of 8-9 tubercles; constriction at midregion slight; two distinct undulations at base of the semicells and slight ones often present beyond these; chloroplasts shaped as longitudinal bands with small pyrenoids scattered through them. L 240-650u; W 18-35u. Montgomery: large marsh by hwy U.S.79 at Norfleet's grocery west of Clarksville 14 July 1949 #1376 - Madison: slough by hwy U.S.45-E just south of Gibson county line 15 June 1950 #2270. NSGFKA.

2. Pleurotaenium Ehrenbergii v. elongatum W. West. (Irénée-Marie f)(Nordstedt)(Prescott I)

The variety is more elongated than the typical. L 525-560u; W 23-30u. Weakley: Mr. Bary's pond by hwy Tenn.22 west of Martin 9 July 1949 #1208. NGML.

3. Pleurotaenium maximum (Reinsch)Lund. (Irénée-Marie f)

Cells elongated cylindrical, slightly tapered to truncate apices, slightly constricted at midregion, where a transverse ring-like thickening is usually visible; chloroplasts about ten elongated parallel bands; cell surface punctate. L 496-852u; W 31-84u. Madison(N.C.): pool of some duration by hwy N.C.212 near Cutshall's grocery 25 June 1949 #1894 - Greene: at wier across river at Flag Pond 25 June 1949 #940 - Montgomery: woods pond east of Shady Grove 3 Sept. 1949 (Clebsch)#1910. NAM.

4. Pleurotaenium minutum (Ralfs)Delponte. (Irénée-Marie f)
(Penium minutum (Ralfs)Cleve)
(Nordstedt)(Prescott I) Pl. 25, Fig. 4.

Cells cylindrical, constricted at midregion; apices rounded. L 72-200u; W 10-18u. The species is distinguished from the others of the genus by the lack of a swelling at the base of the semicells, somewhat rounded apices, and small size. The proportion of length to width is generally greater than in the cells of #1421. Overton: in shallow water of artificial lake at Standing Stone State Park 15 July 1949 #1421. NSFK.

5. Pleurotaenium trabeculum (Ehr.)Naeg. (Irénée-Marie f) (Nordstedt)(Prescott I) Pl. 25, Fig. 5.

Cells elongated cylindrical, slightly constricted at midregion, tapering slightly to truncate, unornamented apices; semicells with basal swelling. L 340-620u; W 25-40u.

Irénée-Marie remarks that this speceis is intermediate between P. Ehrenbergii and P. maximum. The former is distinguished easily by the apical tubercles, but the latter is difficult to separate, if there is indeed a separation between the two. The recorded dimensions intergrade considerably.

Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1421-4 - Wilson: creek running over shelving limestone of Nashville Basin by hwy U.S.70-N about eight miles west of Lebanon 14 July 1949 #1417 - Montgomery: pond by hwy U.S.79 at Tom Edwards' store west of Clarksville 14 July 1949 #1370-1 farm pond by hwy U.S.41 alt. near Ringgold 18 March 1950 #2083. VNSGFKML.

6. Pleurotaenium trabeculum v. rectum (Delp.)W. West. (Irénée-Marie f)(Nordstedt)(Prescott I)

This variety is distinguished from the typical best by its smaller size. In addition, the sides are said to be more parallel and the midregion swellings more pronounced than in the typical. L 212-408u; W 18.5-24u. Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1420. NGFM.

STAURASTRUM Meyen 1829

A pronounced characteristic of species in this genus is their variability. Radial symmetry in apical view is prevalent, but it may be triangular or polyangular, and lobes or arms are usually present. In a few cases the symmetry is bilateral but these show a structure unmistakably related to the others. The semicells are variously shaped in face view, and there is almost always a rather deep equatorial sinus.

* species not included in text

1. Cells without appendages or arms at the angles, especially as seen in vertical view.................................. 2
1. Cells with appendages or arms at angles as seen in either front or vertical view.................................. 21
   2. Cells with shallow equatorial sinuses, cell diameter in Tennessee specimen at least 2/3 of greatest width.................. <u>S. Meriani</u> Reinsch
   2. Cells with deep sinuses........................ 3
3. Surface of cells smooth or punctate................ 4

3. Surface of cells granulose or spinose.............. 15

4. Cell angles with spines......................... 8

4. Cell angles spineless........................... 5

5. Sinus opening widely toward outside...........
.... *S. muticum* Bréb.

5. Sinus linear for at least half of
depth.. 6

6. Semicells slightly concave at
apices.................... *S. retusum* Turn.

6. Semicells not concave at the
apices................................... 7

7. Cells 45u or less in length, semicell
elliptic in face view........ *S. muticum* Bréb.

7. Cells over 45u long, shape of semi-
cells somewhat pyramidal, with basal
angles rounded............ *S. orbiculare* Ralfs

8. Single spine present at each cell
angle.................................... 9

8. More than one spine at each angle
of cell.................................. 14

9. Isthmus section of cells very short.............. 10

9. Isthmus section of cells elongated,
semicells distinctly separated from
one another...................................... 13

10. Semicells transversely elliptic
or rhomboid in outline....................... 11

10. Semicells semicircular or triangular.. 12

11. Semicells transversely elliptic..............
.... *S. Dickei* Ralfs

11. Semicells rhomboid........................
.... *S. Dickei* v. *rhomboideum* West & West

12. Semicells semicircular. *S. dejectum* Bréb.

12. Semicells triangular, margins straight..............................
.... *S. Dickei* v. *rhomboideum* West & West

13. Spines short and curved toward the equator................... *S. cuspidatum* Bréb.

13. Spines long and divergent...................
.... *S. cuspidatum* v. *divergens* Nordst.

14. Cells with four strong spines at the angles, two directed vertically, and two horizontally, cell length over 75u.....................
.... *S. minnesotense* Wolle

14. Cells with two almost vertically aligned spines at the angles, a marginal spine at each side of angles perpendicular to the side in apical view (actually directed upward), and two sub-marginal spines, also directed outward, at

points about 1/3 and 2/3 the
distance along the sides..................
.... S. spiculiferum G. M. Smith

15. Cell surface granulose, at least around the angles.............................. 16

15. Cell surface spiney............................. 18

16. Cell angles ending in spines...............
.. S. avicula v. subarcuatum (Wolle)W. West

16. Cell angles without spines.................... 17

17. Sinus sharp at apex and opening gradually.................. S. alternans Bréb.

17. Sinus opening quite widely, then gradually toward outside, apical view often quadrangular.......S. dilatatum Ehr.

18. All spines of about equal length and evenly distributed over surface............ S. gladiosum Turn.*
(for comparison with S. setigerum Cleve)

18. Spines of varying lengths, localized in arrangement.................................. 19

19. Semicells with three stout spines in the same vertical plane at the cell angles.................... S. setigerum Cleve

19. Semicells with 5-6 stout spines around the corners and shorter ones between..................................... 20

20. Cells less than 30u long without spines....... S. *spiculiferum* G. M. Smith

20. Cells more than 75u long without spines............. S. *minnesotense* Wolle

21. Appendages present only at angles................. 22

21. Appendages on apical margin cells as well as angles.............................. 32

22. Semicell apex biradiate only.............
.... S. *natator* West

22. Semicells three- to nine-radiate.............. 23

23. Apical view three-radiate only.................. 24

23. Apical view more than three-radiate............... 29

24. Semicells twisted somewhat on the vertical axis so that the appendages of the two are not superimposed in apical view.................. 25

24. Semicells not twisted on vertical axis, appendages superimposed............ 27

25. Lobes approximately alternating from apical view............... S. *alternans* Bréb.

25. Lobes neither aligned nor alternate.............. 26

26. Lobes very stubby, shorter than the diameter of the pole.................
.... S. *polymorphum* Bréb.

26. Lobes slightly narrower and about as long as the diameter of the

pole.................... *S. inflexum* Bréb.

27. Semicells inverted bell-shaped in side view................. *S. Manfeldtii* Delp.

27. Semicells not inverted bell-shaped in side view.................................... 28

28. Lobes very narrow, terminating in two long end spines................. .... *S. lacustre* G. M. Smith

28. Lobes sturdier, with three short terminal spines......... *S. gracile* Ralfs

29. Semicells four-radiate in apical view............. 30

29. Semicells more than four-radiate.................. 31

30. Lobes narrow and rather long............. .... *S. paradoxum* Meyen

30. Lobes short-truncate *S. polymorphum* Bréb.

31. Cells unornamented in vertical view.......... .... *S. polymorphum* Bréb.

31. Cells with emarginate granules at each lobe groin in vertical view............ .... *S. crenualatum* (Naeg.)Delp.

32. Cells triangular in vertical view.................................... 33

32. Cells circular in vertical view............... 34

33. Lobes granulose.... *S. furcigerum* (Ehr.)Bréb.

33. Lobes smooth............................... .... *S. furcigerum* v. *armigerum* (Bréb.)Nordst. (see species comments)

34. Lobes smooth or undulate................

..... S. arctiscon v. glabrum West & West

34. Lobes granulose. S. arcticson (Ehr.)Lund.

1. Staurastrum alternans Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I) Pl. 27, Fig. 5.

Cells triangular in end view, sides concave, angles slightly extended and rounded; arms surrounded by rings of granules, alternating or superimposed on those of other semicell in vertical view; side view of semicells inverted trapezoid. L 20-35u; W 21-37u; Is 7-13u. The species is quite variable in shape. Rabun(Ga.): plankton from pond by hwy U.S.23 near Clayton 13 Aug. 1949 #1725 - Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1738 - Polk: spring water in ditch by hwy U.S.64 near Ocoee Dam #3 14 Aug. 1949 #1762 - Overton: large shallow lake containing many aquatic plants by hwy Tenn.52 one mile northwest of Livingston 15 July 1949 #1465 - Davidson: fish pool by Vanderbilt University greenhouse 17 March 1950 #2060 - Montgomery: field pond at Meriwether 18 March 1950 #2097 - Chester: small drain by path in Chickasaw State Park 16 June 1950 #2275 - Obion: pond on Mr. Hawkins' farm by Walnut Log Road from Union City 1 July 1949 #1135. VGFK.

2. Staurastrum arctiscon (Ehr.)Lund. (Irénée-Marie f) (including Staurastrum arctiscon v. glabrum West & West) (Nordstedt) Pl. 27, Fig. 4.

Vertical view of cell body generally circular, forming a hub with spoke-like arrangement of arms in two whorls, the lower whorl with about nine arms, the upper (directed upward) with about six; some granules and undulations present on the arms; side view of semicell body depressed globose in shape. L 51-96u; W 40-68u; Is 21-33u. Variety glabrum West & West lacks the granules and undulations on the arms, but the characters intergrade. Rabun(Ga.): pond by hwy U.S.23 near Clayton 13 Aug. 1949 #1725 - Montgomery: woods pond east of Shady Grove 3 Sept. 1949 (Clebsch)#1910 - Chester: around edges of artificial lake in Chickasaw State Park 15 June 1950 #2270. VNFKM(the species) NGK (the variety).

3. Staurastrum avicula v. subarcuatum (Wolle)W. West. (Irénée-Marie f)(Nordstedt)(Prescott I)

Vertical view of cells triangular, sides slightly concave, angles pointed, ending in two slightly divergent points, surface covered with rows of granules which encircle the arms; side view of cells broadly hourglass-shaped with slightly convex poles. L 20-32u; W 27-37u; Is 10-14u. Obion: stock pond just west of Kenton on county road 8 July 1949 #1244.

4. Staurastrum crenulatum (Naeg.)Delp. (Irénée-Marie f) (Nordstedt)(Prescott I)

Vertical view of cell body circular, or hub-shaped, with three or five radiating arms, about as long as the diameter of the cell body, one or two small raised ridges present at the perimeter between the arms; arms undulate or dentate, circled with rings of granules, ending in three or more points; side view of semicell body inverted trapezoid. L 20-28u; W 20-33u; Is 5-7u. Montgomery: marsh pond just west of New Providence 14 July 1949 #1349. V.

5. Staurastrum cuspidatum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I) Pl. 28, Fig. 1.

Cells about as long as broad; semicells transversely elliptic and joined with a cylindric isthmus; apical view triangular, sides slightly concave, angles rounded and terminating in a short, sharp spine which is incurved toward the midregion of the cell. L 20-31u; W 16-26u; Is 5-8u; T 5-20u. Overton: shallow water in margins of artificial lake in Standing Stone State Park 15 July 1949 #1418. FK.

6. Staurastrum cuspidatum v. divergens Nordst. (Irénée-Marie f)(Nordstedt)(Prescott I)

Vertical view of cells triangular, sides concave, angles rounded and ending in long spines directed outward and upward; side view with cylindrical isthmus; semicells inverted hemi-elliptical. L 18-25u; W 16-23.5u; Is 4-6.5u. This species is a variable one in proportions, although the overall measurements may not vary much. Lumpkin(Ga.): on pilings of artificial lake in Vogel State Park 14 Aug. 1949 #1735. F.

7. Staurastrum dejectum Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Cells of the same general type as S. cuspidatum v. di-

vergens, but the proportions are broader and the spines possibly shorter. L 18-28u; W 17-32u; Is 4-8u. There seem to be as many ideas concerning the disposition of this species as there are reports of it. Number 1244 differs from some of the others figured. A variable population is certainly indicated. Lumpkin(Ga.): on pilings in artificial lake at Vogel State Park 14 Aug. 1949 #1735. VSGFKAM.

8. *Staurastrum* *Dickiei* Ralfs. (Irénée-Marie f)(Nordstedt) (Prescott I)

Vertical view of cells triangular, margins concave, angles rounded and furnished with spines directed toward the midregion of the cell; side view of semicells elliptic with pointed ends. L 35-46u; W 34-48u; Is 5-7u. Obion - Lake: margins of Reelfoot Lake 15 June 1950 #2255. L.

9. *Staurastrum* *Dickiei* v. *rhomboideum* West & West. (Irénée-Marie f)(Prescott I)

Differs from the species by having the semicells almost triangular in side view outline rather than elliptic, with stout straight spines directed toward the midregion. L 36-46u; W 38.5-48u; Is 8.5-13u. Lawrence: pond (pH 5.0) containing a considerable number of aquatic plants by hwy U.S.64 near Lawrenceburg 29 June 1949 #1062.

10. *Staurastrum* *dilatatum* Ehr. (Irénée-Marie f)(Nordstedt) (Prescott I)

Vertical view of cells generally triangular, sometimes quadrangular, margins concave, angles extended into short arms with rounded ends; surface covered with encircling rows of granules; semicells inverted trapezoid, margins straight but rounding into inflated apical angles, apical margin somewhat convex. L 16-46u; W 17-48u; Is 7-13u. This species is differentiated from S. alternans best in side view. Montgomery: marshy pond just west of New Providence 14 July 1949 #1365 - pond at corner of Dotsonville Road 9 Oct. 1949 (Clebsch)#2024-6-7-8-31 - field pond at Meriwether 18 March 1950 #2096. NF.

11. Staurastrum furcigerum Bréb. (Irénée-Marie f)(Nord-
(including Staurastrum furcigerum v. armigerum (Bréb.) Nordst.)
stedt)(Prescott I) Pl. 28, Figs. 2,3.

Vertical view of cells usually triangular but may have up to nine arms, sides more or less straight, angles extended into arms ending in two or three spines, above and diverging from the main arms are pairs of slightly smaller secondary arms directed somewhat upward rather than laterally; all arms ringed with circles or granules, the margins dentate to slightly undulate; body of semicells in side view essentially transversely elliptic, the angles extended into arms. For the typical, L (with spines) 50-72u; W 45-80u; Is 12.5-18u. For v. armigerum (Bréb.)Nordst., L 49-80u; W 52-70u; Is 10-15u.

Size obviously is not a satisfactory category for separation of this variety. The typical has a single accessory arm aligned just above the primary arm and the surface is dentate and strongly granulated, whereas the variety is only undulate or even may have a smooth surface, with longer and narrower arms. Number 1370 combines the characters of the typical and variety perfectly.

Montgomery: plankton from pond by hwy U.S.79 at Tom Edwards' store west of Clarksville 14 July 1949 #1370. SGFK.

12. <u>Staurastrum</u> <u>gracile</u> Ralfs. (Irénée-Marie f)(Nordstedt) (Prescott I)

Vertical view of cells triangular with arms about as long as the body section, lateral margin with a line of small linear ridges along each edge; arms extending laterally, extending into 4-5 sharp points, ringed with several circles of granules, margin slightly undulate; body of semicells inverted trapezoid in side view. L 27-107u; W 44-118u; Is 5.5-13u. Obion - Lake: Reelfoot Lake 1929.[1] SGF.

13. <u>Staurastrum</u> <u>inflexum</u> Bréb. (Irénée-Marie f)(Nordstedt) (Prescott I)

Vertical view of cells triangular, angles extended into arms tipped with three short spines; margin of arms undulate, and surface concentrically ringed with granules; top and bottom triangles offset, arms neither superimposed nor alternating; side view with deep sinus, shape of cells hourglass-like in center section, broadly expanded at the

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1 Reported in Eddy, 1930

oles, the apical margin straight or slightly concave. L 19-26u; W 30-40u; Is 4.5-8u. Montgomery: pond on Dotsonville Road near Clarksville 9 Oct. 1949 #2024 - Madison: slough by hwy U.S.45-E just south of Gibson county line 15 June 1950 #2270.

14. Staurastrum lacustre G. M. Smith. (Irénée-Marie f) (Prescott I)

Vertical view of cells triangular, angles extended into long narrow arms which terminate in two rather long divergent spines, arms directed upward and outward, surface dentate to undulate and ringed with circles of granules; side view hourglass-shaped, the lateral margins diverging to form long arms at upper angles. L (extreme) 70-86u; W 77-100u; Is 9-10u. The long narrow arms with two terminal spines characterize the species well. Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1736. F.

15. Staurastrum Manfeldtii Delp. (Irénée-Marie f)(Nordstedt) (Prescott I)

Vertical view of cells triangular, margins slightly convex, angles extending into short arms which are laterally extended and tipped with three short spines, margin of semicell apex ornamented with border of emarginate protrusions; side view of cells hourglass-shaped with apical margin convex. L 36-57u; W 52-100u; Is 9-13u. Obion - Lake: plankton from Blue Basin 12 July 1949 #1324. K.

16. Staurastrum Meriani Reinsch. (Irénée-Marie f)(Nordstedt)

(Prescott I)

Vertical view of cells triangular, pentangular, or approaching elliptic, with no arms; surface covered by granules; side view of semicells inverted trapezoid, or obovoid in outline, as long as wide; equatorial sinus merely a shallow notch. L 36-46u; W 20-26u; Is 13-18u. Number 1733 is much smaller than these limits (L 28u; W 14u; Is 12u), and the granules seem to be aligned, but it seems unwarranted to erect a variety at this time, while the degree of variability of the species is not well-known. Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1733. NK.

17. Staurastrum minnesotense Wolle. (Irénée-Marie f)(Nordstedt)(Prescott I) Pl. 27, Figs. 6,7.

Vertical view of cells triangular, with straight sides, two long spines at each angle aligned one over the other, in addition there are two laterally directed marginal spines shortly back from the angle and a third intramarginal dorsal pair of spines directed on each side of the spines at the angles; cell wall punctate; side view of semicells fusiform with narrow isthmus. L 84-125u; W 71-112u; Is 20-42.5u. Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1736. F.

18. Staurastrum muticum Bréb. (Irénée-Marie f)(Nordstedt)(Prescott I) Pl. 28, Fig. 4.

Vertical view of cells triangular, sides concave, angles broadly rounded; side view of semicells elliptic; L/W ratio 1/1 or very near that. L 20-40u; W 20-41u; Is 7-12u. Differentiated from S. orbiculare Ralfs by the more concave sides, in vertical view, and the elliptic rather than hemispherical semicells, in side view. Weakley: Mr. Bary's pond by hwy Tenn. 22 west of Martin 8 July 1949 #1208. NSF.

19. Staurastrum natator West. (Irénée-Marie f)(Nordstedt)(Prescott I)

Vertical view of cells hexagonal, the poles extended to form an arm-like appendage terminating in two short sharp spines, arms directed diagonally upward in face view with dentate or crenate margins ringed with circles of small granules; the longer sides of the apices, those adjacent to the arms, bordered with a line of three small ridges each; side view of semicells rectangular in outline, sinuses are narrow along the equator, a circular group in the center of the cell face and a line of granules along the dorsal margin. L (without arms) 32-38.5u; W 11-25u; Is 8-12.5u. Arms 30-60u long. Tennessee: collection made during summer, 1949. A.

20. Staurastrum orbiculare Ralfs. (Irénée-Marie f)(Nordstedt)(Prescott I)

Vertical view of cells triangular with straight or slightly concave margins, angles rounded; side view of semicells flattened hemispherical with slightly rounded lower lateral angles. L 25.5-56u; W 23-49u; Is 8-16u. The typical is differentiated from S. mutlcum by the less concave sides in vertical view, and hemispherical rather than elliptic shape of the semicells in side view. Lawrence: swamp (pH 5.0) containing several aquatic plants by hwy U.S.64 near Lawrenceburg 29 June 1949 #1062 - Gibson - Obion: bottom coating on highest pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1238. NF.

41. Staurastrum paradoxum Meyen. (Irénée-Marie f)(Nordstedt) (Prescott I)

Vertical view of cells triangular or quadrangular, sides slightly concave, angles extended into arms about length of cell body; margin of arms dentate, ringed with circles of granules, ending in three short spines; side view of cells hourglass-shaped, arms diverging somewhat upward. L (without arms) 21-36u; W 19-25u; Is 5-12u. Arms 20-50u long. Irénée-Marie differentiates this species from S. gracile by the diverging, slightly narrower arms, and, in vertical view, the decoration of the margin with a row of ridges in that species. Rabun(Ga.): plankton from pond by U.S.23 near Clayton 14 Aug. 1949 #1725 - Knox: Chilowee Park Lake 15 July 1938 (Bold)unnumbered[1] - Colbert(Ala.): cold water spring at Tuscumbia 4 Sept. 1949 (Hall)#1953 - Montgomery: marsh pond just west of New Providence 14 July 1949 #1365. VNFKM.

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1 Reported in Silva, 1949

92. Staurastrum polymorphum Bréb. (Irénée-Marie f)(Nordstedt)(Prescott I)

Vertical view of cells triangular to septangular, sides slightly concave, angles extended into stubby arms, slightly shorter than the body of the cell; margin of arms undulate, ringed with circles of granules which also extend around margins of central portion, arms ending in three very short spines; side view showing various shapes, hourglass-shaped, semicell body inverted trapezoid, or with transversely fusiform semicells, arms extended laterally. L 20-30u; W 21-40u; Is 5.5-10u. Cherokee(N.C.): plankton of Hiwassee Lake near Dam 14 Aug. 1949 #1744 - Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1429 - Davidson: fishpool by Vanderbilt University greenhouse 18 March 1950 #2060 - Todd(Ky.): ditch pond by hwy U.S.79 quite near Tennessee state line 11 Sept. 1949 (Clebsch) #1923 - Montgomery: large pond at Oakwood 17 Sept. 1949 (Clebsch)#1928 - Lawrence: swamp (pH 5.0) by hwy 64 near Lawrenceburg 29 June 1949 #1062. FKM.

93. Staurastrum retusum Turn. (Irénée-Marie f)(Nordstedt) (Prescott I)

Vertical view of cells triangular, sides concave, angles rounded; side view of semicells trapezoid with rounded angles and concave poles; sinus narrow and deep. L 15.5-30u; W 15.5-30u; Is 3.5-10u. The poles of #1762 are barely retuse so that it seems to approach S. orbiculare, which is, however, concave at the apices rather than truncate. Polk: spring water in ditch by hwy U.S.64 near Ocoee Dam #3 14 Aug. 1949 #1762.

24. Staurastrum setigerum Cleve. (Irénée-Marie f)(Nordstedt) (perhaps including Staurastrum setigerum v. pectinatum West & West)

(Prescott I) Pl. 28, Figs. 5,6.

Vertical view of cells triangular, sides concave, angles ending in a vertically aligned rank of three spines, and two concentric rings of 3-6 spines each on the face; side view of semicells elliptic to almost triangular. L 41-56u; W 27-56u; Is 11-20u. Variety pectinatum, L 34-54u; W 31-49u; Is 8.5-17u. Size is not a valid criterion for differentiating the typical and the variety, so the only possible remaining character is the length of the spines, of which the inside ring in apical view is lengthened, outside reduced in the variety. Number 1213 shows all spines long, #1660 all short. Lumpkin(Ga.): artificial lake in Vogel State Park 14 Aug. 1949 #1735 - Blount: among aquatic plants in Laurel Lake near Kinzel Springs 4 Aug. 1949 #1660 - Putnam: reservoir of Cookville Waterworks 14 June 1949 #807 - Moore: pools below mill dam at Cumberland Springs 29 June 1949 #1032 - Weakley: pond at Gardner Station by hwy Tenn.22 west of Martin 8 July 1949 #1211. NGFM.

25. Staurastrum spiculiferum G. M. Smith. (Irénée-Marie f) (Prescott I)

Vertical view of the cells triangular with concave sides, angles truncating and more obtuse, terminating in one or two spines; back from the angles are pairs of laterally directed spines and behind these and slightly higher is a third pair, also laterally directed; side view of semicells triangular to hexagonal, with flat apices. L 20-29u; W 16-26u; Is 6.5-9u. Polk: spring water in ditch beside hwy U.S.64 near Ocoee Dam #3 14 Aug. 1949 #1762 - Overton: pond containing considerable number of aquatic plants (__Sagittaria__, __Potamogeton__, __Lemna__ spp. etc.) at Timothy 15 July 1949 #1456. NF.

XANTHIDIUM Ehrenberg 1837

The length of cells here is somewhat greater than the breadth. The semicells are variously shaped in side or face view, and usually compressed to some extent in vertical view. Certain varieties, however, are radially symmetrical, approaching __Staurastrum__.

A rather constant genus character is that there are at the angles always spine-like appendages, which are always paired, or else bifurcate or trifucate processes.

The representation of this genus encountered in the region has been disappointing. It is smaller in number of species and a less frequently occurring genus than some of the other desmids, and likely has stricter habitat requirements.

1. Two long, simple, paired spines at the lower lateral and apical angles of the semicells in face view...................... 2

1. Cell surface adorned with short, heavy trifurcate processes which are not paired, but occur in two horizontal ranges at the lateral margins, and in a circumpolar range.................. <u>X.</u> <u>armatum</u> (Bréb.)Rab.

   2. Spines long, about equal to semicell length, often slightly curved, mucilage pores, but no granules on the semicell face........................ .... <u>X.</u> <u>pseudobengalicum</u> Groenb.

   2. Spines considerably shorter than semicell length, straight, subapical range of granules present on the semicell face........................ .... <u>X.</u> <u>antilopasum</u> v. <u>polymazum</u> Nordst.

1. <u>Xanthidium</u> <u>antilopasum</u> v. <u>polymazum</u> Nordst. (Irénée-Marie f)(Nordstedt)(Prescott I)

Semicells angular-semicircular to hexagonal in outline, with two pairs of spines present at the lower lateral and apical angles; spines straighter and shorter than those of <u>X.</u> <u>pseudobengalicum</u> Groenb; best specific identification the arc of irregular granules visible below the apex in the face view. L 65-90u; W 58-65u; Is 14-22u; T 28-36u. Tennessee: summer, 1950 collection. NSGFK.

2. Xanthidium armatum (Bréb.)Rab. (Irénée-Marie f)(Nordstedt)(Prescott I) Pl. 28, Figs. 7,8.

Vertical view hexagonal with two ranges of about four stout three-pointed spinous processes along the lateral margins and a circle of the same structures in the center of the vertical face, the facial protuberance in the center of the semicell visible as a lateral truncate cone on each side in vertical view; face view vaguely octagonal, two or three spinous processes in superimposed rows at the angles and the apical ring of processes is visible, as well as the granular protuberance in the center of the face; cell surface punctate. L 114-185u; W 78-127u; Is 30-46u; T 63-88u. Montgomery: marshy pond just west of New Providence 14 July 1949 #1365 - Henry: fairly large pond beside hwy U.S.79 east of Paris 14 July 1950 #1349. NSFM.

3. Xanthidium pseudobengalicum Groenb. (Irénée-Marie f) (Prescott I) Pl. 28, Fig. 9.

Vertical view of cells elliptic with two pairs of spines visible at the angles, and the slight thickening in the middle of the face visible at the lateral margins; face view of semicells trapezoid to elliptic in shape with pairs of long spines at the lower lateral and apical corners; several mucilage pores are present on the raised center portion of the face. L (without spines) 55-63u; W 50-55u; Is

14-17u; T 30-38u. Spines 20-30u long. Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1736. F.

Charophyceae

Charales

Characeae

Chara and its related genera form a group so distinctive in appearance that they have even been assigned the status of a phylum (division). Not only is their vegetative organization complex, but reproductive structures are unlike those found elsewhere in the plant kingdom. Nevertheless, careful study of the morphology of the group has revealed considerable evidence that the plants are of a branched filamentous nature, although the plant as a whole has an unusually complex organization. It is primarily the acceptance of the concept that the Charophyceae are essentially filamentous that justifies their retention here under a class of the green algae. Furthermore, their photosynthetic pigments and products are identical with those of the other green algae, and the same is significantly true of the higher plants.

The discussion of structure included here is kept at an absolute minimum consistent with an understanding of the descriptive terminology used in connection with the species included here. It should be understood, however, that the Characeae constitute an exceedingly difficult group with which to work and that a considerable knowledge of morphology and terminology, as well as a mastery of careful technique in examination is needed. Fritsch I, 1935 and Smith, 1950 are recommended for a fuller discussion than is given below.

The plants of <u>Chara</u>, <u>Nitella</u>, and <u>Tolypella</u> are upright stalks which branch in whorls at intervals (nodes). Both stalks and branches may be composed of simple, if relatively large, uniseriate filaments or elongated cells. In <u>Chara</u>, this skeleton is usually covered and inclosed by a cortication of smaller filaments which arise by secondary growth at the nodes.

Cortication is described as:

haplostichous, in which case the corticating filaments are not rebranched. In this case the number of corticating filaments is equaled by the number of "leaves" or "branchlets" at a node. Pl. 29, Fig. 4.

diplostichous, in which case each primary rank of corticating cells gives rise laterally to an additional filament, so that there are twice as many ranks of cortication as there are branchlets. Pl. 29, Fig. 5. This condition is best judged in longitudinal and cross sections of the stalk.

triplostichous, in which case each primary filament of corticating cells gives rise to a secondary filament on each side. Thus there are three times as many cortical cells as there are branchlets. Pl. 29, Fig. 6.

Primary corticating cells may bear spine cells of considerable length or be entirely smooth. Branches arise in whorls at the nodes, just above the stipulodes or bracts. The branches may be of indeterminate growth, and quite like the parent stalk or else form verticels (branchlets or "leaves") of limited growth. The verticels may be dichotomously or trichotomously branched.

Sexual reproduction is oogamous, some species being monoecious, others dioecious. The oogonia contain a single large egg and are surrounded by a sheath of spirally wound corticating filaments which terminate in a "crown" at the apex. Globose antheridia are composed of a large number of branched filaments surrounded and enclosed by a sheath of flat cells with interlocking lobes. The antherozoids are biflagellated motile cells not unlike those characteristic of most green algae.

Tribe Chareae

CHARA Linneaus 1754

Cortication occurs only in this genus, but not all species are corticated. In fruiting condition the genus is easily distinguished by its oogonia which have only five crown or cap cells at the apices, rather than the ten found in Nitella and Tolypella.

1. Plants completely ecorticate. C. coronata Ziz.

1. Plants partly or completely corticate............. 2

2. Main axis corticate, "leaves" or "branchlets" ecorticate, branchlets tending to form nest-like clumps.............. C. gymnopitys A. Braun

2. Branchlets corticate for at least part of length.............................. 3

3. First segment of branchlets ecorticate............. 4

3. First segment of branchlets corticate.............. 5

4. Antheridia and oogonia frequently borne at same node..... C. zelandica Willd.

4. Antheridia and oogonia borne on separate nodes........ C. sejuncta A. Braun

5. Plant conspicuously spiny; upper three or four segments of branchlets ecorticate, cortication ending at node bearing 3-6 thorn-like "leaflets"............. .... C. vulgaris L.

5. Plant not conspicuously spiny; branchlets corticate to near upper end............. .... C. contraria A. Braun

1. Chara contraria A. Braun. (Pascher, Schiller & Migula f) (Prescott f)

Nodes with 7-8 branchlets in a whorl; double row of short blunt stipulodes which frequently fall off leaving only scars; cortication diplostichous, primary cortical cells more prominent, secondary laterals irregularly cylindrical, smaller spine cells short, deciduous in lower part of stem; terminal cells of stem ecorticate, ultimate cell short and spine-like; monoecious, both sex organs at same node; oogonia subtended by 3 bracts which may be shorter to many times longer than the oogonium, posterior bracts very short. Knox: in old concrete reservoir at Neuberts Springs 20 July 1949 #1530.

2. Chara coronata Ziz. (Pascher, Schiller & Migula f)
   (Chara Braunii Gmelin)
(Prescott f) Pl. 29, Figs. 1-3.

Nodes bearing a whorl of 8-10 branchlets composed of a variable number of segments tipped by a crown of short bract cells surrounding a short terminal cell; stem and leaves entirely uncorticated; stipulodes in one series, alternate with the branchlets, and varying greatly in size; monoecious; oogonia with bractioles which are slightly shorter to slightly longer than the mature organ. Lake: Reelfoot Lake on west side of Nix Towhead, near cut-off 14 June 1950 #2262.

3. Chara gymnopitys A. Braun. (see Wood 47 f, for Chara Keukensis (Allen)Robinson)

Nodes with 6-8 branchlets in a whorl; double row of short, pointed stipulodes present; stems corticate except 1-3 terminal segments, branchlets ecorticate; cortication diplostichous, irregular, sometimes appearing triplostichous because of overlapping near the nodes; dioecious, or rarely monoecious; oogonia subtended by about four bractioles which exceed it in length. Pickett: margins of Dale Hollow Dam reservoir at Dale Hollow Crossing of hwy Tenn.42 15 July 1949 #1481-2.

4. <u>Chara sejuncta</u> A. Braun (Prescott f)

Nodes bearing 9-13 branchlets in a whorl; stipulodes in double whorl, upper series longer than lower; stem cortication triplostichous, primary and secondary cells about equal in diameter, in upper portion short and mosaic-like, bearing many recurved spines but almost smooth in older stem internodes; lowest internodes of branchlets ecorticate and exceeded in size by upper rank of stipulodes; monoecious, antheridia and oogonia on different nodes; oogonia subtended by two pairs of bracts, shorter than mature organ. Blount: near shore of Laurel Lake (artificial and about fifteen years old) near Kinzel Springs 4 Aug. 1949 #1652-7 - Montgomery: pond by hwy U.S.79 at Tom Edwards' Store (soil here is Buthrie clay, a prairie remnant) 14 July 1949 #1372 - pond on Dotsonville Road near Clarksville 9 Oct. 1949 #2024-2030 - Rutherford; quarry at LaVergone 15 Oct. 1949 #2227 (card from H. C. Bold mailed 1 Nov. 1949).

5. <u>Chara</u> <u>vulgaris</u> L. (Prescott f)

Nodes bearing a whorl of 6-11 branchlets with a double whorl of stipulodes, the upper longer; upper 3 or 4 cells of uncorticated branchlets, cortication ending abruptly at node bearing 3-6 papillae or thorn-like leaflets of differing sizes; stem corticati-n usually diplostichous, the secondary laterals wider than the primary; nodal cells of primary cortical series produced into shorter or longer spines, often giving plant spiny appearance; sex-organs monoecious, both at same leaf node, oogonium with about six subtending bracts, of which the 4 near the oogonium are longer than the mature fruit, posterior ones short. Knox: clear pond and stream at Carters Mill 2 Aug. 1949 #1609 - Sullivan: small pond on Allison Farm along Barr Creek west of Piney Flats 26 Sept. 1949 (Shanks) #1974.

6. Chara zelandica Willd. (see Wood 47 f, for Chara Haitensis Turp.)

Nodes with 12-16 branchlets in a whorl, 3-4 cm. long; stipulodes elongated, blade-like, in two rows, upper longer; plants corticate except for terminal cell of stem, and basal segment of branchlets; cortication triplostichous; monoecious, antheridia and oogonia often at same node, oogonia bractioles shorter than mature organ. Dickson: Woodhaven Lake in Montgomery Bell State Park 12 Oct. 1949 #1975.

Tribe Nitelleae

NITELLA Agardh 1824

Plants of Nitella are never corticate. The oogonia are surmounted by a crown of ten cap cells, in two vertical ranks at the ends of the five investing filaments. The genus is best distinguished from Tolypella by the position of the antheridia. In Nitella these are borne in terminal position on a determinate branch (verticel), the antheridia being just above the oogonia in monoecious species. In _Tolypella_ the sex organs are in lateral position at nodes of indeterminately growing branches, and oogonia may appear to be placed above or at the same level with the antheridia.

Nitella acuminata subs. _subglomerata_ A. Braun. (Wood 48 f) Pl. 29, Fig. 7.

Branchlets 6-8 in whorl, curving outward once furcate, primary rays (first segment) 2/3-3/4 length of branchlet, secondary rays 2-4, much shorter than primary; ends tapering to acuminate point; fertile branchlets forming dense heads, 2-3 heads within a whorl; branchlets sometimes bearing whorl of 6-8 longer fertile branchlets; fertile branchlet once furcate into 2-3 ultimate rays; monoecious, oogonia and antheridia occurring together at branchlet nodes.

The subspecies is differentiated by sterile branchlets being not much longer than fertile whorls, fertile branchlets over 3 mm long.

Franklin: roadside pool above Cowan 4 April 1949 #1976.

TOLYPELLA Leonhardi 1863

No species of this genus have been identified in the region. Some comments on their characteristics may be found above under _Nitella_ and the general discussion for the Charophyceae. It may be sought in clear, non-acid standing waters, often in company with _Najas flexilis_ (Willd.)Rostk. & Schmidt, which it superficially resembles. Pl. 29, Fig. 8.

EUGLENOPHYTA

Euglenophyceae

Euglenales

Euglenaceae

CRYPTOGLENA Ehrenberg 1831

Cryptoglena nigra Ehr. (Smith f) Pl. 30, Fig. 1.

Cells rigid, oval, slightly pointed posteriorly, with a single flagellum inserted in a shallow anterior indentation; two mirror image chloroplasts, one on either side of the body; nucleus in posterior position. L 11-15u; W 6-9.5u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

EUGLENA Ehrenberg 1838

With the possible exception of Trachelomonas, this genus is the most frequently encountered and prolific of the uni-flagellated algae which are commonly green. It accounts for the sheen of scum frequently present on barnyard pond, and in swamps. From casual field obervation, there seems to be no question but that the abundance is concommitant with the high organic content of the water.

Many species show considerable metabolic (shape changing) properties, and all bend somewhat during movement, in contrast to the closely related genera Lepocinclis and Phacus, which are always rigid. The periplast, or enclosing

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1 Reported in Lackey, 1942

membrane of the cell may be smooth or variously striated. An eyespot is almost always present.

1. Attached to microcrustacea or Hydrocarina. L 16-32u; W 9-14u. ....
.... E. <u>cyclopicola</u> Gickelhorn
1. Cells free-swimming. 2
   2. Haematochrome granules free in cytoplasm and often obscuring chloroplasts, or forming a conspicuous red area in cell. 3
   2. Haematochrome granules not free, not obscuring chloroplasts. 6
3. Cells less than 75u (usually 50-65u) long, chloroplasts seldom obscured, posterior pointed and frequently colorless. .... E. <u>flava</u> Dang.
3. Cells over 75u long, chloroplasts often obscured. 4
   4. Surface of cells smooth, without striae and ridges E. <u>haematodes</u> (Ehr.)Lemm.
   4. Surface of cells with striae or ridges. 5
5. Striations faint, anterior usually not appreciably narrowed, small blunt colorless posterior tip usually retained through most metabolic

changes........................ *E. rubra* Hardy

5. Striations prominent, anterior usually narrowed, posterior tip not apparent in many shapes assumed in metaboly of cell........... *E. sanguinea* Ehr.

6. Body laterally grooved from anterior end.................................... 7

6. Body not grooved, but may be ridged.................................... 8

7. Groove extending length of body L 140-450u; W 19-39u..... *E. oxyuris* Schmarda

7. Groove in anterior part of body only L 220-400u; W 23-35u, no flagellum present........... *E. antefossa* Johns.

8. Body with three prominent ridges running entire length.................. .... *E. tripteris* (Duj.)Klebs

8. Body without such ridges...................... 9

9. Body length six or more times width, or, if a little less, decorated with rows of prominent round or truncate granules.................................... 10

9. Body length less than five times width, without rows of prominent granules.................................... 21

10. Colorless posterior spine-like

tail piece well developed, cells
scarcely metabolic.............................. 11

10. Colorless posterior tail piece
formed only occasionally, if at
all, body metabolic.......................... 14

11. Body surface with rows of prominent
granules.. 12

11. Body surface without prominent granules, although striations may be
present.. 15

12. Granule rows quite close to each
other, the interval between being
the width of the granules or
less, only slight metabolic movement allowed...............................
.... E. Spirogyra v. marchica Lemm.

12. Granule rows farther apart, interval between exceeding width
of granules somewhat, allowing
metabolic movement........................... 13

13. Flagellum less than half body length,
rows of ornamentation spiralling
slightly.................... E. Spirogyra Ehr.

13. Flagellum about body length, ornamentation in longitudinal lines..............
.... E. fusca Klebs

14. Posterior tail piece sharp pointed or extremely long, surface striations evident on body, L 120-150u; W 9-11u.. E. *acutissima* Lemm.

14. Posterior end not long and sharp, striations obscure, L 52-175u; W 8-18u............ E. *acus* Ehr.

15. Paramylum bodies free in cytoplasm................ 16

15. Paramylum bodies attached to chloroplasts.................................... 20

16. Body cylindrical or flat with truncate or rounded posterior end................. E. *Ehrenbergii* Klebs

16. Body never flattened, nor posterior end truncate.......................... 17

17. Chloroplasts broadly oval........................ 18

17. Chloroplasts elongated oval or band-shaped.................................... 19

18. Rod-like paramylum bodies present, two large and plate-like, others small, anterior end obliquely truncate L 35-40u.................................. E. *sciotensis* Lackey

18. Rod-like paramylum bodies absent, L 85-130u...... E. *intermedia* Klebs

19. Chloroplasts elongated discoid. E. *deses* Ehr.

19. Chloroplasts 2-4, bands oriented parallel to the long axis of the body.................. *E. mutabilis* Schmitz

20. Body posterior gradually narrowed from mid-section, usually with small colorless tip, L 68-93u.......................... *E. terricola* (Dang.)Lemm.

20. Body not gradually narrowed posteriorly, end merely tipped with short tail piece, L 35-55u.............................. *E. gracilis* Dang.

21. Body over 55u long.............................. 22

21. Body less than 55u long.............................. 28

22. Paramylum bodies attached to chloroplasts.............................. 23

22. Paramylum bodies not attached to chloroplasts.............................. 27

23. Body broadest anterior to midregion during most of metabolic shapes.................. 24

23. Body not broadest anteriorly in most shapes displayed.............................. 25

24. Spiral ornamentation coarse and prominent, flagellum 1/3 body length, L 90-120u....... *E. caudata* Hueb.

24. Spiral ornamentation delicate, flagellum about length of body.............................. *E. terricola* Dang.

25. Many rod-shaped paramylum granules free and loose in protoplasm, in addition to attached ones.... E. velata Klebs

25. No free, rod-shaped paramylum granules present.................................... 26

26. Chloroplasts spirally arranged, periplast striations very faint, anterior end of cell bilabiate.......... .... E. sociabilis Dang.

26. Chloroplasts not spirally arranged, striation distinct, anterior end of cell not bilabiate................. E. polymorpha Dang.

27. Chloroplasts spirally aligned, body broadly fusiform to cylindrical, irregularly placed spiral surface ornamentation present, L 74-110u............ .... E. splendens Dang.

27. Chloroplasts not spirally aligned, body broadly fusiform, posterior tip colorless, L 55-75u......... E. proxima Dang.

28. Some paramylum bodies attached to chloroplasts............................ 29

28. No paramylum bodies attached to chloroplasts.............................. 31

29. Body length four times width, chloro-

plasts variously arranged.... E. *viridis* Ehr.

30. More than three chloroplasts present, each approximately one quarter length of body, L 35-55u.................... E. *gracilis* Klebs

30. Two or three chloroplasts present, each almost length of body, L 21-34u...... E. *pisciformis* Klebs

31. Posterior end usually narrowed to a tip, usually colorless, periplast striations evident, L 30-45u.................. .... E. *chlamydophora* Mainx

31. Posterior end blunt and colored, periplasts striations not evident................ 32

32. Cells metabolic during locomotion, direction of locomotion never posterior, resting cyst formed on microcrustacea and Hydrocarina, L (motile cells) 16-32u......... E. *cyclopicola* Gickelhorn

32. Cells not metabolic, locomotion often backward, never forming attached cysts, L 18-34u................. .... E. *retronata* Johns.

1. *Euglena acus* Ehr. (Prescott f)(Smith f)

Very slightly metabolic; shape is almost needle-like to fusiform, without a true posterior tail piece; periplast striations faint; chloroplasts numerous and discoid, pyrenoids absent; 7-12 elongated rod-shaped paramylum particles present; flagellum ¼ length of body, L 52-200u; W 7-18u. Number 2337 has paramylum rods which are as broad as those figured for E. acutissima Lemm, and its chloroplasts actually appear to be fused as bands. The long hyaline posterior tip said to characterize E. acutissima is not present, however. Knox: bottom of fish pond at Chilowee Park Zoo 18 June 1949 #878 - minnow pond at Mack's by hwy U.S.11-E about five miles east of Knoxville 1- June 1949 #848 - Anderson: pond by road to Scout Camp about five miles from Andersonville 25 Aug. 1950 #2337 - Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] NSK.

8. Euglena acutissima Lemm. (Pascher & Lemmermann f)(Walton f)

Rigid or slightly metabolic; shape almost needle-like fusiform, with hyaline, needle-shaped posterior tail piece; periplast striate; chloroplasts numerous, discoid, arranged in spiral lines, pyrenoids absent; two elongated paramylum rods present, one anterior, one posterior; flagellum short, 1/5-1/6 length of body. L 80-126u; W 10-35u. Knox: pond on Old Sevierville Pike near Kimberlin Heights 22 June 1938 (Bold)unnumbered[2] - Lake: very shallow area in Cranetown

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1 Reported in Lackey, 1942
2 Reported in Silva, 1949

nesting area in cypress swamp 5 July 1949 #1184. N.

3. Euglena antefossa Johns. (Johnson 44 f) Pl. 30, Fig. 7.

Not at all or very slightly metabolic; shape elongated cylindrical with anterior end rounded, posterior extended into an elongated sharp hyaline tail piece, a short lateral groove extends from the anterior end; longitudinal striations present on periplast; chloroplasts numerous and discoid in shape; paramylum bodies large elongated rods; flagellum apparently lacking. L 140-400u (described as 310u); W 23-35u (30u). The original description mentions only two paramylum rods, with the nucleus between, but number 2314 has a group of rods in posterior position. In addition, the size in the Tennessee specimens is considerably larger than Johnson describes, but the other characters of the species are present in the Tennessee specimens so that there can be no doubt but that they closely resemble the type. Only additional observations can establish the proper species or varietal lines, if they are required here. Knox: in mud at margins of small stream at Jimmy O'Brien's north of Fountain City 9 Aug. 1950 #2314.

4. Euglena caudata Hueb. (Pascher & Lemmermann f)

Metabolic; shape broadly fusiform, anterior end broadest, posterior narrowly elongate with colored tip; spiral striations of periplast prominent; chloroplasts numerous, fusiform to band-shaped, usually arranged parallel to each other, one pyrenoid present per chloroplast; two annular bodies of paramylum attached near middle of each chloroplast, or free; flagellum length of body. L 90-120u; W 27-50u. Jackson (Ala.): marshy pool in Guntersville Reservoir area near Scottsboro 19 Aug. 1949 #1775. N.

5. Euglena chlamydophora Mainx. (Johnson 44 f)

Highly metabolic; shape fusiform, usually broadest at midregion, but either end may be temporarily broader in movement; posterior narrowed to short colorless tip, anterior tapered somewhat in most shapes exhibited; striations of periplast faint; chloroplasts numerous, saucer-shaped, 6-7u broad; paramylum bodies numerous, oval, rectangular or elliptic in shape, relatively small or large; flagellum length of body or less. L 30-45u; W 6-16u. In the Tennessee specimens, the chloroplasts have a definite tendency to group together so that their shape is obscure, and seem to occur only as three bands or masses of chloroplasts. Union: pond by Boy Scout Camp approach road 25 Aug. 1950 #2339.

6. Euglena cyclopicola Gickelhorn. (Johnson 44 f)

Metabolic in motile phase; body cylindrical, rounded at both ends, with anterior end colorless; chloroplasts discoid, 4u in diameter, 10-12 in number; paramylum bodies numerous, oval-shaped; flagellum length of body or slightly longer. L 16-32u; W 9-14u. The thin-walled cysts of this species are attached to microcrustaceans and larval Hydracarina. Obion: pond by Walnut Log road from Union City 14

June 1950 #2250.

7. Euglena deses Ehr. (Pascher & Lemmermann f)(Prescott f)

Sluggishly metabolic and frequently contorting into strange shapes; shape elongated cylindrical or slightly flattened, with short, colored posterior tip; periplast with spiral striations; chloroplasts numerous, discoid; paramylum rods short or long; flagellum short, 1/3 length of cell or less. L 70-200u; W 11-24u. Middle Tenn.: Duck River 1938-9[1] - Robertson: puddle by hwy U.S.41 alt. west of Cedar Hill 20 Aug. 1949 #1852. NSK.

8. Euglena Ehrenbergii Klebs. (Pascher & Lemmermann f) (Prescott f)

Highly metabolic; shape elongated cylindrical or band-shaped with blunt rounded ends; periplast faintly spirally striate; chloroplasts numerous, discoid; paramylum 1-2 elongated cylindrical rods, flattened and discoid, and other small rods; flagellum 1/3-1/2 length of body. L 200-300u; W about 25u. Middle Tenn.: Duck River 1938-9[1] - Obion: among leaves of Potamogeton etc. in Bayou du Chien near Biological Station 2 July 1949 #1165. NK.

9. Euglena flava Dang. (Pascher & Lemmermann f)(Prescott f) (Walton f)

Metabolic; shape fusiform with short colorless posterior tip, bilabiate anterior end; periplast with faint spiral

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1 Reported in Lackey, 1942

striation; chloroplasts 8-16, disc-shaped, with a ring-like pyrenoid in each; two paramylum bodies attached to each chloroplast; flagellum ½ length of body, L 50-65u; W 18-30u. Knox: road rut pools at entrance to Island Home Park area 20 July 1949 #1507.

10. Euglena fusca Kelbs. (Pascher & Lemmermann f)(Walton f) Pl. 30, Figs. 5,6.

Slightly metabolic; shape elongated band-like, tapered posteriorly, ending in a sharp point; periplast spirally striated with rows of numerous short spines on round granules, the row encircling the body about once; chloroplasts numerous, disc-shaped; two large blunt paramylum rods or oval rings; flagellum length of body. L 90-225u; W 23-27u. Middle Tenn.: Duck River 1938-9[1] - Henry: Typha pool in old clay pit at Wallace Motor Court by hwy U.S.79 south of Henry 19 March 1950 #2119. NK.

11. Euglena gracilis Klebs. (Pascher & Lemmermann f)(Prescott f)

Strongly metabolic; shape cylindrically fusiform to blunt oval, with blunt posterior end; periplast spirally striate; 12-15 chloroplasts, irregular disc-like or flattened fusiform-shaped, with a pyrenoid in each; numerous irregular pyramylum bodies free in protoplasm; flagellum length of body. L 35-55u; W 6-22u. Knox: Sanford estate (presumably

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1 Reported in Lackey, 1942

the fish pool) July date 1939 (Bold)unnumbered[1] - marshy backwater of Ft. Loudon Lake at Blue Grass 23 July 1949 #1567 - among vegetation at margin of stagnant pond by Riverside Drive beyond Knoxville Waterworks 25 July 1949 #1586 - Weakley: marsh and pond at Greenfield 30 June 1949 #1119. K.

12. Euglena haematodes (Ehr.)Lemm. (Pascher & Lemmermann)

Completely red, or haematochrome granules localized in a circular area; metabolic; shape fusiform or elongated ob-ovoid, or with somewhat parallel sides, posterior shortly pointed or rounded, anterior conical or slightly bilabiate; periplast indistinctly spirally striate; chloroplasts small, numerous, spindle-shaped, tending to be parallel with striae, each containing small round pyrenoid; paramylum bodies free in protoplasm; eyespot oval, anterior; flagellum 1½ times length of body. L 80-170u; W 24-44u.

13. Euglena intermedia (Klebs)Schmitz. (Prescott f)(Smith f)

Strongly metabolic; shape elongated cylindrical, posterior a short colorless tip, anterior narrowed to a blunt end; periplast with faint spiral striation; chloroplasts numerous, disc-shaped; paramylum bodies 2-10, rod-shaped; flagellum less than 1/5 length of body. L 65-135u; W 8-12u. Jackson(Ala.): marshy pool in Guntersville Reservoir area near Scottsboro 19 Aug. 1949 #1783 - Giles: pools by muddy

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1 Reported in Silva, 1949

creek at Pulaski 29 June 1949 #1050. N.

14. Euglena limosa Gard. (Fritsch I)(Gard f)

Middle Tenn.: Duck River 1938-9.[1] K.

15. Euglena mutabilis Schmitz. (Pascher & Lemmermann f) (Walton f)

Strongly metabolic; shape elongated cylindrical, posterior tapered and extended into an acute point; periplast not striate; chloroplasts 2-4 band-shaped, running entire or half cell length and containing two pyrenoids each; paramylum granules number of small rods or discs; flagellum very short. L 80-90u; W 7u. Weakley: marsh by hwy Tenn. 22 at Mr. Bary's west of Martin 8 July 1949 #1211.

16. Euglena oxyuris Schmarda. (Pascher & Lemmermann f) (Prescott f)(Walton f)

Slightly metabolic, usually twisting in movement; shape quite elongated cylindrical or flattened with elongated colorless posterior tip; periplast spirally striate with series of short granular processes; chloroplasts numerous disc-shaped; paramylum bodies two large ringed elongated plates, one posterior, one anterior; flagellum 1/3-1/2 length of body. L 375-490u; W 30-45u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] NSK.

17. Euglena pisciformis Klebs. (Pascher & Lemmermann f) (Walton f) Pl. 30, Fig. 2.

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1 Reported in Lackey, 1942

Slightly metabolic, moving in zig-zag manner; shape fusiform with short pointed posterior; periplast with faint spiral striation; chloroplasts 2-3, longitudinal band-shape; paramylum bodies annular, discoid-shaped, attached to chloroplasts, or oval free bodies. L 25-30u; W 5-12u v. minor Hansg. L 18-20u; W 4.5-5u. Knox: quiet area of mill pond at Carter's Mill 2 Aug. 1949 #1615-7 - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Obion: Bayou du Chien near Biological Station 2 July 1949 #1151 - Lake: sloughs by hwy Tenn. 78 near Kentucky state line 5 July 1949 #1193. K.

18. Euglena polymorpha Dang. (Pascher & Lemmermann f) (Prescott f)(Walton f)

Somewhat metabolic; shape elongated oval to cylindrical with short tip sometimes present at posterior; periplast spirally striate; chloroplasts 15 or more irregularly shaped discs; oval-shaped paramylum bodies present or lacking; flagellum twice length of body. L 80-90u; W 20-25u. Polk: sandy mud bottomed stream by hwy U.S. 64 near Ducktown 14 Aug. 1949 #1749 - Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] NK.

19. Euglena proxima Dang. (Prescott f)(Walton f)

Metabolic; shape broadly fusiform with colorless posterior tip, bilabiate anterior end; periplast spirally striate; chloroplasts numerous, disc-shaped, often parallel

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1 Reported in Lackey, 1942

with striations; paramylum bodies small, oval or ring-shaped, free from chloroplasts; flagellum 1-1½ times length of body; L 55-75u; W 19-35u. Tennessee: collection made during summer of 1949. N.

20. Euglena retronata Johns. (Johnson 44 f)

Highly metabolic; shape fusiform, broadest in midregion or anterior, usually tapering posteriorly to blunt point; periplast with faint spiral striation; chloroplasts elongate saucer-shaped with irregular margins, 8-12 in number, 5-9u in diameter, parietally placed, but may be forced to rear by accumulated paramylum; paramylum bodies few to many, somewhat oval; flagellum 1½ times length of body. L 18-34u; W 7-15u. Lauderdale(Ala.): farm near creek crossing by hwy U.S.72 east of Wheeler Dam approach 17 June 1950 #2299.

21. Euglena rubra Hardy. (Pascher & Lemmermann f)(Walton f)

Usually colored red with haematochrome; slightly metabolic; shape cylindrical with rounded anterior and abruptly tapering posterior end with small colorless blunt tip; periplast with delicate spiral striation; chloroplasts numerous spindle-shaped, parallel with striations; paramylum numerous spindle-shaped or round bodies; flagellum length of body or slightly more; L 76-200u; W 35-60u. Blount: pond near Charlie Meyers' house in Cades Cove September date 1949 unnumbered - Lake: Cranetwon nesting area in cypress swamp 5 July 1949 #1196. N.

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1 Reported in Lackey, 1942

22. Euglena sanguinea Ehr. (Pascher & Lemmermann f)(Prescott f)

Color red or mostly green with red area; metabolic; shape elongated oval, fusiform, to cylindrical, with short posterior tip or rounded end; periplast spirally striate with indistinct punctae; chloroplasts numerous spindle-shaped, parallel to striation; small paramylum bodies round or oval; flagellum 1½-2 times length of body. L 55-170u; W 24-44u. Knox: in road rut pools at entrance to Island Home Park 20 July 1949 #1507 - marshy backwater of Ft. Loudon Lake at Blue Grass 23 July 1949 #1567 - Anderson: pond in sheep pasture by road to Boy Scout camp about five miles from Andersonville 25 Aug. 1950 #2337 - Overton: barnyard pond by hwy Tenn.42 three miles north of Livingston 15 July 1949 #1467 - Davidson(?): Cumberland River 1938-9[1] - Cheatham: soil bottomed pools fertilized for fish raising on Little Marrowbone Creek Road 20 Aug. 1949 #1837 - Montgomery: large marsh by hwy U.S.79 at Norfleet & Sons' grocery west of Clarksville 14 July 1949 #1376 - old stock pond near Blooming Grove Creek turnoff 14 July 1949 #1414 - Stewart: pond by hwy U.S.79 east of Dover 13 July 1949 #1361 - Henry: pools in recently timbered marshy area just west of Paris 13 July 1949 #1343 - Weakley: Mr. Bary's pond by hwy Tenn. 22 west of Martin 8 July 1949 #1208 - mud puddle by hwy

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1 Reported in Lackey, 1942

Tenn.54 east of Dresden 13 July 1949 #1334 - Obion: pond behind Mr. Hawkins' house on road to Walnut Log from Union City 1 July 1949 #1151 - field embayment at south end of Isom Lake 10 July 1949 #1281 - Shelby: pond at junction of Gerber Road and hwy U.S. 64 30 June 1949 #1089. K.

23. Euglena sciotensis Lackey. (Lackey 39 f)

Slightly metabolic; shape cylindrical with broadly rounded anterior, slightly constricted posterior tapering to an acute point; chloroplasts few, disc-shaped, parietally arranged; paramylum dimorphic, two large oval plates and a few small rods. L 35-40u; W 5-7u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

24. Euglena sociabilis Dang. (Walton f) Pl. 30, Fig. 4.

Metabolic; shape fusiform with short posterior tip; chloroplasts about ten, disc-shaped; paramylum bodies oval or rod-shaped. L 60-110u; W 25-35u. Tennessee: culture at collector's home from material collected during summer of 1949 #2222 - Sevier: mud puddle in road at Pigeon Forge 20 Aug. 1949 #2332.

25. Euglena Spirogyra Ehr. (Pascher & Lemmermann f)(Prescott f)(Walton f)

Slightly metabolic; shape elongated cylindrical or flattened, anterior narrowed, posterior extended into an acute tip, often bent; periplast striate with spiral rows

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1 Reported in Lackey, 1942

of distinct granules, conical or truncate pyramidal in shape, a prominent row perhaps alternating with a less distinct one; chloroplasts numerous, disc-shaped; paramylum two large annular plates and several small rod-shaped bodies; flagellum short, ½ length of body. L 90-150u; W 6-35u. Knox: mud at margins of small stream by Jimmy O'Brien's just north of Fountain City 9 Aug. 1950 #2314 - Anderson: pond in sheep pasture by road to Scout Camp about five miles from Andersonville 25 Aug. 1950 #2337 - Middle Tenn.: Duck River 1939-91[1] - Obion: near south shore of Isom Lake 10 July 1949 #1269 - Lake: slough by hwy Tenn. 78 near Kentucky state line 5 July 1949 #1193 - field pool near Cranetown nesting area 5 July 1949 #1196. NSK.

26. Euglena splendens Dang. (Pascher & Lemmermann f) (Walton)

Metabolic; shape oval or cylindrical with a short posterior tip; periplast striation visible under favorable conditions, with spiral rows of irregular processes between striae; chloroplasts numerous, ribbon-like or long spindle-shaped; paramylum bodies round or short rods; flagellum 1¼ times length of body; L 70-110u; W 21-27u. An excellent distinguishing characteristic of this species is the presence of irregularly shaped raised processes arranged spirally on the periplasts. Johnson comments that the striations are due to these processes, but it seems here that they are, rather, projections on the ridges between grooves or spiral

1 Reported in Lackey, 1942

striations. Knox: Andrew Jackson (Dead Horse) Lake near Farragut 7 July 1938 (Bold)unnumbered[1] - Anderson: pond in sheep pasture by road to Scout Camp about five miles from Andersonville 25 Aug. 1950 #2337. N.

27. Euglena terricola (Dang.)Lemm. (Pascher & Lemmermann f) (Walton f)

Highly metabolic; shape cylindrical, greatest diameter variable in position but usually anterior, posterior tip distinct, colorless; periplast with faint spiral striation; chloroplasts 8-15, band-like or rods, longitudinally arranged; paramylum two annular bodies on each chloroplast; flagellum ½ length of body; L 68-93u; W 8-17u. Anderson: pond in sheep pasture by road to Scout Camp about five miles from Andersonville 25 Aug. 1950 #2337.

28. Euglena tripteris (Duj.)Klebs. (Pascher & Lemmermann f) (Prescott f)

Not at all or only slightly metabolic; shape elongated band-like, spirally twisted with long acute colorless posterior tip, three definite longitudinal areas formed when swimming; periplast striation longitudinal, faint; chloroplasts numerous, disc-shaped; paramylum in form of two large elongated bodies; flagellum 1/2-3/4 length of body; L 70-120u; W 9-16u. Johnson, 1944 figures the species as twisted only once, with smaller paramylum bodies, while his

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1 Reported in Silva, 1949

E. pseudospiroides Swir. is similar to the E. tripteris as described in Pascher & Lemmermann. The two are separated by flagellum length, parallel arrangement of chloroplasts in the former, and visibility of the striations. Knox: Chilowee Park Lake at Knoxville 26 June 1939 (Gold)unnumbered[1] - Limestone(Ala.): hog wallow by hwy U.S.72 east of Athens Ala. 17 June 1950 #2290. N.

29. Euglena velata Klebs. (Pascher & Lemmermann f)(Walton f)

Metabolic; shape elongated oval with short posterior tip; periplast with faint spiral striation; chloroplasts 20-30 lobed plates; paramylum ?; flagellum length of body. L 90-100u; W 25-30u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[2]

30. Euglena viridis Ehr. (Pascher & Lemmermann f)(Walton)

Metabolic; shape usually oval or fusiform, greatest width posterior, posterior pointed but not tipped; periplast spirally striate; chloroplasts six or more elongated rods sometimes collected into median stellate mass; paramylum bodies small, round or oval, attached to chloroplasts; flagellum 3/4 of body to body length. L 40-65u; W 14-20u. Such specimens as number 2338 show characters of E. minima Francé, in that the posterior tapers to a sharp point, three chloroplasts are present and the striation is faint. The large eyespot here is unusual, and apparently not hither-

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1 Reported in Silva, 1949
2 Reported in Lackey, 1942

to recorded for the species. Knox: marshy backwater of Ft. Loudon Lake at Blue Grass 23 July 1949 #1567 - Union: pond by Boy Scout Camp entrance road 25 Aug. 1949 #2338 - Davidson: fish pool by Vanderbilt University greenhouse 17 March 1950 #2060 - Weakley: pond at Mr. Bary's by hwy Tenn.22 west of Martin 8 July 1949 #1208 - farm pond by hwy Tenn.22 a few miles east of Dresden 14 July 1949 #1334 - Obion - Lake: Reelfoot Lake 1929.[1] NSCFK.

LEPOCINCLIS Perty 1849

The cells of this genus are rigid and never compressed, otherwise they are not unlike some *Euglena* spp. in general appearance, the cell outline being elliptic, oval or nearly round. There are numerous discoid chloroplasts and two discoid paramylum bodies.

1. Posterior end of cell extended into
   sharp point.. 2
1. Posterior end of cell rounded.................
   .... *L. texta* (Duj.)Lemm.
   2. Periplast striation distinctly
      spiral, L 30-38u....... *L. ovum* (Ehr.)Lemm.
   2. Periplast striation scarcely
      spiral, L 22-30u.......... *L. Steinii* Lemm.

1. *Lepocinclis ovum* (Ehr.)Lemm. (Pascher & Lemmermann f)

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1 Reported in Eddy, 1930

(Prescott f) Pl. 30, Fig. 8.

Shape oval, with posterior spine; periplast spirally striate; flagellum twice length of body. L 30-38u; W 15-18u. Number 1193 was a bit broader than generally described, although it is within the limits of v. striata (Hueb.)Lemm. Davidson: Cumberland River 1938-9[1] - Montgomery: old stock pond near Blooming Grove Creek turnoff from hwy U.S.79 14 July 1949 #1414 - Obion: pond behind Mr. Hawkins' house on Walnut Log Road from Union City 1 July 1949 #1137 - Lake: sloughs by hwy Tenn.78 near Kentucky state line 5 July 1949 #1193. K.

2. Lepocinclis Steinii Lemm. (Pascher & Lemmermann f)(Smith f)(Walton f)

Shape short fusiform with distinct posterior tip; periplast striate, the striae slightly spiral. L 22-30u; W 8-15u. Jefferson: permanent pond in barnyard near junction of hwy U.S.11-E and Cherokee Dam approach road 25 June 1949 #910-1.

3. Lepocinclis texta (Duj.)Lemm. (Pascher & Lemmermann f) (Walton f) Pl. 30, Fig. 9.

Shape oval with very blunt ends; periplast with distinctly spiralled striations; paramylum bodies numerous; flagellum 2-3 times length of body. L 52-60u; W 38u. Here the flagellum did not appear to be over 1½ times as long as

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1 Reported in Lackey, 1942

the body. Davidson(?): Cumberland River 1938-9[1] - Lauderdale(Ala.): farm pond by hwy U.S.72 east of Wheeler Dam approach 17 June 1950 #2289. NK.

PHACUS Dujardin 1841

The cells here are rigid and somewhat compressed. Frequently they are ridged, cup-shaped or twisted. Periplast striations are always present, and generally are quite distinct. Unlike other flagellates, Phacus preserves with beautiful detail in a dried condition.

* species not in key

1. Periplast striations longitudinal.................. 2
1. Periplast striations spiral......................... 10
   2. Posterior tail as long as body............
      .... P. longicaudatus (Ehr.)Duj.
   2. Posterior tail shorter......................... 3
3. Cells with concavely folded sides............
   .... P. anacoelus Stokes
3. Cells without concavely folded sides............... 4
   4. Cell shape almost circular................
      .... P. orbicularis Hueb.
   4. Cells shape other than almost
      circular...................................... 5
5. Longitudinal dorsal fold reaching

1 Reported in Lackey, 1942

only from the anterior to shortly past the middle of the cell, or cell merely cup-shaped............................
.... *P. pleuronectes* (O. F. M.)Duj.

5. Longitudinal fold running to, or nearly to, the posterior of cell.................... 6

6. Fold sharp, strong, and erect, so that the cell is essentially triangular in cross section...............
.... *P. triqueter* (Ehr.)Duj.

6. Fold not so prominent......................... 7

7. Posterior end of cell broadly rounded........
.... *P. Stokesii* Lemm.*

7. Posterior with some suggestion of a point....................................... 8

8. Posterior merely broadly tapered to a conical point.......................
.... *P. brevicaudatus* (Klebs)Lemm.

8. Posterior abruptly constricted to form a tail piece......................... 9

9. Tail piece very short... *P. acuminatus* Stokes

9. Tail piece longer, perhaps ½ length of body...................... *P. caudatus* Hueb.

10. Posterior end gradually tapered to long sharp point. *P. pyrum* (Ehr.)Stein

10. Posterior end abruptly tapered

to tail piece, or merely conical
or rounded.. 11

11. Posterior abruptly tapering to short
pointed end.. 12

11. Posterior not abruptly tapered to
short, pointed end.................................... 13

12. Spiralling up to right, lateral
edges folded.......... P. oscillans Klebs

12. Spiralling up to left, lateral
edges not folded...... P. cylindrus Poch.

13. Posterior rounded........... P. parvula Klebs*

13. Posterior conical.......... P. Dangardii Lemm.

1. Phacus acuminatus Stokes. (Pascher & Lemmermann f) (Prescott f)(Smith f)

Broadly oval or circular with short posterior tail piece and dorsal fold reaching nearly to posterior end; periplast striation longitudinal; flagellum twice as long as body; paramylum two small round bodies, (only one ringed body observed here). L about 25u; W about 25u. Number 1193 has a longer tail than usual and prominent dorsal fold, so possibly belongs under subs. indica Poch. Knox: goldfish pond at Harry Ijams' place beyond Island Home 20 July 1949 #1509 - Overton: pond containing abundant aquatic plants (Sagittaria, Potamogeton, Lemna spp.) at Timothy 15 July 1949 #1456 - Montgomery: pond by hwy U.S.79 at Tom Edwards' store west of Clarksville 14 July 1949 #1371 - pool beside

Blooming Grove Creek 14 July 1949 #1412 - Weakley: marsh by hwy Tenn.22 at Mr. Bary's west of Martin 8 July 1949 #1211 - Obion: in shallow area among grass in south end of Isom Lake 10 July 1949 #1266 - Reelfoot Lake at Samburg 12 July 1949 #1304 - Lake: from log at waterline in Cranetown nesting area 5 July 1949 #1181-96 - slough by hwy Tenn.78 near Kentucky state line 5 July 1949 #1193. K.

2. Phacus anacoleus Stokes. (Pascher & Lemmermann f)(Prescott f)(Walton f)

Shape oval or spherical with lateral margins concavely folded, or grooved; periplast longitudinally striate; paramylum 1-3 ringed granules; flagellum length of body. L 42u; W 35u. Middle Tenn.: Duck River 1938-9.[1]

3. Phacus brevicaudatus (Klebs)Lemm. (Pascher & Lemmermann f)(Prescott 28 f)(Walton f)

Shape broadly oval without posterior spine but with a dull point, dorsal fold running to posterior end; periplast longitudinally striate; one ringed paramylum body present; flagellum length of body. L 31-35u; W 23-25u. Moore: pools below mill dam at Cumberland Springs 29 June 1949 #1032 - Middle Tenn.: Duck River 1938-9[1] - Davidson: quarry hole near Chocolate Shop on Franklin Road 20 Aug. 1949 #1860 - Montgomery: along Yellow Creek in Riggins Mill section near Shiloh 21 Aug. 1949 (Giebsch)#1880 - Alcorn(Miss.): Crystal

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1 Reported in Laskey, 1942

Lake near Corinth 16 June 1950 #2270 - Weakley: marsh by hwy Tenn.22 at Mr. Bary's west of Martin 8 July 1949 #1211 - plankton from large spring about four miles north of Gardner Station 8 July 1949 #1221 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1181. L.

4. <u>Phacus caudatus</u> Hueb. (Pascher & Lemmermann f)(Prescott f)(Walton f)

Shape oval, almost twice as long as broad, short straight posterior tail piece present, dorsal fold reaching to posterior end; periplast striated longitudinally; paramylum one large annular body and one smaller particle near base of tail piece; flagellum length of body. L 34-50u; W 15-25u. The species is somewhat longer proportioned than <u>P</u>. <u>brevicaudatus</u> and <u>P</u>. <u>acuminatus</u>. Blount: Montvale Springs Lake 30 June 1931 (Bold)unnumbered[1].

5. <u>Phacus cylindrus</u> Poch. (Pochman f) Pl. 30, Fig. 11.

Shape cylindric-oval or cylindric, with short abrupt tail piece posteriorly, emarginate at anterior end; periplast spirally striate in left handed direction; paramylum bodies one large oval plate in center of cell, and, in Tennessee specimen, a round one near the posterior end; flagellum length about equal to body. L 20-26u; W 7-10u. The lower limits set here are for the Tennessee specimen which seems to correspond fairly well with the other characters.

Middle Tenn.: Duck River -

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1 Reported in Silva, 1949

described for the species. Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1196.

6. Phacus Dangeardii Lemm. (Pascher & Lemmermann f)(Walton)

Shape oval, about twice as long as broad, both ends rounded, slightly narrowed posteriorly, emarginate anterior end with groove running about half of cell length; periplast spirally striate; one annular paramylum body near center of cell; flagellum length of body. L 12u; W 6u. The size is extremely small, but otherwise the correspondence of the specimen observed with the descriptions of this species was quite good. Many of the flagellates encountered were likewise smaller than the hitherto published limits. Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1196.

7. Phacus longicaudus (Ehr.)Duj. (Pascher & Lemmermann f) (Prescott f)(Smith)

Shape oval, with straight posterior tail piece about as long as the body proper; periplast longitudinally striate; one large discoid paramylum body; flagellum length less than body. L 85-115u; W 46-70u. The long straight tail piece is the best character for distinguishing the species. Anderson: pond in sheep pasture by road to Scout Camp about five miles from Andersonville 25 Aug. 1950 #2337 - Jackson(Ala.): pool in Guntersville Reservoir area north of Scottsboro 19 Aug. 1949 #1775 - Middle Tenn.: Duck River

1938-9[1] - Davidson: small overflow area from Radnor Lake at Brentwood 20 Aug. 1949 #1804 - Robertson: plankton from round woods pond near hwy U.S.41 about a mile from Cedar Hill 20 Aug. 1949 #1854 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1182. VNK.

8. Phacus orbicularis Hueb. (Pascher & Lemmermann f) (Prescott f)

Cells circular with a short, bent posterior tail piece; periplast longitudinally striate; one large annular paramylum granule; flagellum length of body. L 50-100u; W 30-60u. Knox: Chilowee Park Lake 29 June 1938 (Bold)unnumbered.[2] K.

9. Phacus oscillans Klebs. (Pascher & Lemmermann f)

Cells oval-cylindrical, anterior slightly broader, posterior narrowing slightly, may have either a short point, or be rounded posteriorly; periplast spirally striate; single large paramylum ring about in center of cell; flagellum length of cell. L 20-26u; W 7-10u. The lateral edges fold downward to form a broad, shallow ventral groove. Gibson - Obion: at lower end of middle pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1240.

10. Phacus pleuronectes (O. F. M.)Duj. (Pascher & Lemmermann f)(Prescott f) Pl. 30, Fig. 10.

Shape broadly ovoid, widest postion posterior, bent

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1 Reported in Lackey, 1942
2 Reported in Silva, 1949

posterior tail piece present, median fold extending to or beyond middle of cell; 1-2 round ringed paramylum bodies; flagellum length of body or longer. L 45-49u; W 30-33u. This species is not only one of the commonest and most easily recognized of the genus, but it preserves splendidly dried or in liquid medium. Union(Ga.): stranded pool of Nottely Dam lake backwater by hwy U.S.129 14 Aug. 1949 #1739 - Anderson: pond in sheep pasture by Scout Camp Road about five miles from Andersonville 25 Aug. 1950 #2337 - Middle Tenn.: Duck River 1938-9.[1] VSGFK.

11. Phacus pyrum (Ehr.)Stein. (Pascher & Lemmermann f) (Prescott f)(Walton f)

Shape ovoid, broadest part anterior, tapered and extended into long posterior tail piece; periplast spirally striate and ridged in left handed spiral; two large or several small paramylum granules present; flagellum length of body. L 30-55u; W 13-15u. Knox: road puddle near Carter's Mill 2 Aug. 1949 #1606 - Middle Tenn.: Duck River 1938-9.[1] VSK.

12. Phacus triqueter (Ehr.)Duj. (Pascher & Lemmermann f) (Prescott f)

Shape ovoid, broadest part posterior, posterior with bent spine, conspicuous median dorsal fold reaching posterior end, cell often cup-shaped, ventral surface concave; peri-

1 Reported in Lackey, 1942

plast longitudinally striate; 1-2 ringed paramylum bodies. L 45-49u; W 33-35u. The large median fold or cup-shape characterizes the species well. Jackson(Ala.): ditch pond by hwy U.S.72 near Paint Rock 17 June 1950 - Middle Tenn.: Duck River 1938-9.[1] VNK.

TRACHELOMONAS Ehrenberg 1833

The shell (test or lorica) which surrounds the protoplast distinguishes this genus from related ones. The protoplast contains several discoid chloroplasts, and anterior eyespot, and a single flagellum protrudes out through an opening in the test.

These shell formers comprise what is indeed a varied group of numerous species which has been divided into two or more genera by some investigators on the basis of shape, such as whether the neck is a continuation of the body or merely an appendage. Although it has been monographed by Playfair, 1915, Skvortzow, 1925, and Deflandre, 1926, the understanding of the genus is far from satisfactory. The observation has been made by other investigators, as well as the writer, that variability of shape has not been fully appreciated by students of the group, and consequently there are too many narrowly defined species and varieties which have no consistency of separation from other forms. On the other hand, one has only to look at several collections

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1 Reported in Lackey, 1942.

to find an undescribed form.

No extensive study of the genus has been undertaken in America, and no recent exhaustive publication on it exists in the English language, although such a study would be valuable and interesting. However, nothing more is being attempted here than the identification of some specimens by means of literal interpretations from the monographers, an occasional evaluation of species encountered, and the mere translation of enough other descriptions to provide some basic information for future student. Even though ideas of speciation offered by the monographers and the present writer may be wrong, they do form a basis for further study.

1. Tests spherical, depressed-spherical
   or subspherical.................................... 57
1. Tests shaped otherwise.................................... 2
   2. Tests oval.................................... 29
   2. Tests shaped otherwise.................................... 3
3. Tests cylindrical or conical.................................... 23
3. Tests shaped otherwise.................................... 4
   4. Tests obovoid (largest width near
      flagellar opening).................................... 15
   4. Tests shaped otherwise.................................... 5
5. Tests ovoid (larger posteriorly).................................... 12
5. Tests variously shaped, not ovoid.................................... 6
   6. Tests shape elliptic, L 20-26u;
   W 9-12u.............. T. pulcherrima Playf.

(if shape is apparently elliptic, and form in question does not agree fully with T. pulcherrima, try ovoid group #5)

6. Tests not elliptic.............................. 7

7. Tests almost hemispherical in shape, with flattened surface anterior, large spines around mouth and elsewhere on surface, L 20u; W 22-25u............... T. lismorensis Playf.

7. Tests shaped otherwise............................ 8

8. Test nearly hexagonal, L 30-34u; W 14u............... T. hexangulare Delf.

8. Test not hexagonal, generally urceolate.................................. 9

9. Widest portion of test posterior to middle, rounding abruptly to short posterior point, gradually to broad anterior neck, L about 35u; W about 24u...................... T. Zmiewika Swir.

9. Widest portion of tests about at center.. 10

10. Central portion of tests, exclusive of tapered end portions, longer than wide, L 45-53u; W 24-26u............ T. urceolata Stokes

10. Broadest portion shorter than wide, L 50-130u; W 30-60u................................. *T. ensifera* (Daday)Defl. (for varieties see No. 11)

11. Posterior end merely acutely tapered, center portion extremely depressed, neck cylindrical, L 50u; W 34u...... *T. ensifera* v. *depressa* Silva

11. Posterior spine extremely narrow, center portion somewhat depressed only, neck tapering toward flagellar opening................................. *T. ensifera* v. *spikata* Silva

12. Test about as long as wide........................ 13

12. Test longer than wide........................ 14

13. Bulb-shaped tests, with straight converging margin to flagellum opening, L equal to W, 12-20u.. *T. atomaria* Skvor.

13. Constriction back of flagellum opening forming sort of neck, shape of test approaching oval, L 12u; W 10u (Tennessee specimens only)................................. *T. atomaria* v. *elegans* Skvor.

14. Tests shape derived from broadly tapering neck superimposed on

oval body, L 28-40u; W 12-15u............
.... *T. bulla* (Stein)Defl.

14. Tests shape derived from single wall, no separate body and neck, L 18-20u; W 12-14u............
.... *T. ovalis* Daday

15. Tests with conspicuous caudal appendage at posterior end, and neck appended on anterior end...................... 16

15. Tests without such appendages...................... 17

16. Caudal spine long, neck long, body surface covered with short spines, L 29-53u; W 21u................
.... *T. caudata* (Ehr.)Stein

16. Caudal tip merely acute, conical, neck fairly long, with crenate or dentate lip, L 40u; W 22u............
.... *T. Bernardinensis* Vischer

17. Tests shaped almost hemispherical, anterior flattened, surface decorated with several large spines..................
.... *T. lismorensis* Playf.

17. Tests shaped otherwise, surface smooth with minute spines or punctate.. 18

18. Tests shaped obovoid, with plain

neck, rounded posterior, L 24-
29u; W 12-16u....... _T._ _ampuliformis_ Defl.

18. Neck short and dentate or absent.............. 19

19. Test surface distinctly punctate,
cells almost as broad as long, L 19-
24u; W 18-20u.............. _T._ _Stokesii_ Drez.

19. Test surface not distinctly punc-
tate, proportions longer........................ 20

20. Tests smooth surfaced........................ 21

20. Tests surfaced with many minute
spines.. 22

21. Short dentate collar around fla-
gellar opening, L 26-30u; W 19-25u...........
.... _T._ _eurystoma_ Stein

21. No collar present around flagellar
opening, L 24-26u; W 18u.....................
.... _T._ _eurystoma_ v. _Klebsii_ Playf.

22. L 24-30u; W 18-19u..........................
.... _T._ _obovata_ (Stokes)Defl.

22. L 30-45u; W 20-30u..........................
.... _T._ _obovata_ v. _Klebsiana_ Defl.

23. Trapezoid-shaped poles giving tests
a hexagonal shape....... _T._ _hexangulare_ Defl.

23. Test not hexagonal........................... 24

24. Posterior of tests tapered to
give a conical shape........................ 25

24. Tests not approximately conical.............. 26

25. Test surface smooth, L 24-26u;
W 12-14u................... *T. conica* Playf.

25. Test surface punctate, L 26u; W 13u..........
.... *T. Lemmermannii* Wolos.

26. Surface with short spines.................... 27

26. Surface without spines....................... 28

27. Length/width ratio about 3/1, L 30u;
W 10u..................... *T. Klebsii* Defl.

27. Length/width ratio about 2/1 or
less, L 24-35u; W 14-22u...... *T. allia* Drez.

28. Short neck or collar present,
L 25u; W 14u....... *T. dubia* (Swir.)Defl.
or, L 16-20u; W 8-10u. *T. cylindrica* Ehr.
The difference seems obscure,
perhaps *T. dubia* has a longer
neck, perhaps *T. cylindrica* is
slightly more tapered at the
ends, but the size difference
between the two seems inconclusive

28. No neck or collar present, L 16-
20u; W 8-10u.........................
.... *T. cylindrica* v. *decollata* Playf.

29. Surface of tests smooth or punctate.............. 30

29. Tests ornamented with spines or
granules...................................... 42

30. Short collar or neck recessed, as a tube, back into the body of test, L 22-27u; W 19-23u.. *T. varians* Defl.

30. No tubular recession into test................ 31

31. Mouth of flagellar opening wide, 1/3 of cell width................................ 32

31. Opening narrower.................................. 33

32. Tests oval-elliptic shaped, short collar around flagellar opening, L 24-35u; W 15-21u.. *T. teres* Mask.

32. Tests oval or ovoid-shaped, flagellar opening flaring out in a vase-like manner.................................. *T. atomaria* v. *elegans* Skv.

33. Neck present at flagellar opening................ 34

33. No neck present.................................. 38

34. Neck bent to one side, L 19-23u; W 16-18.5u............ *T. Playfairii* Defl.

34. Neck not bent.................................... 35

35. Surface punctate, L 25-26u; W 17-20u.......... *T. planktonica* v. *oblonga* Drez. and L 19u; W 17u........ *T. planktonica* Swir.

35. Surface of tests smooth.......................... 36

36. Neck a truncate cone, giving

tests an ovoid shape....................
.... *T. bulla* (Stein)Defl.

36. Neck cylindrical............................ 37

37. Collar present around base of neck,
L 18-23u; W 15-18u...... *T. recticollis* Defl.

37. No collar present around neck,
L 30-33u; W 20u...... *T. euchlora* (Ehr.)Lemm.

38. Tests subglobose shaped, almost
as broad as long, L 22-26u;
W 16-22u............ *T. subglobosa* Playf.

38. Tests somewhat longer than broad............. 39

39. Tests smooth surfaced........................... 40

39. Tests punctate surfaced, annular
thickening may be present around
flagellar opening, L 12-20u;
W 10-16u................. *T. intermedia* Dang.

40. L 13-16u; W 11-12u...... *T. oblonga* Lemm.

40. Proportions slightly longer,
length 15u or over........................... 41

41. L 27-30u; W 18-20u.......... *T. abrupta* Swir.

41. L 15-22u; W 9-12u.. *T. abrupta* v. *minor* Defl.

42. Tests granular surfaced or sca-
brous (rough)................................ 43

42. Tests with spines or spikes..................... 45

43. Neck smooth surfaced, with dentate
or crenate lip, L 19-25u; W 15-19u...........
.... *T. crebea* (Kell1.)Defl.

43. Neck scabrous, as well as body of test............ 44

44. Neck long, L 24-33u; W 16-20u............
.... *T. scabra* v. *longicollis* Playf.

44. Neck shorter............ *T. scabra* Playf.*

45. One or two rings of spines around flagellar opening only............................ 46

45. Spines disposed otherwise........................ 47

46. Spines sharp, L 25-38u; W 23-25u.........
.... *T. acanthostoma* (Stokes)Defl.

46. Spines distinctly bluntly pointed, L 28u; W 25u............................
... *T. acanthostoma* v. *nankinensis* Skvor.

47. Spines distributed on y at rear, or both ends of tests............................... 48

47. Spines in median areas to some extent............ 49

48. Spines only at rear, L 28-37u; W 20-27u.......... *T. armata* (Ehr.)Stein

48. Spines longer at rear, shorter around flagellum opening.................
.... *T. armata* v. *Steinii* Lemm.

49. Spines in middle and rear portions especially recurved toward posterior end, L 26u; W 16-23u...... *T. spinosa* Stokes

49. Spines not recurved.............................. 50

50. Very short surface spines present, showing a polar distribution, with

median areas rather smooth,
L 24-30u; W 16-24u (Tennessee
specimens only)........................
.... T. hispica v. duplex Defl.
(see T. armata v. Steinii Lemm.
for comparison)

50. Spines on all portions of tests.............. 51

51. Spines blunt, longer at posterior
end, L 30-40u; W 25-35u... T. Dangardii Defl.

51. Spines sharp.................................. 52

52. Spines quite long at ends,
shorter in midregion, L 46-
55u; W 36-38u........... T. superba Swir.

52. Spines all about same size.................. 53

53. Spines minute, neck of test rather
long, L 30u; W 20u..... T. Syndeyensis Playf.

53. Spines larger, not minute, neck
shorter... 54

54. Spines quite large, 1/3 cell
width in length, L 40-53u;
W 32-35u............ T. spectabilis Defl.

54. Spines smaller.............................. 55

55. Tests with plain, short, cylindrical
neck, L 46u; W 35u.... T. Charkowiensis Swir.

55. Neck, if present, with dentate or
serrate lip..................................... 56

56. Neck, if present, merely a short collar with dentate edge, L 20-42u; W 15-26u.... T. hispida (Perty)Stein

56. Neck definite, with serrate lip or flagellar opening.......... T. hispida v. crenulatocollis (Mask.)Skvor.

57. Tests smooth surfaced, punctate, or perforate only.................................. 58

57. Tests ornamented in some manner.................... 62

58. Long cylindrical neck with rimmed opening, L equal to W, 25-30u............................. T. Palmeri (Drez.)Defl.

58. No long neck present.......................... 59

59. Tests perforate surfaced, L equal to W, 10-20u.......... T. perforata (Awer.)Defl.

59. Tests not perforate............................ 60

60. Surface finely punctate, often displaying annular thickening around flagellar opening, test shape tending toward oval................................... T. intermedia Dang.

60. Surface smooth................................ 61

61. Tests spherical shaped..... T. volvocina Ehr.

61. Tests depressed spherical shaped........................ T. volvocina v. compressa Drez.

62. Test surface covered with slightly

spiralling lines or striae, L equal to W, 14-23u........................ T. rugulosa (Stein)Defl.

62. Test surface spiny............................... 63

63. Test diameter 8-10u (L 9-10u; W 8-9.5u)...................... T. elegans Conrad

63. Tests larger....................................... 64

64. L 18-20u; W 10-16u.................... .... T. bacillifera v. minima Playf.

64. Test 20u or more in length...................... 65

65. L equal to W, 20-29u..... T. Woycickii Koczw.

65. L 35-40u; W 33-38u..... T. bacillifera Playf.

1. Trachelomonas abrupta Swir. (Deflandre f) Pl. 31, Fig. 1.

Test oval-shaped, almost twice as long as broad, ends blunt, no neck at flagellar opening. L 24-30u; W 14-19u. Variety minor Def. L 15-22u; W 14-18u. Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1421 - Montgomery: pond by hwy U.S.79 at Tom Edwards' store west of Clarksville 14 June 1949 #1370 - large marsh by hwy U.S.79 at Norfleet & Sons grocery west of Clarksville 14 July 1949 #1376.

2. Trachelomonas acanthostoma (Stokes)Defl. (Pascher & Lemmermann f)(Prescott f) Pl. 31, Fig. 2.

Shape globose or subglobose, flagellar opening surrounded by one or two rows of short spines; surface minutely punctate.

L 25-35u; W 23-35u. Obion: field embayment in south end of Isom Lake 10 July 1949 #1283 - Lake: sloughs by hwy Tenn. 78 near Kentucky state line 5 July 1949 #1193. N.

3. Trachelomonas acanthostoma v. nankinensis Skvor. (Skvortzow f) Pl. 31, Fig. 3.

Shape globose or subglobose with two irregular rows of spines around the flagellar opening, the inner generally longer, spines conspicuously blunt as compared with those of the species. L 28u; W 25u for the specimen only. Gibson - Obion: middle pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1242.

4. Trachelomonas allia Drez. (Deflandre f)(Prescott 27 f) Pl. 31, Fig. 4

Shape cylindric-oval with blunt ends, flagellar opening with or without short collar; surface evenly covered with short spines. L 24-35u; W 14-22u. Knox: bottom of pond at Carter's Mill 2 Aug. 1949 #1608 - Lincoln: pond on farm by hwy U.S.241 north of Fayetteville 19 Aug. 1949 #1795 - Weakley: Mr. Bary's pond by hwy Tenn.22 west of Martin 8 July 1949 #1586.

5. Trachelomonas ampuliformis Defl. (Deflandre f) Pl. 31, Fig. 5.

Shape obovoid, a short or longer plain collar around the flagellar opening. L 24-29u; W 12-16u. Knox: margins of stagnant pond by Riverside Drive east of Knoxville Waterworks 25 July 1949 #1586.

6. Trachelomonas armata (Ehr.)Stein. (Deflandre f)(Prescott f) Pl. 31, Fig. 8.

Shape broadly oval with rounded ends, posterior circle of short or longer spines present, and anterior group of spines may or may not be present. L 28-37u; W 20-27u. Weakley: pond and marsh at Greenfield 30 June 1949 #1118 - Obion: near south shore of Isom Lake 10 July 1949 #1268. K.

7. Trachelomonas armata v. Steinii Lemm. (Pascher & Lemmermann f)(Prescott f)

This variety is larger than the typical, with long posterior spines and shorter anterior spines. L 37-40u; W 30-33u. Since the species is a variable one, several varieties have been described. Stewart: pond by hwy U.S.79 east of Dover 13 July 1949 #1361.

8. Trachelomonas atomaria Skvor. (Deflandre f) Pl. 31, Fig. 6.

The test is jug-shaped or bulb-shaped, compressed or globose, with a wide flagellar opening, but no neck; surface smooth. L equal to W, 12-20u. Knox: Ft. Loudon Lake in Little River Estuary at hwy U.S.411 crossing 12 June 1949 #803 - Obion: Nelumbo area of Reelfoot Lake near Samburg 12 July 1949 #1306.

9. Trachelomonas atomaria v. elegans Skvor. (Skvortzow f) Pl. 31, Fig. 7.

The variety is distinguished by the more abrupt narrowing to the broad flagellar opening. Tennessee specimens L 12u;

W 10u. Montgomery: spring pond in Spring Creek bottom pasture about ten miles northeast of Clarksville 11 Sept. 1949 (Clebsch)#1925.

10. Trachelomonas bacillifera Playf. (Deflandre f) Pl. 31, Fig. 9.

Shape globose or subglobose with several spines distributed evenly over the surface; flagellar opening surrounded by collar with crenate edge. L 35-40u; W 33-38u. The species differs from T. allia in shape, collar, and smaller number of spines. Lincoln: ponds on farm by hwy U.S.241 north of Fayetteville 19 Aug. 1949 #1791.

11. Trachelomonas bacillifera v. minima Playf. (Deflandre f)

The proportions in the variety are the same as in the species, but the tests are smaller, the specimens here with many short spines on the surface and no neck. L 20u; W 18u. Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1736.

12. Trachelomonas Bernardinensis Vischer. (Deflandre f) Pl. 31, Fig. 10.

Shape obovoid with a pointed posterior and short cylindrical neck with dentate or crenate edge. L 40u; W 22u. Weakley: Mr. Bary's pond by hwy Tenn.22 west of Martin 8 July 1949 #1208.

13. Trachelomonas bulla (Stein)Defl. (Deflandre f) Pl. 31, Fig. 11.

Shape elongated bulb-shaped or ovoid, tapering to broad flagellar opening. L 28-39u; W 12-15u. The plan of the test is the same as that of T. atomaria, but the proportions differ. Number 1245 shows four longitudinal ridges, visible as knobs in cross section. This differs from the smooth outline of the species as generally figured. Obion: stock pond by county road near Mason Hall 8 July 1949 #1245.

14. Trachelomonas caudata (Ehr.)Stein. (Deflandre f)(Pascher & Lemmermann f) Pl. 31, Fig. 12.

Shape oval, short acute posterior tail piece, long cylindrical neck with a dentate edge surrounding flagellar opening; surface of test body covered with short straight spines. L 29-53u; W 21u.

15. Trachelomonas Charkowiensis Swir. (Deflandre f) Pl. 31, Fig. 13.

Shape oval with rounded ends, plain, short neck around flagellar opening; surface covered with small spines. L 46u; W 35u. The sides of T. allia are more parallel than this species and T. bacillifera is globose or subglobose in shape. Weakley: Mr. Bary's pond by hwy Tenn.22 west of Martin 8 July 1949 #1207.

16. Trachelomonas conica Playf. (Deflandre f) Pl. 31, Fig. 14.

Shape cylindrical with conical tapered posterior end and truncate anterior end, there may or may not be a short collar around the flagellar opening; test surface smooth. L 24-26u; W 12-14u. The smooth surface is apparently the only good difference between this species and _T. Lemmermannii_ Wolos.

17. _Trachelomonas cylindrica_ Ehr. (Deflandre f)(Prescott f) Pl. 31, Fig. 16.

Shape cylindrical with rounded ends and short collar around flagellar opening. L 16-20u; W 8-10u. Middle Tenn.: Duck River 1938-9.[1]

18. _Trachelomonas cylindrica_ v. _decollata_ Playf. (Deflandre f) Pl. 31, Fig. 15.

The variety differs from the species by having no neck. Knox: goldfish pool at Knoxville Waterworks 25 July 1949 #1575 - Overton: mud puddle near gate of pond by hwy Tenn.42 three miles north of Livingston 15 July 1949 #1468.

19. _Trachelomonas Dangeardii_ Defl. (Deflandre f) Pl. 31, Fig. 17.

Shape subglobose or broadly oval with rounded ends, short, smooth collar around flagellum opening; long blunt posterior spines, short spines distributed over surface of test. L 30-40u; W 25-38u. Gibson - Obion: entrance to highest pond on Abe Shatz' farm east of Kenton 8 July 1949 #1237.

20. _Trachelomonas dubia_ (Swir.)Defl. (Deflandre f) Pl. 31, Fig. 18.

Shape cylindrical or long oval with blunt ends and a

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1 Reported in Lackey, 1942

l in neck. L 25u; W 11-14u. The line separating this species from T. cylindrica and T. abrupta is a faint one, and may not actually exist. The size of T. dubia is larger than the former and the latter lacks a neck or collar, but both of these features are variable in other species. Cumberland: puddle by hwy U.S.70-N on grass in front of New Salem Baptist Church 16 March 1950 #2056.

21. Trachelomonas elegans Conrad. (Deflandre f)

Shape subspherical; surface covered with short fine spines. L 9-10u; W 8-9.5u. The only distinction which can be drawn between this species and T. bacillifera v. minima is size, T. elegans being smaller.

22. Trachelomonas ensifera (Daday)Defl. (Deflandre f) (Pascher & Lemmermann f) Pl. 31, Fig. 19.

The shapes found among the tests of this species are variable, but best may be described as being composed of a spherical to transversely oval median portion extending into a stout, sharp posterior spine and tapering anteriorly to an extended neck. L 75-130u; W 40-60u. No two drawings of the species show the same proportions, but most of them are clearly within the normal variation of the species. The normal variation might also include the two varieties described below, but they seem distinctive enough to warrant description.

23. Trachelomonas ensifera v. spicata var. nov. Pl. 31, Fig. 20.

Central portion of tests depressed oval, tapering sharply to long narrow posterior spike, tapering concavely to anterior flagellar opening; surface smooth; flagellum length not observed. L 80u; W 40u. Lake: slough by hwy Tenn.78 near Kentucky state line 5 July 1949 #1192.

24. Trachelomonas ensifera v. depressa var. nov. Pl. 31, Fig. 21.

Central part of test transversely oval, with an even margin, tapering abruptly, then more gradually to an acute posterior end which is blunt and not spike-like; anterior tapering quite abruptly to form a long cylindrical neck; surface smooth; flagellum length not observed. L 50u; W 35u. Lake: sloughs by hwy Tenn.78 near Kentucky state line 5 July 1949 #1192.

25. Trachelomonas euchlora (Ehr.)Lemm. (Pascher & Lemmermann f)(Prescott f)

Shape broadly cylindric, rounded posteriorly, abruptly narrowed anteriorly and extended to form a neck around the flagellar opening, which is straight or slightly bent; surface smooth. L 30-33u; W 20u. Obion: plankton from south end of Isom Lake 10 July 1949 #1265.

26. Trachelomonas eurystoma Stein. (Deflandre f)(Pascher & Lemmermann f)(Walton f)

Shape ovoid, broadest anteriorly, posterior rounded or conical; short collar around flagellar opening. L 26-30u;

W 19-25u. Davidson(?): Cumberland River 1938-9.[1]

27. Trachelomonas eurystoma v. Klebsii Playf. (Deflandre f) Pl. 31, Fig. 22.

The variety is differentiated from the species by its very short collar, or complete lack of a neck or collar. L 24-26u; W 18u.

28. Trachelomonas hexangulare Defl. (Deflandre f) Pl. 31, Fig. 23.

Shape cylindrical, tapering to truncate posterior pole, and to smooth anterior neck, therefore more or less hexagonal in shape; surface smooth; neck plain, cylindrical. L 30-34u; W 14u. Obion: surface of Bayou du Chien at Biological Station 1 July 1949 #1143.

29. Trachelomonas hispida (Perty)Stein. (Pascher & Lemmermann f)(Prescott f)

Shape oval with both ends rounded; short collar with dentate edge may be present; surface covered with short spines. L 20-42u; W 15-26u. In forms without a neck, the difference between this species and T. bacillifera v. minima is obscure. Perhaps there is a small, but valid difference in proportion, T. hispida being slightly longer (20 x 15u compared with 20 x 18u). The proportions also differ in comparison with T. elegans, which is somewhat smaller. Middle Tenn.: Duck River 1938-9[1] - Obion - Lake: margins of

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1 Reported in Lackey, 1942

Reelfoot Lake 14 June 1950 #2256. NK.

30. Trachelomonas hispida v. crenulatocollis (Maskall)Skvor. (Pascher & Lemmermann f)(Prescott f - a form) Pl. 31, Fig. 24.

This variety differs from the typical in having a definite neck with a serrate edge. L 20-40u; W 15-26u. The serrate edge of the neck is the only obvious difference between this variety and T. Charkowiense which has similar proportions. Whereas the specimens here are much smaller than in that species, the size range published hitherto almost reached the extreme lower dimensions of T. Charkowiense. Obion: foam from leeward side of Bayou du Chien near Biological Station 2 July 1949 #1154 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1176.

31. Trachelomonas hispida v. duplex Defl. (Deflandre f) Pl. 31, Fig. 25.

The variety differs from the species in exhibiting spines only at the ends. L 24-30u; W 16-24u for the Tennessee specimens. The principal but slight difference between this variety and T. armata is that the posterior spines are longer in T. armata. In addition, these specimens are smaller than most of those of T. armata, but a clear separation of the two on the basis of size is not apparent, and their proportions are similar. Blount: Montvale Springs Lake, near dam 18 Aug. 1950 #2324 - Knox: in margin of stagnant pond by Riverside Drive east of Knoxville

Waterworks 25 July 1949 #1586 - Obion: near south shore of Isom Lake 10 July 1949 #1268.

32. Trachelomonas intermedia Dang. (Deflandre f)(Pascher & Lemmermann f)(Walton) Pl. 31, Fig. 26.

Shape oval with bluntly rounded ends, an annular thickening is described for the flagellar opening (only a bare suggestion of it has been observed in Tennessee specimens); surface finely punctate. L 12-20u; W 10-16u. Lumpkin(Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1736 - Lincoln: farm pond by hwy U.S.241 north of Fayetteville 19 Aug. 1949 #1791.

33. Trachelomonas Klebsii Defl. (Deflandre f)

Shape cylindric, both ends bluntly rounded; flagellar opening with or without low collar; surface covered with short spines. L 30u; W 10u. The longer proportions are the only discernible difference between this species and T. allia, which is a very variable species. Davidson: fish pool by Vanderbilt University greenhouse 17 March 1950 #2060.

34. Trachelomonas Lemmermannii Wolos. (Deflandre f)(Pascher & Lemmermann f)

Shape cylindrical, tapering to a conical posterior, anterior end blunt or truncate, without a collar; surface finely punctate. L 26u; W 13u. The proportions and size of the tests coincide well with those of T. conica but that species lacks the finely punctate surface. Obion - Lake:

Blue Basin of Reelfoot Lake 12 July 1949 #1324.

35. Trachelomonas lismorensis Playf. (Deflandre f) Pl. 31, Fig. 28.

Shape broadly obovoid with anterior part broadest, posterior broadly rounded; rather large spines scattered over the surface of the test with a tendency for the longest ones to be in the mid-section, sometimes with a ring of spines around the flagellar opening. L 20u; W 22-25u. Obion: near south shore of Isom Lake 12 July 1949 #1269.

36. Trachelomonas oblonga Lemm. (Deflandre f)(Pascher & Lemmermann f)

The only difference between this species and T. intermedia is that the surface of this species is smooth; shape oval; annular thickening around flagellar opening. L 13-16u; W 11-12u.

37. Trachelomonas obovata v. Klebsiana Defl. (Deflandre f)

Shape broadly oval, posterior end somewhat conical in shape; surface covered with very short, fine spines, differentiating it from T. eurystoma. L 24-30u; W 19-19u. Weakley: pond by hwy Tenn.54 at Ore Springs east of Dresden 14 June 1950 #2244.

38. Trachelomonas ovalis Daday. (Deflandre f)(Walton f) Pl. 31, Fig. 29.

Shape ovoid, broadest portion posterior, posterior rounded, anterior tapering to flagellar opening. L 18-20u; W 12-14u. Knox: gold fish pond at Knoxville Waterworks 25

July 1949 #1575.

39. Trachelomonas Palmeri (Drez.)Defl. (Deflandre f)

Shape spherical with a long neck which is rimmed around its opening. Diameter 25-30u. Odion: plankton from Isom Lake near south shore 10 July 1949 #1265.

40. Trachelomonas perforata (Awer.)Defl. (Deflandre f) (Pascher & Lemmermann f)(Walton f)

Shape spherical with low collar or thickening around flagellar opening; surface perforate. Diameter 10-20u. Obion: road mud puddle near south shore of Isom Lake 10 July 1949 #1284.

41. Trachelomonas planktonica v. oblonga Drez. (Deflandre f)

Shape oval to ovoid, with rounded ends, a fairly long neck tapering toward the flagellar opening which may have a plain or serrate margin; surface punctate. L 25-26u; W 17-20u. The neck is the chief distinction between the typical form and T. intermedia which has an overlapping size range with it. This variety is larger than either. Robertson: plankton from round pond near woods by hwy U.S. 41 one mile south of Cedar Hill 20 Aug. 1949 #1854.

42. Trachelomonas Playfairii Defl. (Deflandre f)

Shape oval with both ends blunt or rounded; neck surrounding flagellar opening long and bent; surface smooth. L 19-23u; W 16-18.5u. Lincoln: pond on farm by hwy U.S. 241 north of Fayetteville 19 Aug. 1949 #1791.

43. Trachelomonas pulcherrima Playf. (Deflandre f)

Shape elliptic, with rounded ends; short collar around flagellar opening. L 20-26u; W 9-12u. The difference between this species and T. dubia is slight, the shape here being elliptic rather than oval. Proportion and size are similar. Overton: pond containing considerable number of aquatic plants (Sagittaria, Potamogeton, Lemna etc.) at Timothy 15 July 1949 #1456.

44. Trachelomonas recticollis Defl. (Deflandre f)

Shape broadly oval with blunt ends, flagellar opening in a long neck. L 18-23u; W 15-18u. The punctations of T. planktonica v. oblonga are lacking here, although the shape and size of the two are somewhat similar. Stewart: pond by hwy U.S.79 east of Dover 13 July 1949 #1361.

45. Trachelomonas robusta (Swir.)Defl. (Deflandre f)(Prescott f)

Shape subspherical; surface bearing several short sharp spines. L 12-20u; W 10-16u. Sevier: plankton from Little Pigeon River at Pigeon Forge 29 July 1949 #1593 - Knox: in quiet water of pond at Carter's Mill 20 Aug. 1949 #1615.

46. Trachelomonas rugulosa (Stein)Defl. (Deflandre f) (Pascher & Lemmermann f)

Shape spherical or subspherical with a short plain collar around flagellar opening; surface with slightly spiral anastomosing folds. Diameter 14-23u. Montgomery:

large marsh by hwy U.S.79 at Norfleet & Sons grocery west of Clarksville 14 July 1949 #1376.

47. Trachelomonas scabra v. longicollis Playf. (Deflandre f)

Shape oval with a long neck having a crenate or dentate margin at the opening; surface scabrous, irregular. L 24u; W 16-20u. The variety is differentiated from the typical only by the longer neck. Obion: plankton from Reelfoot Lake at Samburg 13 July 1949 #1305.

48. Trachelomonas Syndeyensis Playf. (Deflandre f)

Shape oval with short neck having dentate margin at the opening; surface bearing several minute spines scattered over it. The difference between this species and T. hispida is not well marked. Here the neck is a bit longer, and the cell-proper tapers more toward the ends. Lumpkin (Ga.): plankton from artificial lake in Vogel State Park 14 Aug. 1949 #1736.

49. Trachelomonas spectabilis Defl. (Deflandre f)(Prescott f)

Shape oval with rounded ends; several very large spines are arranged on the surface. L 40-53u; W 32-35u. The spines are larger and fewer than those of T. hispida. Knox: old concrete reservoir at Neubert's Springs 20 July 1949 #1529.

50. Trachelomonas spinosa Stokes. (Deflandre f)(Pascher & Lemmermann f)(Prescott f)

Shape oval with rounded, somewhat attenuated ends;

very short annular thickening around flagellar opening, or none present; surface covered with long spines which on middle or posterior portions of test are recurved. L 26u; W 16-23u. Lake: pools of Cranetown nesting area in cypress swamp 5 July 1949 #1189.

51. Trachelomonas Stokesii Drez. (Deflandre f)

Shape obovoid, broadest portion anterior; no neck around flagellar opening; surface finely punctate. L 19-24u; W 18-20u. The broader proportions separate this species from T. Lemmermannii, and the punctations distinguish it from T. eurystoma v. Klebsii, and T. obovata v. Klebsiana. Knox: Lakeside Lake by Sevierville highway about five miles south of Knoxville 20 July 1949 #1537.

52. Trachelomonas subglobosa Playf. (Deflandre f)

As the name indicates, the shape is essentially subglobose, whereas T. oblonga and T. intermedia are slightly longer in proportion; no neck or only a short ring-like thickening present around flagellar opening; surface smooth. L 22-26u; W 22u. Montgomery: old stock pond near junction of hwy U.S.79 and Blooming Grove Creek Road 14 June 1949 #1414 - Henry: pond by hwy Tenn.54 east of Dresden 14 June 1950 #2244 - Obion: plankton at Spillway bridge 10 July 1949 #1262.

53. Trachelomonas superba Swir. (Deflandre f)(Prescott 27 f)

Shape oval with rounded ends; no neck, or merely a ring-like thickening around flagellar opening; large spines on surface, the largest being at the ends. L 46-55u; W 36-39u. The spines are of the type found in T. spectabilis but the longer spines at the ends here differentiate the two species. Montgomery: old stock pond near junction of hwy U.S.79 and Blooming Grove Creek road 14 July 1949 #1414.

54. Trachelomonas teres Maskell. (Deflandre f)(Pascher & Lemmermann f)(Walton f)

Shape oval or elliptic with rounded ends; short collar around flagellar opening; surface punctate. L 24-35u; W 15-21u. Weakley: plankton from large spring four miles north of Gardner Station 8 July 1949 #1221 - Obion: field embayment at south end of Isom Lake 10 July 1949 #1283.

55. Trachelomonas urceolata Stokes. (Deflandre f)(Pascher & Lemmermann f)(Walton f) Pl. 31, Fig. 30.

Shape of central portion of test oval to cylindrical, posteriorly tapered to a spike, anterior abruptly tapered to wide cylindrical neck. L 45-53u; W 24u. Whereas the tail piece on number 1370 is a bit longer than that shown in the available published illustrations, the species is variable enough to permit the Tennessee forms to be assigned here. This species should be compared with T. ensifera. Sevier: road mud puddle at Pigeon Forge 20 Aug. 1950 #2332 - Montgomery: plankton from pond by hwy U.S.79 at Tom Edwards' store west of Clarksville 14 June 1949 #1370.

56. Trachelomonas varians Defl. (Deflandre f) Pl. 31, Fig. 27.

The recessed neck, extending back slightly into the body of the cell, as a pipe, is the distinguishing mark of the species; test oval; the surface smooth. L 22-27u; W 19-23u. Stewart: pond by hwy U.S.79 east of Dover 13 July 1949 #1361.

57. Trachelomonas verrucosa Stokes. (Deflandre f)(Pascher & Lemmermann f)(Welton f)

Shape spherical; surface covered with small bumps. Diameter 12-25u. The available figures show no neck, or only a simple ring-like thickening around the flagellar opening, but number 1923 has a crenate edge at the opening or a very short collar is present. Obion: mud puddle along road near south end of Isom Lake 10 July 1949 #1284.

58. Trachelomonas volvocina Ehr. (Deflandre f)(Pascher & Lemmermann f)(Prescott f)

Shape spherical; surface smooth; a ring-like thickening or short collar around flagellar opening. Diameter 7-21u. Middle Tenn.: Duck River 1938-9[1] - Gibson - Obion: on sticks in inlet to highest pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1237.

59. Trachelomonas volvocina v. compressa Drez. (Deflandre f)

Differs from the species by being compressed anterior-posteriorly. Size about same as species. Gibson - Obion:

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1 Reported in Lackey, 1942

inlet to highest pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1237.

60. Trachelomonas Woycickii Koezw. (Deflandre f)

Shape spherical; no collar or thickening around flagellar opening, surface with short spines evenly distributed over it. Diameter 20-29u. The species is larger than T. elegans and smaller than T. bacillifera. Weakley: pond and marsh at Greenfield 30 June 1949 #1118.

61. Trachelomonas Zmiewika Swir. (Deflandre f)

(possibly including T. Zmiewika v. curta Defl.)

Shape ovoid, largest width posterior, tapering abruptly to small pointed posterior spine, anterior evenly tapered to mouth. L 35u; W 24u. This species belongs to the same group as T. ensifera and T. urceolata, and it is differentiated by the abrupt posterior tapering and short spine, and by the long anterior tapering.

There is great variability of the pattern ascribed to the species. For instance, T. gibberosa Playf. may be included within the variability, in which case the name should have precedence over Swirenko's.

Madison(Ala.): reservoir of Guntersville Dam Lake above Scottsboro 19 Aug. 1949 #1782 - Obion: plankton from south end of Isom Lake 10 July 1949 #1265 - Lake: pools of Cranetown nesting area in cypress swamp 5 July 1949 #1189.

Astasiaceae

ANISONEMA Dujardin 1841

Cells of the species of this genus are of variable metaboly and possess one forward projecting, swimming flagellum, and one trailing. The flagella differ from one another chiefly in behavior, not in observable structure, such as can be seen in those of Heteronema. No chromoplasts are present.

Inasmuch as the cells are rather elusive and identification during this study involved considerable conjecture, the entire genus key of Lemmermann is included here, but it should not be considered the last word on the taxonomy of the genus.

*species not included in text

1. Cells nonmetabolic.............................. 2
1. Cells metabolic................................. 6
   2. Cells oval in side view..................... 3
   2. Cells shaped otherwise...................... 4
3. Swimming (protruded) flagellum length of body, L 11u; W 7u........... A. ovale Klebs
3. Swimming flagellum twice the length of body, L 14-30(?)u; W 7-12u.................. .... A. emarginata Stokes
   4. Cells ovoid in shape, L 25-40u; W 10-22u.................... A. acinus Duj.*
   4. Cells not ovoid............................. 5

5. Cells obovoid in shape, L 60u; W 20u..........
.... A. truncatum Stein*

5. Cells spindle-shaped, L 11u A. pusillum Stokes*

6. Cells striate, L 15u; W 7u.................
.... A. striatum Klebs*

6. Cells not striate, L 14-16u;
W 9-12u................... A. variabile Klebs

1. Anisonema emarginata Stokes. (Pascher & Lemmermann f)

Rigid or slightly metabolic; shape oval (ovoid in Tennessee specimens); forward protruding flagellum about 1½-2 times length of body. L 14u, possibly up to 30u. Polk: embayment of Ocoee Dam Lake #1 by hwy U.S.64 14 Aug. 1949 #1763.

2. Anisonema ovale Klebs. (Pascher & Lemmermann f)(Smith f)

Slightly metabolic generally, but number 1662, if correctly identified, was metabolic to the extent of being almost amoeboid in its movements at times; shape oval (usually figured as ovoid), often unsymmetrical, and somewhat compressed dorso-ventrally; one contractile vacuole in the anterior part of the cell, and possibly a second posterior one; several small paramylum granules present; two flagella of about the same thickness but of unequal length, the shorter (length of body) directed forward, the longer (three times length of body), trailing through a ventral groove. L 11-30u; W 7-20u. Blount: among aquatic plants in Laurel Lake near Kinzel Springs 4 Aug. 1949 #1662 - Sumner: cultured from collection in small stream by hwy U.S. 31-E northeast of Gallatin 27 March 1950 #2197 - Montgomery: plankton from pond by hwy U.S.79 at Tom Edwards' store west of Clarksville 14 July 1949 #1371.

3. Anisonema variabile Klebs. (Pascher & Lemmermann f) Pl. 32, Figs. 2,3.

Cells metabolic; shape usually vaguely ovate or cylindrical; forward protruding flagellum being about length of body, trailing flagellum about 1½ times length of body. L 14-16u (here 20u); W 9-12u. Knox: Lakeside Lake by Sevierville Highway five miles south of Knoxville 20 July 1949 #1540.

ASTASIA Ehrenberg 1830

Astasia lagenula (Schew.)Lemm. (Pascher & Lemmermann f) Pl. 32, Fig. 1.

Somewhat metabolic; shape elongate-ovoid, posterior end broader and more rounded than the anterior; oval eyespot present near anterior end; contractile vacuole in median posterior position; several small rounded paramylum bodies present; flagellum length that of body. L 25-30u; W 10u. Number 1509 is actually too small for the limits which have been recorded for the species (they are 12-16u long), but corresponds rather well otherwise. It is not described as a new form since there is insufficient evidence concerning presence or absence of intermediate sizes. Tennessee: common culture of summer 1949 collections 7

March 1950 #2222 - Knox: gold fish pond of Harry Ijams' place beyond Island Home 20 July 1949 #1590 - Cumberland: rain puddle in grass in front of New Salem Baptist Church by hwy U.S.70-N March 1950 #2056 - Davidson: Radnor Lake near Brentwood 20 Aug. 1949 #1799.

ENTOSIPHON Stein 1878

Entosiphon sulcatum (Duj.)Stein. (Pascher & Lemmermann f)
(including E. ovatum Stokes)
Pl. 32, Fig. 4.

Cells rigid; shape oval in broad side view, longitudinally furrowed with 4-12 ridges, somewhat compressed dorso-ventrally, posterior blunt, anterior somewhat emarginate or crenate; several contractile vacuoles present in various parts of the cell, but one or two only are generally visible; two flagella, the forward extending about length of body, trailing one up to two times length of body. L 20-30u; W 10-15u.

The broader interpretation of E. sulcatum is employed here (see Smith, 1933). The distinction between this and E. ovatum based on the larger number of longitudinal ridges in the latter (10-12 distinguished from 4-8) and slightly longer trailing flagellum (twice length of body instead of slightly longer than length of body). Further investigation may clarify the matter.

The conical siphon or gullet, with a rod apparatus, running the length of the cells is a diagnostic character of the entire genus, but careful observation is required to see it. Knox: fountain of Knoxville Waterworks fish pool 25 July 1949 #1576 - swampy area on Univ. Tenn. farm near hwy U.S. 411 1 Aug. 1949 #1596 - culture in Univ. Tenn. botanical laboratory 1 Aug. 1949 #1604 - plankton from pond at Carter's Mill 2 Aug. 1949 #1628 - Davidson: fish pool by Vanderbilt University greenhouse 17 March 1950 #2060 - Montgomery: ditch by junction of hwy U.S.79 and Fosters Cave Road at W. C. Austin's farm 18 March 1950 #2080 - pond by hwy U.S. 41 alt near Ringgold 18 March 1950 #2082.

EUGLENAMORPHA Wenrich 1923

Euglenamorpha Hegneri Wenrich. (Smith f) Pl. 30, Fig. 3.

Cells quite metabolic, the shape changing considerably; many granules present, presumably paramylum; gullet quite distinct; three flagella give the genus its most distinctive character. There is doubt about both of the cases reported here, one a colorless cell, the other green. Neither came from the reported endozoic habitat, the intestinal tract of Rana tadpoles. However, they were found in frog infested waters. Furthermore, no stigma was observed. Knox: old concrete reservoir at Neubert's Springs 20 July 1949 #1529 - Weakley: pond by hwy Tenn.22 at Gardner Station 8 July 1949 #1213.

EUGLENOPSIS Klebs 1892

The cells of this genus are spindle-shaped, uniflagellated, and colorless. The best genus character is the excentric insertion of the rather long flagellum.

The characters of the genus are hereby modified to the extent that the cells of this species are decidedly metabolic instead of being only slightly so.

1. Cells decidedly metabolic, L 12-15u;
   W 7-12u........................ E. minor Silva
1. Cells scarcely metabolic, L 21-30u;
   W 7-10u........................ E. vorax Klebs

1. Euglenopsis minor sp. nov. Pl. 32, Fig. 5.

Cells fairly metabolic; shape normally fusiform, but becoming subspherical or oval in metaboly, short posterior point may be evident even in the subspherical shape; spiral striations of periplast not visible, perhaps present; large round paramylum bodies present; excentrically placed flagellum, about two times length of body. L 12-15u; W 7-12u. The species is somewhat metabolic and much smaller than E. vorax Klebs, the only other species.

2. Euglenopsis vorax Klebs. (Pascher & Lemmermann f) (Smith f)

Cells slightly metabolic; spindle-shaped; delicate spiral striae of periplast sometimes visible; small cytostome present near flagellar insertion; nucleus central; round paramylum bodies often accumulated in quantity; flagellum single, length greater than that of body. L 21-30u; W 7-10u.

HETERONEMA Dujardin 1841

The distinguishing characters of this genus are its two structually different flagella and its pronounced metaboly. If Lackey's observations, however, are correct in noting that *Peranema* has a second flagellum the line between the two genera becomes obscure. The two genera certainly are quite closely related.

Since all the *Heteronema* species observed in the region of this study are new, some previously described ones are included in the key for purposes of comparison.

* species not included in text

1. Cells with spiral ridges, 5-6 turns visible, giving a screw shape, swimming flagellum twice length of body, trailing 3/4 of length, L 42u; W 24-30u........................ *H. spirale* Klebs*
1. Cells without spiral ridges............................ 2
   2. Cell periplast smooth or with very delicate spiral striations.......................... 3
   2. Periplast distinctly spirally striate.. 8
3. Posterior end of cells rounded........................ 4
3. Posterior end pointed, cells straight, swimming flagellum length of body, trailing $1\frac{1}{2}$-2 lengths, L 17u; W 2.5-3u...................... *H. acus* (Ehr.)Stein*

4. Cells sigmoid, swimming flagellum longer than body, trailing ½ as long as the body......... *H. tremulum* Zach.*

4. Cells straight.................................... 5

5. Cells spindle-shaped, swimming flagellum longer than body, L 45-50u; W 8-10u................... *H. acus* (Ehr.)Stein*

5. Cells not spindle-shaped.......................... 6

6. Cells elongate-oval in shape, flagellum bifurcate, L 28u................ .... *H. bifurcatum* Silva

6. Cells smaller or larger, flagellum not bifurcate.................................. 7

7. Cell length 12-16u, shape long oval........... .... *H. longiovalis* Silva

7. Cell length 40-70u...... *H. nebuloglabra* Silva

8. Trailing flagellum shorter than body, L 40-57u; W 10-30u.................. .... *H. nebulosa* (Duj.)Klebs*

8. Trailing flagellum longer than body, L 39u............. *H. globiferum* Stein*

1. *Heteronema bifurcata* sp. nov. Pl. 32, Fig. 6.

Considerably metabolic; shape elongate-oval or cylindric, sometimes slightly curved when swimming; periplast apparently smooth; heavier flagellum extending forward 1 2/3 lengths of body and definitely bifurcate at tip, insertion of flagella in gullet, similar to Peranema tricho-phora (Ehr.)Stein. L 28u; W 10u. Knox: in quiet water of pond at Carter's Mill 2 Aug. 1949 #1615.

2. Heteronema longiovalis sp. nov. Pl. 32, Fig. 7.

Elongate-ovoid with broadest portion posterior; periplast apparently smooth; longer, heavier flagellum extending forward about 1½ lengths of body, secondary, thinner flagellum trailing, about half length of body. L 12-16u; W 6u. Knox: goldfish pool at Knoxville Waterworks 25 July 1949 #1581.

3. Heteronema nebuloglabra sp. nov. Pl. 32, Figs. 10,11.

Highly metabolic; shape varying from fusiform to demi-john-shaped, or ovoid, broadest portion anterior, truncated or obtusely pointed posterior, anterior tapering abruptly to the base of the gradually tapering hyaline neck portion; numerous irregular paramylum granules of various sizes present; periplast apparently smooth; heavier flagellum extending straight forward about length of body, thinner flagellum shorter than body; nucleus large, anterior, lateral; at least one posterior contractile vacuole present. L 40-70u; W 20-30u. The resemblance of the species to H. nebulosa (Duj.)Lemm. is great, the only convincing difference being the definite spiral striation of H. nebulosa. Some of the cells observed were definitely green, completely upsetting the writer's ideas of the entire group, but subsequent observations showed that individuals may be colorless as well, so the color possibly was a result of ingested green matter. Tennessee: common culture from collections made during summer of 1949 7 March 1950 #2223.

JENNINGSIA Schaeffer 1918

Jenningsia diatomophaga Schaef. (Smith f) Pl. 32, Fig. 8.

Colorless; highly metabolic; shape cylindric or ovoid; periplast spirally striate with movable club-shaped appendages 1-2u long; single strong flagellum slightly shorter than length of body; pharyngeal rod apparatus composed of two rods and a short curved trichite; paramylum bodies ring-shaped, discoid, or spherical. L 180-260u; W about 40u. Inasmuch as this flagellate is known only from the original description, and did not reappear during the present study, the writer's conclusions about its classification are neccessarily derived from Schaeffer's paper, and from comparisons with the more careful studies of Peranema. Criteria employed to separate the two are the presence of "several" pharyngeal rods, ring-shaped paramylum bodies, the striae or short hair-like appendages, and the specific selection of diatoms for food. Of these, only the ring-shaped paramylum bodies seem to be in contrast with the comparable structure in Peranema, but discoid and spherical particles are present in both. "Several" pharyngeal rods are not shown by Schaeffer's drawing, instead there is a third rod, and a trichite of the type also found occasionally in other colorless flagellates. The hair-like appendinge on the periplast is somewhat different than those recorded for most *Peranema*, but the analogy with the diversity of periplast ornamentation in *Euglena* should minimize the importance of this character. The diet of diatoms is also found among individuals of *Peranema*(?) (numbers 1262-82) which were identified as *Jenningsia* at the time on that account, but are far too small for the limits described for *Jenningsia diatomophaga*.

While there is no apparent reason for the retention of *Jenningsia* as a genus separate from *Peranema* the writer feels that it would be unwise to relegate a name to synonymy without first observing the actual specimens on which it is based.

Knox: Lonsdale marshes Feb. and March 1918[1] - Obion: plankton at Spillway Bridge 10 July 1949 #1262 - field embayment at south end of Isom Lake 10 July 1949 #1282.

MENOIDIUM Perty 1852

Species of this genus exhibit rigid, uniflagellated, colorless cells. Longitudinal ridging may or may not be present, and the pharyngeal rod apparatus is said to be absent.

The key below includes the species treated by Lemmermann as well as those identified and described here in the text.

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1 Reported in Schaeffer, 1918

*species not included in text

1. Cells straight or slightly curved.................... 3
1. Cells sickle-shaped or sigmoid....................... 2
   2. Cells sickle-shaped, with sharp posterior end (L 120u; W 14u)............... .... *M. falcatum* Zach.*
   2. Cells sigmoid, L 42-78u; W 5-10u................. *M. tortuosum* Stokes
3. (L 30-40u; W 7-10u) flagellum little more than half length of body................. .... *M. pellucidum* Perty
3. (L 16-25u; W 7-8u) flagellum about length of body....... *M. incurvum* (Fres.)Klebs

1. *Menoidium incurvum* (Fres.)Klebs. (Pascher & Lemmermann f) (Smith f)

Cells rigid; cylindric-oval in shape, both ends broadly rounded; periplast longitudinally striated with broadly placed rows; contractile vacuole in posterior portion of cells; flagellum length of body. L 16-25u; W 7-8u. The specimen cited here was definitely not curved, but otherwise was quite close to the descriptions of the species. Knox: at margin of stagnant pond by Riverside Drive east of Knoxville Waterworks 25 July 1949 #1586. NK.

2. *Menoidium pellucidum* Perty. (Pascher & Lemmermann f) (Smith f)(Walton f) Pl. 32, Fig. 9.

Cells rigid; body cylindric-elliptic in shape, with conically rounded ends, may be curved, as in *M. incurvum*, anteriorly tapered to a sort of extended nose; flagellum length little more than half that of body. L 30-40u; W 7-10u. This specimen here did not exhibit the nose-like development of the anterior end, but was rounded on both ends. The identification was made chiefly on the basis of longer proportion and shorter flagellum than *M. incurvum*. Knox: fountain of fish pool at Knoxville Waterworks 25 July 1949 #1576.

3. *Menoidium tortuosum* Stokes. (Pascher & Lemmermann f) (Walton)

Cells essentially rigid; sigmoid; nucleus central; paramylum granules elongated; flagellum about half length of body. L 42-78u; W 5-10u. Knox: in gold fish pool at Knoxville Waterworks 25 July 1949 #1575.

MONOMASTIX Scherffel 1912

Monomastix opisthostigma Scherffel. (Pascher & Lemmermann f) (Smith f) Pl. 32, Fig. 12.

Cells slightly metabolic; cylindric-elliptic, pyriform or becoming lunate in metaboly; two lateral chromatophores with a pyrenoid each; eyes ot round and located toward the posterior of the cell; flagellum somewhat longer than body. L 6-22u; W 3-8u. The cyst formed by the species is spherical and has a crenate outline in polar view, and a reticulate surface. It is about 8u in diameter. Knox: very shallow pool in pond at Carter's Mill 2 Aug. 1949 #1616.

PERANEMA Dujardin 1841

Organisms belonging to this genus are among the most common inhabitants of stagnant water, or rather in water rich in organic content. A great number of individuals were observed during this study and their diversity supports Conn's forty-five year old suggestion that the extreme variation of forms of Peranema indicates several species of the genus. Or, rather, the writer would modify the suggestion, by stating his opinion that the common "Peranema trichophora" is a species complex of intergrading forms. On the basis of size, there are at least two races, the smaller 24-30u long and the larger 40-45u long. Admittedly without any pretense at statistical analysis, it appeared to the writer that the sum of observations indicate high "frequencies" or maxima in a size frequency curve in the particular ranges mentioned above. There were indeed individuals outside these ranges, such as those 36u and 51u long. Lackey, 1933 observed specimens up to over 70u, with some attaining 90u in length. Proportions do not vary materially, but there are some differences in the shape of the posterior ends.

Peranema trichophora (Ehr.)Stein. (Pascher & Lemmermann f) (Prescott f)(Smith f) Pl. 32, Fig. 13.

Cells colorless; highly metabolic; shape cylindric-conical, tapered toward the anterior and truncate or rounded posteriorly; irregular paramylum bodies usually present in greater or lesser amount; periplast described as being spirally striate (but may be smooth as well in some of the forms included here), the rows of striae are said to consist of short hairs; swimming flagellum length of body to 1½ times length. L 22-70u; W 12-20u.

Lackey reports a second flagellum, which the writer failed to notice. If present, the relationship between Peranema and Heteronema becomes obvious.

Hamilton: winter pond of long duration in cultivated field by hwy Tenn.58 in northern part of county 28 June 1949 #977 - Middle Tenn.: Duck River 1938-9[1] - Obion: field embayment of Isom Lake 10 July 1949 #1281 - and innumerable collections from still waters throughout the area including collection numbers 1137, 1196, 1211, 1240, 1334, 1357, 1421, 1507, 1545, 1548, 1558, 1566, 1586, 1596, 1763, 1791, 1799, 1854, 1858, 2060, and 2156.

PETALOMONAS Stein 1859

As in Scytomonas, the cells of this genus are uniflagellate and rigid, but they differ from those of Scytomonas by being somewhat flattened and asymmetrical. The nucleus is often to the left side of the cell in dorsal view. There is a tendency toward an ovoid shape in broad side (dorsal or ventral) view.

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1 Reported in Lackey, 1942

* species not included in text

1. Longitudinal ridge or ridges present on cells.. 2
1. Cells without longitudinal ridges.................... 3
   2. Single longitudinal dorsal ridge, L 23u..................... P. carinata Francé
   2. More than one ridge present, L 12-28u............. P. abscissa (Duj.)Stein
3. Cells with six curled or curved appendages on posterior end, general cell outline oval, flagellum twice length of body, L 27-30u; W 21-23u.. P. sexlobata Klebs*
3. Cells lacking posterior appendages.................. 4
   4. Longitudinal furrows present on dorsal and ventral sides, L 22-28u................. P. mediocanellata Stein
   4. Furrow present only on ventral side, L 14-23u..... P. angusta (Klebs)Lemm.

1. Petalomonas abscissa (Duj.)Stein. (Pascher & Lemmermann f) (Smith f)

Cells rigid; broad side view shaped asymmetrically ovoid with sharp anterior end broadly rounded posterior, cross section roughly elliptic with convex ventral surface, dorsal surface with 2-3 ridges. L 12-28u; W 8-17u.

The varieties of Klebs which are included by Lemmermann are:

v. convergens Klebs. Cell anterior pointed, posterior emarginate, with ridges converging anteriorly. L 19u; W 17u.

v. parallela Klebs. Cells rounded anteriorly and emarginate posteriorly, with ridges parallel and unequal. L 30u; W 17u.

v. deformis Klebs. Cell anterior pointed, posterior truncate, three parallel ridges on dorsal surface. L 22u; W 11u. Jefferson: permanent pond near junction of hwy U.S.11-E and Cherokee Dam approach road 25 June 1949 #910 - Knox: fish pool at Knoxville Waterworks 25 July 1949 #1575 - swampy area on Univ. Tenn. farm near hwy. U.S.411 1 Aug. 1949 #1596-7.

2. Petalomonas angusta (Klebs)Lemm. (Pascher & Lemmermann f) (Walton f) Pl. 32, Fig. 14.

Cells rigid; shape of broad side view elongated ovoid, anterior conically tapered, posterior broadly rounded, in cross section ventral surface nearly flat, slightly convex, ventral surface convex with single median longitudinal furrow; flagellum length of body. L 14-23u; W 7-14u. Number 2056 falls short of exact correspondence with the description by being broadly, rather than narrowly, ovoid, but the other features agree better here than with P. mediocanellata Stein. L 16u; W 10u here only, recorded previously as L 14-23u; W 7-14u. Cumberland: rain pool in grass by hwy U.S.70-N in front of New Salem Baptist Church 16 March 1950 #2056.

3. *Petalomonas carinata* Francé. (Pascher & Lemmermann f) (Walton f)

Cells rigid; shape elongated ovoid, both ends rounded, posterior broader, dorsal longitudinal keel formed by broad membranous fold rolled toward the right; vacuoles and nucleus on median line of cell L 23u; W about 13u. K.

4. *Petalomonas mediocanellata* Stein. (Pascher & Lemmermann f)(Walton f)

Cells rigid; shape broadly ovoid, anterior conically tapering, posterior broadly rounded; narrow longitudinal furrow on dorsal surface, wider one on ventral surface; flagellum length of body. L 20-25u; W 14-19u. Proportions alone are not sufficient characters for the assignment of specimens to this species, since such individuals as number 2056 attain the proportions of *P. mediocanellata*, but may be assigned to *P. angustata* because of the lack of a dorsal furrow. Montgomery: marsh pond just west of New Providence 13 July 1949 #1365 - Henry: Kentucky Dam Lake (Old Tennessee River) at Paris Landing 13 July 1949 #1357. K.

SCYTOMONAS Stein 1883

This genus is like *Petalomonas* in that the cells are rigid, uniflagellated and lacking in chromoplasts, however here there is no dorso-ventral compression or longitudinal furrowing or ridging. The flagellum insertion is reminescent of *Peranema*, being turned and slightly swollen at the base.

* species not in text

1. Cells ovoid or fusiform, L 7.5-20u;
   W 7-8u, flagellum about 1¼ times
   length of body................ <u>S.</u> <u>pusilla</u> Stein*
1. Cells shaped otherwise............................... 2
   2. Cells very narrowly oval, L 24-30u;
      W 6-7u...................... <u>S.</u> <u>stene</u> Silva
   2. Cell broader, oval................................ 3
3. Cells about L 20u; W 8u. <u>S.</u> <u>major</u> (Berl.)Lemm.
3. Cells about L 50u; W 20u....... <u>S.</u> <u>ovale</u> Silva

Subsequent observations may show that the last two species of the key are the same, but at present they seem to be clearly separable.

1. <u>Scytomonas</u> <u>major</u> (Berl.)Lemm. (Pascher & Lemmerman f)

Cells oval-shaped with rounded ends; flagellum is described as 1¼ times the body in length, but is 1½ times here; length described as 20u but it was only 14u here. The identification may be at fault. Montgomery: hog pond with willows etc. just north of Hazelwood 18 March 1950 #2095.

2. <u>Scytomonas</u> <u>ovale</u> sp. nov. Pl. 32, Fig. 16.

Cells colorless and ametabolic; broad side view oval-shaped with somewhat tapered rounded ends; no longitudinal ridges or striae apparent; small paramylum granules present; contractile vacuole not observed; flagellum of slightly longer than body length to 1⅓ times length of body. L 50u; W 20u. The appearance is similar to <u>Scytomonas</u> <u>stene</u> Silva, and the flagellum is inserted as in <u>Peranema</u> <u>trichophora</u> i.e. through a gullet and curved to one side. Tennessee: common culture of material collected in summer of 1949 7 March 1950 #2224.

3. <u>Scytomonas</u> <u>stene</u> sp. nov. Pl. 32, Fig. 15.

Cells colorless and ametabolic; essentially round or oval in cross section. Shape very long oval with rounded ends, no longitudinal ridges or striae apparent; minute paramylum granules present; contractile vacuole not observed; flagellum length of body or longer. L 24-30u; W 4-5u. Montgomery: woods pond east of Shady Grove 3 Sept. 1949 #1910 (Clebsch).

SPHENOMONAS Stein 1878

<u>Sphenomonas</u> <u>quadrangularis</u> Stein. (Pascher & Lemmermann f) (Smith f) Pl. 32, Fig. 17.

Cells rigid; shape broadly fusiform, or largest part posterior, cross section compressed quadrangular or pentagonal; primary flagellum length of body or slightly longer, secondary flagellum very short; nucleus posterior. Cells L 20-40u; W 8u. The most obvious distinction between this species and <u>Anisonema</u> spp. is the angular cross-section, although the difference is not a fundamental one. Another possible difference is the rigidity of <u>Sphenomonas</u>, and the presence of some degree of metaboly in <u>Anisonema</u>. The relation between the two genera should be examined further. Knox: fish pond at Knoxville Waterworks 25 July 1949 #1575.

PYRRHOPHYTA

Cryptophyceae

Cryptomonadales

Cryptomonadaceae

CRYPTOCHRYSIS Pascher 1911

Cryptochrysis commutata Pasch. (Pascher & Lemmermann f) Pl. 32, Fig. 19.

Shape described as almost bean-like, but is generally oval, but bilobed at the anterior end, one lobe protruding beyond the other, furrow narrow and linear; two folded parietal golden brown chromoplasts are described but as many as four seem to be present here. L 19-28u; W 10-12u here only, but recorded as L 15-20u; W 6-10u. The cells here have a longitudinal furrow similar to that of Cryptomonas spp. but narrower. Lumpkin (Ga.): artificial lake in Vogel State Park 14 Aug. 1949 #1736 - Tennessee: common culture from materials collected summer, 1949 7 March 1950 #2224.

CRYPTOMONAS Ehrenberg 1831

The golden brown chromoplasts are a surprisingly good field character for this genus and closely related Cryptomonads. In Pascher's classification the genus is further distinguished by the well developed V-shaped groove, running from the anterior end backward.

1. Cell furrow scarcely reaching from anterior to midregion of cell... C. erosa Ehr.
1. Cell furrow reaching 2/3 of way to posterior end................ C. ovata Ehr.

1. Cryptomonas erosa Ehr. (Pascher & Lemmermann f)(Prescott f)

Cell shape obovoid to somewhat elliptic, one side of anterior protruding beyond other; two golden brown, green, blue-green or reddish chromoplasts are present, the golden brown color being quite distinctive; flagella of unequal length, the longer about 2/3 the length of the body. L 15-32u; W 8-16u. Cumberland: rain puddle by hwy U.S.70-N in front of New Salem Baptist Church 16 March 1950 #2056 - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Montgomery: hog wallow with willows etc. north of Hazelwood 18 March 1950 #2095. NK.

2. Cryptomonas ovata Ehr. (Pascher & Lemmermann f)(Fritsch I f) Pl. 32, Fig. 18.

Cells obovoid or oval, ends broadly rounded, with one side of anterior protruding beyond other; two or three longitudinally arranged chromatophores running full length of cell; fairly small difference in flagella length, the longest being about 3/4 the length of the body. L 20-80u; W 6-20u. Cumberland: cultured from collection in rather swift stream at Ozone 16 March 1950 #2053 - Middle Tenn.:

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1 Reported in Lackey, 1942

Cumberland and Duck Rivers 1938-9[1]. NK.

RHODOMONAS Karsten 1898

Rhodomonas lacustris Pasch. & Rutt. (Pascher & Lemmermann f) Pl. 32, Fig. 20.

Cells rigid; shape obovoid, bilobed at the anterior end, one lobe protruding ahead of other; chromoplast single, rather massive, or a parietal plate, with large pyrenoid, colored red or wine, the pigment being water soluble; furrow a narrow groove; two unequal flagella present. L 10-13u; W 5-8u. The single reddish chromoplast differentiates this genus from closely related ones. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

Dinophyceae

Dinococcales

While the dinoflagellates exhibiting an immobile state which is of some duration and displaying a morphologically distinct structure from the motile state are included in a separate order here, it should be kept in mind that the relationship with the motile forms is close and Schilling, in Pascher, 1913 includes Cystodinium in the Glenodiniaceae group.

Cystodiniaceae

CYSTODINIUM Klebs 1912

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1 Reported in Lackey, 1942

Cystodinium bataviense Klebs. (Thompson 49 f) Pl. 33, Fig. 1.

Shape broadly lunate or asymmetrically fusiform with very short thick polar horns; color is golden brown to chocolate, localized in numerous spindle-shaped or irregular chromatophores. L 55-170u; W 36-60u.

The original description mentions two zoospores per cell, but both Thompson's Maryland material and this shows that either one or two gymnodinoid cells are formed within the body. Thompson observed, however, that the daughter cells never became flagellated.

The definite clumping of cells apparent in the Tennessee material is not surprising in light of Thompson's observation that mother cell walls disintegrate to a sticky jelly. Vegetative cells are smaller then reproducing ones. Haywood: slough by hwy U.S.70 near Brownsville 30 June 1949 #1096-7.

Dinastridiaceae

DINASTRIDIUM Pascher 1927

Dinastridium sexangulare Pascher. (Fritsch I f)(Smith f) Pl. 33, Fig. 2.

This species is irregularly hexangular in outlines with simple or bifurcate horns at the angles; color and chromatophores are typical for most dinoflagellates. Diameter 40u.

Number 1854 and 1858 differed from the available figures in that the horns are much stubbier. However, the appearance is not too different from the daughter cells shown in published illustrations.

Robertson: plankton from pond near woods a mile south of Cedar Hill by U.S.41 20 Aug. 1949 #1854 - wet ground of gum swamp 20 Aug. 1949 #1858.

Gymnodiniales

Gymnodiniaceae

Included in the family are the naked dinoflagellates, with preponderantly motile habits and no armor plating.

Gymnodinium and Hemidinium are distinguished from each other by their transverse groove which, in the former entirely circles the cell, but furrows only half the cell in the latter.

GYMNODINIUM Stein 1883

1. Shape of cells oval, edges of transverse groove flaring, chromoplasts blue, L 25-35u; W 18-20u. *G. limneticum* Lackey
1. No blue chromoplasts present, size smaller or larger.................................. 2
   2. Ends of cells markedly different, upper (epicone) elongated conical, lower (hypocone) short, flatly truncate, L 44u; W 24-37.5u................ .... *G. palustre* Schill.

2. Ends of cells similar in shape,
although they may differ in size............... 3

3. Cell broadly ovoid in shape, lower part (hypocone) smaller than upper, (epicone), groove edges without a flaring lip, L 32-45u; W 25-30u............... .... *G. neglectum* (Schill.)Lind.

3. Cell shape oval, dorsi-ventrally flattened, lower part of cell slightly smaller than upper part, L 12-15u; W 11-13u...................... *G. ordinatum* Skuja

1. *Gymnodinium limneticum* Lackey. (Lackey 36 f)

Cells regularly oval in outline from side view, almost reniform in end view, lower part of cell (hypocone) somewhat larger than upper part (epicone); transverse furrow wide deep and not descending, longitudinal furrow in lower part only, not extending into upper part; large oval sub-central nucleus in hypocone; 8-12 oval-shaped discoid chromatophores present; trailing flagellum about 1½ times length of body. L 25-35u; W 12-20u. Obion - Lake: Reelfoot Lake, as the most common dinoflagellate September 1935.[1]

2. *Gymnodinium neglectum* (Schill.)Lind. (Eddy f)(Schilling f) (Thompson, 47 f) Pl. 33, Fig. 3.

Shape broadly ovoid and very slightly flattened dorso-

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1 Reported in Lackey, 1936

ventrally; transverse furrow slightly below middle and descending to left; longitudinal furrow extending only into lower part, possibly to the lower apex (antapical end); wall composed of numerous small, nearly perfectly hexagonal plates (see Thompson 47 f); eyespot located in transverse furrow; color yellow-brown to dark brown. L 32-35u; rarely 45u; W 25-30u. Knox: road puddle near Carter's Mill 2 Aug. 1949 #1806 - Montgomery: woods pond east of Shady Grove 3 Sept. 1949 #1910.

3. Gymnodinium ordinatum Skuja. (Thompson 47 f)

Cells oval-shaped in broad side view, dorso-ventrally flattened; transverse furrow slightly below middle of cell, longitudinal furrow in lower part only (hypocone); trailing flagellum twice length of body; yellow-brown to olive-brown in color, localized in four chromatophores; no eyespot. L 12-15u; W 10-13u. Polk: spring water ditch by hwy U.S.64 near Ocoee Dam #3 14 Aug. 1949 #1762.

4. Gymnodinium palustre Schill. (Schilling f)(Smith f)

Cells oblong-ovoid with lower part (hypocone) shorter and quite truncate, the upper part (epicone) more elongate, tapered and rounded at the end; transverse furrow fairly long and not descending, the hypocone edge forming a sort of lip around it, longitudinal furrow shallow and extending slightly into epicone and hypocone of the cell; color yellow to dark brown. L 40-44u; W 24-37.5u. Blount: plankton from river by Peery Bros. Mill at Walland 19 June 1949 #863.

HEMIDINIUM Stein 1883

<u>Hemidinium</u> <u>nasutum</u> Stein. (Schilling f)(Prescott f)(Smith f)
Pl. 33, Fig. 4.

Cell outline elliptic; flatter on one side than the other, dorso-ventrally flattened; transverse furrow about half way circling the cell, descending to the left and to the posterior margin; chromoplasts yellow-brown; trailing flagellum 1¾-2 times length of body. L 24-32u; W 15-22u. Montgomery: woods swamp by Hwy U.S.41 near Kentucky state line 18 March 1950 #2099.

Peridiniales

This order includes the armored dinoflagellates. Plates of <u>Glenodinium</u>, however, are often so difficult to discern that the genus was grouped with the unarmored dinoflagellates for a long time.

Glenodiniaceae

GLENODINIUM Stein 1883

The genus includes those forms with a very delicate armor in which plates are present but often distinguished only with difficulty.

1. Longitudinal furrow confined to lower
   part (hypocone) of cell, L 40u; W 35u.........
   .... <u>G.</u> <u>gymnodinium</u> Penard
1. Longitudinal furrow extending some-

what into both halves of cell.......................... 2

2. Cells broadly oval or sub-spherical, both ends broadly rounded, no spines on plates, L equal to W, 20-25u.................... *G. oculatum* Stein

2. Cells ovoid, spines present on lower plates of hypocone, L 31-38u; W 27-31u. *G. quadridens* (Stein)Schill.

1. *Glenodinium gymnodinium* Penard. (Schilling f)(Prescott f)

Cells are typically oval-shaped, but are often broadly elliptic, considerably flattened dorso-ventrally, concave on ventral surface, convex on dorsal; transverse furrow slightly spiralled downward, longitudinal furrow confined to lower part (hypocone) extending to antapical pole; chromatophores yellowish-brown; trailing flagellum about length of body. L 40u; W 35u. Obion - Lake: Reelfoot Lake 1929[1] - Lake: sloughs by hwy Tenn.78 near Kentucky state line 5 July 1949 #1192.

2. *Glenodinium oculatum* Stein. (Eddy f)(Schilling f) Pl. 33, Fig. 5.

Cells oval-shaped, with broadly rounded ends, somewhat flattened on ventral side, poles about equal in size; transverse furrow around middle of cell, longitudinal furrow extending only into lower part (hypocone), possibly to lower

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1 Reported in Eddy, 1930

apex (antapical pole); color brown; trailing flagellum about 1½ times length of body, L equal to W, 20-25u.

Number 1193, which is figured, shows a cyst and a motile cell being released from a cyst. The slightly atypical shape of the cell may be due to the juvenile condition of the cell, or possibly the identification is at fault. Montgomery: woods pond east of Warfield, 13 miles southeast of Clarksville 10 Sept. 1949 #1923 - Weakley: plankton in large spring four miles north of Gardner Station 8 July 1949 #1221 - Lake: sloughs by hwy Tenn. 78 near Kentucky state line 5 July 1949 #1193.

3. Glenodinium quadridens (Stein)Schiller. (Thompson 47 f) Pl. 33, Fig. 7.

Cells ovoid-shaped, somewhat flattened dorso-ventrally; upper part (epicone) conical, lower part bluntly rounded; lower plates sometimes with single spines; transverse furrow slightly descending; longitudinal furrow extending into both upper (epicone) and lower (hypocone) parts, being unusually broad in lower part and reaching lower apex (antapical pole). L 31-38u; W 27-31u. Middle Tenn.: Duck River 1938-9[1] - Knox: embayment of Ft. Loudon Lake at Blue Grass 20 July 1949 #1566.

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1 Reported in Lackey, 1942

Heterodiniaceae (Ceratiaceae)

CERATIUM Schrank 1793

Ceratium hirundinella (O. F. M.)Schrank. (Prescott f) (Smith f) Pl. 33, Fig. 9.

The asymmetry and long horns of the cells distinguish this dinoflagellate; the anterior valve (epicone) is extended into a single very long horn, and there are three shorter, stouter horns in the posterior valve (hypocone). The ornamentation is usually easily discernible, the plates being areolate (with holes or compartments), the margins of the plates with many short, sharp points. L 95-400u. Davidson: concrete pools of Kelly's Kennels near Nashville 20 Aug. 1949 #1827 - Obion: plankton from slough near Spillway 5 July 1949 #1186 - Obion: Reelfoot Lake 1929.[1] N.

Peridiniaceae

GONYAULAX Diesing 1866

Gonyaulax palustris Lemm. (Prescott f)(Smith f) Pl. 33, Fig. 8.

Gonyaulax is separated from *Peridinium* by its single, rather than two, antapical plates.

Cells almost spherical in shape, with rounded or flattened posterior (antapical) pole; transverse furrow broad, descending by half its width down to the left; longi-

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1 Reported in Eddy, 1930

tudinal furrow extending slightly into upper part (epicone) and 2/3 way into lower part (hypocone); stigma not present. L equal to W 27-34u. Knox: Fountain City Lake 12 July 1938 (Bold)unnumbered[1] - Gibson - Obion: plankton from lower pond fertilized for fish raising on Abe Shatz' farm east of Kenton 8 July 1949 #1243.

PERIDINIUM Ehrenberg 1830

This genus is probably the most frequently observed of the dinoflagellates, although, in quantity, it rarely matches the huge "blooms" known for Ceratium hirundinella. The armor plate is well developed here, the plates smooth or areolate and the sutures plain or transversely striate. Its shape is far more symmetrical than that of Ceratium.

If Gonyaulax is separated, the separation is made on the basis of the two antapical plates in Peridinium, a single one in Gonyaulax.

1. Cell shape ovoid, upper part (epicone) large and conical, lower part (hypocone) smaller and broadly rounded, L 18-24u; W 13-20u.... P. pusillum (Penard)Lemm.
1. Cells larger, two parts not differing as greatly in shape, though they differ in size.. 2
    2. Plates especially around poles,

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1 Reported in Silva, 1949

displaying a comb or spines, L equal to W, 50-70u... P. Willei Huitf.-Kass

2. Plates of armor (theca) undecorated by combs or small spines, L equal to W, 45-60u................ P. cinctum Ehr.

1. Peridinium cinctum Ehr. (Prescott f)(Schilling f)

Cells spherical or oval in shape, upper part (epicone) slightly larger than lower (hypocone); transverse furrow broad, lipped on both margins, descending to the left about width of furrow, longitudinal furrow extending a short way into upper part and to lower apex (antapical pole); plates quite distinctly areolate, sutures between them wide and transversely striated. L equal to W, 45-60u. Lawrence: swamp (pH 5.0) containing considerable number of aquatic plants by hwy U.S.64 near Lawrenceburg 29 June 1949 #1062 - Henry: gravel pit by hwy U.S.79 east of Paris near landing 13 July 1949 #1351 - Obion - Lake: Reelfoot Lake 1929.[1] NSGF.

2. Peridinium pusillum (Penard)Lemm. (Prescott f)(Schilling f)

Cells ovoid-shaped, upper end (epicone) larger and conical, lower (hypocone) broadly rounded; transverse furrow almost horizontal, longitudinal furrow extends very slightly into epicone and quite broadly to antapical pole; color yellow-green. L 18-24u; W 13-20u.

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1 Reported in Eddy, 1930

Number 1566 differs from typical descriptions in certain details, possibly due to faulty observation. The apical plate visible in dorsal view is pointed rather than slightly convex and tapers to a point between the visible precingular plates rather than being truncate.

Knox: Ft. Loudon Lake backwater into Seven Springs branch at Blue Grass 23 July 1949 #1566 - Moore: mill pond at Cumberland Springs 29 June 1949 #1096 - Lawrence: swamp containing several aquatic plants (pH 5.0) by hwy U.S.64 near Lawrenceburg 29 June 1949 #1062.

[illegible]. <u>Peridinium</u> <u>Willei</u> Huitf.-Kass. (Prescott f)(Schilling f) Pl. 33, Fig. 6.

Broadest side of cell roughly circular in shape, slightly depressed (but see comment on number 2096 etc.), upper part (epicone) somewhat more rounded than depressed, lower part (hypocone); transverse furrow wide with rimmed edges, descending a little more than its width, longitudinal furrow extending slightly into epicone but quite broad and reaching the antapical pole; color brown. L equal to W, 50-70u.

Numbers 2020 and 2098 at first seemed different from this species. They are markedly compressed, being only 20u thick, and the furrow arrangement does not agree in detail with available illustrations. Furthermore, the drawing was made of a "left-handed" specimen, whereas all previously published drawings seem to be of "right-handed" individuals. Furthermore, the proportions are slightly different from those published, being actually wider than long. L 60u; W 30u.

Madison(N.C.): mill run at junction of hwys U.S.25 & U.S.70 and N.C.208 near Hot Springs 26 Sept. 1949 (Iltis)#2020 - Montgomery: field pond near Meriwether 18 March 1950 #2098 - Obion - Lake: Reelfoot Lake 1929.[1]

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1 Reported in Eddy, 1930

CHRYSOPHYTA

Xanthophyceae

Heterococcales

Chlorobotryaceae

CHLOROBOTRYS Bohlin 1901

The spherical or sub-spherical cells of this genus are bunched in a colony of from two to sixteen or more cells and surrounded by a homogeneous gelatinous sheath. The cell walls are impregnated with silica in two diatom-like overlapping sections, but this structure can be demonstrated only by diatom preparation technique, namely, boiling in acid. The iodine starch test gives a negative reaction here.

1. Cell diameter 12-27u.. C. regularis (West)Bohlin
1. Cell diameter 7-8u... C. neglecta Pasch. & Geit.

1. Chlorobotrys neglecta Pasch. & Geit. (Pascher, Schiller & Migula f) Pl. 34, Fig. 1.

Distinguished from C. regularis only by the smaller size and more oil globules or haematochrome granules. W 7-8u. Cherokee(N.C.): plankton from Hiwassee Lake near dam 14 Aug. 1949 #1743.

2. Chlorobotrys regularis (West)Bohlin. (Pascher, Schiller & Migula f)(Prescott f)(Smith f)

Cells spherical with 2-5 parietal chromatophores, one or two red oil drops and a fairly thick wall; several cells together in gelatinous matrix. W 12-27u. Anderson: plankton from Norris Lake near Andersonville Dock 30 Aug. 1949 #1868.

Chlorotheciaceae

CHARACIOPSIS Borzi 1895

This genus is the counterpart of the green *Characium*, and undoubtedly some specimens have been misplaced between them, so a starch test and search for oil globules is always advisable in determination, since a positive starch test indicates *Characium*, while a negative one and the presence of oil indicates *Characiopsis*.

The unicellular plants are sessile and, in these species, stalked. They contain yellow-green chromatophores without pyrenoids.

1. Long stalk, 3/4 as long as cell to length of cell, cell pyriform or oblanceolate.............. *C. pyriformis* Borzi
1. Stalk shorter.................................... 2
   2. Cell spherical to asymmetrically elliptic with short excentric stalk........ .... *C. gibba* Borzi
   2. Cell elliptic, about twice as long as broad.................... *C. teres* Pasch.

1. Characiopsis gibba Borzi. (Pascher, Schiller & Migula f) Pl. 34, Fig. 2.

Spherical to unsymmetrically elliptic, with short excentric gelatinous stalk; usually two chromatophores. Diameter 8-10u. Obion - Lake: on Oedogonium spp. in Blue Basin of Reelfoot Lake 13 July 1949 #1324.

2. Characiopsis pyriformis Borzi. (Pascher, Schiller & Migula f)(Prescott f) Pl. 34, Fig. 3.

Cells elliptic to obovate or oblanceolate, anterior pole rounded, lower pointed, tapering into gelatinous stalk; two to four large chromatophores. L 18-25u; W 5-10u. Both collections recorded differ in detail from the description found, number 1376 approaching an oblanceolate shape whereas it is described only as obovate, while number 1245 has a stalk as long as the cell, whereas it is described as only up to three-quarters length. Montgomery: on vegetable fragments in marshy pond by Hwy U.S. 79 at Norfleet's grocery 14 July 1949 - Obion: on vegetable fragments in stock pond by road near Mason Hall 8 July 1949 #1245.

3. Characiopsis teres Pasch. (Pascher, Schiller & Migula f) Pl. 34, Fig. 4.

Cells elliptic, length about twice width, both ends rounded; thin gelatinous stalk not tapering to base. L 20-27u; W 8-14u. Number 1220 differs from the description in size, being only 20 x 8u instead of the recorded minimum of 25 x 12u, and the stalk is shorter than the one-third cell length described. Weakley: scraped from barrel sunk in spring branch about four miles north of Gardner Station 8 July 1949 #1220.

Ophiocytiaceae

CENTRITRACTUS Lemmermann 1900

Centritractus belonophorus (Schm.)Lemm. (Fritsch I f)(Pascher, Schiller & Migula f)(Prescott f) Pl. 34, Fig. 9.

Cells oblong with pointed ends ending in extremely elongated stout sharp spines which are straight or slightly bent; the two halves of the cell wall fitting together at the center of the cell; chromatophores two to four, irregular yellow-green plates. L 8-15u; W 5-9u. Spines 20-50u. Middle Tenn.: Duck River 1938-9.[1]

OPHIOCYTIUM Naegeli 1849

The cells of these species are sessile, floating, or mixed with other algae, and solitary, or epiphytic to form dendroid colonies. They are unicellular and most species are elongated, cylindrical, or sausage-shaped. There are several chromatophores which are H-shaped at best development, but are generally difficult to discern.

1. Cells elongated, cylindrical, almost straight, epiphytic on each other in dendroid manner... O. arbusculum (A. Braun)Rab.

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1 Reported in Lackey, 1942

1. Curved, unattached cells.............................. 2
   2. Ends of cells spineless...................
      .... O. parvulum (Perty)A. Braun
   2. At least one end of cells with
      spines... 3
3. One end of cells with a spine.................
   .... O. cochleare A. Braun
3. Both ends of cells with a spine..............
   .... O. capitatum Wolle

1. Ophiocytium arbusculum (A. Braun)Rab. (Pascher, Schiller & Migula f)(Prescott f)(Smith f) Pl. 34, Fig. 5.

Cells elongated cylinders, attached by a short stalk, second or perhaps third generation bunching at apical end of preceding generation. L 20-100u; W 3-7u. Giles: in marshy stream by hwy U.S.64 10 miles of Pulaski 29 June 1949 #1060.

2. Ophiocytium capitatum Wolle. (Pascher, Schiller & Migula f)(Prescott f)(Smith f) Pl. 34, Fig. 6.

The cells of this species are elongated cylinders with rounded ends, straight curved or twisted; delicate spines at both ends. L 10-1000u; W 5-15u. Middle Tenn.: Duck River 1938-9.[1] NF.

3. Ophiocytium cochleare A. Braun. (Pascher, Schiller & Migula f)(Prescott f)(Smith f) Pl. 34, Fig. 7.

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1 Reported in Lackey, 1942

Cells elongated cylinders, straight, curved or contorted, with ends rounded; spine at one end only. L 10-500u; W 6-7u. Davidson: among filamentous algae in pool near Glen Echo Lake 19 Feb. 1939 (Bold)#B-3936[1] - Obion: among debris in slough west of Union City by hwy Tenn.5 1 July 1949 #1129. N.

4. Ophiocytium parvulum (Perty)A. Braun. (Pascher, Schiller & Migula f)(Prescott f)(Smith f) Pl. 34, Fig. 8.

Cells elongated cylinders, straight curved or contorted, with rounded ends; without end spines. L 10-1000u; W 3-15u but generally 4-5u. Obion: roadside marsh just west of Kenton on county road 2 July 1949 #1244. NFK.

Heterotrichales

Tribonemataceae

TRIBONEMA Derbes and Solier 1856

This genus contains the only common filamentous algae outside the Chlorophyta and a few diatoms. Whereas Tribonema is a conspicuous cold weather form in the north it can be found at any season of the year in Tennessee, but often filamentous greens are more conspicuous. The cells are cylindrical or barrel-shaped, their walls composed of H-shaped thickenings as is also the situation in Microspora. There are discoid parietal chromatophores.

1. Cells with two to four chromatophores........

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1 Reported in Silva, 1949

.... *T. minus* (Wille)Hazen

1. Cells with more than four chromatophores......

.... *T. bombycinum* (Ag.)Derb. & Sol.

1. *Tribonema bombycinum* (Ag.)Derb. & Sol. (Pascher, Schiller & Migula f)(Prescott f)(Smith f) Pl. 34, Fig. 10.

The elongate filaments of this species are made up of slightly barrel-shaped cells more than twice as long as broad, with cell walls showing H-pieces; many disc-shaped chromatophores in cells. L 10-100u; W 5-20u.

It is believed that this species by no means can be considered a winter-spring plant. Rather it is about equally abundant in summer, but is less conspicuous because of the presence of more luxuriant growth of other algae. Swain(N.C.): pool beside stream (3000 ft.) near Round Bottom C. C. C. Camp 18 Oct. 1941 #110[1] - small pool beside stream (3200 ft.) Bradley Fork 5 Sept. 1941 #123[1] - Haywood (N.C.): wet exposed schist east of Newfound Gap 6 Sept. 1941 - Sevier: wet conglomerate rock (3500 ft.) Little River Trail near top 18 Aug. 1941 #65[1] - pool in old river channel (3800 ft.) Ramsey Prong 4 Sept. 1941 #141[1] - Jefferson: in rocked out quite weedy spring drain east of Cherokee Dam 15 June 1949 #908[1] - Montgomery: 1949 winter collection near Clarksville (Clebsch)#2000 - ditch outside W. C. Austin's farm by hwy U.S.79 and Foster's Cave Road 18 March 1950

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1. Reported in Silva and Sharp, 1944

#2081. VNK.

?. Tribonema minus (Wille)Hazen. (Hazen f)(Pascher, Schiller & Migula f)(Prescott f) Pl. 34, Fig. 11.

Cells of this species are cylindrical or barrel-shaped, walls H-piece; one to four chromatophores per cell. L 8-12u; W 5-7u.

There are fewer chromatophores here than in T. bombycinum. It should be noted that Pascher includes cell length (less than twice the width) as a distinction from T. bombycinum, having apparently ignored Hazen's comments on the species and his authorship which precedes West's. Hazen drew no distinction based on cell length. It should be noted further that size is not a criterion of difference since Hazen mentions T. bombycinum f. tennue Hazen which is only 3-6u broad.

Montgomery:- Houston: near Erin, April 1949 (Clebsch)#2001 - Montgomery: seepy stream in gum-oak woods, Doty Woods just west of Oakwood 18 March 1950 #2070 - ditch outside W. C. Austin's farm at junction of hwy U.S.79 and Foster's Cave Road 18 March 1950 #2081.

In addition numbers 874, 942, 906, 1060, 1269, 1324 and 1684 were identified as this species and represent collections scattered through the region at different seasons, but they require re-examination since the full meaning of Hazen's differentiation of the species was not clear when first identified. VNSFK.

Heterosiphonales

Botrydiaceae

BOTRYDIUM Wallroth 1815

Botrydium granulatum (L.)Grev. (Pascher, Schiller & Ligula f)(Prescott f)(Smith f) Pl. 35, Fig. 1.

Multinucleate, globose or pyriform thalli of this species are visible to the naked eye on wet soil, often in considerable quantity, anchored to substrate with colorless branching rhizoidal system; many zoospores may be released from an apical rupture of the thallus. Diameter up to 1½ mm. Maury: moist soil by Orphans' Home at Spring Hill 24 Sept. 1938 (Bold)#B-132.[1] VNFK.

Vaucheriaceae

VAUCHERIA De Candolle 1803

Here the siphonaceous tendency in algae has reached a high degree of development, but cross walls are formed usually preceding aplanospore formation, or where sex organs are formed. They vary strikingly from the green algae, among which they have traditionally been placed, in their storage of photosynthetic products as oil rather than starch. Smith, 1950 has transferred them to the Heterokontae. Specific differences are based on the form and location of the sex organs, since vegetative characteristics,

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1 Reported in Silva, 1949

including size, are virtually useless for the purpose.

* species not included in text

1. Oogonia sessile or nearly so, antheridial branches separate from oogonial ones.. 2
1. Oogonia and antheridia on same lateral branch with antheridium terminal...................... 3
   2. Antheridia almost straight cylinders....... .... V. ornithocephala Ag.*
   2. Antheridia strongly curved, hooked......... .... V. sessilis DeC.
3. Fertile lateral branches long, more than twice the width of the main filament.. 4
3. Fertile lateral branches shorter.................... 5
   4. Short pedicels discernible, attaching oogonia to fruiting branch.............. V. hamata (Vauch.)DeC.
   4. One oogonium per fertile branch, essentially sessile and apparently apical, being recurved on antheridium at the same angle as the antheridium........... V. terrestris Lyngb.
5. Two or several oogonia on very short pedicels............ V. geminata (Vauch.)DeC.
5. One or two oogonia on longer pedicels,

drooping or recurved....... V. uncinata Kuetz.*

1. Vaucheria geminata (Vauch.)DeC. (Heering 21 f)(Prescott f) Pl. 20, Fig. 5.

Monoecious; antheridium and oogonium produced on same lateral branch, recurved tubular antheridium apical in position and oogonia laterally attached slightly below on fertile branch; two short pediceled oogonia are present opposite each other, each with a fertilization pore directed more or less upward. Filaments W 55-110u. Oogonia L 70-110u; W 60-110u.

Form or variety racemosa Walz. has been distinguished by having more than two oogonia on a single fertile branch, but these observations agree with Hoppaugh, 1930 that the "form" often grows on the same strand with the typical sex organs and should not be recognized.

Quite often the fertile branches of plants found in Tennessee are inflated rather than tubular, and instead of being simple structures, they proliferate one or more times, Pl. 22, Fig. 4, generally from the normal position of one of the oogonia. Such structures are considered a result of local conditions, perhaps high calcium content or parasitism. Knox: swamp on Univ. Tenn. farm 10 May 1949 (Iltis)#1992 (with abnormal expressions) - Coffee: moist soil at edge of creek below Rutledge Falls northeast of Tullahoma 3 July 1949 (Sharp)#2374 - Williamson: in shallows of Deacon Creek at Brentwood 30 Dec. 1938 (Bold)#B-3914[1] - Montgomery: marsh by Norfleet & Sons grocery by hwy U.S.79 west of Clarksville 14 July 1949 #1376 (with racemose oogonial branches) - pool in rock shelf by Ringgold Mill dam 18 March 1950 #2086.

2. Vaucheria hamata (Vauch.)DeC. (Heering 21 f)(Prescott f) Pl. 21, Fig. 1.

Monoecious; antheridium and oogonium borne on same lateral branch, single or two on long pedicels; oogonia and antheridia bent in same direction, but at a distinct angle from each other, or, if two oogonia are present, antheridium is between them. The oogonia are on short pedicels. Filament W 37-70u. Oogonia L 85-100u; W 50-95u.

Plants with single oogonia are distinguished from V. terrestris Lyngb. by the oogonium pedicel at an angle to the antheridium rather than being almost sessile and closely appressed to the antheridium. Plants with two oogonia are distinguished by the longer pedicels which exceed the antheridium in height.

Montgomery: among bryophytes under log at foot of Cumberland River Bluffs 17 Sept. 1949 (Clebsch)#2063. NK.

3. Vaucheria sessilis (Vauch.)DeC. (Heering 21 f)(Prescott f) (Smith f) Pl. 21, Fig. 3.

Monoecious; antheridia and oogonia borne side by side

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1 Reported in Silva, 1949

sessile or nearly so, on main filaments; antheridium on short bent stalk between oogonium; pore of oogonium directed obliquely upward. Filaments W 60-110u. Oogonia L 80-98u; W 60-80u. Along with V. geminata and V. terrestris this species is among those commonly found in the region.

It is agreed with Heering and with Hoppaugh that the position of the oogonial beak or pore is not a sufficient or consistent enough character upon which to base species differentiation. V. repens (Hass.)Hansg., V. clavata (Vauch.)DeC. and possibly V. ornithocephala Reinsch are separated on just these characters by their authors, and Heering has reduced the first two of these to the following varieties.

Vaucheria sessilis f. repens (Hass.)Heering. Long axis of the oogonium is parallel to the filament, its beak and pore opening vertically.

Vaucheria sessilis f. clavata (Vauch.)Heering. The long axis of the oogonia is perpendicular to the filament, its beak and pore opening vertically.

Sevier: in stream running over bankside beside road near Sugarlands C. C. C. Camp site (1600 ft.) 20 April 1949 #621[1]
Knox: on mud by stream at bridge on hwy U.S.11-E about three miles east of Knoxville 18 June 1949 #848 - Putnam: small leak flow at Cookeville reservoir dam 14 June 1949

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1 Reported in Silva, 1949

#824. VNS.

4. Vaucheria terrestris Lyngb. (Heering 21 f)(Prescott f)
Pl. 21, Fig. 2.

Monoecious; antheridia and oogonia borne of same lateral branch, recurved or coiled tubular antheridium terminal and oogonium attached closely below, sessile or very short pediceled on fertile branch, oogonium recurved on antheridium so as to appear terminal, with both recurved at the same angle. Filaments W 35-120u. Oogonium L 80-125u; W 70-130u. The species is found in both aquatic and wet terrestrial habitats.

The solitary oogonium, very shortly stalked and bent in the same plane with the antheridium distinguishes the species from V. hamata. In addition the oogonium wall is shed with the spore rather than being left empty.
Sumner: on rocks of small stream by hwy U.S.31-E in field northeast of Gallatin 27 March 1950 #2197. VN.

Chrysophyceae

Chrysomonadales

Chromulinaceae

CHROMULINA Cienkowski 1870

Chromulina ovalis Klebs. (Pascher & Lemmermann 13 f)(Smith f)
Pl. 34, Fig. 15.

These cells are elliptic or oval in shape with a retuse anterior and rounded posterior; chromatophore rich golden brown colored in the observed specimen, described as cup-shaped (but appears to be a parietal fold here); two contractile vacuoles, (although only one was observed here); the eyespot a small granule (which possibly may be merely an oil globule); flagellum almost twice length of body. L 9-14u; W 6-7u. Obion: Bayou du Chien at Biological Station 2 July 1949 #1151.

CHRYSOCOCCUS Klebs 1892

The variously shaped tests exhibited by this genus set it apart from neighboring ones. Practically the only American student of the group has been Lackey, who found them frequently in the Tennessee region. Accordingly, the writer has been chagrined not to be able to identify a single one from his many collections.

Confusion with Trachelomonas can be largely avoided by reference to size, Chrysococcus being smaller. In addition its flagellar opening is larger than in most species of Trachelomonas.

1. Tests spherical or nearly so........................ 2
1. Tests otherwise.................................... 3
   2. Diameter 9-14u, usually 11u C. major Lackey
   2. Diameter about 6u....... C. rufescens Klebs
3. Tests cylindrical.................................. 4
3. Tests hemispherical, elliptic, or
   urceolate-shaped................................... 5
   4. Sides concave, posterior truncately

rounded............... C. cylindrica Lackey

4. Sides convex, posterior tending toward conical............ C. asper Lackey

5. Truncate anterior tapering abruptly to smaller opening, giving a hemispherical shape to tests....................... .... C. hemisphaera Lackey

5. Tests hemispherical.................................... 6

6. Tests broadly and rather evenly oval..................... C. ovalis Lackey

6. Tests rather urceolate, or a true cone, or with a conical posterior.......... .... C. asper Lackey

1. Chrysococcus asper Lackey. (Lackey 39 f) Pl. 34, Fig. 16.

The tests of this species are brown, bullet-shaped or obovate, often constricted and lipped at the blunt end; single flagellum arising near lip of shell; single large light-brown, parietal chromatophore; small contractile vacuole near flagellum base; reproduction probably by transverse fission, new shell formed before daughter cell leaves mother shell. L 8-12u; W 5-8u. Flagellum 5-8u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

2. Chrysococcus cylindrica Lackey. (Lackey 38 f) Pl. 34, Fig. 17.

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1 Reported in Lackey, 1942

These tests are thin-shelled short cylinders with concave sides, convex posterior end, anterior tapering abruptly to large relatively small mouth; color transparent to deep brown. L 6u; W 4-5u? Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

3. Chrysococcus hemisphaera Lackey. (Lackey 38 f) Pl. 34, Figs. 18,19.

The tests in this species are hemispherical or asymmetrically spherical with large mouth at least half of shell diameter in width; transverse axis usually longer; ringed with more or less distinct rings; mouth more or less lipped. L 7u; W 8u.

Differentiated from C. ovalis by the truncate anterior end.

Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

4. Chrysococcus major Lackey. (Lackey 38 f) Pl. 34, Fig. 20.

Here the tests are spherical without decorations or thickenings, very small flagellar opening; spherical protoplast containing two, or rarely one, yellow-brown chromatophores and a single contractile vacuole; shell brown but never deeply colored. W 9-14u, usually 11u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

5. Chrysococcus ovalis Lackey. (Lackey 38 f) Pl 34, Fig. 21.

Tests of this species are oval, longitudinal axis longer, fairly large mouth with more or less a lip; shell with more

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1 Reported in Lackey, 1942

or less a lip; shell with more or less distinct rings of linear depressions; shell brown. L about 5u; W about 4u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

6. Chrysococcus rufescens Klebs. (Lackey 38 f)(Pascher & Lemmermann f)(Smith f) Pl. 34, Fig. 22.

The tests of this species are spherical or sub-spherical, mouth small or larger, never half the diameter in width; thickenings present at posterior end and sometimes around rim of flagellar opening. W about 6u. Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

Mallomonadaceae

MALLOMONAS Perty 1852

The silicious-plated and spined motile cells assigned here are unlike anything in their immediate group, but, unfortunately, for the unsuspecting inexperienced student, they may bear resemblance to certain protozoa. The identifications included here were all made before the writer acquired a working knowledge of the group and may require modification. The treatment of key and text below is conventional.

1. Cells obovoid, posterior extended into broad tail.................. M. caudata Conrad
1. Cells elliptic or long oval........................ 2

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1 Reported in Lackey, 1942

2. Longer proportioned, plates rectangular or deltoid, spines anteriorly sparse........... *M. producta* Iwanoff

2. Broader elliptic or oval, plates even but not deltoid..................... .... *M. alpina* Pasch. & Rutt.

1. *Mallomonas alpina* Pasch. & Rutt. (Pascher & Lemmermann f) Pl. 34, Fig. 13.

Cells elliptic to oval (?) rounded at both ends, perhaps narrowed anteriorly; delicate plates in neat rows; some anterior spines bent sharply backwards. L 25-45u, (up to 70u(?); W 8-12u, (up to 20u(?). Obion: in pond behind Mr. Hawkins' house on road to Walnut Log from Union City 1 July 1949 #1137.

Number 1137 differs from the available figure of both *M. alpina* and *M. helvetica* Pascher, which, Pascher felt, may be a subspecies of *M. alpina*. However, this individual is within the size range of *M. helvetica* and otherwise resembles *M. alpina* so, allowing for possible variability, it seems proper to label it so.

2. *Mallomonas caudata* Conrad. (Pascher & Lemmermann f)(Prescott f)

Cells obovoid, perhaps posteriorly produced into broad tail; surface covered with delicate plates and body length spines described as toothed near the ends. L 50-80u; W 15-30u. Knox: plankton in limestone sink lake at Lakeside 20

July 1949 #1540. NK.

3. Mallomonas producta Iwanoff. (Pascher & Lemmermann f) (Prescott f)(Smith f)

Cells ellipsoid or long oval with rounded ends; spines denser toward posterior, no teeth observed; plates rectangular to almost deltoid. L 40-70u; W 9-15u.

The paucity of anterior spines and narrow proportions set off the species from closely related ones.
Obion: in pond behind Mr. Hawkins' house on road to Walnut Log from Union City 1 July 1949 #1137.

Syncryptaceae

SYNCRYPTA Stokes 1885

Syncrypta volvox Ehr. (Pascher & Lemmermann f)(Prescott f) (Smith f) Pl. 35, Fig. 2.

Ovoid or pyriform cells of this species are radially united in free, swimming colonies enclosed in a broad gelatinous sheath which often contains numerous granules; two laminate chromatophores and two contractile vacuoles present. Cells L 8-14u; W 7-12u. Colony diameter 20-70u.
Weakley: net collection from barrel sunk in spring branch four miles north of Gardner Station 8 July 1949 #1220 - Obion: foam from leeward side of Bayou du Chien near Biological Station 2 July 1949 #1154.

Synuraceae

SYNURA Ehrenberg 1838

Synura uvella Ehr. (Pascher & Lemmermann f)(Prescott f) (Smith f) Pl. 35, Fig. 3.

Ovoid or pyriform cells of this species are radially united by gelatinous stalks into spherical to cylindrical free swimming colonies; two yellow-green parietal chromatophores; two to three contractile vacuoles; flagella equal in length, but differing in activity. Cells L 20-40u; W 8-17u. Sevier: pool formed by choked spring by roadside at picnic area, Greenbrier 24 Nov. 1946 #363. NSGK.

Ochromonadaceae

DINOBRYON Ehrenberg 1835

Even when a protoplast is absent this genus is recognized by the more or less funnel shaped tests, which form a dendroid colony in the species included here, but in other cases are solitary.

1. Tests regularly urceolate, in rather compact colonies........... D. sertularia Ehr.
1. Tests with margins wavey, arranged to form divergent colonies. D. divergens Imhof

1. Dinobryon divergens Imhof. (Pascher & Lemmermann f) (Prescott f)(Smith f)

Individual tests irregularly elongate cylindrical, pointed posteriorly, often slightly flared anteriorly; the colonies show divergent "branching", differing in this respect from *D. sertularia*. Knox: Chilowee Park Lake at Knoxville 29 June 1938 (Bold)unnumbered.[1] N.

2. *Dinobryon sertularia* Ehr. (Pascher & Lemmermann f)(Prescott f)(Smith f) Pl. 34, Fig. 14.

Individual tests vase-shaped with pointed posterior, flaring mouth, forming colonies not as divergent as those of *D. divergens*. Shell L 30-45u; W 10-14u. Lumpkin(Ga.): plankton from artificial lake at Vogel State Park 14 Aug. 1949 #1738 - Cherokee(N.C.): plankton from Hiwassee Lake near dam 14 Aug. 1949 - Knox: Chilowee Park Lake at Knoxville June 1950 unnumbered - Chilowee Park Lake at Knoxville 15 June 1938 (Bold)unnumbered[1] - Obion: plankton from Reelfoot Lake at Samburg 10 July 1949 #1285. NSGFK.

UROGLENA Ehrenberg 1833

Uroglena volvox Ehr. (Pascher & Lemmermann f)(Smith f) Pl. 35, Fig. 5.

The pyriform cells of this genus are radially united with long strands into gelatinous spherical or ellipsoid colony of 40-400 cells; individual cells with two unequal flagella, a single contractile vacuole, two anterior contractile vacuoles, and a single parietal chromatophore. Cells L 12-20u; W 8-13u.

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1 Reported in Silva, 1949

Number 1738, a small colony, did not exhibit the dichotomously branched gelatinous thread system at its best development.

Lumpkin(Ga.): plankton from artificial lake at Vogel State Park 14 Aug. 1949 #1738. N.

UROGLENOPSIS Lemmermann 1899

Uroglenopsis americana (Calkins)Lemm. (Pascher & Lemmermann f)(Prescott f)(Smith f) Pl. 35, Fig. 4.

Here spherical, ellipsoid or pyriform cells are embedded in the periphery of a broad spherical or elliptic gelatinous matrix, colonies of up to 1000 cells; individual cells with two unequal flagella, one or two golden brown chromatophores; eyespot visible. Cells L 5-8u; W 3-6u. Cheatham: in soil bottomed fish raising pools on Little Marrowbone Creek Road 20 Aug. 1949 #1838. N.

Rhizochrysidales

Rhizochrysidaceae

CHRYSAMOEBA Klebs 1893

Chrysamoeba radians Klebs. (Pascher & Lemmermann f)(Smith f) Pl. 35, Fig. 6.

This genus splendidly exhibits an example of the amoeboid tendency in algae. The amoeboid stage puts forth slender pseudopodia of about body length and practices both holophytic and holozoic nutrition. The flagellated state is derived from this by a change to an elliptic or ovate shape. There are one or two golden-brown chromatophores (but they were not apparent in the specimens considered here). Diameter 10-24u. Lumpkin(Ga.): artificial lake in Vogel State Park 14 Aug. 1949 #1738 - Madison(Ala.): reservoir of embayments at Guntersville Lake above Scottsboro 19 Aug. 1949 #1782.

LAGYNION Pascher 1912

Lagynion Scherffelii Pasch. (Pascher & Lemmermann f) (Prescott f)(Smith f) Pl. 34, Fig. 12.

Tests brown; bottle-shaped; solitary or gregarious; protoplast with a long thread-like pseudopodium, one or two chromatophores. Davidson(?): Cumberland River 1938-9.[1] NK.

RHIZOCHRYSIS Pascher 1913

Rhizochrysis spp. Pl. 35, Fig. 7.

This is an amoeboid Chrysophycean which has not been recorded as occurring in flagellated stages, but is much like the comparable stage of Chrysamoeba. The characters are not too far from what G. M. Smith described as R. limnetica G. M. Smith. Spicule-like pseudopodia of up to twice the length of the body are present, but other structures, including chromatophores, are obscure. Knox: stagnant pond beside Riverside Drive beyond Knoxville Waterworks 25 July 1949 #1588 - Henry: gravel pit beside hwy U.S.79 east of Paris 13 July 1949 #1351.

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1 Reported in Lackey, 1942

Bacillariophyceae

Centrales

Discineae

Coscinodiscaceae

COSCINODISCUS Ehrenberg 1838

<u>Coscinodiscus</u> <u>subtilis</u> Ehr.

Davidson: concrete pools at Kelly's Kennels at Nashville 20 Aug. 1949 #1824.

CYCLOTELLA Kuetzing 1834

<u>Cyclotella</u> <u>Meneghiniana</u> Kuetz.

Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

MELOSIRA Agardh 1824

1. <u>Melosira</u> <u>granulata</u> Ehr.

Madison(N.C.): on rocks in river (pH 5.5-6, 73°F) by hwy N.C.208 near Tenn. state line 25 June 1949 #931 - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Lauderdale - Colbert(Ala.): rocks in running water below Wilson Dam 4 Oct. 1949 (Hall)#1949.

2. <u>Melosira</u> <u>varians</u> Agardh

Madison(N.C.): roadside springhole near river at junction of hwys N.C.208 and 212 25 June 1949 #932 - Sevier: on bank in seeping and running water under Mill at Pigeon Forge 29 July 1949 #1592 - Blount: rocks in pools (1325 ft.)

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1. Reported in Lackey, 1942

Abrams Creek at Hannah Mt. trail crossing 26 Aug. 1941 #84[1] - rocks (1750 ft.) in fork of Abrams Creek below Sams Creek Road 25 Aug. 1941 #96[1] - Knox: stream at Price's grocery on Old Sevierville Pike beyond Island Home 20 July 1949 #1518 - inside concrete drainpipe from Knoxville Waterworks 22 July 1949 #1573 - Overton: around margins of artificial lake in Standing Stone State Park 15 June 1949 #1428 - Davidson(?): Cumberland River 1938-9[2] - concrete pools at Kelly's Kennels at Nashville 20 Aug. 1949 #1824, and innumerable others.

STEPHANODISCUS Ehrenberg 1845

Stephanodiscus niagarae Ehr. and S. astraea (Ehr.)Grun. are said to be widely distributed in lake plankton, but neither has been reported from southeastern United States.

Solenineae

Soleniaceae

RHIZOSOLENIA Ehrenberg 1843

Rhizosolenia eriensis H. L. Smith

Middle Tenn.: Cumberland and Duck Rivers 1938-9.[2] N.

Bidulphiaceae (Eucampiodeae)

ATTHEYA T. West 1860

Attheya Zachariasi Brunn.

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1 Reported in Silva and Sharp, 1944
2 Reported in Lackey, 1942

Davidson(?): Cumberland River 1938-9.[1]

Penales

Araphidinae

Tabellariaceae

TABELLARIA Ehrenberg 1840

1. Tabellaria fenestra (Lyngb.)Kuetz.

Lumpkin (Ga.): artificial lake at Vogel State Park 14 Aug. 1949 #1735 - Moore: in mill pond at Cumberland Springs 29 June 1949 #1026, and several other collections. NSF.

2. Tabellaria floccuosa (Roth)Kuetz.

Moore: in mill pond at Cumberland Springs 29 June 1949 #1026 - Montgomery: pool in Parson's Cave Branch near Foster's Cave #2 15 June 1949 #1491 - Weakley: farm pond by hwy Tenn.54 east of Dresden 14 July 1949 #1739, and others. NSF.

Odontidiaceae

MERIDION Agardh 1824

1. Meridion circulare (Grev.)Agardh

Madison(N.C.): roadside spring hole near junction of hwys N.C.208 and 212 25 June 1949 #933 - Blount: rocks in small stream (4500 ft.) at Little River Trail 18 Aug. 1941 #67[2] - coating on submerged rocks in pool at Abrams Falls

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1 Reported in Lackey, 1942
2 Reported in Silva and Sharp, 1944

19 June 1949 #881 - Knox: among mosses on rocks in spring outflow of large spring at Seven Springs 23 July 1949 #1563 - among grasses in shallow area of pond at Carter's Mill 2 Aug. 1949 #1610 - Overton: pond completely covered with *Sagittaria* sp. north of Monroe 15 June 1949 #1479-80 - Parsons Cave Branch near Fosters Cave #2 14 June 1949 #1391, and many others.

2. *Meridion intermedium* H. L. Smith

Knox: Tennessee River at Knoxville around 1877 (see Smith, 1933 or 1950)

ODONTIDIUM Kuetzing 1844

1. *Odontidium hiemale* (Lyngb.)Kuetz.

(*Diatoma hiemale* (Lyngb.)Heib.)

Middle Tenn.: Cumberland and/or Duck Rivers (reported in Lackey, but any source indication was omitted, probably through misprint).

2. *Odontidium vulgare* (Bory)Pritzer

(*Diatoma vulgare* Bory)

Montgomery: field pond at Meriwether 18 March 1950 #2097.

Fragilariaceae

ASTERIONELLA Hassall 1850

1. *Asterionella formosa* Hass.

Davidson(?): Cumberland River 1938-9.[1] NK.

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1 Reported in Lackey, 1942

2. Asterionella gracillima (Hantzsch) Heib.

Davidson(?): Cumberland River 1938-9[1] - Weakley: farm pond by hwy Tenn.54 east of Dresden 14 July 1949 #1332 - Obion - Lake: Reelfoot Lake 1928.[2]

CERATONEIS Ehrenberg 1840

1. Ceratoneis arcus Kuetz.

Blount: in seepage through concrete dam at Peery Bros. Mill at Walland 19 June 1949 #867.

2. Ceratoneis arcus v. amphioxys (Rab.) Hust.

Blount: in seepage through concrete dam by Peery Bros. Mill at Walland 19 June 1949 #867.

FRAGILARIA Lyngbye 1819

1. Fragilaria capucina near v. mesolepta (Rab.) Grun.

Blount: in seepage through concrete dam at Peery Bros. Mill at Walland 19 June 1949 #867.

2. Fragilaria crotonensis Kitton

Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

3. Fragilaria construens (Ehr.) Grun.

Overton: margins of artificial lake at Standing Stone State Park 15 June 1949 #1422 - Moore: in mill pond at Cumberland Springs 29 June 1949 #1026. Neither identification is as satisfactory as might be desired.

4. Fragilaria Harrisonii W. Smith

Blount: on rocks in falling water at Abrams Falls 19

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1 Reported in Lackey, 1942
2 Reported in Eddy, 1930

June 1949 #880 - Knox: among masses in outflow of large spring at Seven Springs 23 July 1949 #1563.

3. Fragilaria virescens Ralfs.

Madison(N.C.): on rocks in river near junction of hwys N.C.208 and 212 25 June 1949 #951 - Swain(N.C.): mucky trail-side pool (3000 ft.) Bradley Fork 5 Sept. 1941 #129[1] - Sevier: brink (4200 ft.) of Ramsey Cascades 4 Sept. 1941 #134[1] - Blount: in swift brook (1750 ft.) near Abrams Creek 23 Aug. 1941 #73[1] - marsh (4650 ft.) lower end of Russell Field 25 Aug. 1941 #78[1] - seepage through concrete dam at Peery Bros. Mill at Walland 19 June 1949 #867 (resembles v. eliptica somewhat) - Davidson: concrete pools at Kelly's Kennels at [illegible]nville 20 Aug. 1949 #19[illegible]4 (a variant).

4. Fragilaria virescens v. capitata Ostrup

Swain(N.C.): quiet pool (3200 ft.) in rapid stream, Bradley Fork 5 Sept. 1941 #122.[1]

SYNEDRA Ehrenberg 1830

1. Synedra rumpens v. familiaris (Kuetz.)Grun.

Sevier: moist siliceous bluff (1600 ft.) Little River Gorge below Elkmont 9 Sept. 1941 #4111[1] - Maury: trailside bank alongside Barr Creek near Mr. Worley's farm near Hampshire 15 June 1949 #895.

2. Synedra acus Kuetz.

Overton: margins of artificial lake at Standing Stone

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1 Reported in Silva and Sharp, 1944

State Park 15 July 1949 #1428. GK.

3. Synedra nana Meister

Weakley: farm pond by hwy Tenn. 54 a few miles east of Dresden 14 July 1949 #1332.

4. Synedra rumpens Kuetz.

Moore: millpond at Cumberland Springs 29 June 1949 #1026.

5. Synedra tennuissima Kuetz.

Obion - Lake: Reelfoot Lake 1930.[1]

6. Synedra ulna (Nitzsch)Ehr.

Madison(N.C.): on rocks in river near junction of hwys N.C. 208 and 212 25 June 1949 #939 - Sevier: moist siliceous bluff (1600 ft.) Little River Gorge below Elkmont 9 Sept. 1941 #4111[2] - Blount: rocks (1750 ft.) in fork of Abrams Creek below Sams Gap Road 26 Aug. 1941 #96[2] - Knox: stream at Price's grocery on Old Sevierville Pike beyond Island Home 20 July 1949 #1517 - small stream near Vestal on Martin Mill Pike 20 July 1949 #1520 - among mosses on submerged rocks in outflow of large spring at Seven Springs 23 July 1949 #1564 - Overton: Rhea's Big Spring on hwy Tenn. 42 six miles north of Livingston #1477 - pond completely covered with Sagittaria spp., north of Monroe 15 June 1949 #1480 - Moore: millpond at Cumberland Springs 29 June 1949 #1026 -

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1 Reported in Eddy, 1930
2 Reported in Silva and Sharp, 1944

Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Davidson: concrete pools at Kelly's Kennels 20 Aug. 1949 #1324-2 (a variant).

7. Synedra ulna v. aequalis (Kuetz.)Hust.

Moore: millpond at Cumberland Springs 22 June 1949 #1026.

8. Synedra ulna v. biceps (Kuetz.)Schoen.

Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1] K.

9. Synedra ulna v. genuina f. constricta Mayer

Blount: in seepage through concrete dam by Peery Bros. Mill at Walland 19 June 1949 #867. The specimen seems to be a little off type.

10. Synedra ulna v. delicatissima

Middle Tenn.: 1938-9.[1] The writer was unable to locate any reference to this variety, and the author, when querried, was not able to give information at the time, but it is rather strongly felt that the author probably intended S. acus v. delicatissima W. Smith, which may be found in Schoenfeldt, 1913.

11. Synedra ulna v. oxyrhynchus f. constricta Hust.

Blount: rocks in swift stream (2700 ft.) Hannah Mt. trail 26 Aug. 1941.[2]

12. Synedra ulna v. radians

Middle Tenn.: 1938-9.[1]

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1 Reported in Lackey, 1942
2 Reported in Silva and Sharp, 1944

The situation is quite similar to the v. delicatissima above, in this case there is a S. radians Kuetz. in Schoenfeldt.

18. Synedra ulna v. Ramesi (Heribaud and Peragallo)Hust.

Sevier: rocks (1450 ft.) in Fighting Creek 3 Sept. 1941 #118 - Blount: rock in two feet of clear water (1150 ft.) at Forks of Little River 31 Aug. 1941 #108[1] - seepage through concrete dam by Peery Bros. Mill at Walland 19 June 1949 #867 which seems to be intermediate between this variety and v. impressula Hust.

Raphidioeinea

Eunotiaceae

EUNOTIA Ehrenberg 1837

1. Eunotia alpina (Naeg.)Hust.

Weakley: farm pond by hwy Tenn.54 east of Dresden 14 July 1949 #1332.

2. Eunotia arcus Ehr.

Knox: with floating Rhizoclonium hieroglyphicum (Ag.) Kuetz. in Ft. Loudon Lake embayment at Blue Grass 20 July 1949 #1563.

3. Eunotia arcus v. bidens Grun.

Knox: with floating Rhizoclonium hieroglyphicum (Ag.) Kuetz. in Ft. Loudon Lake embayment at Blue Grass 20 July

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1 Reported in Silva and Sharp, 1944

1949 #1563.

4. Eunotia exigua (Bréb.)Rab.

Sevier: damp rock in Silers Bald Trail (6500 ft.) near Clingman's Dome 18 Aug. 1941 #62.[1]

5. Eunotia flexuosa Kuetz.

Overton: muck by spring at tent camp of Standing Stone State Park 15 July 1949 #1446.

6. Eunotia lunaris (Ehr.)Grun.

Swain(N.C.): mucky trailside pool (3000 ft.) Bradley Fork 5 Sept. 1941 #125[1] - Weakley: farm pond by hwy Tenn. 54 east of Dresden 14 July 1949 #1332 (a variant). M.

7. Eunotia microcephala Krasske

Swain(N.C.): quiet pool (3200 ft.) in rapid stream Bradley Fork 5 Sept. 1941 #122[1] - mucky trailside pool (3000 ft.) Bradley Fork 5 Sept. 1941 #125[1] - Sevier: sandy stagnant pool (3000 ft.) Ramsey Prong 4 Sept. 1941 #140[1] - Blount: rock in small stream (4500 ft.) Little River Trail 19 Aug. 1941 #67.[1]

8. Eunotia monodon Ehr.

Knox: among grass in shallow area of pond at Carter's Mill 2 Aug. 1949 #1610. Some characters of E. gracilis (Ehr.) Rab. are present, however.

9. Eunotia pectinalis v. minor f. intermedia Krasske

Sevier: (at N.C. state line) spring (5500 ft.) at

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1 Reported in Silva and Sharp, 1944

Double Springs Gap 18 Aug. 1941 #84[1] - sandy stagnant pool (3000 ft.) Ramsey Prong 4 Sept. 1941 #140[1] - Blount: marsh (3850 ft.) at lower end of Russell Field 25 Aug. 1941 #78[1] - coating on submerged rocks in pool at Abrams Falls 19 June 1949 #881 (a variant).

10. Eunotia praerupta Ehr.

Knox: on ground near bait pond at Mack's east of Knoxville on hwy U.S.70 18 June 1949 #867.

11. Eunotia valida Hust.

Weakley: farm pond beside hwy Tenn.54 east of Dresden 14 July 1949 #1332.

12. Eunotia veneris (Kuetz.)DeToni

Swain(N.C.): mucky trailside pool (3000 ft.) Bradley Fork 5 Sept. 1941 #125.[1]

Monoraphidineae

Achnanthaceae

Achnanthiodeae

ACHNANTHES Bory 1822

1. Achnanthes conspicua v. brevistriata Hust.

Davidson: in concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1824.

2. Achnanthes dispar Cleve

Knox: Chilowee Park Lake (pH 7.0 26°C) 18 June 1949

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1 Reported in Silva and Sharp, 1944

#830 - Monroe: mud in marshy area of stream choked with water cress (pH 7.0 70°F) 28 June 1949 #950.

3. Achnanthes lanceolata (Bréb.)Grun.

Blount: rock in swift stream (2700 ft.) Hannah Mt. Trail 26 Aug. 1941 #82[1] - Knox: among mosses on rocks in large spring at Seven Springs 23 July 1949 #1563.

4. Achnanthes lanceolata v. rostrata Hust.

Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1428 - Montgomery: along Parsons Cave Branch 14 July 1949 #1391.

5. Achnanthes minutissima Kuetz.

Knox: on ground near bait pond at Mack's east of Knoxville on hwy U.S.70 18 June 1949 #867 - Overton: pond completely covered with Sagittaria spp., by hwy Tenn.42 north of Monroe 15 July 1949 #1479.

6. Achnanthes minutissima v. crytpocephala Grun.

Sevier: moist siliceous bluff (1600 ft.) Little River Gorge below Elkmont 9 Sept. 1941 (Sharp)#4111[1] - Blount: rock in two feet of clear water (1150 ft.) forks of Little River 31 Aug. 1941 #108[1] - Knox: sand bottom of aquarium at Univ. of Tenn. 9 Aug. 1949 #1700.

Cocconeidiae

COCCONEIS Ehrenberg 1838

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1 Reported in Silva and Sharp, 1944

1. Cocconeis pediculus Ehr.

Knox: on mud beside stream three miles east of Knoxville on hwy U.S.70 18 June 1949 #852.

2. Cocconeis placentula Ehr.

Blount: rocks in pools (1325 ft.) Abrams Creek at Hannah Mt. trail crossing 26 Aug. 1941 #84[1] - on Vaucheria spp. in falling water of Abrams Falls 19 June 1949 #880 - Knox: among grass in shallow edge of pond at Carter's Mill 2 Aug. 1949 #1610 - in microcosm Univ. of Tenn. 9 Aug. 1949 #1700 - Monroe: near sweetwater in marshy area of stream choked with water cress 23 June 1949 #950 - Davidson: concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1324 - Montgomery: edge of small stream in ravine east of Greenwood Cemetry 17 Dec. 1949 (Cleosch)#2036.

3. Cocconeis placentula v. euglypta (Ehr.)Cleve

Knox: on submerged rocks in outflow of large spring Seven Springs 23 July 1949 #1563.

4. Cocconeis placentula v. lineata (Ehr.)Cleve

Blount: rocks in pools (1325 ft.)Abrams Creek at Hannah Mt. crossing 26 Aug. 1941 #84[1] - Knox: on mud beside stream three miles east of Knoxville on hwy U.S.70 18 June 1949 #852 - on ground near bait pond at Mack's east of Knoxville on hwy U.S.70 18 June 1949 #867.

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1 Reported in Silva and Sharp, 1944

Biraphidineae

Naviculaceae

Amphiproroideae

AMPHORA Ehrenberg 1840

1. Amphora holsatica Hust.

Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1428.

2. Amphora ovalis Kuetz.

Davidson: in rocky stream in ravine on Little Marrowbone Creek Road 20 Aug. 1949 #1848 - Montgomery: along Parson's Cave Branch 14 June 1949 #1391 - Shelby: feeder stream into pond at corner of Gerber Road and hwy U.S.64 30 June 1949 #1093 (a variant).

3. Amphora perpusilla Grun.

Davidson: concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1824.

CYMBELLA Agardh 1830

1. Cymbella affinis Kuetz.

Blount: rocks in pools (1325 ft.) Abrams Creek at Hannah Mt. crossing 26 Aug. 1941 #84[1] - rock in two feet of clear water (1150 ft.) forks of Little River 31 Aug. 1941 #108[1] - Knox: small stream ½ mile from Vestal on Martin Mill Pike 20 July 1949 #1520 - inside concrete drainpipe from Knoxville Waterworks 22 July 1949 #1573.

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1 Reported in Silva and Sharp, 1944

2. Cymbella cuspidata Kuetz.

Davidson: rocky stream in ravine on Little Marrowbone Creek Road 20 Aug. 1949 #1828. The punctae are too coarse, however, so the identification is quite uncertain.

3. Cymbella cymbiformia (Kuetz.)V. H.

Madison(N.C.): spring hole near junction of hwys N.C. 208 and 212 25 June 1949 #933 - Blount: coating on submerged rocks in pool at Abrams Falls 19 June 1949 #881 - Knox: stream by Price's grocery on Old Sevierville Pike beyond Island Home 20 July 1949 #1517 - Montgomery: along Parsons Cave Branch 14 July 1949 #1391.

4. Cymbella cystula (Hemprich)Grun.

Madison(N.C.): on rocks in river near junction of hwys N.C.208 and 212 25 July 1949 #931.

5. Cymbella hebridica (Gregory)Grun.

Blount: coating on submerged rocks in pool at Abrams Falls 19 June 1949 #881 - Knox: sand bottom of aquarium Univ. of Tenn. 9 Aug. 1949 #1700 - Moore: in millpond at Cumberland Springs 29 June 1949 #1026.

6. Cymbella naviculiformis Aueraw.

Swain(N.C.): mucky trailside pool (3000 ft.) Bradley Fork 5 Sept. 1941 #125[1] - Blount: submerged (1650 ft.) Abrams Creek 28 Aug. 1941 #100[1] - Knox: on mud beside stream at bridge three miles east of Knoxville on hwy U.S.70 18

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1 Reported in Silva and Sharp, 1944

June 1949 - Overton: pond completely covered with *Sagittaria* spp. north of Monroe on hwy Tenn.42 15 July 1949 #1480.

7. *Cymbella prostrata* (Berk.)Cleve

Madison(N.C.): on rocks in river near junction of hwys N.C.208 and 213 25 June 1949 #931 - Blount: submerged rocks (1650 ft.) Abrams Creek 28 Aug. 1941 #100[1] - Montgomery: along Parsons Cave Branch 14 June 1949 #1391.

8. *Cymbella tumida* (Bréb.)V. H.

Blount: submerged rocks (1650 ft.) Abrams Creek 28 Aug. 1941 #100[1] - rock in two feet of clear water (1150 ft.) forks of Little River 31 Aug. 1941 #108.[1]

9. *Cymbella turgida* (Gregory)Cleve

Lumpkin(Ga.): artificial lake at Vogel State Park 14 Aug. 1949 #1735 - Knox: Chilowee Park Lake (pH 7.0 26°C) 18 June 1949 #830 - Moore: millpond at Cumberland Springs 29 June 1949 #1026 - Haywood: slough beside hwy U.S.70 and 79 near Brownsville 30 June 1949 #1096 - Shelby: feeder stream into pond at junction of Gerber Road and hwy U.S.64 30 June 1949 #1093.

10. *Cymbella ventricosa* Kuetz.

Sevier: rocks (1450 ft.) in Fighting Creek 3 Sept. 1941 #112[1] - Blount: submerged rocks (1650 ft.) Abrams Creek 28 Aug. 1941 #100[1] - seepage through concrete dam by Peery Bros. Mill at Walland 19 June 1949 #867.

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1 Reported in Silva and Sharp, 1944

GOMPHONEMA Agardh 1824

1. Gomphonema acuminata Kuetz.

Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1422-8 (a variant).

2. Gomphonema acuminata v. coronata (Ehr.)W. Smith

Knox: stream by Price's Grocery on Old Sevierville Pike near Island Home 20 July 1949 #1518 - Moore: millpond at Cumberland Springs 29 June 1949 #1026.

3. Gomphonema angustatum (Kuetz.)Rab.

Blount: on seeping rocks at Abrams Falls 9 Sept. 1949 #1886 - Overton: wet muck beside spring in tent camping area of Standing Stone State Park 15 July 1949 #1446 - Davidson: concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1524 - in rocky stream in ravine on Little Marrowbone Creek Road 20 Aug. 1949 #1528.

4. Gomphonema augur Ehr.

Moore: millpond at Cumberland Springs 29 June 1949 #1026.

5. Gomphonema commutata Grun.

Blount: rocks (1750 ft.) in fork of Abrams Creek below Sams Gap Road in Cades Cove 25 Aug. 1941 #96.[1]

6. Gomphonema constricta Ehr.

Lumpkin(Ga.): on pilings in artificial lake at Vogel State Park 14 Aug. 1949 #1735 - Blount: on seeping rocks at

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1 Reported in Silva and Sharp, 1944

Abrams Falls 3 Sept. 1949 #1586 - Knox: stream by Price's Grocery on Old Sevierville Pike beyond Island Home 20 July 1949 #1517 - Davidson: concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1824.

7. Gomphonema constricta v. capitata (Ehr.)V. H.

Lumpkin(Ga.): in artificial lake at Vogel State Park 14 Aug. 1949 #1735 - Sevier: moist siliceous bluff (1600 ft.) Little River Gorge below Elkmont 9 Sept. 1941 (Sharp)#4111.[1]

8. Gomphonema gracile Ehr.

Blount: seepage around concrete by Peery Bros. Mill at Walland 19 June 1949 #887 - Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1428 - Obion: farm pond by hwy Tenn.54 a few miles east of Dresden 14 July 1949 #1332.

9. Gomphonema gracile v. lanceolatum (Kuetz.)Cleve

Sevier: quiet pools beside river (2600 ft.) end of Ramsey Cascades Road 4 Sept. 1941 #130.[1]

10. Gomphonema gracile v. naviculoides (W. Smith)V. H.

Sevier: quiet pools beside river (2600 ft.) end of Ramsey Cascade Road 4 Sept. 1949 #130.[1]

11. Gomphonema longiceps Ehr.

Lumpkin(Ga.): artificial lake in Vogel State Park 14 Aug. 1949 #1735 - Obion: farm pond by hwy Tenn.54 a few miles east of Dresden 14 July 1949 #1332 (a variant).

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1 Reported in Silva and Sharp, 1944

12. Gomphonema longiceps f. gracilis Hust.

Lumpkin(Ga.): artificial lake in Vogel State Park 14 Aug. 1949 - Moore: millpond at Cumberland Springs 29 June 1949 #1086.

13. Gomphonema olivaceum (Lyngb.)Kuetz.

Knox: on mud beside stream at bridge on hwy U.S.70 three miles east of junction, near Mack's 15 June 1949 #952.

14. Gomphonema parvula Kuetz.

Madison(N.C.): roadside spring hole near junction of hwy N.C.208 and 212 25 June 1949 #939 (a variant) - Sevier: on bank with seeping and running water under mill at Pigeon Forge 29 July 1949 #1591 - Knox: swampy area on Univ. Tenn. just south of Knoxville 1 Aug. 1949 #1596 - floating in backwater of Ft. Loudon Lake at Knoxville Waterworks 25 July 1949 #1573 - Overton: Rhea's Big Spring by hwy Tenn. 42 six miles north of Livingston 15 July 1949 #1477 (a variant) - Haywood: roadside slough by hwy U.S.70 near Brownsville 30 June 1949 #1096 - Shelby: feeder stream into pond at Gerber Road and hwy U.S.64 30 June 1949 #1093.

15. Gomphonema sphaerophorum Ehr.

Blount: rocks (1750 ft.) in fork of Abrams Creek below Sams Gap Road 25 Aug. 1941 #96[1] - rock in two feet of clear water (1150 ft.) forks of Little River 31 Aug. 1941 #108[1] - on rocks in Abrams Falls 19 June 1949 #880-1 - Knox: small

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1 Reported in Silva and Sharp, 1944

stream ½ mile beyond Vestal on Martin Mill Pike 20 July 1949 #1620 - stream at Price's Grocery on Old Sevierville Pike beyond Island Home 20 July 1949 #1617.

16. Gomphonema ventricosa Gregory

Blount: coating on rock in pool at Abrams Falls 19 June 1949 #861.

Naviculoideae

CALONEIS Cleve 1894

Caloneis formosa (Greg.)Cleve

Overton: margins of artificial lake in Standing Stone State Park 15 July 1949 #1498.

GYROSIGMA Hassall 1845

1. Gyrosigma acuminatum (Kuetz.)Rab.

Blount: seepage through concrete dam by Peery Bros. Mill at Walland 19 June 1949 #867 - Davidson: rocky stream in ravine on Little Marrowbone Creek Road 20 Aug. 1949 #1828.

2. Gyrosigma baltica (Ehr.)Cleve

Montgomery: along Yellow Creek in Riggins Mill Region near Shiloh 21 Aug. 1949 #1860.

3. Gyrosigma Wansbeckii (Donkin)Cleve

Monroe: marshy stream (pH 7, 70°F) choked with water cress by Hwy U.S.11 near Sweetwater 28 June 1949 #950 - Davidson: rocky stream in ravine on Little Marrowbone Creek Road 20 Aug. 1949 #1828 (a variant) - Shelby: feeder spring into pond at Gerber Road and hwy U.S.64 30 June 1949 #1093 (a variant).

NAVICULA Bory 1822

1. Navicula angelica Ralfs

Blount: coating on submerged rock at Abrams Falls 19 June 1949 #881.

2. Navicula cari v. angusta Grun.

Swain(N.C.): transient pool (3000 ft.) Bradley Fork 3 Sept. 1941 #12[1] - mucky trailside pool (3000 ft.) Bradley Fork 5 Sept. 1941 #82[1] - bottom of intermittent spring (3000 ft.) Bradley Fork 5 Sept. 1941 #126[1] - Blount: rocks in small stream (4500 ft.) Little River Trail 18 Aug. 1941 #67[1] - rocks in swift stream (2700 ft.) Hannah Mt. trail 26 Aug. 1941 #82.[1]

3. Navicula crucigera (W. Smith)Cleve

Moore: millpond at Cumberland Springs 29 June 1949 #1026.

4. Navicula cryptocephala Kuetz.

Blount: rocks in pools (1325 ft.) Abrams Creek at Hannah Mt. trail crossing 26 Aug. 1941 #84[1] - rocks (1750 ft.) of fork of Abrams Creek below Sams Gap Road 26 Aug. 1941 #96[1] - submerged rocks (1650 ft.) Abrams Creek 28 Aug. 1941 #100[1] - Weakley: farm pond by hwy Tenn.54 a few miles east of Dresden 14 July 1949 #1332 - Haywood: roadside slough

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1 Reported in Silva and Sharp, 1944

near Brownsville 30 June 1949 #1096 (a variant) - Shelby: feeder stream into pond at Gerber Road and hwy U.S.64 30 June 1949 #1093.

5. *Navicula cryptocephala* v. *pumila* Grun.

Blount: rocks in pool (1385 ft.) Abrams Creek at Hannah Mt. trail crossing 26 Aug. 1941 #84.[1]

6. *Navicula cuspidata* v. *heribaudi* Peragalla

Blount: in seepage through concrete dam by Peery Bros. Mill at Walland 19 June 1949 #867.

7. *Navicula decusis* Ostrup

Blount: rock in two feet of clear water (1180 ft.) forks of Little River 31 Aug. 1941 #108.[1]

8. *Navicula helvetica* Brunn.

Shelby: feeder stream into pond at corner of Gerber Road and hwy. U.S.64 30 June 1949 #1093.

9. *Navicula lucidula* Grun.

Knox: small stream by Martin Mill Pike ½ mile from Vestal 20 July 1949 #1520.

10. *Navicula minuta*

Middle Tenn.: 1938-9.[2] The writer can only speculate as to what was intended here. Perhaps it was *N. minutula* W. Smell, which Schoenfeldt gives as a synonym for *N. pygmea* Kuetz., or *N. minuscula* Grun.

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1 Reported in Silva and Sharp, 1944
2 Reported in Lackey, 1942

10. Navicula mutica Kuetz.

Sevier: rocks (1450 ft.) in Fighting Creek 3 Sept. 1941 #112[1] - moist siliceous bluff (1600 ft.) Little River Gorge below Elkmont 9 Sept. 1941 #4111[1] - Blount: rocks in swift stream (2700 ft.) Hannah Mt. trail 26 Aug. 1941 #82[1] - rock in two feet of clear (1150 ft.) forks of Little River 31 Aug. 1941 #108.[1]

11. Navicula placenta Ehr.

Swain (N.C.): mucky trailside pool (3000 ft.) Bradley Fork 5 Sept. 1941 #125[1] - Blount: rocks in swift stream (2700 ft.) Hannah Mt. trail 26 Aug. 1941 #82.[1]

12. Navicula placentula f. rostrata A. Mayer

Madison(N.C.): roadside spring hole near junction of hwys N.C.208 and 212 25 June 1949 #933.

13. Navicula radiosa Kuetz.

Davidson: rocky stream in ravine on Little Marrowbone Creek Road 20 Aug. 1949 #1828.

14. Navicula radiosa v. tenella (Bréb.)Cleve

Swain(N...): mucky trailside pool (3000 ft.) Bradley Fork 5 Sept. 1941 #125[1] - Blount: in swift brook (1750 ft.) near Abrams Creek 23 Aug. 1941 #73[1] - submerged rocks (1650 ft.) Abrams Creek 23 Aug. 1941 #100[1] - rock in two feet of clear water (1150 ft.) at forks of Little River 31 Aug. 1941 #108.[1]

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1 Reported in Silva and Sharp, 1944

15. Navicula Reinhardtii Grun.

Madison(N.C.): roadside spring hole near junction of hwys N.C.208 and 212 25 June 1949 #933.

16. Navicula rhynchocephala Kuetz.

Blount: rocks in pools (1325 ft.) Abrams Creek at Hannah Mt. trail crossing 26 Aug. 1941 #84.[1]

17. Navicula viridula Kuetz.

Blount: rocks in pools (1325 ft.) Abrams Creek at Hannah Mt. trail crossing 26 Aug. 1941 #84[1] - submerged rocks (1650 ft.) Abrams Creek 26 Aug. 1941 #100.[1]

NEIDIUM Pfitzer 1871

1. Neidium iridis (Ehr.)Cleve

Blount: submerged rocks (1650 ft.) Abrams Creek 26 Aug. 1941 #100[1] - Overton: pond completely covered with Sagittaria spp. north of Monroe along hwy Tenn.42 15 June 1949 #1479.

2. Neidium affine (Ehr.)Cleve

Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1422 - Montgomery: along Parson's Cave Branch 14 July 1949 #1391 (a variant).

3. Neidium dubium f. constrictum Hust.

Overton: floating with other algae in shallow water of artificial lake at Standing Stone State Park 15 July 1949 #1428.

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1 Reported in Silva and Sharp, 1944

4. *Neidium iridis* v. *ampliata* (Ehr.)Cleve

Overton: wet muck beside spring at tent camping area of Standing Stone State Park 15 July 1949 #1446.

5. *Neidium Koslowi* Mereschkowsky

Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1422.

PINNULARIA Ehrenberg 1840

1. *Pinnularia divergens* W. Smith

Madison(N.C.): roadside spring hole near junction of hwys N.C.208 and 212 25 June 1949 #932.

2. *Pinnularia gibba* Ehr.

Madison(N.C.): roadside spring hole near junction of hwys N.C.208 and 212 25 June 1949 #932.

3. *Pinnularia gibba* v. *mesogongyla* (Ehr.)Hust.

Madison(N.C.): on rocks in river near junction of hwys N.C.208 and 212 25 June 1949 #931.

4. *Pinnularia interupta* W. Smith

Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1422-8.

5. *Pinnularia mesolepta* (Ehr.)W. Smith

Shelby: feeder spring into pond at corner of Gerber Road and hwy U.S.64 30 June 1949 #1093.

6. *Pinnularia polyonca* (Bréb.)O. Mueller

Weakley: farm pond by hwy Tenn. 54 a few miles east of Dresden 14 July 1949 #1332.

7. Pinnularia undulata Gregory

Blount: coating on submerged rocks in pool at Abrams Falls 19 June 1949 #881 (a variant).

PLEUROSIGMA W. Smith 1852

The genus has been reported from Middle Tennessee by Lackey, 1942, and from Kentucky.

STAURONEIS Ehrenberg 1843

1. Stauroneis anceps Ehr.

Blount: coating on submerged rocks in pool at Abrams Falls 19 June 1949 #881 (a variant) - Overton: around margins of artificial lake at Standing Stone State Park 15 July 1949 #1428 (a variant).

2. Stauroneis anceps v. rhomoidalis f. linearis (Ehr.)Cleve

Overton: wet muck by spring in tent camping area at Standing Stone State Park 15 July 1949 #1446.

3. Stauroneis dilatata Ehr.

Davidson: concrete pools at Kelly's Kennels 20 Aug. 1949 #1824 - Haywood: slough by hwy U.S.70 near Brownsville 30 June 1949 #1096.

VANHUERCKIA Schuett 1896

1. Vanhuerckia rhomboides (Ehr.)Bréb.

(Frustula rhomboides (Ehr.)DeToni)

Weakley: farm pond by hwy Tenn.54 a few miles east of Dresden 14 July 1949 #1332 - Haywood: slough beside hwy U.S. 70 near Brownsville 30 June 1949 #1096 - Shelby: feeder stream for pond at corner of Gerber Road and hwy U.S.64 30 June 1949 #1093.

2. <u>Vanhuerckia</u> <u>rhomboides</u> v. <u>amphipleuroides</u> Gom.
(<u>Frustula</u> <u>rhomboides</u> v. <u>amphipleuroides</u> Grun.)

Blount: log pier (1775 ft.) of bridge on Sams Gap Road in Cades Cove 24 Aug. 1941 #91[1] - submerged rocks (1650 ft.) Abrams Creek 28 Aug. 1941 #100[1] - rock in two feet of clear water (1150 ft.) Forks of Little River 31 Aug. 1941 #108[1] - coating on submerged rocks in pool at Abrams Falls 19 June 1949 #881.

3. <u>Vanhuerckia</u> <u>vulgaris</u> (Thwaites)V. H.
(<u>Frustula</u> <u>vulgaris</u> (Thwaites)DeToni)

Madison(N.C.): roadside springhole near junction of hwys N.C.208 and 212 25 June 1949 #933 (a variant) - Swain: (N.C.): mucky trailside pool (3000 ft.) Bradley Fork 5 Sept. 1941 #125 - Blount: submerged rocks (1650 ft.) Abrams Creek 28 Aug. 1941 #100[1] - Haywood: slough beside hwy U.S.70 30 June 1949 #1096.

4. <u>Vanhuerckia</u> <u>vulgaris</u> v. <u>saxonicum</u> Rab.
(<u>Frustula</u> <u>vulgaris</u> v. <u>saxonicum</u> Rab.)

Sevier: on bank in seeping and running water under mill at Pigeon Forge 29 July 1949 #1592.

Epithemiaceae

DENTICULA Kuetzing 1844

1. <u>Denticula</u> <u>tenuis</u> Kuetz.

Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1422.

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1 Reported in Silva and Sharp, 1944

2. *Denticula thermalis* Kuetz.

Overton: margins of artificial lake at Standing Stone State Park 15 July 1949 #1422 - Montgomery: along Parson's Cave Branch 14 July 1949 #1391.

EPITHEMIA de Brébisson 1838

Epithemia Hyndmanii W. Smith (Smith)

Davidson: fishpool in greenhouse on Vanderbilt campus 17 March 1950 #2060.

RHOPALODIA O. Mueller 1895

1. *Rhopalodia gibba* (Ehr.)O. Mueller

Overton: margins at edge of artificial lake in Standing Stone State Park 15 July 1949 #1422-8 - Montgomery: along Parson's Cave Branch 14 July 1949 #1391.

2. *Rhopalodia gibberula* (Ehr.)O. Mueller

Lumpkin(Ga.): submerged in artificial lake of Vogel State Park 14 Aug. 1949 #1735 - Blount: on seeping rocks at Abrams Falls 9 Sept. 1949 #1886.

Nitzschiaceae

HANTZSCHIA Grunow 1880

1. *Hantzschia amphioxis* (Ehr.)Grun.

Madison(N.C.): roadside springhole near junction of hwys N.C.209 and 212 25 June 1949 #983 (a variant) - Lumokin (Ga.): plankton cast in artificial lake at Vogel State Park 14 Aug. 1949 #1736 - Blount: coating on submerged rocks in pool at Abrams Falls 19 June 1949 #881.

2. *Hantzschia amphioxys* f. *capitata* (O. Mueller)

Haywood: slough beside hwy U.S.70 near Brownsville 30 June 1949 #1096.

NITZSCHIA Hassall 1845

1. *Nitzschia acicularis* (Kuetz.)W. Smith

Middle Tenn.: Cumberland and Duck Rivers 1938-9.[1]

2. *Nitzschia acuta* Hantz.

Madison(N.C.): rocks in river near junction of hwys N.C.208 and 212 25 June 1949 #931 - Blount: seepage through concrete dam by Peery Bros. Mill at Walland 19 June 1949 #867.

3. *Nitzschia angustata* (W. Smith)Grun.

Montgomery: along Parson's Cave Branch 14 June 1949 #1391.

4. *Nitzschia capitellata* Hust.

Blount: on rocks in falling water at Abrams Falls 19 June 1949 #880.

5. *Nitzschia dissipata* (Kuetz.)Grun.

Madison(N.C.): rocks in river (pH 5.5-6, 73°F) near junction of hwys N.C.208 and 212 25 June 1949 #931.

6. *Nitzschia fonticola* Grun.

Davidson: rocky stream in ravine along Little Marrowbone Creek Road 20 Aug. 1949 #1328.

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1 Reported in Lackey, 1942

7. Nitzschia frustula Kuetz.

Madison(N.C.): roadside spring hole near junction of hwys N.C.208 and 213 25 June 1949 #933 - Overton: pond completely covered with Sagittaria spp. by hwy Tenn.42 north of Monroe 15 July 1949 #1480.

8. Nitzschia Heufleriana Grun.

Davidson: concrete pools of Kelly's Kennels at Nashville 20 Aug. 1949 #1584.

9. Nitzschia Lorenziana Grun.

Blount: in falling water of Abrams Falls 19 June 1949 #851.

10. Nitzschia palea (Kuetz.)W. Smith

Knox: sand bottom of aquarium at Univ. of Tenn. 9 Aug. 1949 #1700.

11. Nitzschia sigma (Kuetz.)W. Smith

Shelby: feeder stream of pond at corner of Gerber Road and hwy U.S.64 30 June 1949 #1093.

12. Nitzschia sublinearis Hust.

Knox: Chilowee Park Lake (pH 7.0, 26°C) 15 June 1949 #830.

Surirellaceae

CYMATOPLEURA W. Smith 1851

1. Cymatopleura solea (Bréb.)W. Smith

Knox: small stream ½ mile beyond Vestal on Martin Mill Pike 20 July 1949 #1520.

2. *Cymatopleura solea* v. *regula* (Ehr.)Grun.

Knox: stream by Price's Grocery on Old Sevierville Pike beyond Island Home 20 July 1949 #1517.

SURIRELLA Turpin 1828

1. *Surirella angustata* Kuetz.

Madison(N.C.): on rock in river near junction of hwys N.C.208 and 212 25 June 1949 #931.

2. *Surirella delicatissima* Lewis

Overton: pond completely covered with *Sagittaria* by hwy Tenn.42 north of Monroe 15 July 1949 #1479-80.

3. *Surirella didyma* Kuetz.

Shelby: feeder stream for pond at corner of Gerber Road and hwy U.S.64 30 June 1949 #1093.

4. *Surirella linearis* v. *constricta* (Ehr.)Grun.

Blount: seepage through concrete dam by Peery Bros. Mill at Walland 19 June 1949 #867 - Knox: mud beside stream crossing hwy U.S.11-E 18 June 1949 #852.

5. *Surirella linearis* v. *helvetica* (Brunn.)Meister

Knox: Chilowee Park Lake (pH 7.0, 26°C) 13 June 1949 #830.

6. *Surirella Moelleriana* Grun.

Madison(N.C.): roadside spring hole near junction of hwys N.C.208 and 212 25 June 1949 #933.

7. *Surirella ovata* Kuetz.

Haywood: slough by hwy U.S.70 near Brownsville 30 June 1949 #1096 (a variant) - Shelby: feeder stream into pond at corner of Gerber Road and hwy U.S.64 30 June 1949 #1093 (a variant).

8. Surirella robusta Ehr.

Knox: in flow from very large spring on Blue Grass Road from Farragut 20 July 1949 #1520 - Weakley: farm pond by hwy Tenn.54 east of Dresden 14 July 1949 #1332.

9. Surirella robusta v. splendida (Ehr.)V. H.

Shelby: feeder stream into pond at Gerber Road and hwy U.S.64 30 June 1949 #1093.

10. Surirella tenera Gregory

Weakley: farm pond by hwy Tenn.54 east of Dresden 14 July 1949 #1332.

11. Surirella tenera v. nervosa Mayer

Blount: rocks in pools (1325 ft.) Abrams Creek at Hannah Mt. trail crossing 26 Aug. 1941 #84[1] - log pier of bridge (1775 ft.) on Sams Gap Road in Cades Cove 24 Aug. 1941 #91.[1]

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1 Reported in Silva and Sharp, 1944

CYANOPHYTA

Myxophyceae

Coccogonales

Chroococcaceae

ANACYSTIS Meneghini 1837

Cells in this genus are spherical, and divide in three planes at right angles to each other, so as to form an irregular thick colony with no particular orientation of cells. A more or less well developed gelatinous matrix holds few to many cells together. The cells are blue-green in color, the contents finely granular or homogeneous.

1. Cells large, 6-8u in diameter..................
   .... *A. aeruginosa* (Zanard.)Drou. & Dail.
1. Cells smaller..................................... 2
   2. Cells 3-5u in diameter *A. marginata* Menegh.
   2. Cells .8-2.5u in diameter..................
      .... *A. firma* (Kuetz.)Drou. & Dail.

1. *Anacystis aeruginosa* (Zanard.)Drou. & Dail. (Drouet & Daily 48)

This is the large species of the genus. Diameter 6-8u. Some cells, apparently of this species, were present in a laboratory culture from the collection listed below, but they disappeared when an attempt was made to increase the numbering by further culturing. Obion: among aquatic plants at edge of Reelfoot Lake near Walnut Log 14 June 1950 #2253.

2. Anacystis firma (Kuetz.)Drou. & Dail. (Drouet & Daily 49)

(Microcystis firma Schm. of Geitler etc.)

The smallest species of the genus. Diameter .8-1.8u. Knox: submerged sides of concrete reservoir at Neubert's Springs 30 July 1949 - bank of spring creek at Seven Springs 23 July 1949 #1567 - Lake: plankton from slough near Tiptonville 5 July 1949 #1157. NSFK.

3. Anacystis marginata Menegh. (Daily 49) Pl. 38, Fig. 1.

(Microcystis marginata (Menegh.)Kuetz. of Geitler etc.)

Cells spherical; blue-green or yellowish; protoplasm granular, as in all species; division in three planes; imbedded in an almost indiscernible gelatinous coating. Diameter 3-6u. This is a medium sized species and the most frequently encountered of the genus in Tennessee. Sevier: wet rock in swift water (3500 ft.) Porters Creek in Greenbrier 3 Aug. 1941 #150[1] - Jackson(Ala.): roadside ditch pond near Paint Rock 17 June 1950 #2291 - Montgomery: pond on Dotsonville Road near Clarksville 9 Oct. 1949 (Clebsch) #2024 - along Yellow Creek in Riggins Mill Region near Shiloh 24 Aug. 1949 #1860. VNSFK.

COCCOCHLORIS Naegeli 1849

In this genus the cells are somewhat cylindrical or

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1 Reported in Silva and Sharp, 1944

elliptic in shape, dividing in one plane perpendicular to the long axis to form irregular colonies enclosed in a gelatinous matrix. Individual cells may display sheaths which are not completely confluent with the colonial mass. Cell contents are granular and blue-green in color.

1. Cells elliptic in shape, rather than cylindric.. C. Castagnei (Kuetz.)Drou. & Dail.
1. Cells cylindric in shape............................ 2
   2. Cell length three or more times width.. 3
   2. Cell length less than three times width................................. 4
3. Length of cells about 3.5-6u; width about 1-1.5u C. nidulans (Richt.)Drou. & Dail.
3. Length of cells about 10-15u; width about 2-3u.................................. .... C. Peniocystis (Kuetz.)Drou. & Dail.
   4. Cell length (2-4u) about twice width (1-2u) C. elabens (Bréb.)Drou. & Dail.
   4. Cells larger.................................. 5
5. Cells 4-7u long; 2-4.5u wide.................. .... C. stagnina Spreng.
5. Cells 8-15u long; 4-8u wide................... C. stagnina f. rupestris (Lyngb.)Drou. & Dail.

1. Coccochloris Castagnei (Kuetz.)Drou. & Dail. (Drouet & (Aphanothece Castagnei (Bréb.)Rab., of Geitler etc.) Daily 48)

This is the only species of the genus which is elliptic in shape, rather than cylindric l. L 3-4u; W 4-8u. F.

2. Coccochloris elabens (Bréb.)Drou. & Dail. (Drouet & (Microcystis elabens (Menegh.)Kuetz., of Geitler etc.) Daily 48)

Cells cylindrical with rounded ends L/W ratio about 2/1. L 2-4u; W 1-2u. Knox: inside seepage on concrete underpass on Scottish Pike 17 Jan. 1949 #477 - Obion: among aquatic plants in edge of Reelfoot Lake near Walnut Log 14 June 1950 #8257.

3. Coccochloris nidulans (Richt.)Drou. & Dail. (Drouet & (Aphanothece nidulans Richt. of Geitler etc.) Daily 48)

Cells cylindrical, ends rounded; L/W ratio 4/1. L 4-6u; W 1.5u.

4. Coccochloris Peniocystis (Kuetz.)Drou. & Dail. (Drouet & (Gloeocapsa Peniocystis Kuetz.) Daily 48) Pl. 36, Fig. 2.

Cell length three or more times width, shape cylindrical, ends rounded. L 10-12u; W 2-3u. Obion: outflow on gravel and mud at Sprout's Spring near Samburg 10 July 1949 #1293-4. NFK.

5. Coccochloris stagnina Spreng.

(Aphanothece stagnina (Spreng.)A. Braun of Geitler etc.)

Cells cylindrical with rounded ends. L 4-7u; W 3-4.5u. Chester: in spring entering artificial lake at Chickasaw State Park 16 June 1950 #2294 - Obion: among aquatic plants in edge of Reelfoot Lake near Walnut Log 14 June 1950 #2257 - roadside slough west of Union City 14 June 1950 #2248. NFK.

6. Coccochloris stagnina f. rupestris (Lyngb.)Drou. & Dail.

(Gloethece rupestris (Lyngb.)Born. of Geitler etc.)

(Drouet & Daily 48)

Cells cylindrical in shape, with rounded ends. L 8-18u; W 5-6u. Knox: wet concrete wall in Univ. Tenn. botany greenhouse 9 Sept. 1950 #2346 - concrete retaining wall of Chilowee Park Lake 14 March 1950 #2042. VNSGFKL.

COELOSPHAERIUM Naegeli 1849

Coelosphaerium Kuetzingianum Naeg. (Geitler f)(Prescott f) (Smith f) Pl. 36, Fig. 8.

Cells spherical or subspherical with more or less granular contents; arranged in single subperipheral layer in a spherical or oblong gelatinous matrix; colony free-floating. Cell diameter 2.5-4u. Knox: laboratory culture from collection made 14 Jan. 1946 #857b - Overton: pond containing considerable number of aquatic plants (Sagittaria, Potamogeton, Lemna etc.) at Timothy 15 June 1949 #1456. NSFK.

DIPLOCYSTIS Trevisan 1848

This genus is separated from Anacystis by being characteristically planktonic, and in containing pseudo-vacuoles. The cell division is similar to that found in *Anacystis*, and the cells form a spherical or variously shaped colony with no particular arrangement of the cells.

1. Diameter of cells 4-6u......................... .... *D. aeruginosa* (Kuetz.)Trev.
1. Diameter of cells 1-2u......................... .... *D. incerta* (Lemm.)Drou. & Dail.

1. *Diplocystis aeruginosa* (Kuetz.)Trev. Pl. 36, Fig. 3. (*Microcystis aeruginosa* Kuetz. of Geitler etc.)

Cells spherical; clustered in clearly discernible gelatinous matrix, the outline of which may be spherical and solid, or irregular in shape and somewhat torn; cell contents blue-green with conspicuous pseudovacuoles. Diameter 4-6u. Knox: laboratory culture at Univ. Tenn. from collection made 14 Jan. 1946 #857b - Middle Tenn.: Cumberland and Duck Rivers 1938-9[1] - Davidson: Percy Warner Lake at Nashville 1933[2] - Valley Lake 20 Aug. 1949 #1915 - Cheatham: soil bottomed fish raising pond on Little Marrowbone Creek Road 20 Aug. 1949 #1846-8 - Montgomery: on pond at corner of Dotsonville Road near Clarksville 1 Oct. 1949 (Clebsch)#2027 - Weakley: Dodd's barnyard pond north of Martin 9 July 1949 #1257 - Obion: plankton from Reelfoot

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1 Reported in Lackey, 1942
2 Reported in Drouet, 1939

Lake at Samburg 12 July 1949 #1305-11 - Marvin Hayes' farm ponds near Samburg 12 July 1949 #1316-7-20-21 - R. J. Latimer's big pond near Community Pride Church 12 July 1949 #1329. VNSFKL.

2. Diplocystis incerta (Lemm.)Drou. & Dail. (Drouet & Daily 48)
(Microcystis incerta Lemm., of Geitler etc.)

The species is smaller than D. aeruginosa. Cell diameter about 1-2u. Obion: stock pond by county road east of Mason Hall 8 July 1949 #1245 - plankton from J. M. Evrett's farm pond near Glass 8 July 1949 #1254 - plankton from Reelfoot Lake near Samburg 12 July 1949 #1305 - plankton from R. J. Latimer's big pond near Community Pride Church southeast of Union City 14 July 1949 #1329. NSFK.

GLAUCOCYSTIS Itzigsohn 1854

Glaucocystis nostochinearum Itzig. (Pascher, Lemmermann & Brunnthaler f)(Prescott f)(Smith f) Pl. 36, Fig. 11.

Cells Oocystis-like, usually oval, rarely round; single or united in groups of 2-8 cells; contents blue-green, blue-green component usually ribbon-like, rarely diffuse, granular. Cells L 18-29u; W 10-18u. Possibly a variety of organisms have been classified under this name but a proper study of a number of specimens has not been made by the writer, so it does not seem possible to make an original judgment at this time. Obion: plankton from Reelfoot Lake in Blue Basin 13 July 1949 #1324. F.

GLOEOCAPSA Kuetzing 1843

As understood here, this genus includes what has popularly been known as the genus <u>Chroococcus</u>, as well as <u>Gloeocapsa</u>. The cells here are basically spherical, but they may be flattened by mutual compression. The cell division is in three planes at right angles to each other. A gelatinous matrix encloses the irregular colony, and stratified sheaths are often visible around individuals or groups of cells.

1. Cells small, 2-6u in diameter, grouping irregular, seldom seen in neat packages of a few cells...... <u>G.</u> <u>alpicola</u> (Lyngb.)Born.
1. Cells larger, usually more regularly grouped, often in neat packets of a few cells....................................... 2
   2. Cell diameter 13-25u even up to 40u.... <u>G.</u> <u>dimidiata</u> (Kuetz.)Drou. & Dail.
   2. Cell diameter smaller.......................... 3
3. Colonies sessile, irregular, sheathes often diffluent.............................. .... <u>G.</u> <u>membranina</u> (Menegh.)Drou. & Dail.
3. Colonies often planktonic, rather regularly arranged in almost cubical colonies, with the stratification of the sheaths usually evident.................. .... <u>G.</u> <u>limnetica</u> (Lemm.)Holl.

1. Gloeocapsa alpicola (Lyngb.)Born. (Elenkin f) Pl. 36, Fig. 4.

Colonies a firmly gelatinous or leathery layer or mass; cells spherical, rarely compressed against each other; contents homogeneous or granular blue-green; sheaths colorless, yellow, rusty, or deep brown. Cell diameter 3-6u.

This name, as used here, includes practically all of the specimens hitherto reported as various species of Gloeocapsa, such as G. magma (Bréb.)Kuetz., G. rupestris Kuetz. etc.

Cherokee(N.C.): dripping wet cliff near Hiwassee Dam Powerhouse 14 Aug. 1949 #1746-7 - Lumpkin(Ga.): wet gneiss near Neal's Gap 14 Aug. 1949 #1732 - Sevier: wet cliff on Myrtle Point, Mt. LeConte 4 Sept. 1941 #135[1] - moist, dark ledge (4175 ft.) Ramsey Cascades 4 Sept. 1941[1] - Knox: jelly on wet places on old concrete dam at Neubert's Springs 20 July 1949 #1526 - floating crust and bottom coating microcosm in Univ. Tenn. botanical laboratory 9 Aug. 1949 #1708-9 - Anderson: constantly drenched steel water tank at Boy Scout Camp 25 Aug. 1950 #2339 - wheel of gristmill near Norris Dam 1 Sept. 1949 #1871 - Morgan: wet cliff near Rugby 6 Aug. 1949 (Sharp)#1665 - Overton: dripping sandstone ledge by roadside a few miles southeast of Timothy near Varna Maynard's mailbox 15 June 1949 #1462 - Powell(Ky.): moist

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1 Reported in Silva and Sharp, 1944

sandstone bluff at Natural Bridge 11 June 1947 (Shanks) #1781 - Montgomery: wet seepage on roof of Foster's Cave #2 11 July 1949 #140 - Weakley: springy marsh on Henry Powers' place nine miles east of Dresden by hwy U.S.79 14 July 1949 #1401a-1402 - Obion: margins of Reelfoot Lake along aquatic plants 14 June 1950 #2257 - Shelby: seepage over concrete bridge along hwy U.S.70 30 June 1949 #1086. VNSGFK.

2. *Gloeocapsa dimidiata* (Kuetz.)Drou. & Dail. (Drouet &

(*Chroococcus turgidus* (Kuetz.)Naeg. of Geitler etc.)

Daily 48)

Colonies irregular, composed of relatively few (up to eight) cells; cells spherical or compressed, contents clear blue-green or granular and brown; individual or groups of sheaths stratified. Cell diameter 13-25u, or up to 40u. Sevier: moist dark ledge (4175 ft.) at Ramsey Cascades 4 Sept. 1941 #136[1] - wet siliceous rocks in Little River Gorge 4 Aug. 1949 #1645, and several others - Knox: pond bottom in field by Ten Mile Creek at Farragut 23 July 1949 #1544 - aquarium at Univ. Tenn. 1 Sept. 1950 #2344. VNSFK.

3. *Gloeocapsa limnetica* (Lemm.)Holl. (Elenkin f)

(*Chroococcus limneticus* Lemm., of Geitler etc.)

Colonies of up to 32 cells, often forming almost cubical masses of spherical and hemispherical cells; cell

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1 Reported in Silva and Sharp, 1944

contents greenish or pale blue-green; sheath wide, hyaline, stratified. Cell diameter 8-13u. N.

4. Gloeocapsa membranina (Menegh.)Drou. & Dail. (Drouet & Daily 50) Pl. 35, Fig. 5.

(Chroococcus minutus (Kuetz.)Naeg. of Geitler etc.)

Colonies irregular, up to eight cells in a group, generally only two together; cells spherical or oblong; contents homogeneous or granular, pale blue-green or yellowish, orange, or bluish; sheath homogeneous, hyaline. Cell diameter 5-11u. Knox: clinging to Chara in concrete reservoir at Neubert's Springs 20 July 1949 #1529 - Montgomery: ditch outside W. C. Austin's farm at junction of hwy U.S.79 and Foster's Cave Road 18 March 1950 #2080. N.

GOMPHOSPHAERIA Kuetzing 1836

The colonies of these species have spherical or oblong gelatinous envelopes. The groups of spherical or pyriform cells are connected by a branching gelatinous thread system.

1. Cells spherical in shape... G. lacustris Chod.
1. Cells pyriform in shape..... G. aponina Kuetz.

1. Gomphosphaeria aponina Kuetz. (Geitler f)(Prescott f) (Smith f)

Cells pyriform in shape, oriented with the broad end outward; contents granular blue-green, dark olive, or yellowish. L 8-15u; W 4-7.5u. Whereas there is no doubt in the writer's mind that this species does occur in plankton of lakes and ponds throughout the region, the fortunes of collecting and identification have missed it. VFK.

2. Gomphosphaeria lacustris Chod. (Geitler f)(Prescott f) (Smith f) Pl. 36, Fig. 12.

Cells spherical or elliptic; contents granular, lighter or darker blue-green. L 2-4u; W 1.5-2.5u. Lumpkin(G.): plankton around margins of artificial lake at Vogel State Park 14 Aug. 1949 #1735 - Knox: jar culture at collector's home 17 Sept. 1949 #1898 - Montgomery: pond on Dotsonville Road near Clarksville 9 Oct. 1949 (Clebsch)#2024-7 - Obion: plankton from slough near Spillway 5 July 1949 #1186 - plankton from Reelfoot Lake at Samburg 12 July 1949 #1305. NFK.

MICROCROCIS Richter 1892

Microcrocis geminata (Lag.)Geit. (Geitler f) Pl. 36, (Holopedium irregulare Lag. of Geitler 25, Smith 33 etc.) Fig. 6.

Cells spherical to short oval, dividing in two planes to form a flat irregular colony; surrounding gelatinous material rapidly diffluent so that cells appear without a sheath. L 6-14u; W 3-7u. Claiborne: pond north of Tazwell 26 June 1938 (Bold's record)unnumbered - Montgomery: damp soil under high porch of Alfred Clebsch home 838 Gracey Ave. Clarksville 19 March 1950 #2111. N.

Unfortunately, a subsequent recheck of #2111 failed to rediscover any cells of this species.

MERISMOPEDIA Meyen 1839

Cells are spherical or oval and divide in two planes at right angles so as to form flat plates with regular rows, in a rectilinear arrangement.

1. Cell diameter .75 to 2.5u, colonies
   generally smaller in extent..................
   .... M. tranquilla (Ehr.)Trev.
1. Cell diameter 2.5 to 6u, colonies
   often large or even convolute................
   .... M. thermalis Kuetz.

1. Merismopedia thermalis Kuetz. (Geitler 25) Pl. 36, Fig. 8.

The larger celled species, generally forming larger colonies than M. tranquilla, including the extensive convolute forms; cells spherical or oval; contents smooth or granular, blue-green, olive, grey, or yellowish. Diameter 2.5-6u. Jefferson: in rock-lined but weedy spring drain near Cherokee Dam 25 June 1949 #908 - Knox: in pond by Ten Mile Creek at Farragut 23 July 1949 #1546 - Madison: roadside slough by Hwy U.S.45-E 14 June 1950 #2270 - Obion: field embayment at south end of Isom Lake 10 July 1949 #1282. NSFKL.

Collections number 1282 and 2270 exhibit the convolute type colonies.

2. *Merismopedia tranquilla* (Ehr.)Trev.

This species is generally smaller in cell size and colony size than *M. thermalis*; cells spherical or oval, contents smooth or granular, blue-green. Diameter 1-3u. Blount: gelatinous mixture floating among *Chara* in Laurel Lake near Kinzel Springs 4 Aug. 1949 #1660 - Knox: Lake backwater at entrance of Seven Springs stream 20 July 1949 #1566 - laboratory culture at Univ. Tenn. 1 Aug. 1949 #1604 - in drip from small dam at Carter's Mill 9 Aug. 1949 #1682 - Overton: in edges of swimming area of artificial lake at Standing Stone State Park 15 July 1949 #1481 - Montgomery: old stockpond near Blooming Grove Creek turnoff from hwy U.S.79 14 July 1949 #1414 - along Yellow Creek in Riggins Mill region near Shiloh 20 Aug. 1949 #1859 - Weakley: stock pond by county road east of Mason Hall 8 July 1949 #1245 - Obion: in *Nelumbo* area of Reelfoot Lake near Samburg 12 July 1949 #1306 - Lake: pond at roadside of hwy Tenn.78 near Kentucky state line 5 July 1949 #1190. NFK.

SYNECHOCOCCUS Naegeli 1849

The genus is distinguished from the others in the family by the solitary nature of the short cylindrical cells, brought about by rapid dissipation of cell mucilage. The cells divide at right angles to the long axis.

1. Cells over 5u broad, very short cylinders.................. *S. aeruginosus* Naeg.
1. Cells 1.5-2u broad, longer cylinders.........

.... *S. elongatus* Naeg.

1. *Synechococcus aeruginosus* Naeg. (Geitler f)(Prescott f) (Smith f) Pl. 36, Fig. 7.

Contents granular blue-green. L 8-10u or larger; W 6-8u. Morgan: wet cliff near Rugby 6 Aug. 1949 #1665 - Davidson: spring at Valley Lake 20 Aug. 1949 #1809 - Maury: rock coating under sheet of water in Barr Creek on Mr. Worley's farm near Hampshire 15 June 1949 #901. VNK.

2. *Synechococcus elongatus* Naeg. (Geitler f)

Cells cylindrical, 1½-3 times long as broad, contents pale blue-green or grayish.

Chamaesiphonales

Chamaesiphonaceae

ENTOPHYSALIS Kuetzing 1843

This genus displays a structure which is intermediate in character between the non-filamentous and filamentous plants, illustrating a continuity among the blue-green algae, although extreme forms differ greatly from each other. The plants are epiphytic, with some polarity between proximal and distal ends. Endospore formation may produce numerous spherical cells, however, and obscure the filamentous structure completely.

1. Plants not fusing laterally to form solid turf...................................

.... E. Brebissonii (Menegh.)Drou. & Dail.

1. Plants fusing laterally to form turf in which the filamentous structure is obscure. E. rivularis (Kuetz.)Drou. & Dail.

1. Entophysalis Brebissonii (Menegh.)Drou. & Dail. (Drouet & Daily 48) Pl. 36, Fig. 10.
(Chamaesiphon incrustans Grun. of Geitler etc.)

Plants short spherical, pyriform or cylindrical epiphytic plants; unicellular at first, cutting off cells at apical end or breaking up into internal "packets" of rounded, more or less Gloeocapsa-like cells, perhaps forming a considerable mass of incrustation on surfaces by successive division and lateral growth. Cells W 2-6u. Sevier: splashed rocks in furiously rushing water at Little Laurel Bridge on Ramsey Prong 9 Sept. 1950 #2353 - Knox: on Oedogonium spp. along banks of Ft. Loudon Lake at Blue Grass 27 Aug. 1949 #1866 - Hamilton: on Pithophora oedogonia (Mont.)Wittr. in aquarium of Grant's 5 & 10¢ store, Chattanooga 29 Sept. 1949 (Hall)#1970 - Jackson(Ala.): on Rhizoclonium hieroglyphicum (Ag.)Kuetz. at embayment bridge along hwy U.S.72 north of Scottsboro 17 June 1950 #2293. VNFL.

2. Entophysalis rivularis (Kuetz.)Drou. (Drouet 43)
(Oncobyrsa rivularis (Kuetz.)Geit. of Geitler etc.)

This species differs from E. Brebissonii principally in the tendency to form deeper vertical layers of cells which may be fused into vertical rows within a cushion of consider-whole depth. Cells W 1.5-2.5u. Washington: wet sprayed concrete in small stream at East Tenn. State College at Johnson City 14 Jan. 1947 #46 - Knox: goldfish pond on Harry Ijams' place, Island Home Pike 20 July 1948 #1510. W.FL.

Clastidiaceae

CLASTIDIUM Kirchner 1880

Clastidium setigerum Kirch. (Geitler 36 f) Pl. 36, Fig. 13.

Short epiphytic elliptical, or elongate elliptical plants with ephemeral apical gelatinous setae; solitary or gregarious; unicellular or cutting endospores off at apex. Knox: jar culture at collector's home 12 Aug. 1949 #1765 - Lauderdale - Colbert(Ala.): on filamentous green algae attached to concrete of Wilson Dam 4 Sept. 1949 (Hall) #1947 - Shelby: barnyard pond nearest road at junction of Gerber Road and hwy U.S.70 30 June 1949 #1090.

STICHOSIPHON Geitler 1931

Stichosiphon filamentosus (Ghose)Geit. (Geitler 30 f) Pl. 36, Fig. 14.

Epiphytic cylindrical plants with rounded apex; unicellular at first, soon forming series of separate spherical oval or short cylindrical cells all of which can escape the gelatinous sheath and form new plants.

The young stages are quite difficult to distinguish from Entophysalis Brebissonii (Menegh.)Drou. & Dail.

Blount: on Vaucheria spp. on seeping rocks at Abrams Falls 9 Sept. 1949 #1866 - Knox: jar culture at collector's home 16 Aug. 1949 #1765 - Montgomery: on filamentous greens among Potamogeton along left bank of Cumberland River at Clarksville 1 Oct. 1949 #2023.

Hormogonales

Oscillatoriaceae

ARTHROSPIRA Stizenberger 1852

Arthrospira Jenneri Gom. (Prescott f)(Smith f) Pl. 37, Fig. 1.

Trichomes forming loose, regular spirals, sides parallel, not or scarcely constricted at cross walls; cells blue-green with granules sometimes along walls; shape quadrate or shorter. Cells L 4-5u; W 3.5-5u. Spiral 14-16u; W 6-9u. Jackson(Ala.): roadside ditch pond near Paint Rock along hwy U.S.72 17 June 1950 #2291 - Obion: field embayment at south end of Isom Lake 10 July 1949 #1282 - Lake: Cranetown nesting area in cypress swamp 5 July 1949 #1175.

Number 2337 is smaller than the recorded dimensions for the species, and perhaps a new variety is justified. Cells L 2-4u; W 3.5-5u. Spirals L 14-16u; W 6-9u. Anderson: pond in sheep pasture about five miles from Andersonville on Scout Camp Road 25 Aug. 1949 #2337.

LYNGBYA Agardh 1824

This genus is grouped with Arthrospira, Oscillatoria, and Phormidium since all contain filamentous species which lack heterocysts and false branches, and are not grouped in a bundle within a common sheath.

The spiral habit of Arthrospira separates it rather easily from the others, and the remaining three are generally differentiated according to the thickness of their sheaths, Lyngbya having the thickest and firmest sheath, Phormidium a narrower one, and Oscillatoria without a persistent sheath at all. Such sheath differences are not altogether constant, and colony type may aid in the separation of the genera, since the filaments of Lyngbya are not fused into the fabric-like layers found in Phormidium.

Unbranched filaments of Plectonema Wollei Farlow may be mistaken for a Lyngbya.

* species not included in text

1. Filaments epiphytic, prostrate for part of length, with ends free in longer expressions........ L. epiphytica Hier.*
1. Filaments not epiphytic.......................... 2
   2. Filaments more or less spiralled or screw-like.......................... 3
   2. Filaments not regularly spiralled or screw-like.......................... 4
3. Cells definitely longer than wide.............
   .... L. contorta Lemm.*

3. Cells more or less quadrate..................
.... L. Lagerheimii (Moeb.)Gom.

4. Species a true plankter, cells 20-
24u broad............ L. Birgei G. M. Smith

4. Species sessile, pad forming, or
mixed with other algae, attached
or floating.............................. 5

5. Sheaths colored............................ 6

5. Sheaths hyaline............................ 8

6. Trichomes 1u or less broad, ochre
colored, cells shorter than broad..........
.... L. ochracea (Kuetz.)Thur.

6. Trichomes 2u broad or larger.................. 7

7. Trichomes about 3u broad, 2-6u long,
sheath reddish yellow to olive................
.... L. versicolor (Wartm.)Gom.

7. Trichomes over 8u broad, length of
cells 1/2-1/3 of width, stratified
sheath hyaline or yellow....................
.... L. aestuarii (Mert.)Lieb.

8. Trichomes 1.5-2u broad, cells
shorter or longer than broad,
definitely violet or purple
colored.. L. purpurea (Hooker & Harvey)Gom.

8. Trichomes not purple or violet.................. 9

9. Trichomes 2-3u broad, end cells

calyptrate..................... L. lutea Gom.*

9\. Trichomes without calyptra, or if with such, then much larger (over 5u broad)...................................... 10

10\. Cells 2-3u broad, end cells not calyptrate, but broadly rounded.................. L. Diguetii Gom.

10\. Cells over 5u broad............................ 11

11\. Cells constricted at cross walls, more or less quadrate-shaped L. putealis Mont.

11\. Cells unconstricted at cross walls, only 1/3-1/2 as long as broad.................. .... L. aestuarii (Mert.)Lieb.

1\. Lyngbya aestuarii (Mert.)Lieb. (Geitler f)(Prescott f) Pl. 37, Fig. 2.

Trichomes straight, twisted, or crowded, not tapering or only slightly tapering toward ends; apex broadly rounded, with a thickened end membrane; sheath at first thin, hyaline, but growing thick, rough, stratified, yellowish or brownish; cell contents finely granular. Cells L 2.5-7.5u; W 8-31u. The species grows abundantly on mud flats about at the water line. Knox: jar culture at collector's home 16 Aug. 1949 #1765 - pond in field of Univ. Tenn. farm 28 Aug. 1950 #2341 - pilings in backwater of Ft. Loudon Lake at Knoxville Waterworks 25 July 1949 #1580 - Cumberland: cultured from collection on wet weather drain into swift mountain stream at

Ozone 16 March 1950 #2054 - Robertson: wet ground around tree bases in swamp a mile south of Cedar Hill 20 Aug. 1949 #1857 - Cheatham: soil bottomed bait raising ponds on Little Marrowbone Creek Road 20 Aug. 1949 #1841 - Colbert(Ala.): moist soil at Spring Creek near Sheffield 5 Sept. 1949 (Hall) #1959 - Montgomery: slow upland branch at Sanctified, Ft. Campbell 12 June 1950 (Clebsch)#2259 - Obion: roadside slough west of Union City on road to Walnut Log 14 June 1950 #2247 - margins of Reelfoot Lake among aquatic plants 14 June 1950 #2257. VNFKL.

2. Lyngbya Birgii G. M. Smith. (Prescott f)(Smith f)

Trichomes straight, not tapering toward ends; apex truncate, not capitate; sheath thick, hyaline; cell contents granular. Cells L 3-6u; W 20-24u. The species is an infrequent true plankter in the region. Obion: in foam on leeward side of Bayou du Chien near Walnut Log 2 July 1949 #1154. NK.

3. Lyngbya Diguetii Gom. (Geitler)(Prescott f)

Trichomes contorted at base but straight for most of length, not tapering toward ends, apex broadly rounded, not capitate; sheath thin, hyaline; cell contents pale blue-green. Cells L 1-4u; W 2-3u. Montgomery: pond at Mt. Carmel by hwy Tenn.112 3 Sept. 1949 (Clebsch)#1908. VNFK.

4. Lyngbya Lagerheimii (Moeb.)Gom. (Geitler f)(Prescott f) (Smith f)

Trichomes more or less spiralled or screw-shaped, sometimes straight, ends not tapered; apex not capitate;

sheath thin, hyaline; cell contents with two granules at the cross walls. Cells L 1-3u; W about 2u. The more or less quadrate cells distinguish the species from L. contorta Lemm. in which the cells are definitely longer than broad. SFKL.

5. Lyngbya ochracea (Kuetz.)Thur. (Geitler f)(Smith)

Filaments straight or bent, very fragile, not tapered toward ends; apex rounded; sheath thin, hyaline when young, becoming ochre-yellow; cell contents greyish, homogeneous. Cells L .5-.8u; W 1u. The writer has not been able to distinguish this species distinctly from autotrophic iron bacteria which are found in extensive delicate expanses of ochreous masses in pools or flows. Even evidence from plate cultures is contradictory. Sevier: seeping bank (1400 ft.) Greenbrier Swimming Pool at Gatlinburg 5 Sept. 1941 #129[1] - mucky pool (3000 ft.) Porter's Creek in Greenbrier 5 Sept. 1941 #156[1]- Blount: seepage through crack in concrete dam by Peery Bros. Mill at Walland 19 June 1949 #869 - Knox: small stream deeply imbedded in red alluvial clay at Ijams' place on Island Home Pike 20 July 1949 #1514 - pools among tree roots in pond by Ten Mile Creek at Farragut 23 July 1949 #1548. VNSGM.

6. Lyngbya purpurea (Hooker & Harvey)Gom. (Geitler 25)

Trichomes straight, not tapered toward ends, apex rounded; sheath thin, hyaline; cell contents violet; cells more or less

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1 Reported in Silva and Sharp, 1944

quadrate, length from half to twice width. Cells L .75-3u; W 1.5-2u.

7. Lyngbya putealis Mont. (Geitler f)

Trichomes straight, not tapered toward ends; apex broadly rounded; sheaths hyaline, unstratified; cell contents granular; blue-green cells more or less quadrate. Cells L 8-13u; W 7.5-13u. The combination of definite constrictions at cross walls, and quadrate cells characterizes the species. Sevier: in spring (2500 ft.) at Hiking Club Cabin in Greenbrier 3 Aug. 1941 #210[1] - Colbert(Ala.): on soil by Spring Creek near Sheffield 4 Oct. 1949 (Hall)#1959 - Montgomery: Seven Mile Ferry on Cumberland River three miles southeast of Clarksville 9 Oct. 1949 (Clebsch)#1905 - below and above lock B on Cumberland River 23 Sept. 1949 #1930. VGFKML.

8. Lyngbya versicolor Gom. (Geitler f)(Prescott f)

Trichomes twisted, entangled, mucous, and densely agglutinated, not tapering toward ends; apex broadly rounded; cell contents sometimes granular, blue-green. Cells L 2-3.5u; W 2.5-3.5u. Sheath 1-2u thick. Sevier: rock in swift water (2500 ft.) Porters Creek in Greenbrier 3 Aug. 1941 #150[1] - Knox: aquarium of Univ. Tenn. botany department 1 Sept. 1950 #2344 - goldfish pond on Harry Ijams' place on Island Home Pike 20 July 1949 #1609 - Lauderdale(Ala.): flowing well by Cypress Creek at Florence 2 Oct. 1949 (Hall)#1936.

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1 Reported in Silva and Sharp, 1944

MICROCOLEUS Desmazieres 1823

In this genus several trichomes are enclosed within a firm sheath, forming a sort of rope. The relatively even surface, firmness of the sheath, and the greater number of trichomes within a sheath generally are used to distinguish the genus from Schizothrix, but there are difficult-to-describe differences which can be detected only by experience.

The genus is generally terrestrial.

* species not included in text

1. End cells capitate, with calyptra............
   .... M. vaginatus (Vauch.)Gom.
1. End cell neither capitate nor calyptrate.. 2
   2. Trichomes less than 3u broad, ends long and tapered...... M. acutissimus Gard.*
   2. Trichomes over 3u broad........................... 3
3. Cells constricted at cross walls.............
   .... M. lacustris A. Braun
3. Cells unconstricted.............................. 4
   4. Trichomes 3-4u broad....................
      .... M. rupicola (Tild.)Drou.
   4. Trichomes 5-7u broad....................
      .... M. paludosus (Kuetz.)Gom.

1. Microcoleus lacustris A. Braun. (Geitler f)(Prescott f) (Smith)

Trichomes constricted at cross walls; not tapered toward ends; apex obtusely conical; cell contents with some coarse granules, pale blue-green. Cells L 8-12u; W 4-5u. Knox: Little River embayment of Ft. Loudon Lake about 1 Aug. 1950 #2354. VNSFM.

2. Microcoleus paludosus (Kuetz.)Gom. (Geitler f)(Prescott f) (Smith) Pl. 37, Fig. 3.

Trichomes unconstricted at cross walls, parallel or twisted; scarcely tapered at ends; apex conical; cell contents pale blue-green. Cells L 4-13u; W 5-7u. Knox: soil in greenhouse of Univ. of Tenn. 11 April 1944 (Sharp)#A442[1] - same site 1 Sept. 1950 #2346 - in murky creek at Neubert's Springs 20 July 1949 #1524 - backwater of Ft. Loudon Lake at Knoxville Waterworks 25 July 1949 #1579. VNF.

3. Microcoleus rupicola (Tild.)Drou. (Drouet 43)
(Schizothrix rupicola Tild. of Geitler etc.)

Trichomes unconstricted at cell walls, loosely entwined or parallel; not tapered toward ends; apex broadly conical; sheath hyaline or becoming brownish and stratified; cell contents blue-green. Cells L 5-8u; W 3-4.5u. Knox: laboratory soil culture at Univ. of Tenn. 1 Sept. 1950 #2345 - Morgan: bare slate face by hwy U.S.27 near Wartburg 15 July

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1 Reported in Silva and Sharp, 1944

1950 #1500 - Colbert(Ala.): embayment of Wilson Lake near dam 16 June 1950 #2265 - Obion: soil at Reelfoot Lake Biological Station 14 June 1950 #2260.

4. Microcoleus vaginatus (Vauch.)Gom. (Geitler f)(Prescott f)(Smith f)

Trichomes unconstricted at cross walls, numerous, parallel within sheath, very gradually attenuate to ends; capitate at apex; sheath hyaline, often completely diffluent; cell contents blue-green to olive-green; cross walls usually granulated; cells subquadrate, or width twice length. Cells L 3-7u; W 3.5-7u.

This is a common terrestrial species. Its capitate trichomes and short cells serve to distinguish it immediately. As Drouet (1934, et al) has pointed out, single strands are frequent, and they are easily mistaken for Oscillatoria or Phormidium.

Sevier: on soil under mill at Pigeon Forge 29 July 1949 #1598 - Same, ground in Chimneys Camp ground 4 Aug. 1949 #1641 - Knox: soil at edge of puddle (925 ft.) Knoxville March 1944 (Sharp)#A441 - road cut puddle at Island Home Park entrance 30 July 1949 #1504 - murky creek at Neubert's Springs 30 July 1949 #1524 - Cumberland: wet weather drain into swift stream at Ozone 18 March 1950 - Montgomery: rain-water pond in river bottom land near Edmonson's Ferry 31 July 1949 (Clebsch)#2039.

OSCILLATORIA Vaucher 1803

Unfortunately the genus name can not indicate a reliable character to the observer, since almost any genus in the family may exhibit oscillating trichomes. To add to the difficulties in differentiating species within the genus, trichomes in those of the genera which generally have observable sheaths may slip out of such sheaths and oscillate vigorously. Careful observation of mature colonies is often necessary if one is to be entirely certain of the plant under observation.

* species not included in text

1. Cells very short (length at most 1/3 of width) 2
1. Cells 1/3 of width or longer in proportion 7
   2. Trichomes scarcely tapered, if at all 3
   2. Trichome clearly tapered to end .... O. anguina (Bory)Gom.
3. Trichomes constricted at cross walls 4
3. Trichomes not constricted at walls 5
   4. Trichomes straight, slightly capitate, and calyptrate...... O. sancta Kuetz.
   4. Trichomes with screw-like ends, neither capitate nor calyptrate........... .... O. ornata Kuetz.*
5. Trichomes straight, and cells with

thickened membrane 11-23u broad *O. limosa* Ag.

5. Trichomes curved, bent, or screw-like.. 6

6. Apex slightly capitate, only slightly bent......... *O. princeps* Vauch.

6. Apex broadly rounded, end distinctly hooked.......... *O. curviceps* Ag.*

7. Trichome characteristically a yellow-green color, cells more or less quadrate 3.5-3u broad..... *O. chlorina* Kuetz.*

7. Trichomes not yellow-green colored................ 8

8. Trichomes screw-like at least toward end................................ 9

8. Trichomes straight, not screw-like although they may be bent at the end.................................. 10

9. Apex cells capitate....... *O. Grunowiana* Gom.

9. Apex cells not capitate. *O. terebriformis* Ag.*

10. Trichome ends untapered.......................... 11

10. Trichome ends tapered............................ 15

11. Cells shorter than broad.......................... 12

11. Cells longer than broad............................ 14

12. Trichomes distinctly constricted at crosswalls.......... *O. chalybea* Mert.*

12. Trichomes not constricted.......................... 13

13. Trichomes over 4u broad........ *O. tenuis* Ag.

13. Trichomes up to 3.2 broad, cell length 1/2-1/3 times width, with thick walls.............. O. articulata Gard.*

14. Trichomes constricted at cross walls................ O. geminata Menegh.*

14. Trichomes unconstricted.. O. amphibia Ag.

15. Trichomes constricted at cross walls.............. 16

15. Trichomes unconstricted.......................... 18

16. Apex clearly capitate.................... .... O. amoena (Kuetz.)Gom.

16. Apex not capitate............................. 17

17. Apical cell conically tapered O. formosa Bory

17. Apical cell broad and more or less rounded.................... O. chalybea Mert.*

18. Apical cell capitate........................ 19

18. Apical cell not capitate...................... 21

19. Cells distinctly longer than broad, L 3-9u; W 2-3u............ O. splendida Grev.

19. Cells quadrate or shorter....................... 20

20. Cells distinctly shorter than broad, often full of pseudovacuoles refracting a distinctly rosy color, L 2-4u; W 6-8u......... O. rubescens DeC.

20. Cells about quadrate, pseudovacuoles not refracting rosy color............... .... O. prolifica (Grev.)Gom.

21. Planktonic, with pseudovacuoles, cells 4-6u broad with various tips but usually straight, and not regularly conical.............. *O. Agardhii* Gom.

21. Without pseudovacuoles, apical cell conical and curved.... *O. brevis* (Kuetz.)Gom.

1. *Oscillatoria Agardhii* Gom. (Geitler f)(Prescott f)

Trichomes straight, unconstricted at cross walls, tapering toward ends; apex obtuse, capitate, calyptra convex-shaped when present; plant mass floating, widely expanded; cell contents coarsely granular, pale blue-green, often showing considerable refraction from pseudovacuoles. Cells L 2.5-3.5u; W 4-6u. Laury: plankton from Laura Lake 24 Sept. 1955 (Bold)#B-110. FK.

2. *Oscillatoria amoena* Gom. (Geitler f)(Prescott f)

Trichomes straight or bending, slightly constricted at the cross walls; apex capitate, with a depressed calyptra, hooked or undulate; cell contents blue-green with granules at wall. Cells L 2.5-4.5u; W 2.5-5u. Montgomery: pond at Dotsonville Road and hwy U.S.76 west of Clarksville 30 April 1950 (Clebsch)#2360. N.

3. *Oscillatoria amphibia* Ag. (Geitler f)(Prescott f)(Smith)

Trichomes straight, unconstricted at cross walls; apex rounded, not capitate or calyptrate; cell contents pale blue-green, scarcely granular, but two usually present at cross walls. Cells L 4-8u; W 2-3u. NFKL.

4. Oscillatoria anguina (Bory)Gom. (Geitler f)(Prescott f)

Trichomes straight below, not constricted at cross walls, hooked or spiral above, long attenuated toward ends; apex obtusely capitate, apical cell enlarged, button-like; cell contents dark blue-green, cross walls granulated; enlarged cells often present in filament. Cells L 1.5-2.5u; W 6-8u. Knox: aquarium at Univ. Tenn. 1 Sept. 1950 #2243. VF.

5. Oscillatoria brevis (Kuetz.)Gom. (Geitler f)(Smith) Pl. 37, Fig. 5.

Trichomes straight, unconstricted at cross walls, tapering towards ends, hooked or twisted to sometimes pointed ends; apex not capitate or calyptrate; cell contents finely granular, olive-green colored. Inflated cells sometimes present in filament. Cells L 1.5-3u; W 4-6.5u. Knox: in small stream by waterwheel on Farragut-Blue Grass road 3 Aug. 1950 #2306 - Cheatham: soil bottomed bait raising pools on Little Marrowbone Creek Road 20 Aug. 1949 #1834 - Colbert(Ala.): on dead fish below Wilson Dam 4 Sept. 1949 (Hall) #1945. VFL.

6. Oscillatoria formosa Bory. (Geitler f)(Prescott f)

Trichomes straight or flexuous, usually slightly constricted at the cross walls, briefly tapered, bent or hooked toward conical apical cells; apex neither capitate nor calyptrate; cell contents bright blue-green, transverse cell walls sometimes finely granulate; cells quadrate or shorter. Cells L 2.5-5u; W 4-6u. Chester: among <u>Chara</u> spp. around edges of artificial lake in Chickasaw State Park 16 June 1950 #2273. VNFKML.

7. <u>Oscillatoria</u> <u>Grunowiana</u> Gom. (Geitler)

Trichomes irregularly spiralled or straight, constricted at cross walls, scarcely tapered toward ends and bent or hooked; apex rounded, scarcely capitate, not calyptrate; cell contents pale blue-green, transverse walls faint, sometimes granulated. Cells L 1.4-4u; W 3.7-5.6u. Knox: on wooden pilings of Ft. Loudon Lake backwater at Knoxville Waterworks 25 July 1949 #1580 - Cheatham: soil bottomed bait raising ponds on Little Marrowbone Creek Road 20 Aug. 1949 #1844 - Montgomery: along Yellow Creek in Riggins Mill region near Shiloh 21 Aug. 1949 #1859.

8. <u>Oscillatoria</u> <u>limosa</u> Ag. (Geitler f)(Prescott f) Pl. 37, Fig. 6.

Trichomes straight, not constricted at cross walls, not tapering toward ends; apex neither capitate nor calyptrate, obtusely rounded; cell contents blue-green or olive, cross walls frequently granulated. Cells L 2-5u; W 11-20u. Sevier: quiet stagnant pool (2250 ft.) in Middle Prong of Little Pigeon River in Greenbrier 3 Sept. 1941 #167[1] - slow water (2500 ft.) near Hiking Club Cabin in Greenbrier 26

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1 Reported in Silva and Sharp, 1944

April 1948 #216 - Knox: floating in Ft. Loudon Lake (pH 8.0) at Duncan's Dock 12 June 1949 #800 - in road rut pools at Island Home Park entrance 20 July 1949 #1507 - plankton from Ft. Loudon Lake backwater at Knoxville Waterworks 22 July 1949 #1579 - Overton: around margins of swimming area in artificial lake in Standing Stone State Park 15 June 1949 #1579 - Lauderdale - Colbert(Ala.): on floating board in running water of Pickwick Lake near Wilson Dam 4 Sept. 1949 (Hall)#1952 - Colbert(Ala.): on concrete settling basin at Sheffield 15 Oct. 1949 (Hall)#1963 - Montgomery: field pond at Meriwether 18 March #2098. VNSGFL.

Quiet standing waters usually form the habitat for this common floating or attached form, throughout the region.

9. <u>Oscillatoria</u> <u>princeps</u> Vauch. (Geitler f)(Prescott f) (Smith f)

Trichomes straight, rigid, not constricted at cross-walls, tapered somewhat briefly and hooked toward ends, apex broad, slightly capitate but not calyptrate; cell contents dark blue-green, granular, but cross walls not granular. Cells L 3½-7u; W 16-60u (generally 25-50u). The species may be expected in almost any stable habitat of quiet water. Blount: open sluggish ditch (950 ft.) Maryville 21 Oct. 1941 #4120[1] - Knox: floating in patches in Ft. Loudon Lake near

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1 Reported in Silva and Sharp, 1944

Duncan Dock 3 Sept. 1949 #1878 - Overton: large shallow lake with many aquatic plants one mile northwest of Livingston 18 July 1949 #1465 - Jackson(Ala.): embayment of Guntersville Lake north of Scottsboro 19 Aug. 1949 #1777-8 - Montgomery: pond at Tom Edwards' store on hwy U.S.79 west of Clarksville 14 July 1949 #1371 - pond near Woodlawn 9 Oct. 1949 (Clebsch)#2025 - Dickson: Woodhaven Lake 4 April 1949 (Shanks)#1990. VNSFKAML.

10. <u>Oscillatoria</u> <u>proboscidea</u> Gom. (Geitler f)

Trichomes straight, not constricted at crosswalls; distinctly tapered toward ends, sickle-shaped or screw-like; apical cells flatly capitate with slightly thickened membrane; cell contents dark blue-green. Cells ½-1/6 as long as broad. L 2-4u; W 12-18u. Montgomery: woods pond east of Shady Grove 3 Sept. 1949 #1909. FL.

11. <u>Oscillatoria</u> <u>rubescens</u> DeC. (Geitler f)(Prescott)

Trichomes straight, unconstricted at crosswalls; tapering slightly toward ends; apical cell flatly capitate and calyptrate; cell containing many pseudovacuoles refracting to give a macroscopic color of rose or red-violet. Cells 2-4u; W 6-8u. Montgomery: old stock pond near junction of hwy U.S.79 and Blooming Grove Creek Road 14 July 1949 #1414 - Stewart: pond along hwy U.S.79 east of Dover 14 July 1949 #1361. VF.

12. <u>Oscillatoria</u> <u>sancta</u> Kuetz. (Geitler f)(Prescott f) (Smith)

Trichomes straight or flexuous, not constricted at cross walls, long attenuated to ends; apical cells conspicuously capitate but not calyptrate; cell contents homogeneous, bright blue-green. Cells L 3-9u; W 2-3u. Knox: plankton sweep in backwater from Ft. Loudon Lake at Knoxville Waterworks 25 July 1949 #1579 - Cumberland: culture of collection made from wet weather drain into swift stream at Ozone 16 March 1950 #2054 - Colbert(Ala.): on concrete of settling basin at Sheffield Ala. 15 Oct. 1949 (Hall) #1265. VNSFKL.

13. Oscillatoria tenuis Ag. (Geitler f)(Prescott f)(Smith) Pl. 37, Fig. 7.

Trichomes straight, fragile, constricted at cross-walls, not tapering, but sometimes curved to end; apical cell rounded with thickened end membrane; cell contents bright or dark blue-green; granulated, crosswalls with row of granules; cells subquadrate to length 1/3 of width. Cells L 2.5-5u; W 4-10u. Blount: barnyard pond (1200 ft.) Cades Cove Road 21 Aug. 1941 #107[1] - moist soil at edge of open ditch (950 ft.) at Maryville 21 Oct. 1941 #4121[1] - Laurel Lake near Kinzel Springs 4 Aug. 1949 #1647-8 - Knox: floating in patches in swampy area on Univ. of Tenn. farm 1 Aug. 1949 #1598 - floating patches in Ft. Loudon Lake near Duncan's Dock 3 Sept. 1950 #1878 - Roane: on boat bottom at Kingston Dock

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1 Reported in Silva and Sharp, 1944

in Watts Bar Lake 16 March 1950 #2052 - Chester: around edges of artificial lake in Chickasaw State Park 16 June 1950 #2273. VNFKL.

14. Oscillatoria tenuis var. natans Gom. (Prescott f)

Cells 6-10u. Sevier: mucky rainfilled rock pool (5000 ft.) Road Prong 1¼ miles below Indian Gap 14 Aug. 1941 #30.[1] F.

15. Oscillatoria tenuis var. tergestina (Kuetz.)Rab. (Geitler f)(Prescott f)

Cells W 4-6u. Tips turn right as do those of the species, according to descriptions. NSF.

PHORMIDIUM Kuetzing 1843

Phormidium is often described as intermediate in structure between Oscillatoria, without a usually discernible sheath and Lyngbya with a definite and firm sheath. A good, though difficult-to-describe, additional character is the lateral confluence of filaments to form a fabric which is far more substantial than a colony or mat of Oscillatoria.

* species not included in text

1. Trichomes less than 1u broad P. Treleasii Gom.*
1. Trichomes broader.................................... 2
    2. Trichomes less than 3u broad...................... 3
    2. Trichomes more than 3u broad...................... 6
3. Apical cells with narrowly conical point.. 5
3. Apical cells not narrowly conical.......................... 4

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1 Reported in Silva and Sharp, 1944

4. Filaments straight, cross walls slightly constricted.................... .... *P.* *tenue* (Menegh.)Gom.

4. Filaments more or less bent, cross walls unconstricted............... .... *P.* *laminosum* (Ag.)Gom.*

5. Trichomes slightly constricted 1-2u broad.................. *P.* *luridum* (Kuetz.)Gom.

5. Trichomes 2-3u broad, cross walls never constricted *P.* *Valderianum* (Delp.)Schm.

6. Trichome ends untapered.................. .... *P.* *Retzii* (Ag.)Gom.

6. Trichome ends tapered.......................... 7

7. Apical cells capitate............................... 8

7. Apical cells not capitate.......................... 10

8. Cells quadrate or shorter............... .... *P.* *papyraceum* (Ag.)Gom.

8. Cells quadrate or longer........................ 9

9. Apical cells obtusely conical, cell contents sometimes granular................. .... *P.* *corium* (Ag.)Gom.

9. Apical cells round, cell contents homogeneous..... *P.* *minnesotense* (Tild.)Drou.

10. Apical cell long conical................. .... *P.* *subfuscum* Kuetz.

10. Apical cell shorter conical or rounded.................................. 11

11. Ends of filaments straight.................................
.... P. favosum (Bory)Gom.

11. Ends bent... 12

12. Cells generally short (length 1/2-1/3 width), end cells with button-like capitation... P. uncinatum (Ag.)Gom.

12. Cells usually at least quadrately long, end cells with truncate or wedge-shaped rather than button-like capitation... P. autumnale (Ag.)Gom.

1. Phormidium autumnale (Ag.)Gom. (Geitler f)(Prescott f) (Smith)

Trichomes usually straight, not constricted at cross walls, tapering briefly to ends; apical cell capitate with rotund calyptra; sheaths narrow, distinct or confluent; cell contents blue-green frequently granulated at cross walls. Cells L 2-5u; W 4-7u. Cherokee(N.C.): coating on rocks below Hiwassee Dam 14 Aug. 1949 #1745 - Sevier: on wet debris (5250 ft.) Newfound Gap 29 March. 1942 #204[1] - shallow water of Murphy Lake at Elkmont 4 Aug. 1949 #1643 - Blount: in water on rocks at Abrams Falls 20 Aug. 1950 #2342 - Knox: pond by Deadhorse Lake near Farragut 30 July 1950 #2303 - wet leaves and trash on wall of Univ. of Tenn. campus 20 Aug. 1950 #2833 - road rut puddle at entrance to

1 Reported in Silva and Sharp, 1944

Island Home Park 20 July 1949 #1503 - Pickett: flat rock of creek a few miles south of state line on Jamestown Road by Hwy Tenn.28 15 July 1949 #1491 - Sumner: cultured from collection on rocks of small stream in field northeast of Gallatin 17 March 1950 #2198. VNFK.

2. Phormidium ambiguum Gom. (Geitler f)(Prescott f)

Trichomes flexuous, interwoven, slightly constricted at cross walls, not tapering to ends, apical cell broadly rounded, end membrane thickened; sheath firm or gelatinous and diffluent, sometimes thick and stratified; cell contents blue-green, sometimes granular especially at cross walls. Cells L 1.5-3u; W 4-6u. Lauderdale - Colbert(Ala.): on rocks in running water below Wilson Dam 4 Sept. 1949 (Hall) #1951. K.

3. Phormidium corium (Ag.)Gom. (Geitler f)(Prescott f)(Smith)

Trichomes flexuous, closely interwoven, not constricted at cross walls; briefly tapered to acute-conical ends; apical cell neither capitate nor calyptrate; sheath thin, distinct or diffluent; cell contents blue-green, sometimes granular. Cells subquadrate to twice as long as broad. L 3.5-8u; W 3-4.5u. Jackson(Ala.): ditch pond alongside hwy U.S.72 near Paint Rock 17 June 1950 #2291. VNS.

4. Phormidium favosum (Bory)Gom. (Geitler f)(Prescott f)

Trichomes flexuous, interwoven, not constricted at cross walls, gradually tapering, possible spiralling to ends;

apical cell conspicuously capitate, obtusely truncate, with hemispherical calyptra; sheath diffluent into gelatinous matrix; cell contents blue-green with single row of granules along cross walls. Cells L 3-7u; W 4.5-8u. Lauderdale - Colbert(Ala.): on rocks in running water below Wilson Dam 4 Oct. 1949 #1949 - Obion: on soil by Reelfoot Lake Biological Station 14 June 1950 #980. V.L.

5. Phormidium inundatum Kuetz. (Geitler f)(Prescott f)

Trichomes rather straight or curved, fragile, tapering briefly to ends; apical cell obtusely conical, not capitate or calyptrate; sheaths thin, diffluent; cell contents blue-green, granules along cross walls. Cells L 4-8u; W 3-5u. Sevier: near Sugarlands C. C. C. Camp (1740 ft.) 11 Aug. 1941 #24[1] - and four other collections from the county reported at the same time. Additional collections have been made during 1947-9, and there is every indication that the species is quite common as a rock coating in the swift clear water of the mountain streams. VNSF.

6. Phormidium luridum (Kuetz.)Gom. (Geitler f)

Trichomes straight and parallel or intermeshed, not constricted or only slightly constricted at cross walls, not tapering to ends, apical cell rounded; not capitate or calyptrate; sheaths thin and diffluent; cell contents clear grey or blue-green. Cells L 2-5u; W 1.5-2u. Colbert:

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1 Reported in Silva and Sharp, 1944

embayment on south side of Wilson Lake 16 June 1950 #2284 - Montgomery: on stick in flume of Ringgold Mill 18 March 1950 #2043. VL.

7. Phormidium minnesotense (Tild.) Drou. (Drouet 42)(Prescott f)
(Oscillatoria minnesotense Tild.)

Trichomes straight, compact, parallel, or slightly bent, conspicuously constricted at cross walls, not tapering to ends; apex straight or slightly bent, with rounded apical cell; not capitate or calyptrate; sheath thin, diffluent; cell contents homogeneous, dark blue-green. Cells L 2-4u; W 2-5u. Davidson: greenhouse soil at Centennial Park of Nashville Oct. 1938 H. C. Bold's #164.[1] VF.

8. Phormidium papyraceum (Ag.) Gom. (Geitler f)

Trichomes strongly flexuous, often closely interwoven, slightly or not at all constricted at cross walls, briefly attenuated to ends; obtuse-conical apical cell, neither capitate nor calyptrate; sheath thin, papery or diffluent; cell contents clear bright blue-green, not granulated, cross walls conspicuous. Cells subquadrate or shorter than wide. L 2-5u; W 3-5u. Sevier: rocks in swift water (5000 ft.) Road Prong below Indian Gap 14 Aug. 1941 #22[2] - moist siliceous boulder (2600 ft.) Porters Creek in Greenbrier 26 April 1942 #211[2] - Blount: rocks in swift water (1750 ft.)

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1 Reported in Drouet, 1942
2 Reported in Silva and Sharp, 1944

Abrams Creek in Cades Cove 23 Aug. 1941 #74 - Lake: Cranetown nesting area in cypress swamp 8 July 1949 #1179. VNFK.

9. Phormidium Retzii (Ag.) Gom. (Geitler f)(Prescott f) (Smith) Pl. 37, Fig. 8.

Filaments more or less straight, fragile, not constricted at cross walls or only at apex, tapering briefly or not tapering to ends; apical cell truncately rounded with slightly thick outer membrane; sheath thin, diffluent; cell contents blue-green or blackish-blue, coarsely granular. Cells L 4-8u; W 4.5-12u. Swain(N.C.): sluggish rock pool (2800 ft.) Cabin Flats on Bradley Fork 7 Sept. 1941 #125[1] - Sevier: boulders in Fighting Creek at Park administration building 19 August 1941 #414[1] - Blount: mud in road drain (1800 ft.) Cades Cove 25 Aug. 1941 #90[1] - shallow water on pebbles (1750 ft.) Abrams Creek 25 Aug. 1941 #94[1] - Morgan: small stream at Culvert south of Rugby Road by hwy U.S.27 15 July 1949 #1497 - Montgomery: rocky falling stream Foster's Cave Creek 14 July 1949 #1491 - Houston: fairly recent fishpool filled by spring water at Erin 21 Aug. 1949 #1867. VNSFKAM.

10. Phormidium subfuscum Kuetz. (Geitler f)(Prescott f)

Trichomes straight, fragile, not constricted at cross walls, briefly tapering to ends; apical cell conical, capitate with calyptra; sheaths diffluent; cell contents dull blue-green, sometimes with two rows of granules at cross

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1 Reported in Silva and Sharp, 1944

walls. Cell L 3-4u; W 5.5-11u. VN.

11. <u>Phormidium</u> <u>tenue</u> (Menegh.)Gom. (Geitler f)(Prescott f) (Smith)

Trichomes more or less straight, intermeshed, not or only slightly constricted at cross walls, attenuated and hooked at ends; apical cell often acute-conical, not calyptrate; sheath thin, diffluent into fibrous jelly; cell contents bright, clear blue-green, cross walls often indistinct. Cells L 2.5-5u; W 1-2u. Jackson: roadside ditchpond along Hwy U.S. 72 near Paint Rock 17 July 1950 #2291 - Lauderdale(Ala.): flowing well by Cypress Creek at Florence 2 Oct. 1949 (Hall) #1966 - Colbert(Ala.): concrete tank at Nitrate Plant #1, Sheffield 16 Oct. 1949 #1969 - Montgomery: hog pond containing willows etc. north of Hazelwood 18 March 1950 #2095 - Chester: along margins of artificial lake in Chickasaw State Park 16 June 1950 #2273 - Obion - Lake: along margins of Reelfoot Lake 14 June 1950 #2257. VNSFKL.

12. <u>Phormidium</u> <u>uncinatum</u> (Ag.)Gom. (Geitler f)(Prescott f) (Smith) Pl. 37, Fig. 9.

Trichomes straight or flexuous, not constricted at cross walls, tapering briefly and curved, hooked, or even spiralling to ends; apical cells conical or round, capitate and calyptrate; sheath gelatinous, diffluent; cell contents blue-green with cross-walls sometimes granulated. Cells L 2-6u; W 6-9u. Sevier: rock in swift water (4900 ft.) Walker Prong 29

March 1942 #205[1] - Blount: Maryville 21 Oct. 1941 (Sharp) #4124[1] - Knox: rocks in shallow water of sinkhole lake at Lakeside 15 March 1950 #2051 - Cumberland: rather swift stream at Ozone 16 March 1950 #2053 - Colbert(Ala.): embayment of Wilson Lake near dam 16 June 1950 #2286 - Montgomery: tributary to Louise Creek 1 mile southwest of Southside 13 May 1950 #2318. VRSFKM.

PLECTONEMA Thuret 1875

Plectonema is distinguished from other genera of the Oscillatoriaceae by its false branching and single trichome within a sheath, and, from other genera with false branching by the lack of heterocysts. Unbranched filaments are very difficult to distinguish from Lyngbya. In the case of P. Wollei Farl. the size and habit aid in placing it properly.

* species not in text

1. Filaments less than 10u broad 2
1. Filaments over 10u broad 3
   2. Filaments 1-2u broad... P. nostocorum Born.
   2. Filaments 4-10u, reddish colored..........
      .... P. roseolum Gom.*
3. Filaments over 25u broad...... P. Wollei Farl.
3. Filaments 11-22u broad... P. Tomasinianum Gom.

1. Plectonema nostocorum Born. (Geitler f)(Prescott f)
Pl. 37, Fig. 10.

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1 Reported in Silva and Sharp, 1944

Trichomes flexuous or straight, constricted at cross walls; falsely branched, singly or in pairs, branching sparse except near base; apical cells rounded; sheath hyaline, thin, may or may not be diffluent, since plant is frequently found in gelatinous matrices of other algae. Cells L 2-2.5u; W 1-1.5u. This species seems difficult to distinguish from small Phormidium species, and only the presence of false branching distinguishes the two satisfactorily. Haywood (N.C.): wet wood of small flume at Cherokee 13 Aug. 1949 #1713 - Cherokee(N.C.): on mine floats in Hiwassee Lake near dam 14 Aug. 1949 #1741 - Sevier: moist siliceous bluff (1700 ft.) below Elkmont 8 Sept. 1941 (Sharp)#4115[1] - Jefferson: semi-permanent zone east of Cherokee Dam on mud in water 26 June 1949 #906 - Knox: greenhouse aquarium of Univ. Tenn. greenhouse [illegible] Oct. 1943 (Sharp)#T 1[1] - same site 20 Aug. 1950 #2334 - sides of concrete reservoir at Neubert's Springs 20 July 1949 #1531 - Cumberland: swift stream, Ozone Creek, at Ozone 18 March 1950 #2053 - Wilson: creek running over shelving limestone by hwy U.S.70-N eight miles west of Lebanon 14 July 1949 #1877 - Davidson: small quarry near Melrose Center 20 Aug. 1949 #1806 - Colbert(Ala.): embayment of Wilson Lake near dam 16 June 1950 #2285 - Montgomery: ditch outside W. C. Austin's farm by hwy U.S.79 at Foster's Cave Road 18 March 1950 #2081 - field pond at Meri-

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1 Reported in Silva, 1944

wether 18 March 1950 #[illegible]097.

2. *Plectonema Tomasinianum* Gom. (Geitler f)(Smith f)

Trichomes flexuous, constricted at cross walls, entangled into caespitose mass; repeatedly branched, often in pairs; apex rounded; sheath thin, hyaline at first, becoming yellowish-brown, thick (3u) and stratified; cell contents blue-green, coarsely granular. Cells L 3-9u; W 11-[illegible]2u. The report by Silva & Sharp, 1944 is in error. Greene: swamp caused by road building and containing *Salix*, *Juncus*, *Typha*, and *Carex* 25 June 1940 #93[illegible]a.

3. *Plectonema Wollei* Farl. (Geitler f)(Prescott f)(Smith) Pl. 37, Fig. 11.

Trichomes straight or curved, not constricted at cross walls, entangled into woolly mass, frequently floating; infrequently showing false branches, mainly in pairs, issuing obliquely; apex truncately rounded; sheath colorless or yellow, orange, rough and stratified; cell contents blue-green or blackish, finely granular. Cells L 4-9u; W 28-47u. Without the false branching, which is a most frequent condition, there is no means of distinguishing the species from a *Lyngbya*. Colbert(Ala.): embayments on south side of Wilson Lake 18 June 1950 #2992 - Montgomery: rocks on left bank of Cumberland River 3½ miles south of Clarksville 5 Sept. 1949 (Clebsch)#1913 - pond on Dotsonville Road corner 9 Oct. 1949 (Clebsch)#2031.

PORPHYROSIPHON Kuetzing 1850

<u>Porphyrosiphon</u> <u>Notarisii</u> (Menegh.)Kuetz. (Geitler f) (Smith f) Pl. 77, Fig. 10.

Trichomes curved, entangled, constricted or unconstricted at cross walls; usually not tapering to ends; apex obtuse-ly rounded; sheaths purple, reddish, or hyaline near apex, layers sometimes differently colored; cell contents blue-green, granular. Cells L 4.8-10μ; W 14-19μ. It is the sheath, and the terrestrial habit which characterize this species. Extensive red-purple mats are formed which can frequently be identified on sight. Henry: Alluvial bottoms along Big Sandy River south of Manleyville 11 May 1947 (Shanks)#1974. WNSFL.

SCHIZOTHRIX Kuetzing 1843

This is one of the most difficult genera of blue-green algae to recognize or describe satisfactorily. It has been divided into a number of separate genera, represented here only by the sections of the genus. The simplest definition of the genus would perhaps be based on the occurrence of a few parallel or entwined filaments enclosed in a common sheath, but there are variations. Often single trichomes lie within a sheath or else the sheaths are confluent and, when lying flat, the colonies as formed look quite like those of <u>Phormidium</u>. The species with tufted colonies or colored sheaths fortunately possess considerably more characters of distinction, and some practice may actually enable one to distinguish the irregular surfaced sheath as belonging to Schizothrix although a single trichome lies within it. Needless to say, well developed colonies are highly desirable if species are to be identified.

* species not included in text

1. Sheaths uncolored, except in very old specimens.. 2
1. Sheaths distinctly colored.............................. 8
   2. Filaments united into tufts......................... 3
   2. Filaments not united into tufts..................... 6
3. Cells shorter than broad, or quadrate................ 4
3. Cells longer than broad, or quadrate................. 5
   4. Trichomes 2u broad S. fragilis (Kuetz.)Gom*
   4. Trichomes 4-6u broad. S. Stricklandii Drou.
5. Trichomes 3-6u broad..... S. Friesii (Ag.)Gom.
5. Trichomes 1-1.5u broad.. S. lacustris A. Braun
   6. End cells rounded, trichomes 1.5-2u broad....... S. lardaceae (Ces.)Gom.
   6. End cells conical................................. 7
7. Trichomes constricted at cross walls, 2-3.5u broad..... S. aikenensis (Wolle)Philson
7. Trichomes not constricted at cross walls, 1-2u broad...... S. calcicola (Ag.)Gom.
   8. Sheaths yellowish, brown, pink, or bluish, trichomes slightly constricted at cross walls... S. Muelleri Gom.

8. Sheaths violet or blue....................
.... S. violacea (Gord.)Drou.*

1. Schizothrix aikenensis (Wolle)Philson. (Philson f)

The species belongs to section Hypheothrix of the genus, including species which are small, prostrate, aquatic or terrestrial, woven into a compact mass, with very little false branching. The sheaths are hyaline.

Trichomes thickly interwoven with an abundance of branches only near the upper ends, constricted at the cross walls, not tapered to ends; apical cell elongated conical; sheaths colorless, firm, the outside surface rough, inside stratified, ends split and tattered, containing few trichomes; cell contents pale blue-green. Cells L 4-6u; W 2-3.5u. Knox: soil by stream at Price's Grocery on Island Home Pike 10 July 1949 #1515. VNSF.

2. Schizothrix calcicola (Ag.)Gom. (Geitler f)(Prescott) (Smith)

The species belongs to section Hypheothrix, see S. aikenensis.

Trichomes short, twisted and entangled, not constricted at cross walls, tapered toward ends; apical cell long conical; sheaths firm, cartilaginous, tapering at apex, cylindrical, becoming thick, rough, stratified, usually enclosing only two trichomes; cell contents pale blue-green, sometimes two granules at cell walls. Cells L 2-6u; W 1-2u. Sevier: rocks under Rockefeller Memorial at Newfound Gap 4 Aug. 1949

#1639 - Knox: inside concrete drainpipe from Knoxville Waterworks 28 July 1949 #1573-4. VSGF.

3. Schizothrix Friesii (Ag.)Gom. (Geitler f)(Prescott f) (Smith) Pl. 37, Fig. 4.

The species belongs to section Symplocastrum of the genus, which includes those terrestrial species which form erect tufts in a symplocoid manner, arising from prostrate base. The sheaths are hyaline.

Trichomes twisted and tangled in prostrate portion, straight and parallel in erect portion, conspicuously constricted at cross walls; apical cells truncately conical; sheaths cylindrical, firm, becoming stratified, pointed at apex, containing single or few trichomes; cell contents coarsely granular, blue-green. Cells L 4-11u; W 3-6u. Sevier: soil (2000 ft.) above Gatlinburg 8 Nov. 1942 (Sharp)#SA 1[1] - Knox: clay soil (1000 ft.) near New Hopewell 24 Dec. 1942 (Sharp)#413[1] - Montgomery: along Yellow Creek in Higgins Mill region near Shiloh 21 Aug. 1949 #1862 - wet woods near Sago 30 July 1949 (Clebsch & Brown)#1903. VNSGFKL.

4. Schizothrix lacustris A. Braun. (Geitler f)(Prescott) (Smith)

The species belongs to section Inactis of the genus, including those species which are aquatic or wet terrestrial,

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1 Reported in Silva and Sharp, 1944

often with numerous false branches, forming cushions if terrestrial, or penicillate floating bundles. Sheaths are colorless or slightly yellow.

Trichomes flexuous, somewhat crowded, constricted at cross walls, fused into cushions consisting of trunk-like lower portion and spreading into upper portion; freely falsely branching only in lower portion; sheath wide, colorless; cell contents pale blue-green. Cells L 1-4u; W 1-1.8u. NS.

5. Schizothrix Muelleri Gom. (Geitler f)(Prescott f)(Smith)

This species belongs to section Chromosiphon of the genus, including those species which are usually terrestrial, and which develop prostrate lower portions from which arises a symplocoid upper portion. Sheaths in older specimens are colored yellowish, brown, pink, or bluish.

Trichomes flexuous, slightly constricted at cross walls, woven into dark masses characteristic of the section, or floating in tufts, not tapering to ends; apical cell obtusely conical; sheath colored, rough, tapered at apex, containing one or a few trichomes; cell contents coarsely granular, blue-green in color. Cells L 7-13u; W 4-9u. Sevier: wet siliceous rocks (2200 ft.) Laurel Falls near Elkmont 6 Sept. 1941 #411.[1]

6. Schizothrix Stricklandii Drou. (Drouet 43)

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1 Reported in Silva and Sharp, 1944

The species belongs to section Symplocastrum of the genus, near S. Friesii, from which it differs ecologically by usually occupying somewhat drier sites than the constantly wet ones supporting S. Friesii.

The filaments are generally longer, the cells shorter, being quadrate or less, rather than quadrate or longer. The most distinctive feature, however, is the thickened outer membrane of the apical cell. Other characters similar to S. Friesii. Cells L [illegible]u; W 4-6u. Anderson: [illegible] coating on flume roof of Grist Mill near Morris Dam 1 Sept. 19[illegible] #1[illegible]. V.MFK.

SPIRULINA Turpin 1827

The regular corkscrew shape of the trichomes distinguishes the genus from others in the family except Arthrospira, which has distinct cross walls, whereas those of Spirulina are absent or difficult to discern, although in some species they have been demonstrated by staining. Sheaths are lacking, as in Arthrospira and Oscillatoria.

1. Cells 3-5u broad..................................
    .... S. princeps (West & West) G. S. West
1. Cells 2u broad or smaller......................... 2
    2. Spirals loose, a little longer than wide, cells 1.5-1.75u broad...........
    .... S. major Kuetz.
    2. Spirals equilateral, trichomes about 2u broad......... S. Nordstedtii Gom.

1. Spirulina major Kuetz. (Prescott f)(Smith f) Pl. 38, Fig. 1.

Spirals of trichomes loose, regular. Cells W 1.5-1.75u. Spirals L 2.75-5u; W 2.5-4u. Knox: pond bottom in field by Ten Mile Creek at Farragut 23 June 1949 #1844. VNFLL.

2. Spirulina Nordstedtii Gom. (Geitler f)(Prescott f)(Smith)

Spirals regular, equilateral. Cells W 2u. Spirals L 5-6u; W 5-6u. F.

3. Spirulina princeps (West & West) G. S. West. (Prescott f)(Smith f) Pl. 38, Fig. 2.

Cells W 3-5u. Spirals L 14u; W 9u. Number 1456 is apparently non-septate and does belong to this genus, but the only described species of its size is S. princeps which is figured with somewhat tighter spirals, so the assignment here is tentative. Blount: small stream near old C. C. C. Camp in Cades Cove 19 June 1949 #275 - Overton: pond containing considerable number of aquatic plants at Timothy 15 July 1949 #1456. VNF.

SYMPLOCA Kuetzing 1843

Trichomes of this genus resemble those of others in the family in that they are untapered, composed of rectangular cells, and lack heterocysts and spores. A homogeneous hyaline sheath is present which is thicker than any except those of Lyngbya, which is primarily aquatic whereas Symploca is terrestrial. The trichomes are single within the sheaths which fuse to form firm prostrate mats from which erect tufts arise. Only Schizothrix among the other genera of the family displays such tufted structures.

1. Trichomes 4.5-8u broad.. S. muscorum (Ag.)Gom.
1. Trichomes 2.5-4u broad...... S. muralis Kuetz.

1. Symploca muralis Kuetz. (Geitler f)(Smith) Pl. 83, Figs. 3,4.

Cells quadrate or shorter than broad. L 1.5-4u; W 2.5-4u. Jackson(N.C.): wet gneiss at Sylva 13 Aug. 1949 #1720 - Swain(N.C.): semipermanent pool (3000 ft.) near Pound Bottom C. C. C. Camp 12 Oct. 1941 #111[1] - Sevier: damp rock just above water (2750 ft.) Porters Creek in Greenbrier 3 Sept. 1941 #151[1] - pool in road (2080 ft.) Greenbrier 3 Sept. 1941 #169[1] - Montgomery: alluvial bank at upper end of King and Queen bluff on Cumberland River 3½ miles east of Clarksville 25 Aug. 1949 (Clebsch)#1903 - dry rocks at Foster's Cave #1 16 March 1950 #2075 - rocks of Bellamy Cave 14 July 1949 #1405. VNSGF.

2. Symploca muscorum (Ag.)Gom. (Geitler f)(Prescott f)(Smith f)

Cells quadrate or longer. L 5-11u; W 5-9u. Sevier: moist siliceous bluff (1800 ft.) Little River Gorge below

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1 Reported in Silva and Sharp, 1944

Elkmont 9 Sept. 1942 (Sharp) #4113[1] - dry ledge at Ramsey Cascade 9 Sept. 1950 #2351 - Knox: soil among wet mosses (950 ft.) in Hogskin Valley April 1949 #292[1] - Montgomery: wet ledge at Foster's Cove 14 July 1949 #1401. VNSGFKL.

Nostocaceae

ANABAENA Bory 1822

In common with the other genera of the family, _Anabaena_ exhibits trichomes composed of rounded, oblong, or barrel-shaped cells, some of which are transformed into heterocysts (transparent thick-walled cells) or thick-walled spores, which frequently differ from the vegetative cells in shape and size.

The species listed here are aquatic. Trichomes are straight, bent, arcuate or spiralled, but never densely entangled and contorted in firm masses as in _Nostoc_. Colonies of _Anabaena_ also lack the gelatinous matrix which imbeds those of _Nostoc_.

1. Trichomes endophytic in _Azolla_.................
   .... _A._ _Azollae_ Strasburger
1. Trichomes free living.............................. 2
   2. Trichomes more or less straight, cells spherical to barrel-shaped, L 2.5-6u; W 4-5u...... _A._ _variabilis_ Kuetz.
   2. Trichomes somewhat bent or regularly spiralled...................................... 3

3. Trichomes regularly arcuate, S-shaped, or regularly spiralled, not united into bundles.................................... 4
3. Trichomes variously bent, united into bundles, cells somewhat longer than broad............. A. flos-aquae (Lyngb.)Bréb.
    4. Trichomes merely arcuate or S-shaped.................. A. circinalis Rab.
    4. Trichomes spirally wound A. spiroides Kleb.

1. Anabaena Azollae Strasburger. (Geitler)(Prescott f)

The species is associated with the aquatic fern Azolla. Trichomes aggregated in small bundles; cells spherical to cylindrical with rounded ends; heterocysts shaped like vegetative cells, larger. Cells L 5-8u; W 5u. Heterocysts L 10u; W 8u. Obion: on Azolla spp. in Bayou du Chien at Biological Station 2 July 1949 #1160. N.

2. Anabaena circinalis Rab. (Geitler f)(Prescott f)

Trichomes generally curved in neat half circles or arcs, but occasionally may be straight; cells barrel-shaped; heterocysts subspherical; spores remote in position from heterocysts, oblique cylindrical-shaped, with rounded ends, smooth colorless walls, cells L 4-10u; W 2.5-5u. Heterocysts L 8-10u; W 8-10u. Spores L 20-30u; W 16-18u. Cheatham: gelatinous scum floating in soil bottomed fertilized fish raising pools on Little Marrowbone Creek Road 20 Aug. 1949 #1846. NF.

3. Anabaena flos-aquae (Lyngb.)Bréb. (Geitler f)(Prescott f) Pl. 38, Fig. 5.

Trichomes usually curved, united in bundles; cells barrel-shaped or compressed-spherical; heterocysts slightly larger than vegetative cells, shaped similarly; spores next to, or remote from, heterocysts, cylindrical with rounded ends, curbed, oblique, inequilateral with smooth, colorless or yellowish wall, often surrounded by gelatinous sheath. Cells L 6-8u; W 4-8u. Spores L 20-50u; W 7-13u. Lake: pool in soya bean field near Cranetown nesting area 5 July 1949 #1205. NFK.

4. Anabaena variabilis Kuetz. (Geitler f)(Prescott f)

Trichomes flexuous, slightly constricted at cross walls; cells spherical to barrel-shaped; heterocysts spherical or oval; spores oval, in series of some length, remote from heterocysts, walls smooth, yellowish brown. Cells L 2.5-6u; W 4-5u. Heterocysts L 8u; W 6u. Spores L 8-14u; W 7-9u. The species forms a gelatinous mass which spreads on soil or floats freely. Sevier: trickling water in rock roadside drain (3000 ft.) road to Newfound Gap 11 Aug. 1941 #13[1] - Knox: goldfish pond at Knoxville Waterworks 25 July 1949 #1487 - Montgomery: field pond at Meriwether 18 March 1950 #2096. VFK.

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1 Reported in Silva and Sharp, 1944

APHANIZOMENON Morren 1838

Aphanizomenon flos-aquae (L.)Ralfs. (Prescott f)(Smith f)
Pl. [illegible], Fig. 6.

Colonies in thin, spindle-like flocculent bundles, made up of short straight trichomes, tapering slightly at the ends; cells more or less quadrate, cylindrical; heterocysts one in each trichome, approximately cylindrical or slightly tumid; spores elongated cylindrical, remote from heterocyst, contents granular, walls smooth, colorless. Cells [illegible]-12u; W [illegible]-6u. Heterocysts L 12-[illegible]0u; W [illegible]-7u. Spores L 6-8u; W 7-[illegible]u. Obion: Pond behind Hawkins' house on Walnut Log Road from Union City 1 July 1[illegible] 1137 - Obion - Lake: Reelfoot Lake 1[illegible]9.[1] NK.

CYLINDROSPERMUM Kuetzing 1843

This genus occupies a place near Anabaena and Nostoc because of the similarity of spores and heterocysts to such structures in these genera. It is distinguished from both by the location of spores only next to the terminal heterocysts. Cylindrospermum species are predominantly terrestrial, although some are aquatic.

1. Spores occurring singly.............................. 2
1. Spores in chain-like series C. catenatum Ralfs
   2. Spore walls roughly punctate, L 20-35u; W 10-15u........ C. majus Born. & Flah.
   2. Spore walls smooth.............................. 3

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1 Reported in Eddy, 1930

8. Spores L 14-20u; W 9-12u.. C. muscicola Kuetz.

8. Spores L 20-38u; W 12-14u.......................

.... C. licheniforme (Bory)Kuetz.

1. Cylindrospermum catenatum Ralfs. (Geitler)(Prescott f) Pl. [illegible], Fig. 7.

Filaments of quadrate or cylindrical cells, constricted at cross walls; heterocysts oblong; spores [illegible], smooth walled, [illegible] colored, occurring in series of two [illegible]. Cells L [illegible]-6u; [illegible]u. Heterocysts L 6-7u; [illegible]u. Spores L 10-18u; W 7-10u. [illegible] Cave 14 July 1949 #138 - [illegible] in Reelfoot Lake 1[illegible] June 1950 #[illegible]. VNK.

2. Cylindrospermum licheniforme (Bory)Kuetz. (Geitler) (Prescott)

Trichomes of cylindrical cells, slightly constricted at cross walls; heterocysts oblong; spores [illegible] elliptic with pale blue-green contents, smooth, brownish or reddish wall. Cells L 4-5u; W 4-4.5u. Heterocysts L 7-10u; W [illegible]-6u. Spores L 20-38u; W 12-14u. Colonies gelatinous, expanded on wet substratum, blackish-green colored. Dickson: on mud near brook at Charlotte 1 Oct. 1938 (Gold)#B 125. VMSFK.

3. Cylindrospermum majus Kuetz. (Geitler f)(Prescott f) (Smith)

Trichomes of cylindrical or almost quadrate cells, constricted at the cross walls; heterocysts oblong; spores oblong or elliptic, with rough punctate wall, brown colored. Cells L 5-6u; W 4-5u. Heterocysts L 5-7u; W 7-10u. Spores L 10-15u; W 20-38u. Davidson: old quarry near Melrose Center 20 Aug. 1949 #1516. VS.

4. Cylindrospermum muscicola Kuetz. (Prescott f)(Smith f)

Trichomes of cylindrical or almost quadrate cells, constricted at the cross walls; heterocysts oblong; spores [illegible], wall smooth, orange-brown colored. Cells L [illegible]-5u; W 4u. Heterocysts L 5-7u; W [illegible]. Spores L 16-20u; W 8-10u. Knox: wet mud [illegible] Univ. [illegible] 1 Aug. 1949 #1[illegible]-1[illegible] - Cumberland: in swift stream, Crane Creek, at Camp [illegible] 1949 #[illegible] - Davidson: wet soil at edge of [illegible] Lake [illegible] Aug. 1949 #1-1[illegible]. VN?FK.

NODULARIA Mertens 1822

Nodularia sphaerocarpa Born. & Flah. (Beitler 38)(Prescott)(Smith) Pl. 4, Fig. 4.

The very short disciform cells differentiate this and others of the genus from the rest of the family; heterocysts about same size as cells; spores depressed-spherical, smooth walled, brownish colored, two to twelve in a series; sheath thin, diffluent. Cells L 4u; W 6-7u. Heterocysts L 4u; W 7-8u. Spores L 6-8u; W 8-10u. Davidson: on vegetation in pool at Nashville 12 Oct. 1938 (Bold) #B 143. K.

NOSTOC Vaucher 1803

This is the largest and most frequently encountered genus of the family. In common with the others, its un-

unbranched trichomes are made up of spherical or barrel-shaped cells which may develop into heterocysts or spores. However, it is distinguished from the others because its colonies are inclosed in a distinct gelatinous matrix, which is tough and leathery in some species. The trichomes are contorted and entangled, sometimes surrounded with individual sheaths, as well as the colonial sheath.

1. Colonies firm, gelatinous with leathery
   outer surface.. 2
1. Colonies soft, without leathery outer
   surface.. 5
   2. Sheaths of individual trichomes
      distinct, at least near periphery
      of colony.. 3
   2. Sheaths of individual trichomes
      indistinct or completely indis-
      cernible.............. N. sphaericum Vauch.
3. Mature colonies large, up to several
   inches in extent........... N. commune Vauch.
3. Mature colonies small, not over half
   inch in diameter....................................... 4
   4. Trichomes 8-9u broad. N. microsporum Menegh.
   4. Trichomes 6-8u broad. N. microscopicum Carm.
5. Aquatic species.. 6
5. Terrestrial species.. 8
   6. Trichomes densely interwoven...............

.... N. Linckia (Roth)Born. & Flah.

6. Trichomes more or less loosely interwoven................................ 7

7. Sheaths of individual trichomes distinct, at least near periphery of colony.................... N. piscinale Kuetz.

7. Sheaths of individual trichomes indistinct...................... N. carneum Ag.

8. Cells considerably longer than broad.......... N. ellipsosporum (Des.) Rab.

8. Cells no longer than broad...................... 9

9. Trichomes densely interwoven, cells 3-4u broad...................... N. muscorum Ag.

9. Trichomes loosely interwoven, cells 2-3u broad................. N. humifusum Carm.

1. Nostoc carneum Ag. (Geitler)(Prescott f) Pl. 88, Fig. 9.

This species belongs to the section Intricata of the genus, including the species with soft, gelatinous aquatic colonies, which are spherical at first and later irregularly expanded.

Filaments loosely entangled, flexuous, cells oblong cylindrical, about twice as long as wide; heterocysts oblong cylindrical; spores oval or elliptic, wall smooth, thin, hyaline. Cells L 6-8u; W 3.5-4u. Heterocysts L 8u; W 6u. Spores L 8-10u; W 6u. Davidson: limestone pools at Nashville 12 Jan. 1947 (Bold)#B 145. F.L.

7. Nostoc commune Vauch. (Geitler f)(Prescott f)(Smith) Pl. 88, Fig. 10.

This species belongs to section Communia, including those species with terrestrial, occasionally submerged, colonies which are at first spherical but become spreading, flattened, lobed, and irregular.

Trichomes entangled, cells depressed spherical or barrel-shaped; heterocysts spherical; spores not observed. Cells L 4.5-6u; W 4.5-6u. Heterocysts L 7u; W 7u.

The colony is blue-green, olive, brown, and quite leathery, at least on the outside.

Blount: on rock at Abrams Falls in Cades Cove 20 Aug. 1950 (Sharp)#2335 - Knox: abundant on thin soils overlying Lenoir limestone in pasture of Univ. Tenn. farm 6 Feb. 1941 #1052 - Lincoln: wet limestone outcrops in cedar barrens 6 April 1949 (Sharp)#2007 - Colbert(Ala.): on ground near Plant #1 at Sheffield 16 Oct. 1949 (Hall)#1962 - Montgomery: near Bellamy Cave 14 July 1949 #1407. VNFKAL.

8. Nostoc ellipsosporum (Des.)Rab. (Geitler f)(Prescott f)

This species belongs to section Humifusa, including those species with terrestrial colonies which are soft and gelatinous, spherical at first, becoming flattened.

Trichomes loosely entangled, cells cylindrical; heterocysts spherical or oblong; spores elliptic or oblong; cylindrical, with smooth walls; hyaline or yellowish colored. Cells L 6-14u; W 4u. Heterocysts 6-14u; W 6-7u. Spores L

1_-19u; W 6-8u.

The colonies are expanded and rather firmly gelatinous. White: by hwy U.S.70-N around relatively new vineyard pond 18 March 1950 #2089. VNSKLF.

4. Nostoc humifusum Carm. (Geitler f)

This species belongs to section Humifusa of the genus, see N. ellipsosporum.

Trichomes densely entangled, sheaths usually yellow and distinct, cells spherical to twice as long as wide; heterocysts spherical; spores spherical or oval with wall smooth, yellowish, blue-green contents. Cell L _-8u; W _-_u. Heterocysts L 3u; W 3u. Spores L 6u; W 4u. Chester: in spring entering artificial lake in Chickasaw State Park 16 June 1950 #2274. VNSF.

5. Nostoc Linckia (Roth)Born. & Flah. (Geitler f)(Prescott f)

This species belongs to section Intricata of the genus, see N. carneum.

Filaments compactly contorted, entangled, sheaths distinct near colony surface, cells depressed spherical or spherical; heterocysts spherical or oval; spores spherical or barrel-shaped; wall smooth becoming darkened with age. Cells L 3.5-4u; W 3.5-4u. Heterocysts L 5-6u; W 5-6u. Spores L 7-8u; W 6-7u. Montgomery: field pond at Meriwether 18 March 1950 #2097.

6. Nostoc macrosporum Menegh. (Geitler)(Tilden f)

This species belongs to section Pruniformia, including species which have terrestrial or aquatic colonies which are spherical-shaped, surrounded by a firm outer membrane.

Filaments loosely entangled, curved or spiralling, sheaths often distinct, yellowish, cells short disc-shaped or barrel-shaped; heterocysts spherical or oval; spores spherical, flattened or depressed, wall thin, smooth, hyaline. Cells L 8-9u; W 8-9u. Heterocysts L 9-10u; W 9-10u. Rutherford: calcareous soil and mosses, Snail Shell Cave 1[illegible] March 19[illegible] (solo)#3[illegible]. N.

7. <u>Nostoc</u> <u>microscopicum</u> Carm. (Geitler)(Prescott)(Smith) Pl. 25, fig. 11.

This species belongs to section <u>Pruniformis</u> of the genus, see <u>N.</u> <u>microsporum</u>.

Trichomes loosely entangled, sheaths may be distinct, yellow cells spherical to barrel-shaped; heterocysts more or less spherical; spores oval; wall smooth, hyaline. Cell L [illegible]-8u; W 8-8u. Heterocysts L 7u; W 7u. Spores L 8-7u; W 8-15u. Colonies small, rarely 1 mm. in diameter. Cherokee(N.C.): dripping cliff near Hiwassee Dam powerhouse 14 Aug. 1949 #1747 - Sevier: moist siliceous bluff (1600 ft.) Little River Gorge below Elkmont 8 Sept. 1941 #418[1] - Fentress: rather dry ledge by Hwy Tenn.28 near Pall Mall 15 July 1950 #1493-4 - Colbert(Ala.): on soil by Spring Creek near Sheffield 5 Sept. 1949 (Hall)#1958 - Montgomery: with

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1 Reported in Silva and Sharp, 1944

[illegible] on limestone outcrops south of Woodlawn along Cooper's Creek 30 April 1950 #1361. VNSGK.

4. Nostoc muscorum Ag. (Geitler f)(Prescott f)(Smith)

This species belongs to section Humifusa of the genus, see N. ellipsosporum.

Trichomes densely entangled, cells spheroidal or barrel-shaped or cylindrical; up to twice as long as broad; heterocysts spherical or barrel-shaped; spores oblong, in series of several; wall smooth, yellowish. Cell L 3-7u; W 3-4u. Heterocysts L 6-7u; W [illegible]-7u. Spores L 8-10u; W [illegible]-6u. Knox: soil of an old field (1000 ft.) near [illegible] 24 Dec. 1940 (Sharp)#S 41[illegible][1] - wet ground of Ft. Loudon Lake shore near Duncan's Dock 3 Sept. 1949 #1440 - Davidson: small quarry near Melrose Center 20 Aug. 19[illegible] #1808-3 - Montgomery: path in creek bottom two miles southeast of Clarksville 18 Oct. 19[illegible] (Clausen)#[illegible]. VNSGK.

5. Nostoc piscinale Kuetz. (Geitler)(Prescott)

This species belongs to section Intricata of the genus, see N. carneum.

Trichomes loosely entangled, cells compressed spherical or longer than broad; heterocysts spherical or oblong; spores spherical; in series of several; cell diameter about 4u. Heterocyst diameter 4.5-6u. Spores L 6-7u; W 6-7u. Montgomery: woods pond by hwy U.S.41 just south of Guthrie,

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1 Reported in Silva and Sharp, 1944

Ky. 18 March 1950 #2099. SK.

10. Nostoc sphaericum Vauch. (Geitler f)(Prescott f)

This species belongs to section Communia of the genus, see N. commune.

Trichomes densely entangled, cells compressed spherical, or barrel-shaped; heterocysts spherical; spores oval; walls thick, smooth, brownish. Cells L 4-5u; W 4-5u. Heterocysts L 6u; W 6u. Spores L 7u; W 5u. The colonies are spherical at first but becoming folded and tuberculate. Lincoln: wet limestone outcrops in cedar barrens 6 April 1949 (Sharp)#1955 - Davidson: ravine north of Nashville near Ashland City 30 Aug. 1949 #1880 - Colbert(Ala.): on soil by Spring Creek at Sheffield 5 Sept. 1949 (Hall)#1958. VTL.

RAPHIDIOPSIS Fritsch and Rich 1929

Raphidiopsis curvata Fritsch & Rich. (Fritsch II f)(Smith f) Pl. 38, Fig. 19.

The tapered filaments make this species unique among the family. Trichomes curved or multi-sigmoid with cylindrical cells, long tapered to sharp ends; spores inter-calary. Cells L 10u; W 14u. Montgomery: on stick in flume of Ringgold Mill 18 March 1950 #2084.

Scytonemataceae

AULOSIRA Kirchner 1878

Aulosira implexa Born. & Flah. (Geitler f)(Daily 43 f) Pl. 39, Figs. 1-3.

Trichomes straight, scarcely or not bent in young filaments, cells barrel-shaped or cylindrical with constrictions at cross walls; heterocysts cylindrical, quadrate or oblong, intercalary in position; spores numerous, oblong, between heterocysts; sheath sometimes diffluent. Cells L 7-10u; W 7-17u. Spores L 16-34u; W 8-19u. Davidson: greenhouse of Vanderbilt University according to note from H. C. Bold sent 11 Oct. 1949.

DESMONEMA Berkley and Thwaites 1849

<u>Desmonema</u> <u>Wrangelii</u> Born. & Flah. (Geitler f)(Smith f) Pl. 69, Fig. 4.

Filaments somewhat flexuous, the trichomes repeatedly falsely branched, and growing side by side in older filaments, cells discoid, constricted at cross walls; heterocysts spherical, basal, single or paired; spores oval or elliptic, single or multiple; sheaths colorless or yellowish, enclosing two or more trichomes by lateral confluence. Cells L 3-4u; W 9-10u. Colonies forming as layers or tufts in swift water. Sevier: pool in rock (5000 ft.) Road Prong below Indian Gap 14 Aug. 1941 #99[1] - Wilson: creek running over shelving limestone of Nashville basin along Hwy U.S. 70-N eight miles west of Lebanon 15 July 1949 #1417 - Montgomery: along Parson's Cave branch near Cave 14 July 1949 #1391 - Maury: coating rock under sheet of water in Barr

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1 Reported in Silva and Sharp 1944 as <u>Plectonema</u> <u>Tomasinianum</u> Gom.

Creek near Mr. Worley's farm 1[illegible] June 1949 #0[illegible]5.

DIPLOCOLON Naegeli 1859

Perhaps this is no more than an expression of Scytonema, but it is distinctive and until now the writer has not been able to see complete proof of the transition from typical Scytonema expressions, so Diplocolon is retained for the time being.

Diplocolon heppii Naeg. (Geitler f)(Smith f) Pl. 39, Fig. 5.

Trichomes flexuous and interwoven, false branching freely within a common matrix formed from partial confluence of individual broad sheaths, constricted at cross walls; cells quadrate to disciform; heterocysts spherical or compressed spherical, trichome often breaking below it. Cells L 5-10u; W [illegible]-10u. Heterocysts L 6-1[illegible]u; W [illegible]-1[illegible]u. Oxbow: in stumps at edge of Bayou du Chien near Biological Station [illegible] July 1949 #1163.

FREMYELLA DeToni 1936

This is the genus which has been listed as Microchaete in most familiar publications until recently. It is one of the genera with the false branching character, where the branch arises next to a heterocyst, as is the case in the more familiar Tolypothrix, and breaks through the sheath there. However, in Fremyella the filament usually breaks and the usual condition of observation is as an unbranched filament with basal heterocyst.

Fremyella tenera (Thur.) DeToni. (Prescott f. and Smith 33 f. as Microchaete tenera Thur.)(Smith 50 f) Pl. 59, Fig. 6.

Trichomes slightly flexuous, tending to form small star-shaped plant masses; length of lower cells twice width, upper cells quadrate; heterocysts oblong, basal or intercalary; sheath thin, close, colorless. Cells W 5-7u. Henry: gravel pit beside hwy U.S.79 east of Paris #2118.

HASSALLIA Berkley 1845

The status of this genus is subject to question. H. byssoidea (Berk.) Hass. has often been included in Tolypothrix, but in certain collections the basal parts certainly show Scytonema-like double false branching. Nevertheless, the colonies are distinctive, and recognizable in practice, being composed of a more or less prostrate portion from which a regular turf of false branches arises.

Hassallia byssoidea (Berk.) Hass. (Geitler f. and Smith as Tolypothrix byssoidea (Berk.) Kirch.) Pl. 59, Fig. 7.

Trichomes abundantly falsely branched, at wide angles, so as to create a tufted effect, branching usually arising singly next to a heterocyst; cells cylindrical, 2-3 times wider than long; spores, when present, much longer than vegetative cells, in series of several. Cells L 4-8u; W 7-12u. Filaments 10-15u broad. Sevier: moist siliceous bluff (1700 ft.) Little River Gorge below Elkmont 8 Sept. 1941 #4118[1] - wet quartz boulder (1500 ft.) at Park adminis-

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1 Reported in Silva and Sharp, 1944

station building 19 Aug. 1941 (Sharp) #A 431[1] - Knox: bark of red cedar (1000 ft.) near Claxton School 1 Jan. 1943 (Sharp) unnumbered.[1]

SCYTONEMA Agardh 1824

The taxonomic difficulties encountered in this genus are comparable with those found in <u>Schizothrix</u>. <u>Scytonema</u> has sometimes been divided into two genera, but, even though a single genus seems adequate, a realignment of species is still needed. Plants will vary in appearance depending on the part of the plant observed, the age, and unspecified external factors, so good material and careful study are particularly desirable for considerations of the genus.

* species not in text

1. Sheaths homogeneous or with parallel stratification 2
1. Sheaths with clearly divergent stratification 9
    2. Aquatic species 3
    2. Terrestrial species 4
3. Cells quite short, 1/3 of width at middle regions... <u>S. cincinnatum</u> (Kuetz.) Thur.
3. Cells quadrate or longer than broad at middle regions........... <u>S. coactile</u> Mont.*

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1 Reported in Silva and Sharp, 1944

4. Cells at middle region shorter
than broad, for most part........................ 5

4. Cells at middle region mostly
longer than broad........................ 7

5. Trichomes twisted, cells short..............
.... S. stuposum (Kuetz.)Born.*

5. Trichomes not twisted........................ 6

6. False branches adherent for a distance above branching point..............
.... S. javanicum (Kuetz.)Born.*

6. False branches separating at or near point of branching...................
.... S. ocellatum Lyngb.

7. Filaments 18-21u broad, cells rather long [illegible].. S. guyanense (Mont.)Born.

7. Filaments 15u broad or less........................ 8

8. Sheath firm, filaments 7-15u broad.................. S. Hoffmannii Ag.

8. Sheath gelatinous, filaments 9-15u broad.............. S. varium Kuetz.*

9. Divergent stratification not parallel, but spreading.............................. 10

9. Divergent striations parallel for most part.................................... 11

10. Stratification well developed in wing-like sheaths....................

.... S. densum (A. Braun)Born.*

11. Stratification clearly marked and considerably divergent, filaments 18-38u broad......... S. myochrous (Dillw.)Ag.

11. Stratification only slightly divergent........... 12

12. Filaments 18-[illegible]u broad... S. figuratum Ag.

12. Filaments 10-15u broad......................

.... S. tolypothricoides Kuetz.

1. Scytonema alatum (Carm.)Borzi. (Geitler f)(Prescott f) (Smith) Pl. 40, Fig. 1.

This species belongs to section Petalonema of the genus, or the separate genus Petalonema of Geitler and elsewhere, including those species with divergently striated gelatinous sheaths, and which exhibit both single and double false branching, the former in the upper parts, the latter lower.

Trichomes green or rusty, brownish, tending to form gelatinous tufts, solitary branches [illegible], curved, twisted; cells shorter than broad; heterocysts oblong, a little larger than the vegetative cells; sheath very wide with broadly divergent, spreading stratification, hyaline inside, yellow-brown outside, constricted at intervals. Cells W [illegible]-15u. Filaments [illegible]u. Van Buren: on wet rocks in spray below Falls Creek Falls in coarse dull green cushion 4 May 1947 #377.

2. Scytonema cincinnatum (Kuetz.)Thur. (Geitler f)(Smith) Pl. 40, Fig. 2.

This species belongs to section *Euscytonema*, including those species with homogeneous or parallel stratified sheaths.

Trichomes green, or brownish violet, constricted at cross walls; cells disciform to subquadrate; heterocysts subquadrate or further compressed, yellow colored; spores globose-elliptic; sheaths firm, hyaline or rarely brownish. Cells L 8-10u; W 14-38u. Filaments 16-40u broad.
Knox: among luxuriant growth of *Spirogyra* in Dead Horse Lake near Farm [illegible] 3 Aug. 1950 #7304. K.

8. *Scytonema figuratum* Ag. (Geitler [illegible] Prescott [illegible] as *Scytonema mirabile* (Dillw.) Born.) Pl. [illegible], Fig. 7.

This species belongs to section *Myochrotes* of the genus, including those species with divergent but hardly spreading sheath stratification, and which exhibit only double false branching.

Trichomes with double branching, forming a woolly mass; cells often greyish colored, oblong below, discoid above; heterocysts brown, quadrate or oblong; sheath yellow-brown, showing slightly divergent striae, becoming thin above apical cells. Cells 6-12u broad. Filaments 15-21u broad.
Sevier: moist siliceous bluff (1700 ft.) Little River Gorge below Elkmont 8 Sept. 1941 (Sharp) #4117[1] - Polk: coating on dripping rocks by hwy U.S. 64 near Ocoee Dam #3 14 Aug. 1949

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1 Reported in Silva and Sharp, 1944

#1757 - Davidson: ravine north of Nashville near Ashland City 20 Aug. 1949 #1832 - Cheatham: by hwy Tenn.49 near Ashland City 20 Aug. 1949 #1849. VNSFKM.

4. Scytonema guyanense (Mont.)Born. (Geitler f)(Smith)

This species belongs to section Euscytonema of the genus, see S. cincinnatum.

Trichomes falsely branched into long flexuous strands, forming vertical tufts; cells quadrate or longer than wide; sheaths firm, parallel stratified, yellowish-brown. Cells 10-16u broad. Filaments 15-21u broad.

Sevier: moist siliceous bluff (1700 ft.) Little River Gorge below Elkmont 8 Sept. 1941 (Sharp)#4119.[1] VNSF.

5. Scytonema Hofmannii Ag. (Geitler f)(Prescott)(Smith)

This species belongs to the section Euscytonema of the genus, see S. cincinnatum.

Trichomes falsely branching with their bases fused for some distance above the point of branching, forming erect curly tufts; cells of varying lengths, often longer than wide; heterocysts usually oblong; sheaths firm, hyaline, unstratified. Cells 5-10u broad. Filaments 7-12u, rarely 15u broad.

Knox: moist limestone around spring at Carter's Mill 2 Aug. 1949 #1630 - wet sand in Univ. Tenn. botany greenhouse 1 Sept. 1950 #2346 - Davidson: ravine north of Nashville near

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1 Reported in Silva and Sharp, 1944

as Lake City 20 Aug. 1949 #1981 - Montgomery: woods [illegible] of [illegible] Grove 6 Sept. 1949 (Clebsch) #1110 - bluff above Seven Mile Ferry on Cumberland River 2d Dec. 1948 (Clebsch) #1066. VNSGF.

6. Scytonema myochrous (Dillw.) Ag. (Geitler f)(Prescott f) (Smith)

This species belongs to section Myochrotes of the genus, see S. figuratum.

Trichomes twisted and interwoven, arranged in pairs to form a woolly mat; lower cells oblong, upper discoid; heterocysts brown, quadrate or oblong; sheaths yellow-brown with divergent, but not spreading, stratification. Cells 6-12u broad. Filaments 18-36u broad. Knox: moist limestone above spring at Carter's Mill 9 Aug. 1949 #1981. VNSGF.

7. Scytonema ocellatum Lyngb. (Geitler f)(Prescott f) (Smith)

This species belongs to section Euscytonema of the genus, see S. cincinnatum.

Trichome false branches usually short, not adherent above the base; cells quadrate or only slightly shorter than wide; heterocysts almost quadrate, yellow in color; sheaths indistinctly stratified. Cells 6-14u broad. Filaments 10-18u broad.

Knox: dolomite boulder at Carter's Mill 14 Jan. 1949 (Sharp) #2015. VNGFK.

8. Scytonema tolypothrichoides Kuetz. (Geitler f)(Prescott f)(Smith)

The species belongs to section Myochrotes of the genus, see S. figuratum.

Trichomes [illegible] to form a medial mass which is often free flowing, cells quadrate or elongate; heterocysts short or long, sometimes slightly reddish in color; sheaths hyaline, indistinctly striated, only [illegible] given out. Cells 8-12u broad. Filaments 10-18u broad. Sevier: wet rocks (2900 ft.) at Laurel Falls near Elkmont 6 Sept. 1941 #417[1] - siliceous rocks (1600 ft.) Little River gorge below Elkmont 9 Sept. 1941 (Sharp) #110.[1]

TOLYPOTHRIX Kuetzing 1843

The genus is distinguished from Scytonema by the customary occurrence of single false branches, rather than pairs of them. This arrangement results from initiation of branches at heterocysts rather than between them.

* species not in text

1. Sheaths thin.................................. 2
1. Sheaths thick................................. 4
   2. Aquatic species............................ 3
   2. Terrestrial species..... T. rupestris Wolle*
3. Cells 5-8u broad............. T. tenuis Kuetz.

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1 Reported in Silva and Sharp, 1944

3. Cells over 8-18u broad..... T. [illegible] Kuetz.

3. Filaments 14-16u broad, sheaths

sticky.............. T. conglutinata Borzi*

4. Filaments [illegible]-17u broad.....................

.......................T. [illegible] [illegible] & West*

The above key is a compiled one, from several sources, since only [illegible] have been found in the Tennessee Region.

1. Tolypothrix distorta Kuetz. (Geitler f)(Prescott f) (Smit) Pl. [illegible], Fig. [illegible].

Trichomes [illegible], [illegible] tufts [illegible]; cells [illegible], [illegible]-shaped, constricted at cross walls, [illegible]; heterocysts [illegible] spherical to cylindrical, one to three in series. Sheaths thin, hyaline to brown. Cells [illegible]-1[illegible] broad. Filaments 10-15u broad. [illegible]: on [illegible] covered sandstone by Hwy Tenn. 52 west of Rugby near bridge 17 June 1940 #[illegible]4. VSGL.

2. Tolypothrix tenuis Kuetz. (Geitler f)(Prescott f)(Smith f)

Trichomes in tufted [illegible] or small cushion, attached or free floating; cells quadrate or longer, slightly constricted at cross walls; heterocysts rounded quadrate; sheaths thin, colorless or yellow. Cells 4-6u broad. Filaments 4-10u broad. Montgomery: woods pond east of Shady Grove 3 Sept. 1949 (Clebsch)#1911 - Shelby: Joe Priestley's aquarium, Memphis 19 March 1950 #2131.

Stigonemataceae

Fischerella Gomont 1895

Fischerella ambigua (Born. & Flah.) Gom. (Geitler f)(Tilden f)

(Scytonema ambiguum Kuetz. of Smith 33 etc.)

Pl. 41, Fig. 1.

[illegible] represent [illegible] stage [illegible], derived [illegible] ever, [illegible] from [illegible] genus is [illegible] for [illegible] until [illegible] else [illegible].

Filaments branching unilaterally to produce [illegible] -ments, [illegible]; cells and heterocysts oblong to cylindrical; sheath gelatinous, hyaline or brown. Cells [illegible]-3µ [illegible]. Filaments 6-8µ broad. Knox: clay soil (1000 ft.) near New Hopewell 14 Dec. [illegible] (Sharp) #S 411[1] - dolomite boulder at Carter's Mill 14 Jan. [illegible] (Sharp) #1018 - damp soil [illegible] on Ijams' Place Island Home Pike 20 July [illegible] #1813 - Cheatham: by Hwy Tenn. [illegible] near Ashland City [illegible] Aug. 1949 #15[illegible] - Montgomery: seepage on roof of Foster's Cave #2 14 July 1949 #14[illegible] - Henry: [illegible] by Hwy Tenn. [illegible] west of Paris 14 June 1950

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1 Reported in Silva and Sharp, 1944

[illegible] 41. [illegible]EFF.L.

HAPALOSIPHON Naegeli [illegible]

[illegible] filaments [illegible] Stigo-nema [illegible] cells [illegible] in the [illegible] Stigonema.

1. Cells [illegible], [illegible] ...... H. hibernicus [illegible] West

2. Cells [illegible] ...... H. pumilis (Kuetz.) [illegible].

1. Hapalosiphon hibernicus [illegible] West. (Smith f)(Prescott f) Pl. [illegible]1, Fig. [illegible].

[illegible] filaments [illegible], [illegible] in [illegible] or tufts; cells [illegible] cylindrical; heterocysts [illegible] cylindric; sheaths thin, colorless. Cells 4-7u broad. [illegible]: wet cliff in Rich[illegible] Creek Gorge above Dayton [illegible] Sept. 194[illegible] (S[illegible])#1957.

2. Hapalosiphon pumilis (Kuetz.) [illegible]. (Prescott f)(Smith f)

The filaments are [illegible] branched, [illegible] patches or tufts; cells quadrate to rounded; sheath [illegible], color-less or yellow-brown when old. Cells [illegible]u broad. Fila-ments 1[illegible]u broad in main filaments, [illegible]-1[illegible]u broad in side branches. NSGF.

LOEFGRENIA Gomont [illegible]

Loefgrenia anomala Gom. (Geitler f) Pl. 38, Fig. 15.

Epiphytic cylindrical colonies, [illegible] quite long; cells surrounded by a thin gelatinous [illegible] ex; cells [illegible] Entophysalis [illegible] (Lere [illegible].) [illegible]. Sevier: in Little Pigeon River (1760 ft.) [illegible] 1941 #[illegible][1] – Knox: on [illegible] in small stream [illegible] Crater's [illegible] of Knoxville [illegible] June 1940 [illegible] – [illegible]: [illegible] Fern's Cave [illegible], [illegible] stream [illegible] limestone [illegible] July 1940 [illegible] – [illegible]: on [illegible] in Reelfoot Lake [illegible] July 194[illegible] #[illegible]36.

[illegible]

[illegible] species within the genus are usually difficult to define, especially [illegible] is seen [illegible] environmental expressions can be observed. The treatment given in the key and text below is [illegible] traditional [illegible], since there has not been sufficient time to complete

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1 Reported in Prescott, Silva & Wade, 194[illegible], and in Silva & Sharp, 1944, the latter as Chamaesiphon Rostafinskii Hansg.

[illegible] study for [illegible] writing, [illegible] is probably [illegible] the [illegible]sion [illegible] natural [illegible] of [illegible]ur.

* [illegible] not included in [illegible]xt

1. [illegible] .... [illegible]
1. [illegible] .... [illegible]
   . [illegible] 8-1[illegible] broad........................
   .... S. [illegible] (K[illegible]tz.)B[illegible]. & F[illegible].
   . Fil[illegible] 5
. Fil[illegible] tufts,
   [illegible]
   [illegible]. S. [illegible] (Dillw.)Th[illegible].
. Fil[illegible], [illegible]
   [illegible], [illegible] of
   cells or groups [illegible] in
   [illegible] above..........S. [illegible] (K[illegible].) [illegible].
   4. Filaments less [illegible] broad..................... 5
   4. Fil[illegible] broad..................... 6
5. Filaments 14-[illegible] [illegible].. S. [illegible]tum (Ag.)H[illegible]s.
5. Filaments 27-37u broad..... S. [illegible] Cooke
   6. Cells relatively closely placed,
      many short side branches formed..............
      .... S. mamillosum (Lyn[illegible].)Ag.
   6. Cells relatively distant from each
      other, no conspicuous development
      of short side branches... S. informe Kuetz.*

1. <u>Stigonema</u> <u>hormoides</u> (Kuetz.) Born. & Flah. (Geitler f) (Prescott f)(Smith) Pl. [illegible], fig. [illegible].

[illegible] with [illegible]; [illegible] com-pressed, [illegible] in a thick, hyaline, homo-geneous sheath; [illegible]. Cells [illegible]-1[illegible]u broad. Filaments 7-2[illegible]u broad. [illegible] U.S. [illegible] below [illegible] Dam #[illegible] Aug. 1[illegible] #17[illegible]. [illegible].

[illegible]. <u>Stigonema</u> <u>mamillosum</u> (Lyngb.) Ag. (Geitler f)(Prescott f) (Smith) Pl. [illegible], fig. [illegible].

Main [illegible]; cells [illegible] com-pressed; [illegible] colored [illegible] old. Main filaments [illegible] to 8[illegible]u broad. [illegible] 45-8[illegible]u broad, [illegible] gradually. The large size [illegible] this species from all except <u>S.</u> <u>informe</u> Kuetz. In contrast to that species, <u>S.</u> <u>mamillosum</u> has [illegible] closely placed cells, and [illegible] side branches, on which hormogones are borne. Cocke: [illegible] log on Inadu Knob trail [illegible] Jan. 1947 #191. VNSKL.

3. <u>Stigonema</u> <u>minutum</u> (Ag.) Hass. (Geitler f)(Smith)

Trichomes of main filament consist of two or more rows of cells; cells often surrounded by darker colored envelope [illegible] concentrically stratified. Cells 1[illegible]-15u broad. Filaments 19-28u broad. Sevier: dark moist ledge (4175 ft.) Ramsey Cascades 4 Sept. 1941 #135.[1] VNSKL.

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[1] Reported in Silva and Sharp, 1944

1. Stigonema ocellatum (Dillw.)Thur. (Geitler f)(Prescott f) (Smith)

Trichomes in mature filaments consist of a single row of cells with infrequent second lateral cells. This is the largest species in which the cell arrangement is predominantly uniseriate; sheath stratified, yellow or yellow-brown. Filaments 24-45u broad. VSF.

2. Stigonema panniforme (Ag.)Born. & Flah. (Geitler f)

Trichomes in mature filaments consisting of a single row of cells with an occasional second one laterally; cells shorter than broad; heterocysts scattered; sheath thick, stratified, yellowish or yellow-brown. Filaments 24-36u broad. Sevier: wet rocks at Ramsey Cascades 9 Sept. 1950 # 350. NS.

3. Stigonema turfaceum (Berk.)Cooke. (Geitler f)(Prescott f) (Smith)

Trichomes of mature filaments consisting of two or more rows of cells, heterocysts collateral; sheaths thick, concentrically stratified, yellowish brown. Filaments 27-37u broad. Generally larger than S. minutum but smaller than S. mamillosum. MG.

Rivulariaceae

A. AMPHITHRIX Agardh 1824

Amphithrix janthina (Mont.)Born. & Flah. (Geitler f)Smith f)

Pl. [illegible]1, Fig. 3.

Pl[illegible]t [illegible]ss differentiated [illegible], [illegible] portion [illegible] erect portion [illegible] [illegible]-[illegible]ts; cells [illegible]; [illegible], [illegible]; [illegible] absent. [illegible] W [illegible].

[illegible] is oft[illegible] in specimens [illegible] [illegible] cylindrical [illegible]. [illegible]: [illegible] stream ([illegible] ft.) [illegible] 1[illegible] Aug. [illegible] - [illegible]: [illegible] July 1[illegible] - [illegible] concre[illegible] in [illegible]'s Spring[illegible] July 1[illegible] - [illegible] near [illegible]-Blue [illegible] R[illegible] July [illegible] - [illegible]concrete [illegible] of [illegible] [illegible] 1[illegible] - [illegible]: stream [illegible] [illegible] Penn. [illegible] miles [illegible] of [illegible] City [illegible] Aug. [illegible] #1[illegible] - [illegible]: [illegible]lu[illegible] [illegible] of [illegible] at Lake [illegible] S[illegible]bour[illegible] 1[illegible] July 19[illegible] #1[illegible]. [illegible]. CAL[illegible]RIK [illegible] 19[illegible]

The branched trichomes of this genus are generally observed as single within a sheath, and only rarely in multiseriate condition, or breaking through the side of a parent sheath to form a branch. Basal heterocysts are present in all species, although those of some are not transparent, and hence hardly recognizable.

* species not included in text

1. Basal [illegible] trans-
parent, [illegible]................................ 2
1. Basal [illegible] -
serv[illegible]...................................... 3
   a. Fil[illegible],
      [illegible] -[illegible]
      [illegible].... C. Juliana (Men[illegible])Born. & Fl[illegible]
   a. Fil[illegible],
      [illegible]. C. [illegible] R. B.*
2. [illegible]
   base.. 4
3. Filaments [illegible]
   [illegible]se... 5
   a. [illegible] -[illegible], [illegible],
      [illegible].... C. stellaris Born. & Fl[illegible].*
   a. [illegible] 7-[illegible], [illegible]
      [illegible], [illegible]fied........................
      .... C. fusca (Kuetz.)Born. & Fla[illegible].
   c. Fil[illegible] 1-[illegible] in middle re-
      [illegible], shortl[illegible] base......................
      .... C. adscendens (Na[illegible].)Born. & Fl[illegible].*
5. Filaments [illegible]-15[illegible]........................... 6
   a. Sheaths [illegible], filaments mostly
      solitary.... C. parietina (Naeg.)Thur.
   a. Sheaths colorless, filaments

[illegible] 1.......... C. Braunii Born. & Fl[illegible].*

1. C[illegible] [illegible] ([illegible]z.)[illegible] Fl[illegible]. ([illegible])(F[illegible]-[illegible])([illegible])

[illegible], [illegible]; [illegible]

[illegible]; [illegible], [illegible], [illegible] tin[illegible]. [illegible] cell[illegible] 7-[illegible]. [illegible] [illegible]-[illegible]. [illegible]: [illegible] ([illegible].) Li[illegible] [illegible] Sept. [illegible] (S[illegible])#[illegible][1] - [illegible]: [illegible] Sept. 1[illegible] #1-[illegible]7 - Kr[illegible]: [illegible] [illegible] Pike [illegible] J[illegible] - R[illegible]: [illegible] R[illegible] [illegible] Dayton [illegible] Sept. 1[illegible] (S[illegible])#1[illegible]7 - S[illegible]ner: stream [illegible] U.S. [illegible]-[illegible] [illegible] #[illegible]. [illegible].

[illegible]. C[illegible] Juli[illegible] ([illegible].)Born. & Fl[illegible]. ([illegible]s [illegible] Juliana ([illegible].)Born. & Fl[illegible].)(Smith)(Tilden ?) [illegible]. [illegible], [illegible].

Filaments [illegible] for[illegible] [illegible]ted layer[illegible] fil[illegible]ents, [illegible] often thickened at the [illegible]; cell l[illegible] [illegible]; [illegible]cysts [illegible] and not differing much from ordinary vegetative cells in color; [illegible], colorless. [illegible] cells [illegible]-1[illegible] u broad. Fil[illegible] 1[illegible]-1[illegible] [illegible]. [illegible]s[illegible]ton: [illegible]lls of concrete spring basin [illegible] Horse Creek (14[illegible] ft.) 1[illegible] J[illegible]n. 19[illegible]7 #[illegible]71. VNF.

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1 Reported in Silva and Sharp, 194[illegible]

[illegible]. Calothrix parietina (Naeg.)Thur. (Butler f)(Prescott f)
Pl. 41, Fig. 6.

Filaments [illegible] in small groups, bases thickened [illegible] but not [illegible], [illegible] and [illegible] in [illegible] fine point; [illegible] cells [illegible] width; [illegible] heterocysts [illegible] cells, [illegible]; [illegible] sheath [illegible], [illegible] in upper portions. [illegible] cells [illegible]-10u [illegible]. [illegible] 10-[illegible]u broad. Sevier: [illegible] in swift stream (3[illegible] ft.) Little Pigeon River [illegible] 1941 #1[illegible]7[1] - [illegible] in [illegible] L[illegible] Elkmont [illegible] #1[illegible] - Knox: [illegible] Chilhowee Park Zoo [illegible] 19[illegible] #[illegible]45 - [illegible] in sulfur [illegible] Newberry's [illegible] July 1948 #1[illegible] - Anderson: [illegible] Dam [illegible] Sept. 1949 #1571 - [illegible]: [illegible] cliff in [illegible] Creek [illegible] 1949 (Sharp)#1[illegible]7 - [illegible] - [illegible](al.): attached to large rocks below Wilson Dam [illegible] Sept. 1949 (Hall)#1[illegible] - Montgomery: [illegible] outside W. C. Austin's farm [illegible] Foster's Cave Road and Hwy U.S.79 15 March 1[illegible] #[illegible]. [illegible]

DICHOTHRIX Zanardini 1-88

Its branching habit distinguishes Dichothrix from the other genera of the family. Generative cells (hormogonia) develop within the parent sheath, and grow out through the

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1 Reported in Silva and Sharp, 1944

[illegible] of it, [illegible] repetition of this sort of development brings about an arborescent pattern of branching.

* Species not included in text

1. Sheaths [illegible] and frayed [illegible] ends.. 2
1. S[illegible] 4
2. Principal filaments over 15u broad in [illegible] 3
2. Principal [illegible] -15u [illegible] .... D. [illegible] (Ag.) Born. & Flah.*
3. Principal filaments 1[illegible]-15u broad in median sections... D. [illegible] Born. & Flah.
3. Principal filaments [illegible]-[illegible]u [illegible] in [illegible] section[illegible], [illegible] in[illegible] [illegible]........... D. Hosfordii (Wolle) Born.*
4. Principal filaments over 15u broad in median sections........................ .... D. Baueriana (Grun.) Born. & Flah.
4. Principal filaments less than 15u broad.... D. Orisiana (Kuetz.) Born. & Flah.*

1. Dichothrix Baueriana Born. & Flah. (Geitler [illegible])(Smith) Pl. [illegible], Fig. 6.

Trichomes tapering into long setae, false branches often broadly spreading; cells quadrate or half as long as [illegible]; [illegible] narrow, unstratified, hyaline or yellowish. Trichomes 6-7.5u broad. Filaments 10-[illegible]u broad. Kans: [illegible] of concrete reservoir [illegible] Neubert's Springs [illegible] July [illegible] #1?38 - [illegible] Neubert's Springs [illegible] July [illegible] #1??. NF.

[illegible]. Dichothrix [illegible] Born. & Flah. ([illegible])([illegible])

[illegible]

GLOEOTRICHIA Agardh [illegible]

In its [illegible] manner to Rivularia, [illegible] development of the generative cells ([illegible]) at about the same level, laterally. Gloeotrichia, however, is distinguished by the development of conspicuous spores, usually next to the upper cysts.

* species not included in text

1. Hard, dense colonies, individual filaments difficult to separate G. Pisum (Ag.) Thur.
1. Softer colonies 2
   2. Cells containing pseudovacuoles ....
   .... G. echinulata (J. E. Smith) Richt.*

2. Cells [illegible] 3

3. Cells [illegible] than broad, sheath con-
spicuously [illegible] near base of
filament................ G. [illegible] (Hedw.)[illegible].*

3. Cells [illegible] broad, no con-
spicuous [illegible] base.........
.... G. [illegible] W. S. West*

1. [illegible] (A[illegible].)[illegible]. ([illegible])(Prescott [illegible])
(Smith) Pl. [illegible], Fig. 1.

[illegible] colonies, dis-
[illegible];
[illegible] heterocysts,
[illegible]. Cells [illegible]-7[illegible] broad.
[illegible] L [illegible]; [illegible]. [illegible] on Dotsonville
[illegible] Co. [illegible] (Chessel)[illegible] - [illegible] by
[illegible] U.S.41 [illegible] Ringgold [illegible] 1950 [illegible]. F.

RIVULARIA Roth 1797

In a similar manner to Gloeotrichia, this genus forms
[illegible] colonies, which result from the
growth of [illegible] cells ([illegible]) at about the same
level, laterally. Pl. [illegible], Fig. [illegible]. Rivularia lacks the spores
found in Gloeotrichia, however.

* species not included in text

1. Hard, dense colonies formed, filaments
difficult to separate............. R. dura Roth*

1. Colonies [illegible]ter................................ [illegible]

[illegible]. Tric[illegible]s [illegible]-[illegible] [illegible]d.....................

.... [illegible]. [illegible] [illegible].

[illegible]. Tric[illegible]es [illegible]-[illegible] [illegible]....................

.... T. minutul[illegible] (Kuetz.) Born. & Fl[illegible].*

Al[illegible] no [illegible] [illegible] [illegible] [illegible] i[illegible]ntified during this stud[illegible], and onl[illegible] one, [illegible]. [illegible] [illegible]. [illegible]. [illegible], [illegible] [illegible]en reported [illegible] [illegible]nt[illegible] [illegible]t, [illegible] [illegible] [illegible] includ[illegible]s three specie[illegible] [illegible] [illegible] [illegible] encountered.

RHODOPHYTA

Rhodophyceae

Protoflorideae

Bangiales

Erythrotrichaceae

COMPSOPOGON Montagne 1850

Compsopogon coeruleus (Babis)Mont. (Smith f) Pl. 42, Fig. 4.

Branched, green-violet colored filaments of macroscopic size (about 1.5 mm in diameter) forming tangles a foot or more in length; all except apical portions or small branches are composed of a brick-work of cells; reproduction is said to be by means of large and small neutral spores which may arise from any surface cell.

This plant has appeared in huge quantites on more than one occasion in two places along the southern part of the Tennessee Valley Authority Lake system, near Sheffield, Alabama in the headwaters of Pickwick Lake and in Hamilton county (Tenn.): just above Hales Bar Dam 19 Sept. 1949 (Hall) #1900 - Dr. T. E. Hall of T. V. A. has made both of the mentioned collections.

Porphyridiaceae

PORPHYRIDIUM Naegeli 1849

Porphyridium cruentum Naeg. (Pas er, Schiller & Migula f)

(Prescott f)(Smith f) Pl. 42, Fig. 3.

Plants unicellular, terrestrial, forming a gelatinous red layer on damp surfaces; cells spherical to short cylindrical; containing stellate chromatophore with central pyrenoid, or several irregular chromatophores with pyrenoids; dividing cells sometimes attached by gelatinous strand or stalk. Diameter 5-24u. Knox: wet sand of Univ. of Tenn. greenhouse at Knoxville 7 May 1947 #694.

Florideae

Nemalionales

Chantransiaceae

AUDOUINELLA Bory 1823

In this genus are found simple branched filaments of elongated cylindrical cells, and there is little reduction in size of the cells from main branches to the ultimate ends. (Pl. 42, Fig. 5) The color of the filaments may be red-violet, or possibly blue-green, and there are generally several discoid chromoplasts in each cell.

Reproduction in Audouinella is identical with that of Batrachospermum and Lemanea, although their vegetative structure is altogether different. Round, asexual monospores are formed in bunches on short lateral branches. In sexual

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1 Reported in Silva and Sharp, 1944

reproduction, lateral carpogones terminate in typical trichogynes, and antheridia are produced in bunches on short lateral branches. The zygote develops into a cystocarp with carpospores.

It is difficult to distinguish the genus from Chantransial stages of Batrachospermum or Lemanea unless sexual organs can actually be observed.

While two samples of the genus have been collected from Sevier county, neither sample has been in condition for satisfactory identification to species.

Batrachospermaceae

BATRACHOSPERMUM Roth 1797

Although several collections of members of this genus have now been made, it still may be considered as a "good find". So far, it has been discovered only in the clear cold running waters of springs or fast streams.

As in the case with most of the complex red algae, pronounced polymorphy is apparent in the life cycle. There is a branched, filamentous juvenile or Chantransial stage which may reproduce itself by asexual spores, and a mature sexual stage which is composed of a central axis branched in whorls at intervals (Pl. 43, Fig. 3). Some of the branches may corticate the central axis but most form a bushy tuft around their point of origin. In unusual cases all branches may be involved in a firm cortication.

Sex organs are usually produced in the branch clusters, the spermatangia always at the end cells, the female structure close to or removed from the axis, depending on the species. The female structure is not single, but consists of a branch of a few cells surmounted by a trichogyne cell, the basal cells are branched to form a "[illegible]" of accessory cells which take no further part in the sexual process. The stalk is referred to as a "[illegible]blast". Fertilization of the egg cell, below the trichogyne takes place after union of a nonmotile sperm cell with the trichogyne. The zygote cell branches into filaments which cut off "carpospores", the entire group of which composes a "cystocarp" or "cabbage head" cluster, which is usually imbedded in a branch cluster.

Identification in the genus is quite difficult.

1\. Plants usually dioecious (males long and sparsely branched; females bushy, short branched) - large plants forming masses up to six inches or more in length, trichogynes elliptic or ovoid-shaped .... *B. Boryanum* Sir.

1\. Plants monoecious 2

2\. Trichogyne shaped like an exclamation point or elongated urn 3

2\. Trichogyne inverted conical or cylindrical 5

3. Female br[illegible] often
borne outside branch whorls B. [illegible] Sir.
3. Female [illegible] carpogonia only
in branch whorls.................................... 4
4. Carpogonia [illegible] in [illegible] of
branch whorl, several in number...........
.... B. moniliforme Rot.
4. Female [illegible] in [illegible] part of
whorls, [illegible]
whorl.................. B. [illegible] Sir.
5. Trichogyne inverted conical B. vagum (Roth) Ag.
5. Trichogyne cylindrical, [illegible].............
.... B. virgatum (Kuetz.) Sir.

1. Batrachospermum Boryanum Sir. (Pl. [illegible] f)(Prescott, Schiller & [illegible] f)(Smith [illegible]) Pl. [illegible], Figs. 1,2,4a.

Plants often quite large, [illegible] inches long in specimens observed, in [illegible] cases oldest branches [illegible], [illegible], and quite tough; color varying according to light and other conditions, green, brown, red-violet, and even lavender; carpogonia borne toward outside of branch cluster; the egg-shaped trichogyne inside the carpogonial mass identifies the species among those listed here.

A good field character is the presence of different [illegible] male and female strands (as well as occasional apparently hermaphroditic ones), the females being shorter and quite bushy, while the males are longer and scarcely [illegible]nched.

Kane: spring at Carter's Hill [illegible] April 1947 #770[1] - same site [illegible] Aug. 1948 #1[illegible] - [illegible] : [illegible] Schmidt's [illegible] 7 May 1950 (Clebsch)#378. IL.

7. Batrachospermum ectocarpum Sir. (Flint [illegible])(Prescher, Schiller & Migula f) Pl. 45, Fig. 2c.

Plants [illegible], usually [illegible] long but [illegible] individually [illegible]; color varies from dull olive-green [illegible] [illegible]; [illegible] [illegible]-shape [illegible]; [illegible] from [illegible], [illegible] [illegible] Seven Springs 13 July 1948 #1868 - Montgomery: Reit's Garden Spring 3 miles east, southeast of Clarksville [illegible] Aug. 1948 (Clebsch)#1997.

8. Batrachospermum moniliforme Roth. (Flint f)(Prescher, Schiller & Migula f)(Prescott) Pl. 45, Fig. 2b.

Plants monoecious; growing up to about three inches long, but are usually shorter; color dull olive-colored or brownish-green and occasionally dark green, becoming brown or reddish-brown on drying; carpogones borne near outside of branch clusters; the trichogynes elongated club-shaped. Sevier: in small sluiceway from stream running through

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1 Reported in Silva, 1949

[illegible] (C[illegible].) [illegible] 1[illegible] [illegible] 19[illegible] (C[illegible]) [illegible].

[illegible]. <u>Batrachospermum [illegible]</u> Sirodot (Pl. [illegible])(Bourrelly, [illegible]) Pl. [illegible], Figs. [illegible].

Plants [illegible]; [illegible], [illegible]; [illegible], [illegible]; [illegible]. [illegible]: [illegible] in [illegible] Connell Farm near [illegible] 1[illegible] [illegible].

[illegible]. <u>Batrachospermum [illegible]um</u> ([illegible]).[illegible] (Pl. [illegible])(Bourrelly, [illegible]) Pl. [illegible], Fig. [illegible].

Plants [illegible] in [illegible], [illegible] extensively [illegible] ya-like structures, [illegible] found [illegible] altogether on the [illegible] sections of the plant in which [illegible] in [illegible] <u>Batrachospermum</u> [illegible]; [illegible] [illegible]-green, blue-green, or green; [illegible] the [illegible] center of branch clusters, [illegible] bulbous [illegible], [illegible], or [illegible] cylinders. Caroline (Va.): [illegible] 10-1[illegible] miles south of Fredericksburg, [illegible] June 1948 (Ilis) unnumbered - this is

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1 Reported in Silva, 19[illegible]

[illegible] outside the [illegible] considered [illegible] it is [illegible] new record and since it [illegible] will [illegible], it seems desirable to include it [illegible]. L.

[illegible]. Batrachospermum [illegible] (Kuetz.)Sir. ([illegible]) (Pascher, Schiller [illegible]) Pl. [illegible], Fig. [illegible].

Plants [illegible]; [illegible] in length [illegible]-3 inches; [illegible] filaments of main [illegible] lobes [illegible]; [illegible] to color dull [illegible] green, [illegible] dark green; [illegible] of [illegible] el [illegible]; [illegible] [illegible]. [illegible]: [illegible] Falls [illegible] June [illegible] #[illegible] - [illegible]: on [illegible] in [illegible] Lake [illegible] Sept. [illegible] #[illegible] - Coffee: on [illegible] in [illegible] stream in northern part of County [illegible] April [illegible] (Sumo) #[illegible] ([illegible] represent a new species) - [illegible]: [illegible] Cumberland Springs [illegible] June [illegible] #[illegible] - [illegible]: [illegible] Anthoceros at Burr falls [illegible] June 1[illegible] #[illegible] - [illegible] creek above falls #[illegible].

[illegible]YA [illegible] 18[illegible]

Tuomeya fluviatilis Harvey. (Flint 4[illegible] f)(Prescott f)(Smith f) Pl. 43, Fig. 5.

Normally the plant is [illegible] branched cartilaginous structure which [illegible] three inches in length, sometimes having a Batrachospermum-like arrangement of uncorticated whorls along an axis, at the tips. Plant monoecious; the [illegible] borne in the vertical [illegible] or in [illegible] clusters in the [illegible] present; trichogynes [illegible] filamentous in the vertical section [illegible] when free. [illegible] much in common with the "[illegible]" stage of Batrachospermum, and should [illegible] be placed near that genus, rather than near Lemanea.

The only Tennessee report (Shaver, [illegible]) [illegible] Creek Falls, Van Buren County, April, [illegible] is incorrect, since the specimens were subsequently shown to be Sacheria fucina (Bory) Sir. VBA.

Lemaneaceae

The species of this family are divided between two genera, Lemanea and Sacheria of Sirodot, and in recent years Israelson [illegible] accepted this division in his writings. However, for most of the last half century American students have followed Atkinson (1890) in his practice of recognizing a single genus, Lemanea, with subgenera Eulemanea and Sacheria representing the two different groups.

Sexual reproduction in Lemanea and Sacheria is identical, and quite like that of Batrachospermum, allowing only for changes due to the different vegetative structure of the sexual plants. Here the sexual shoot or bristle which arises from the filamentous juvenile stage is cartilaginous almost from the first. The structural plan of the cartilaginous sexual bristle is not unlike that of Batrachospermum, although the [illegible] structure is quite different. A central filamentous strand of long cells is [illegible] at intervals, [illegible] become involved [illegible] cortical [illegible] cylinder. In *Sacheria* the central filamentous strand is spirally wound with secondary [illegible], [illegible] in *Lemanea*. Pl. [illegible], Figs. 11, 12. The [illegible] nodes. An [illegible] [illegible] levels [illegible] points [illegible] central [illegible], [illegible] displaced. In *Lemanea* [illegible] is represented by a complete [illegible] at their level, but in *Sacheria* [illegible] in circles of more or less [illegible] papillae. Specific differences are based on the size and [illegible] of [illegible] papillae, number of papillae in *Sacheria*, the amount [illegible] of the swelling [illegible] the [illegible] bristle, the nature of the Chantransial stage, and, to a lesser extent, size and color.

LEMANEA Bory 1808

The division of the two species here is based largely on the writer's own experience with a limited number of specimens and is subject to the consequent errors. The practice generally observed has been to list all specimens found in the Southeast as *L. australis* Atk. Dr. C. [illegible]. Palmer has been helpful in pointing out the difficulties encountered in [illegible] conclusions [illegible] . [illegible] named [illegible] L. [illegible] (Atk.)[illegible], [illegible] species listed here, [illegible] properly [illegible] . Nevertheless, the writer feels [illegible] quite distinct [illegible] is represented [illegible] samples collected.

1. [illegible]

[illegible]

[illegible] .... L. [illegible] Atk.

1. [illegible],

[illegible],

[illegible].. L. [illegible] (Atk.)[illegible]

1. Lem[illegible] australis Atk. (Atkinson 1[illegible] f) Pl. [illegible], Figs. [illegible].

[illegible] married; [illegible] in nearly [illegible], strongly [illegible]-stricted [illegible] center portion, internodal surface almost cylindrical; color light green to olive-green [illegible], green [illegible]; [illegible] in Tennessee speci-mens; [illegible] borne in internodal positions; Central [illegible] described [illegible] alternately, [illegible] in-creasing in size [illegible] to apex. Sevier: Bent Gun'l Flats [illegible] adjacent [illegible] of Little Pigeon River 3-8 Sept. 1941 #1[illegible] - boulders in stream (1750-[illegible] ft.) Little

Figure [illegible] River [illegible] Ramsey [illegible] 7 [illegible] 194[illegible] #[illegible]6-8-7 - [illegible]: [illegible] junction [illegible] [illegible] Lyne [illegible] June 19[illegible] #1[illegible] (questionable [illegible]). [illegible]

[illegible]. *[illegible]* (A[illegible].) [illegible]. (A[illegible] Kir[illegible])(P[illegible], (*[illegible]* A[illegible].)

[illegible] e, [illegible]) [illegible], [illegible].

[illegible]; [illegible] in [illegible]; [illegible] in considerably [illegible], [illegible] in [illegible]; [illegible] olive-green [illegible] [illegible] [illegible]-[illegible]; [illegible] twisted [illegible]; [illegible] University [illegible]; [illegible] filament [illegible], [illegible], [illegible]. Kn [illegible]: [illegible] Island [illegible], at Price's [illegible] April [illegible] 1947 (Illis)#[illegible][2] - same [illegible] Jan. 1949 #[illegible] - [illegible]: [illegible] yards of sur-

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1 [illegible] 19[illegible], [illegible] distribution, [illegible] in Silva [illegible], 1944.
2 Reported in Prescott, Silva [illegible], 1949

[illegible] creek [illegible]
[illegible] – [illegible] C[illegible]
[illegible] – [illegible]
[illegible] VK.

[illegible]

[illegible] *Le[illegible]* [illegible] [illegible] [illegible]. It [illegible], [illegible] in the South- [illegible], [illegible] differences in [illegible], color, [illegible] are present [illegible] in the Cu[illegible]rds. [illegible] [illegible] rarely [illegible] [illegible] exposed to [illegible].

S[illegible] (Pers.)Str. ([illegible]) ([illegible]) ([illegible]) Pl. [illegible], Fi . [illegible].

[illegible] (. .C.): [illegible] in [illegible] low [illegible] (S[illegible]) #[illegible] – Sevier: Little Pigeon [illegible] C. C. C. C[illegible] in [illegible]- [illegible] V[illegible]y 11-1[illegible]. 1941 #[illegible] – below old Mill at [illegible] [illegible] Porter's Cr[illegible] Sept. 1941 #17[illegible] –

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1 [illegible] in [illegible], [illegible]

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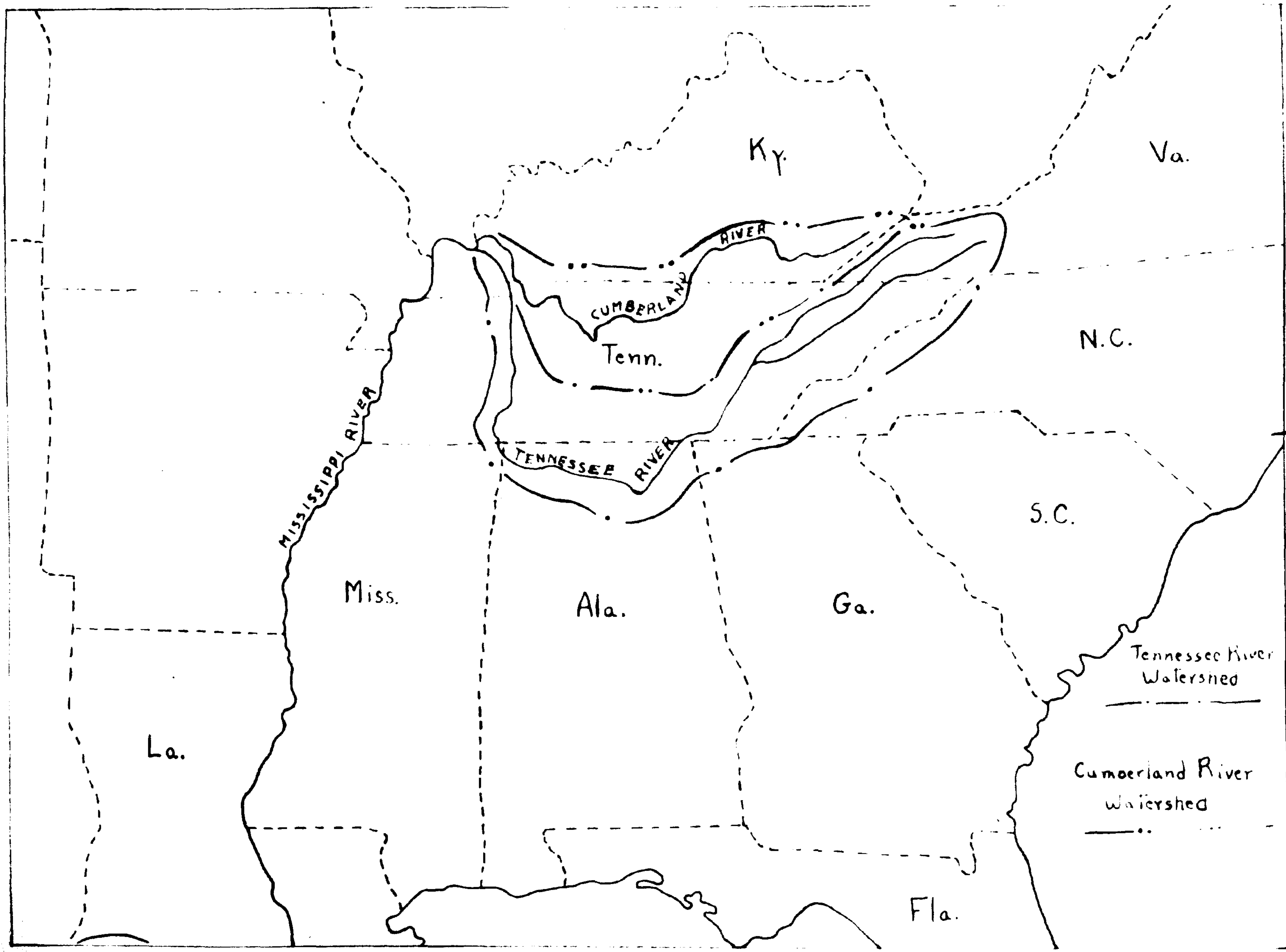
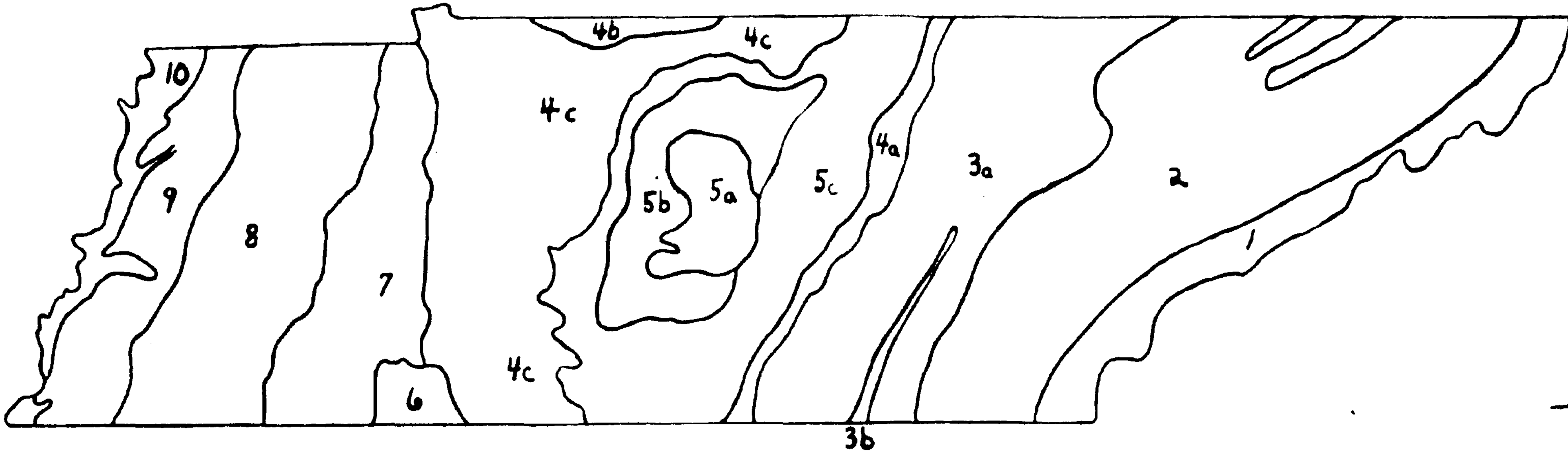
Map 1



Map 1 Area represented in algal survey



Map 2

1. The Blue Ridge Province

2. The Ridge and Valley Province

3. The Cumberland Plateau
   a. the plateau proper
   b. the Sequatchie Valley

4. The Highland Rim
   a. eastern valley fills
   b. Kentucky Barrens extension
   c. general rim surface

5. The Nashville Basin
   a. inner basin
   b. Maury-Mimosa-Stony Land soil ring
   c. Baxter-Dellrose-Mimosa soil ring

6. Eutaw-Tuscaloosa Sand & Gravel

7. The Cretaceous Belt

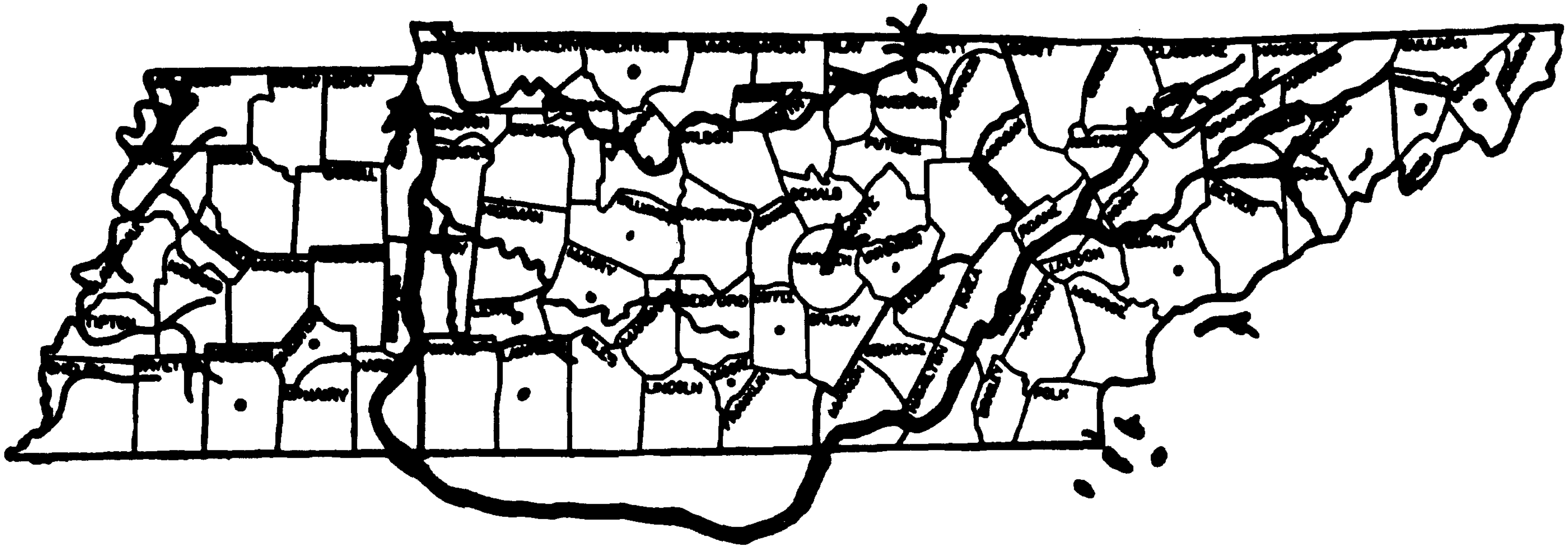
8. The Eocene Belt

9. The Pleistocene Loess Belt

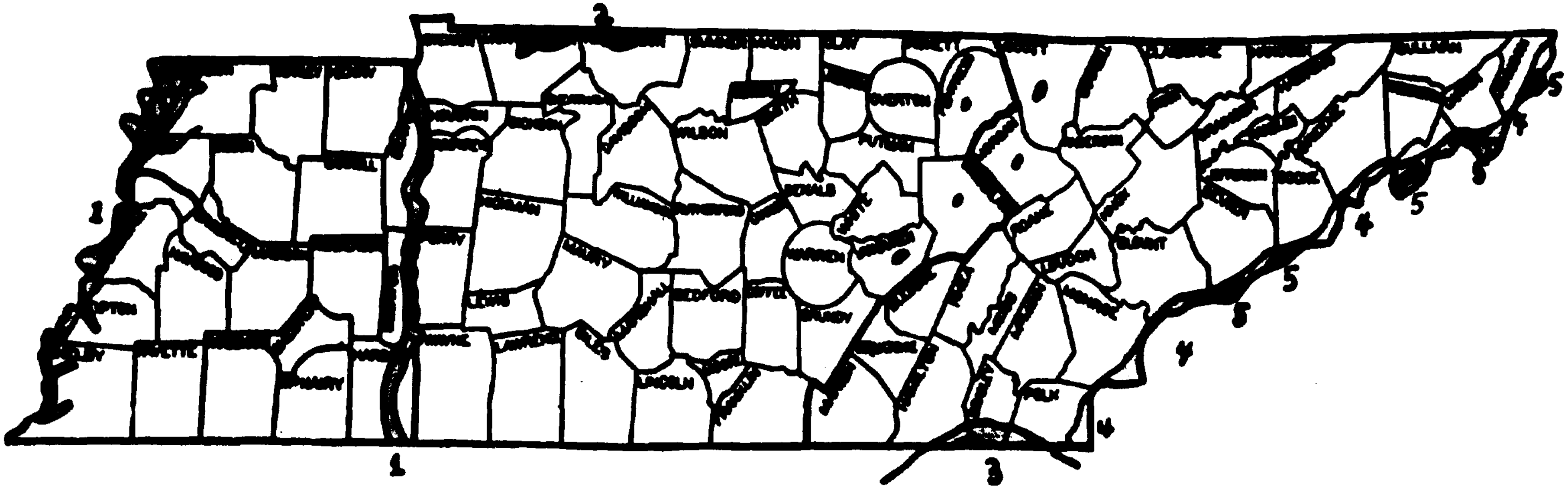
10. The Recent Alluvial Area

Map 2 Natural Subdivisions in Tennessee

Map 3



a. Major Streams, Lakes, and Minor Bodies of Standing Water



(1) Cypress-Tupelo-Red Gum
(2) prairie remnant
(3) northeastern hardwoods
(4) Spruce-Fir
(5) Oak-Pine

b. Forest Areas Differing From Over-all Hardwood Cover

Plate 1. (scale 1000:1)

Figs. 1-3.	Collodictyon triciliatum Carter (Fig. 2, showing rhizopodia, not to scale)
Fig. 4.	Heteromastix angulata Korsh.
Figs. 5, 6.	Pedinomonas minor Korsh. (after Pascher)
Figs. 7, 8.	Pyramimonas tetrahynchus Schmarda (Fig. 7 not to scale)
Fig. 9.	Carteria globosa Korsh. (after Pascher)
Fig. 10.	Chlamydomonas globosa Snow
Fig. 11.	Chlamydomonas nasuta Korsh.
Fig. 12.	Chlorogonium tetragamum Bohlin
Fig. 13.	Furcilla rotunda sp. nov.
Figs. 14, 15.	Lobomonas rostrata Hazen (Fig. 15 not to scale)
Figs. 16, 17.	Platymonas elliptica G. M. Smith (after Smith)

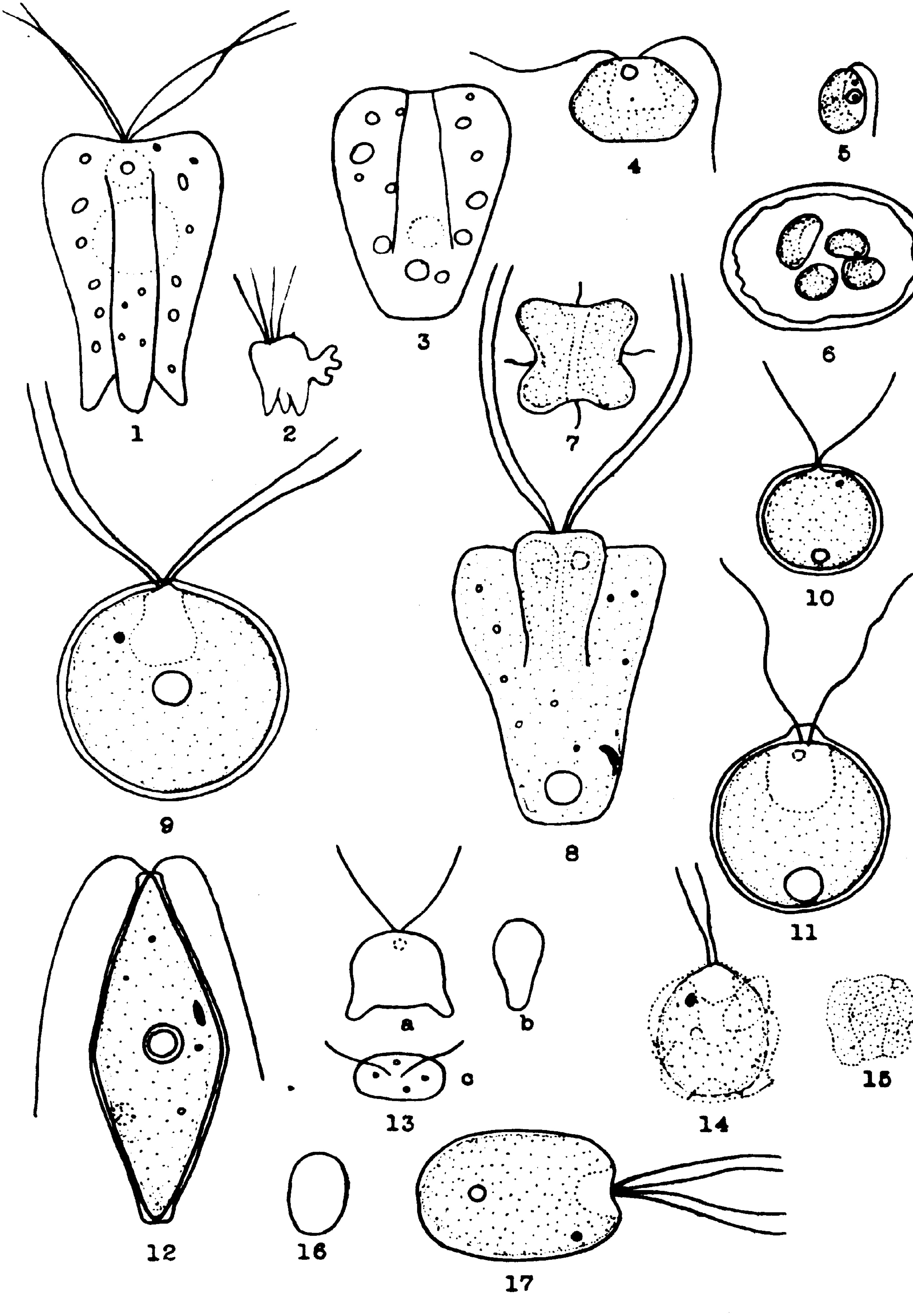

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Plate 2. (scale 1000:1)

Figs. 1, 2.	Scherffelia phacus Pasch. (Fig. 1 not to scale)
Fig. 3.	Sphaerellopsis fluviatilis (Stein)Pasch.
Fig. 4.	Dysmorphococcus Fritschii Takeda
Figs. 5, 6.	Pedinopera granulosa Pasch. X 500
Figs. 7, 8.	Pteromonas aculeata Lemm. (Fig. 8 not to scale)
Figs. 9, 10.	Phacotus subglobosus Pasch.
Figs. 11, 12.	Pteromonas angulosa Lemm.
Figs. 13, 14.	Thoracomonas phacotoides G. M. Smith
Figs. 15, 16.	Wislouchiella planktonica Skvor.

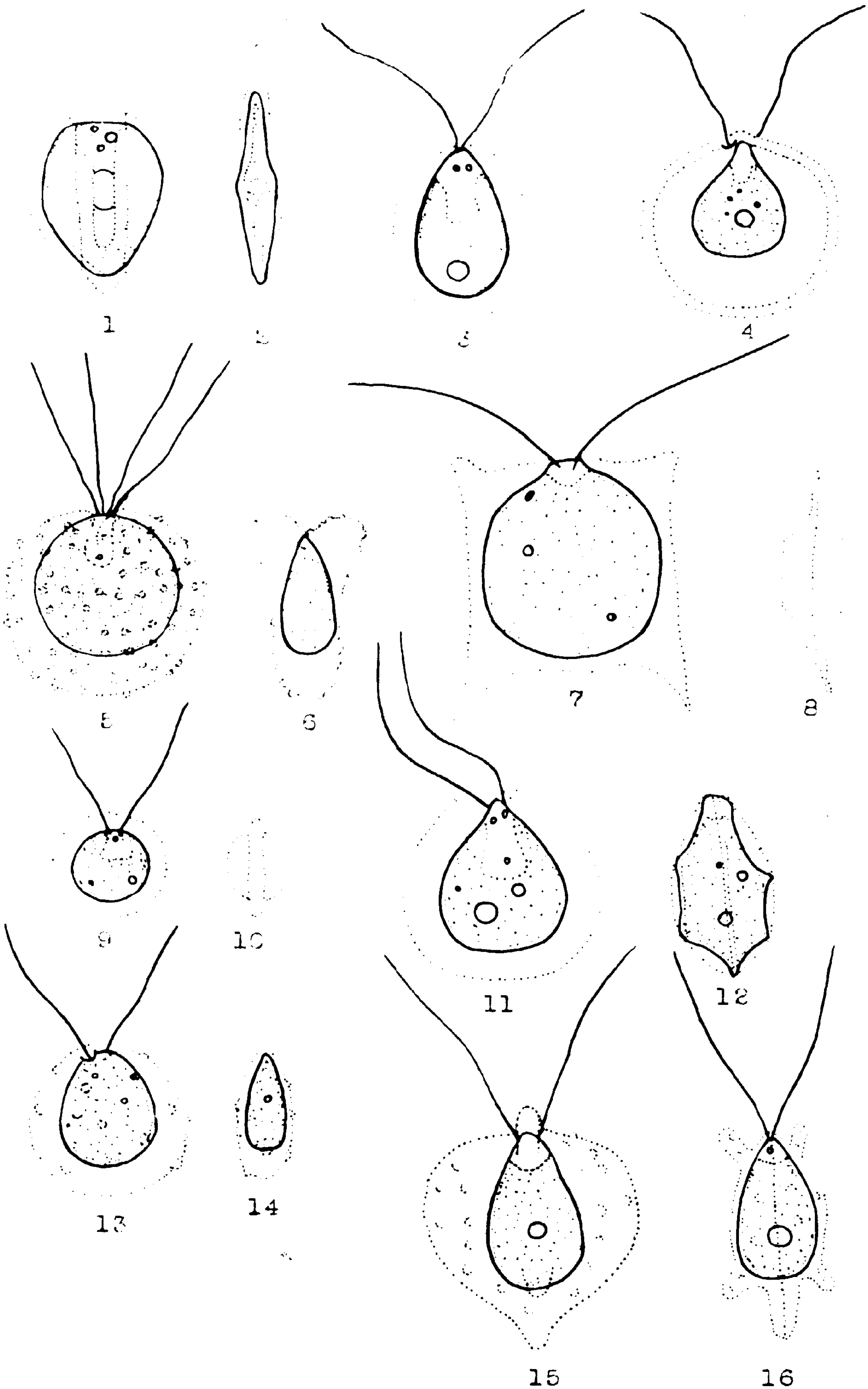
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Plate 3. (scale 1000:1)

Fig. 1.	Eudorina elegans Ehr.
Fig. 2.	Gonium formulosum Pasch.
Fig. 3.	Gonium sociale (Duj.)Warm.
Fig. 4.	Pandorina morum Bory
Fig. 5.	Platydorina caudata Kofoid
Fig. 6.	Ploeodorina californica Shaw

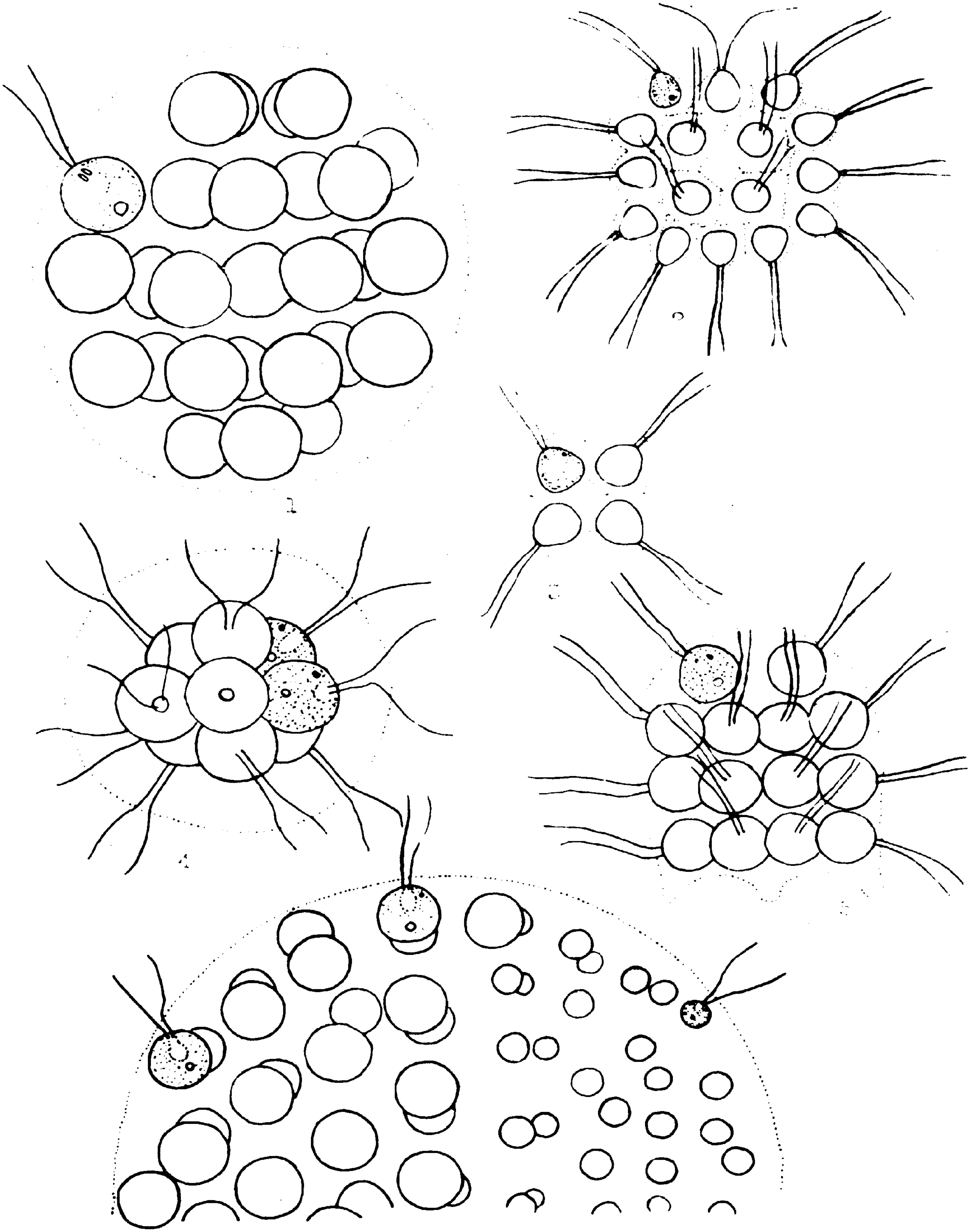

Plate 4. (scale 1000:1)

Figs. 1-3.	Volvox tertius Meyer (Fig. 3 not to scale)
Figs. 4, 5.	Volvox perglobator Powers (Fig. 5 not to scale)
Figs. 6, 7.	Haematococcus lacustris (Girod.)Rostaf.
Fig. 8.	Asterococcus limneticus G. M. Smith
Fig. 9.	Gloeocystis confluens (Kuetz.)Richt.
Fig. 10.	Sphaerocystis Schroeteri Chod.
Fig. 11.	Coccomyxa dispar Schm.
Fig. 12.	Nannochloris bacillaris Naum.

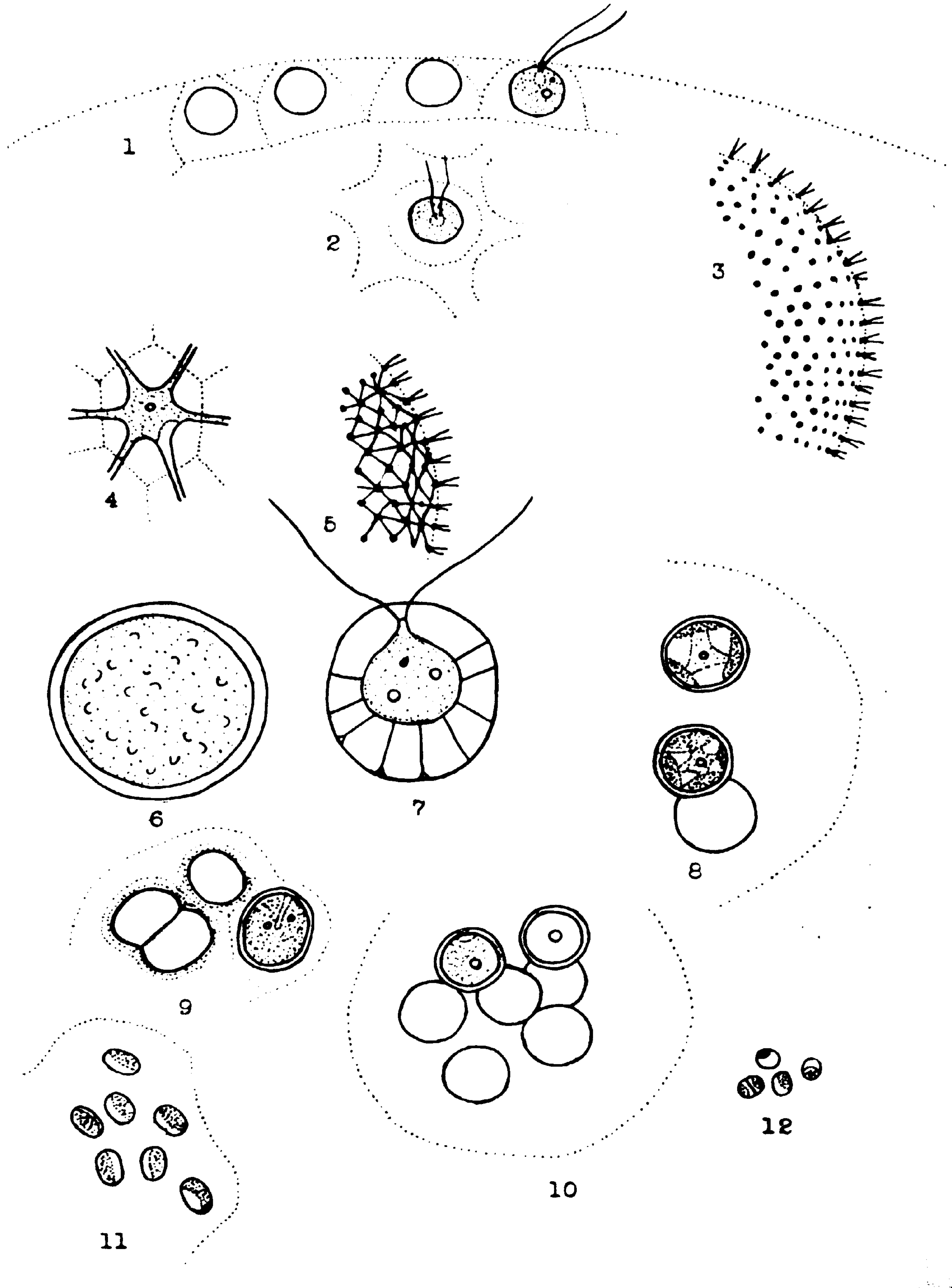
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Plate 5

Fig. 1. Tetraspora cylindrica (Wahlb.)Ag. X 1

Fig. 2. Tetraspora gelatinosa (Vauch.)Desv. X 1

Fig. 3. Tetraspora lubrica (Roth)Ag. X 1

Fig. 4. Tetraspora spp. cell arrangement in matrix

Fig. 5. Elaktothrix viridis (Snow)Printz X 1000

Fig. 6. Ourococcus bicaudatus Grobéty X 1000

Fig. 7. Binuclearia tatrana Wittr. X 1000

Fig. 8. Uronema confervicola Lag. X 1000

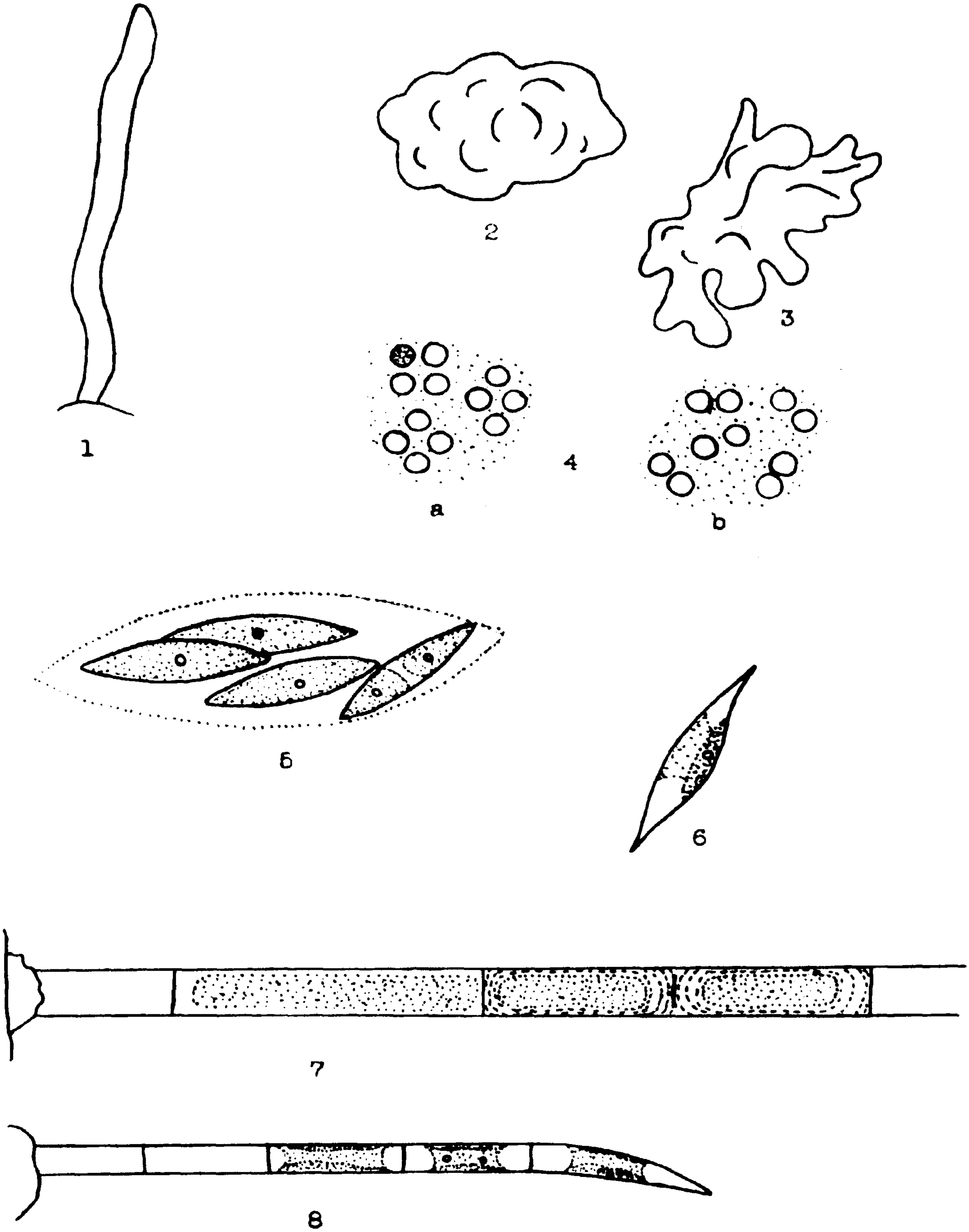
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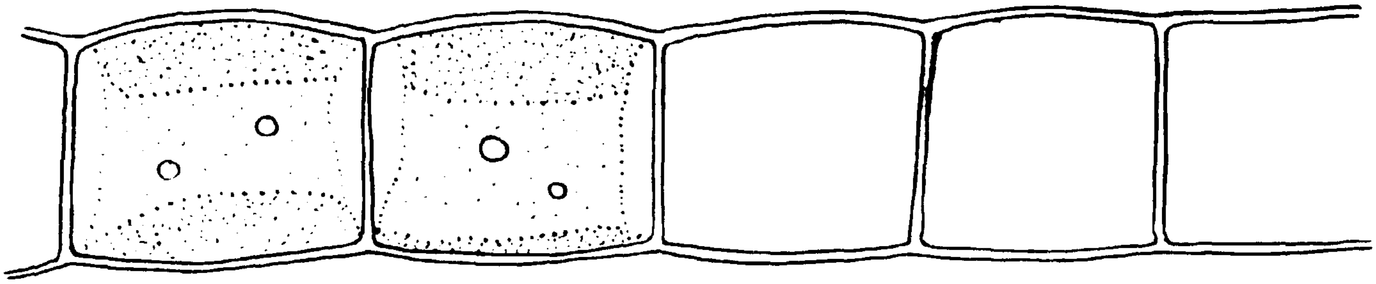
Plate 6. (scale 1000:1)

Figs. 1-3.	Schizomeris Leibleinii Kuetz. (Figs. 2, 3 X 250)
Fig. 4.	Stichococcus bacillaris Naeg.
Fig. 5.	Geminella hormidioides sp. nov.
Fig. 6.	Hormidium subtile (Kuetz.)Heering
Fig. 7.	Ulothrix tenerrima Kuetz.
Fig. 8.	Ulothrix tenuissima Kuetz.
Fig. 9.	Ulothrix variabilis Kuetz.



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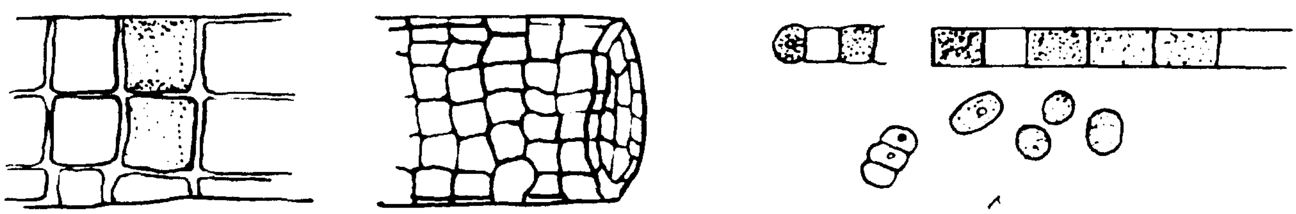

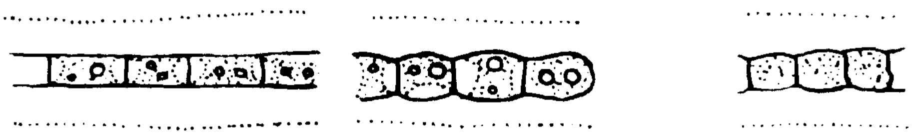

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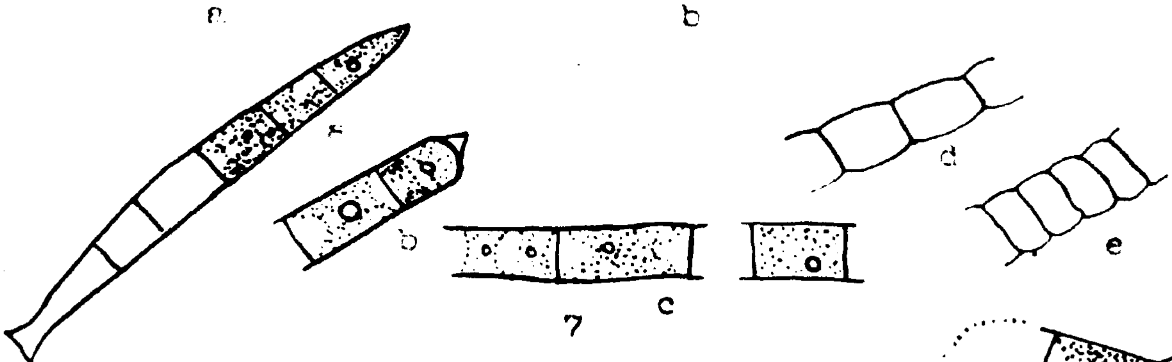

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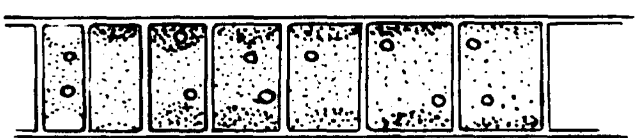

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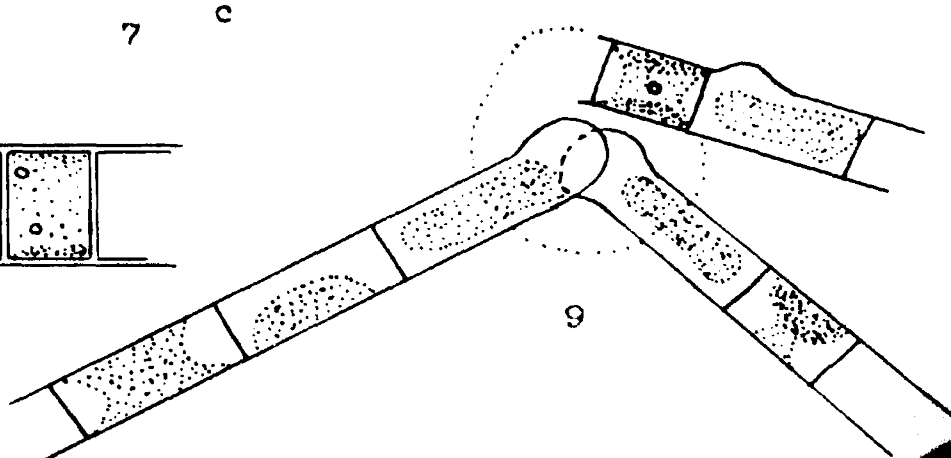

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Plate 7. (scale 1000:1)

Fig. 1.	Microspora amoena (Kuetz.)Lag.
Fig. 2.	Microspora Wittrockii Lag.
Fig. 3.	Microspora pachyderma (Wille)Lag.
Fig. 4.	Cylindrocapsa geminella Wolle
Fig. 5.	Aphanochaete repens A. Braun

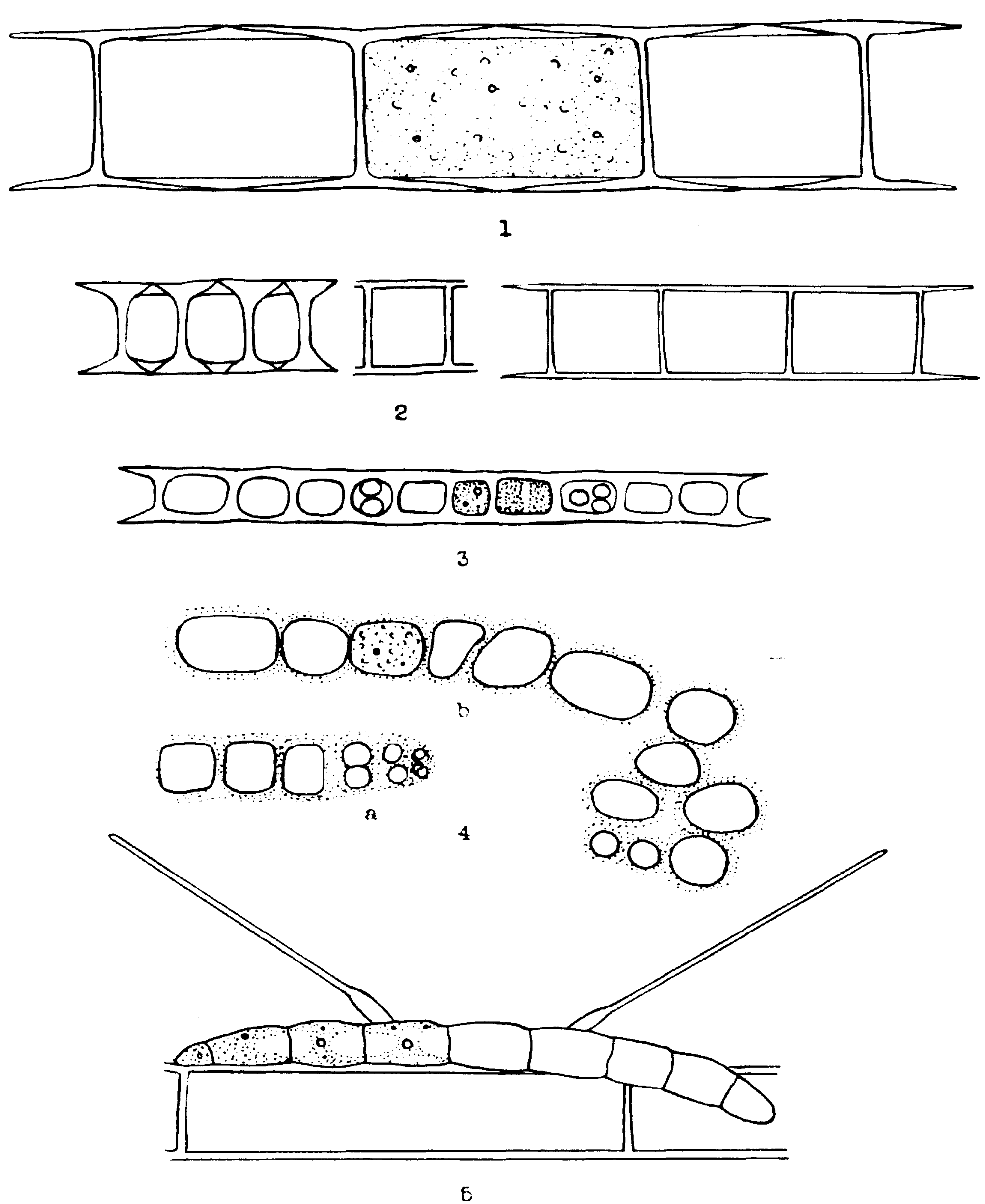
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Plate 8

Fig. 1. Chaetophora incrassata (Huds.)Hazen X 1

Fig. 2. Chaetophora pisciformis Ag. X 1

Fig. 3. Chlorotylium cataractarum Kuetz. X 1000

Fig. 4. Microthamnion Kuetzingianum Naeg. X 1000

Fig. 5. Chaetophora spp. (C. pisciformis Ag., C. elegans (Roth)Ag. or C. attenuata Hazen) X 1

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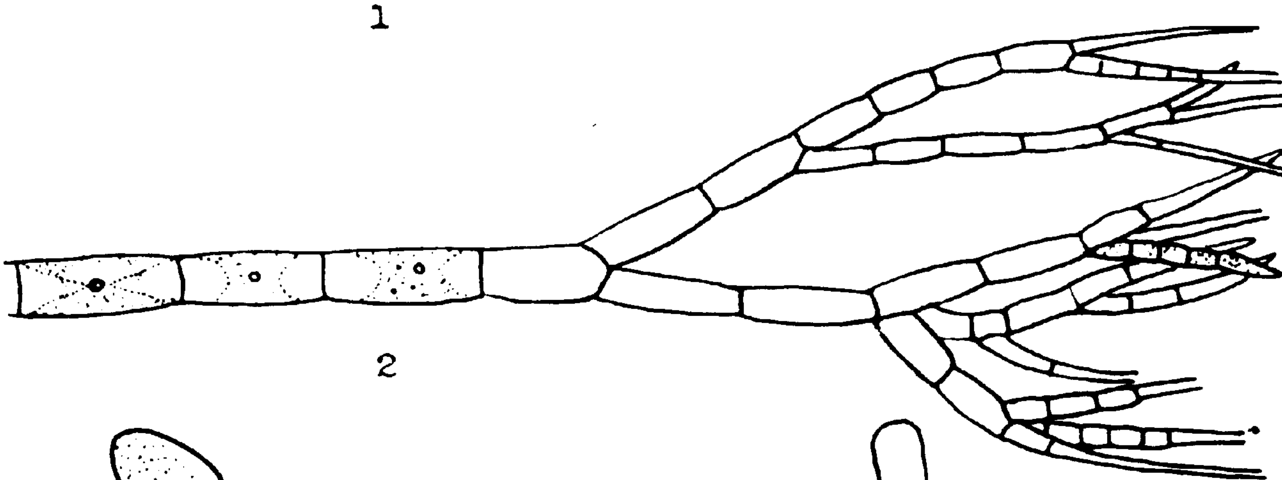

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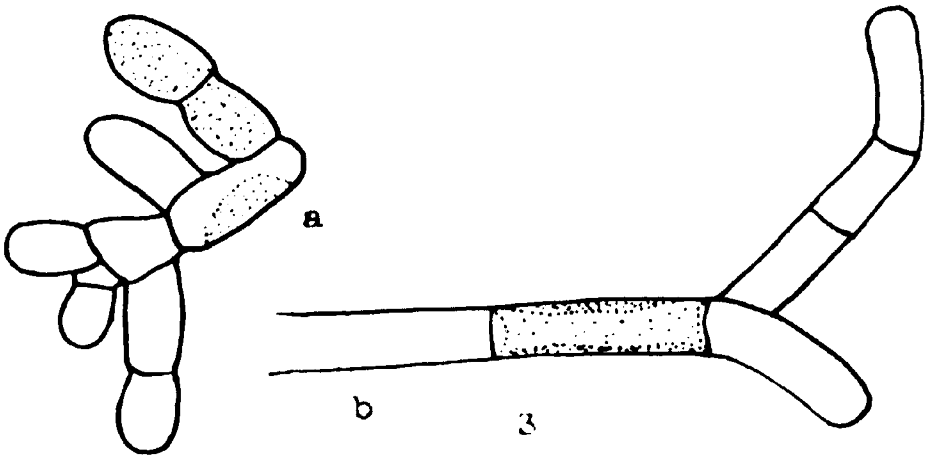

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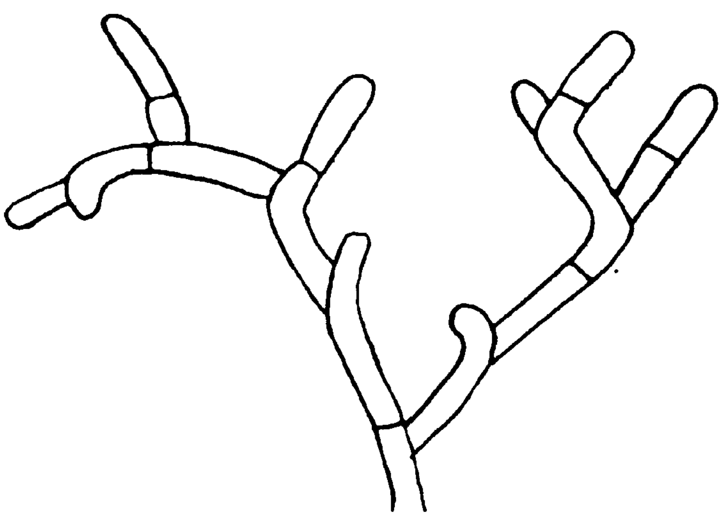

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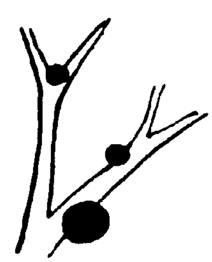

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Plate 9. (scale 1000:1)

Fig. 1.	Draparnaldia acuta (Ag.)Kuetz. (b. not to scale)
Fig. 2.	Stigeoclonium lubricum (Dillw.)Kuetz. (b. not to scale)
Fig. 3.	Stigeoclonium attenuatum (Hazen)Col.

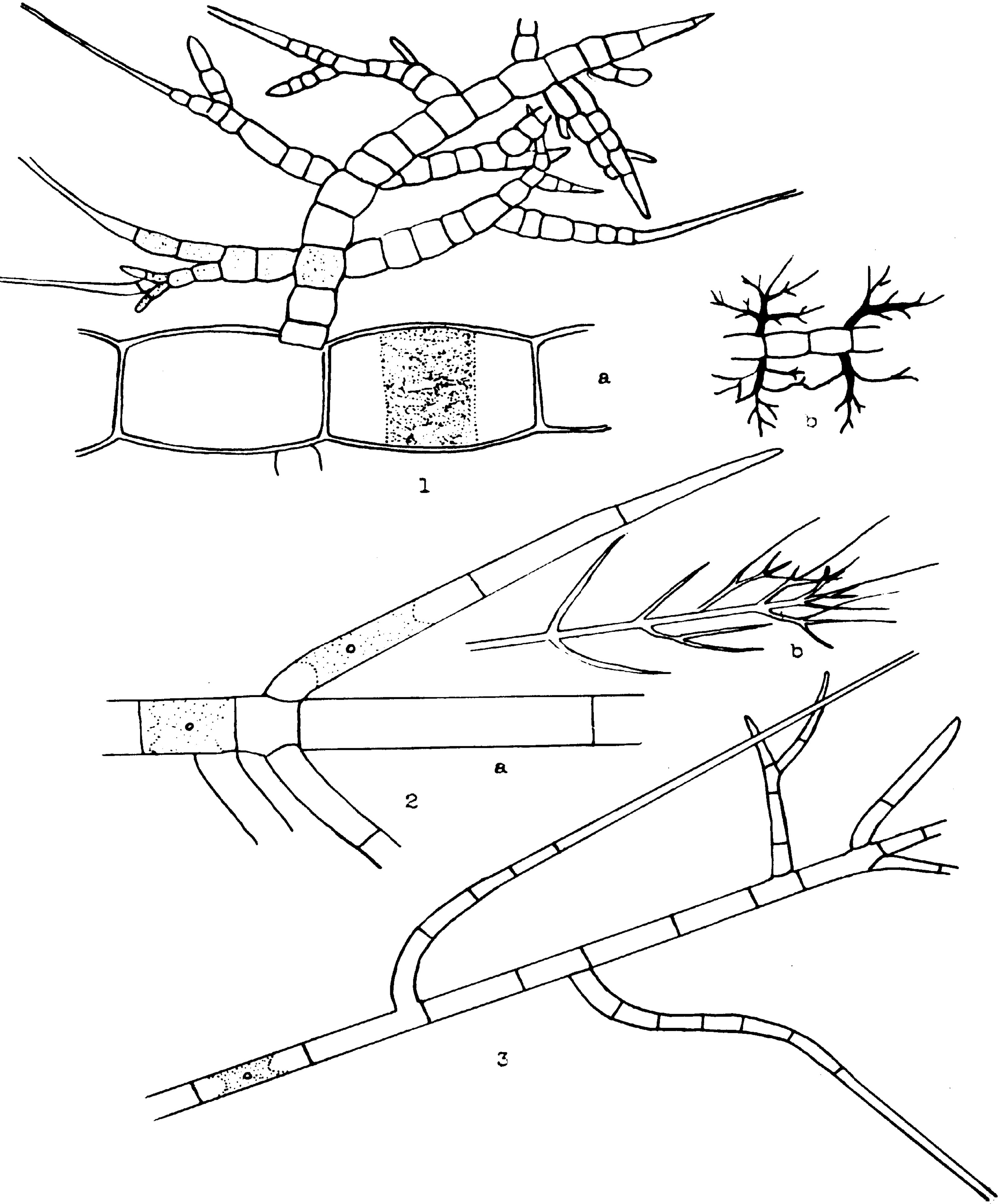
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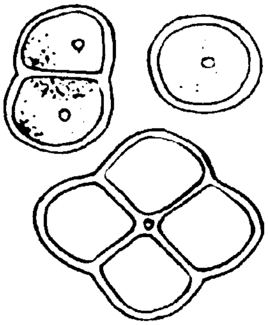
Plate 10. (scale 1000:1)

Fig. 1.	Protococcus viridis Ag.
Fig. 2.	Chaetosphaeridium globosum (Nordst.)Kleb.
Fig. 3.	Trentepohlia abietina (Flotow)Hansg.
Fig. 4.	Trentepohlia aurea (L.)Martius
Fig. 5.	Coleochaete scutata Bréb. X 100
Fig. 6.	Coleochaete irregularis Prings. X 100



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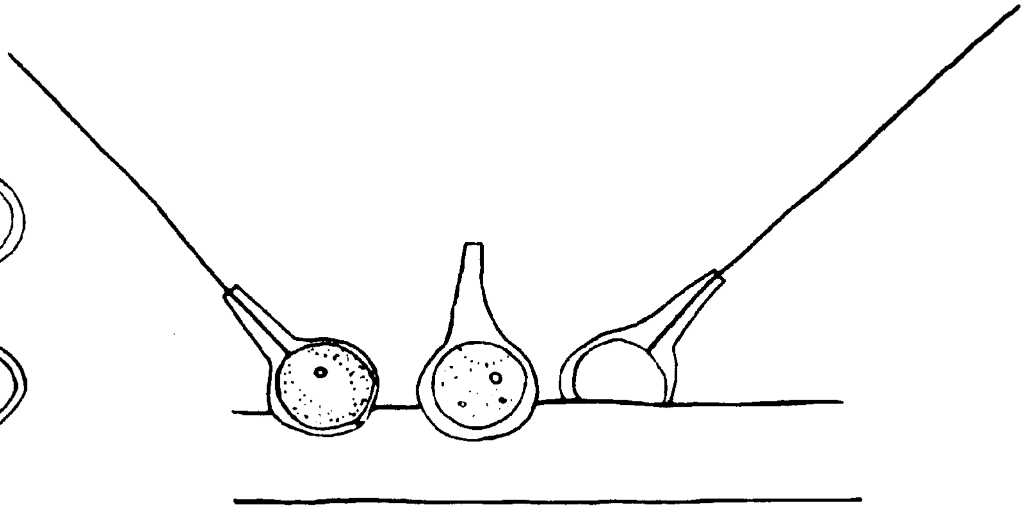
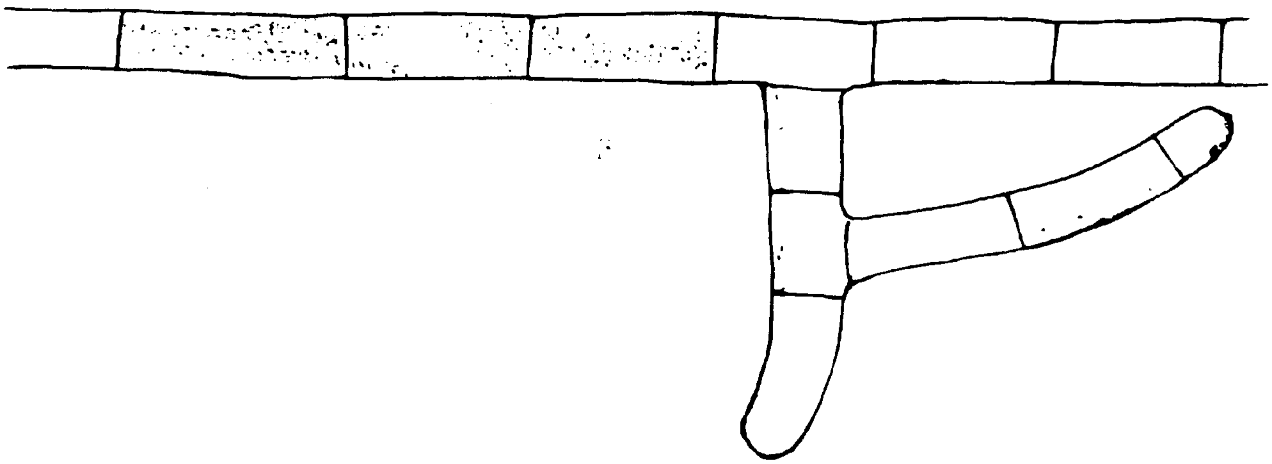
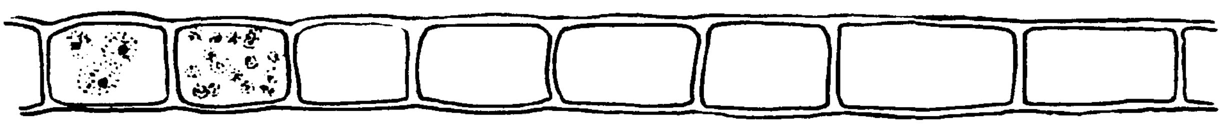
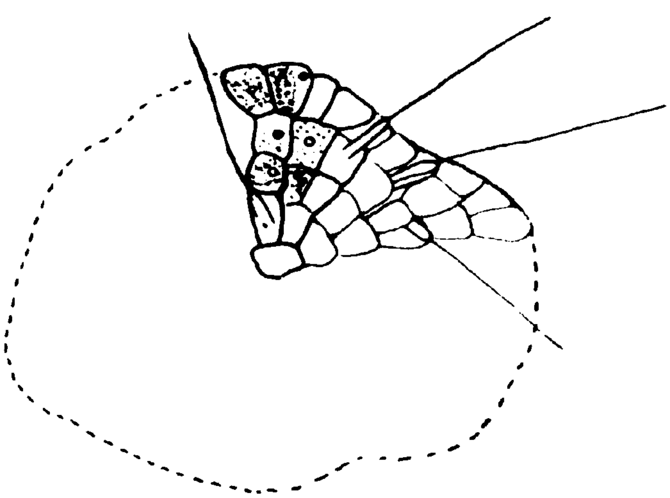








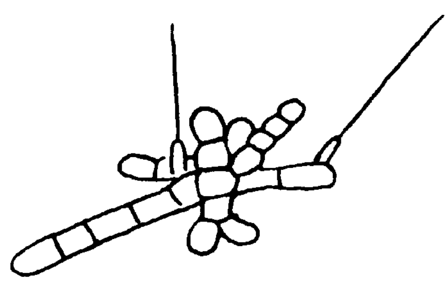
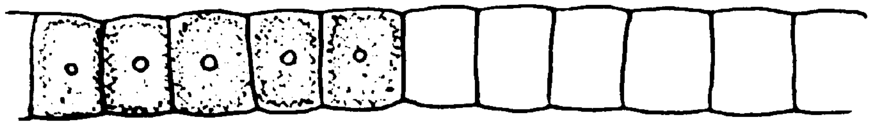


Plate 11. (scale 1000:1)

Fig. 1.	Schizogonium murale Kuetz.
Fig. 2.	Protosiphon botryoides (Kuetz.)Klebs
Figs. 3, 4.	Hydrodictyon reticulatum (L.)Lag. (Fig. 4 X 1)
Fig. 5.	Pediastrum angulosum (Ehr.)Menegh.
Fig. 6.	Pediastrum simplex (Meyen)Lemm.



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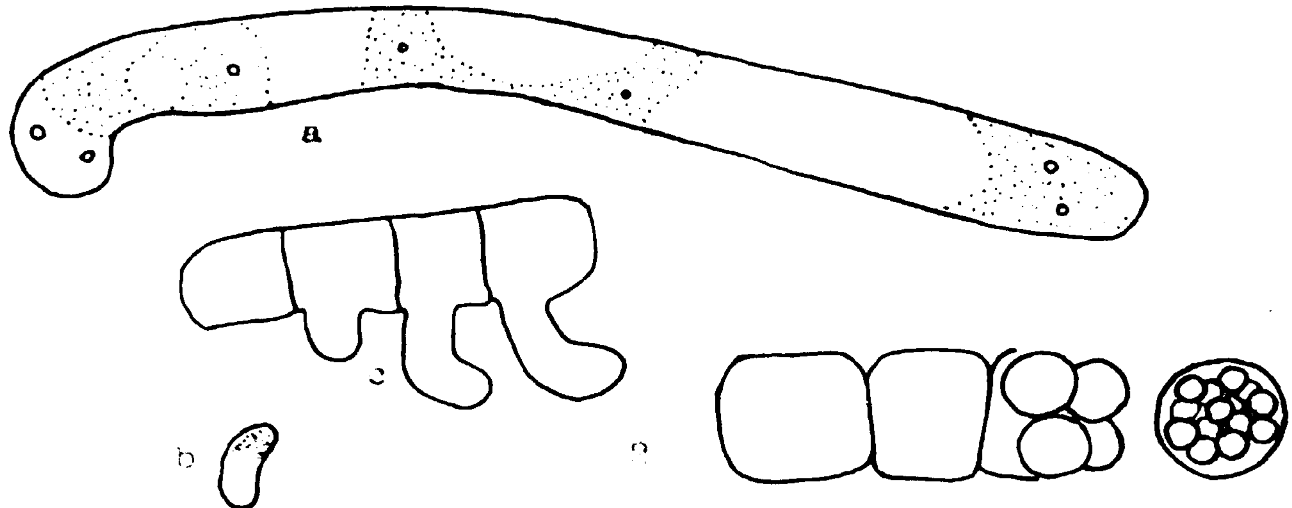

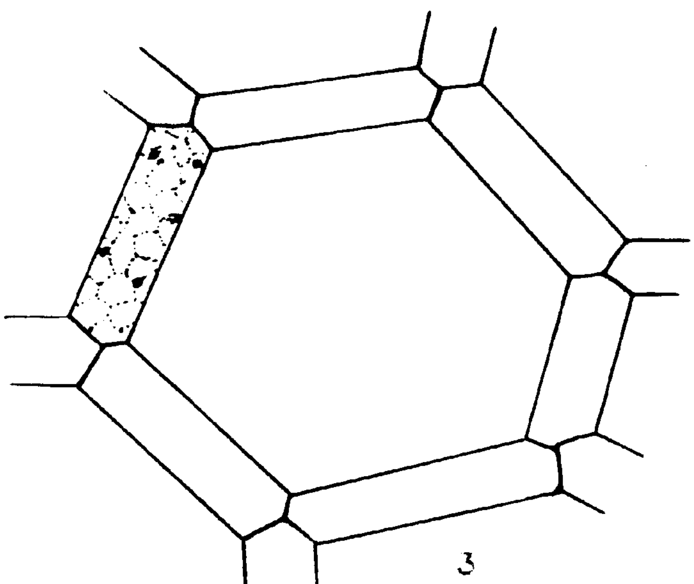

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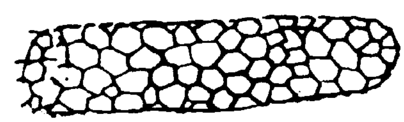

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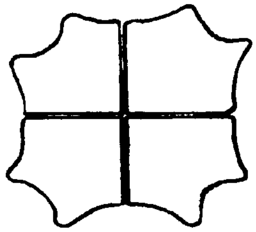

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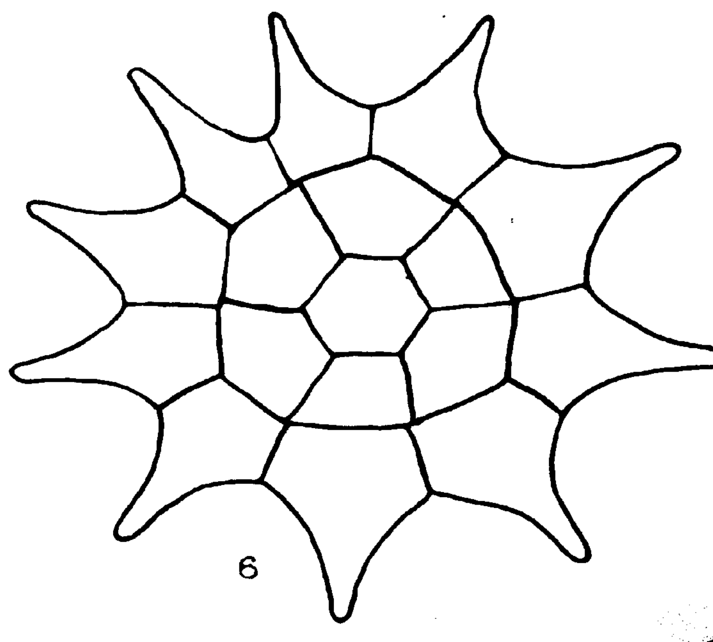

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Plate 12. (scale 1000:1)

Fig. 1.	Acanthosphaeria Zachariasi Lemm.
Fig. 2.	Chlorococcum humicola (Naeg.)Rab.
Fig. 3.	Trebouxia Cladoniae (Chod.)G. M. Smith
Fig. 4.	Golenkinia radiata Chod.
Fig. 5.	Golenkinia radiata v. brevispina Tiff. & Ahl.
Fig. 6.	Desmatractum bipyramidatum (Chod.)Pasch.
Fig. 7.	Characium ambiguum Hermann
Fig. 8.	Characium Braunii Bruegger
Fig. 9.	Characium stipitatum (Bach)Wille
Fig. 10.	Characium limneticum Lemm.
Fig. 11.	Schroederia setigera (Schroed.)Lemm. X 2000
Fig. 12.	Schroederia ancora G. M. Smith

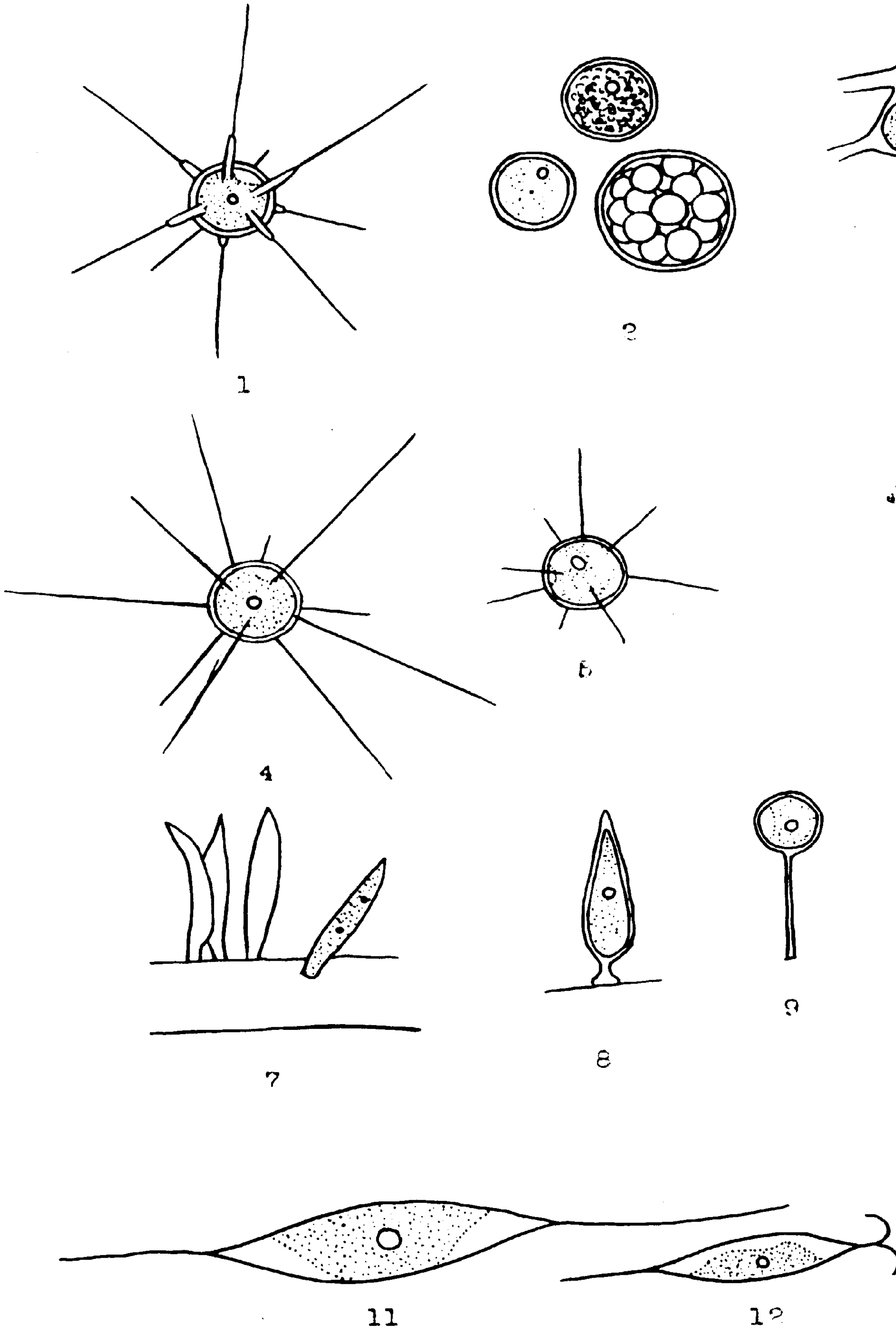
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Plate 13. (scale 1000:1)

Fig. 1.	Sorastrum spinulosum (Ehr.)Menegh.
Fig. 2.	Coelastrum cambricum Arch.
Fig. 3.	Coelastrum cubicum Naeg.
Fig. 4.	Ankistrodesmus spiralis (Turn.)Lemm.
Fig. 5.	Ankistrodesmus falcatus (Corda)Bréb.
Fig. 6.	Chlorella vulgaris Beyer.
Fig. 7.	Chlorella pyrenoidosa Chick.
Fig. 8.	Zoochlorella parasitica Brandt (b. about X 2500)
Fig. 9.	Bohlinia echidna (Bohlin)Lemm.
Fig. 10.	Botryococcus Braunii Kuetz.
Fig. 11.	Dictyosphaerium pulchellum Wood
Fig. 12.	Dimorphococcus lunatus A. Braun
Fig. 13.	Closteriopsis longissima Lemm.

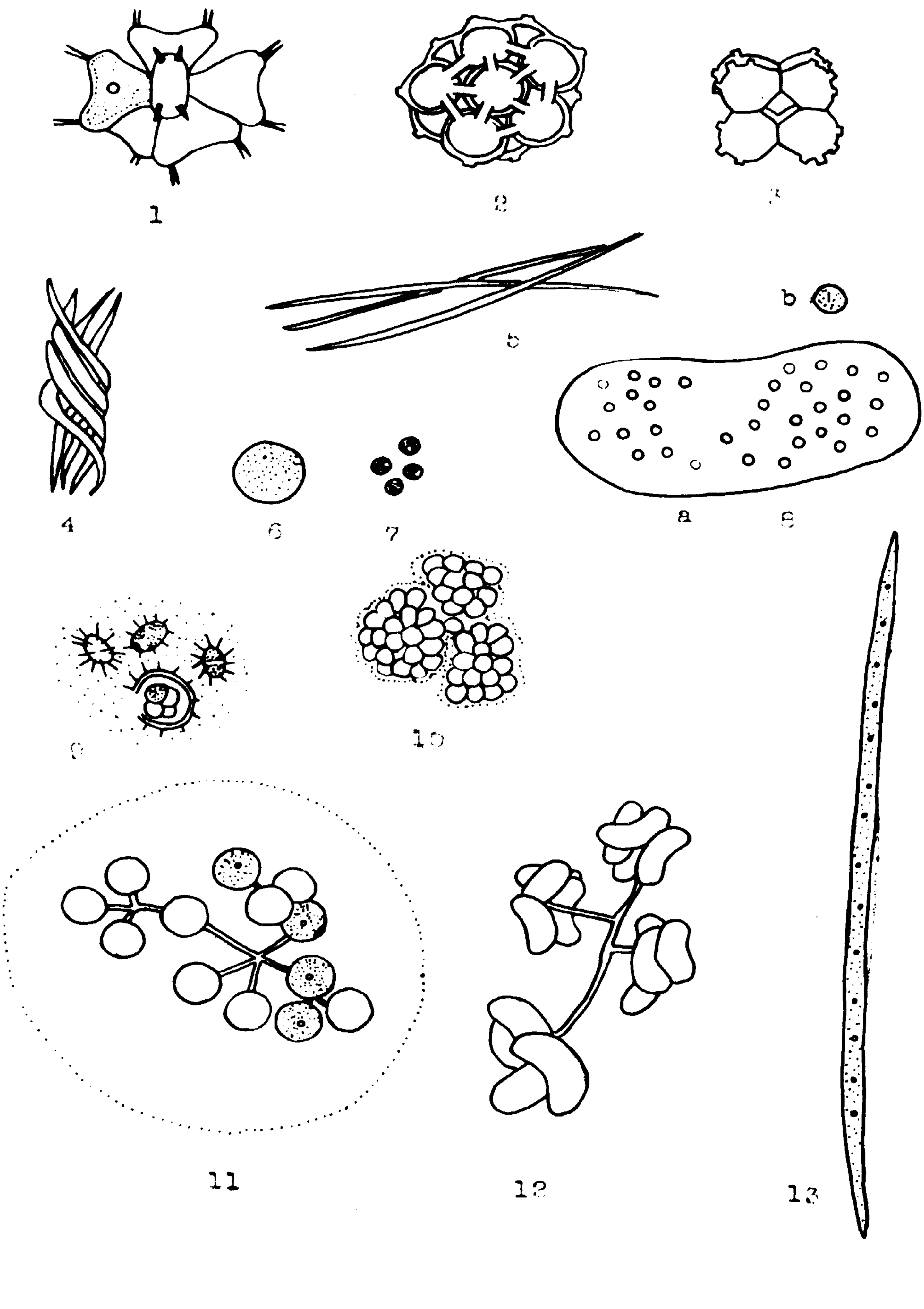
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Plate 14. (scale 1000:1)

Fig. 1. Eremosphaera viridis DeBary X 100

Fig. 2. Excentrosphaera viridis G. T. Moore X 100

Fig. 3. Franceia Droescheri (Lemm.)G. M. Smith

Fig. 4. Kirchneriella subsolitaria G. M. Smith

Fig. 5. Kirchneriella lunaris (Kirch.)Moeb.

Fig. 6. Chodatella subsalsa Lemm.

Fig. 7. Polyedriopsis spinosa Schm.

Fig. 8. Quadrigula Chodatii (Tanner-Fullman)G. M. Smith

Fig. 9. Tetraëdron gracile (Reinsch)Hansg.

Fig. 10. Tetraëdron regulare Kuetz. (b. not to scale)

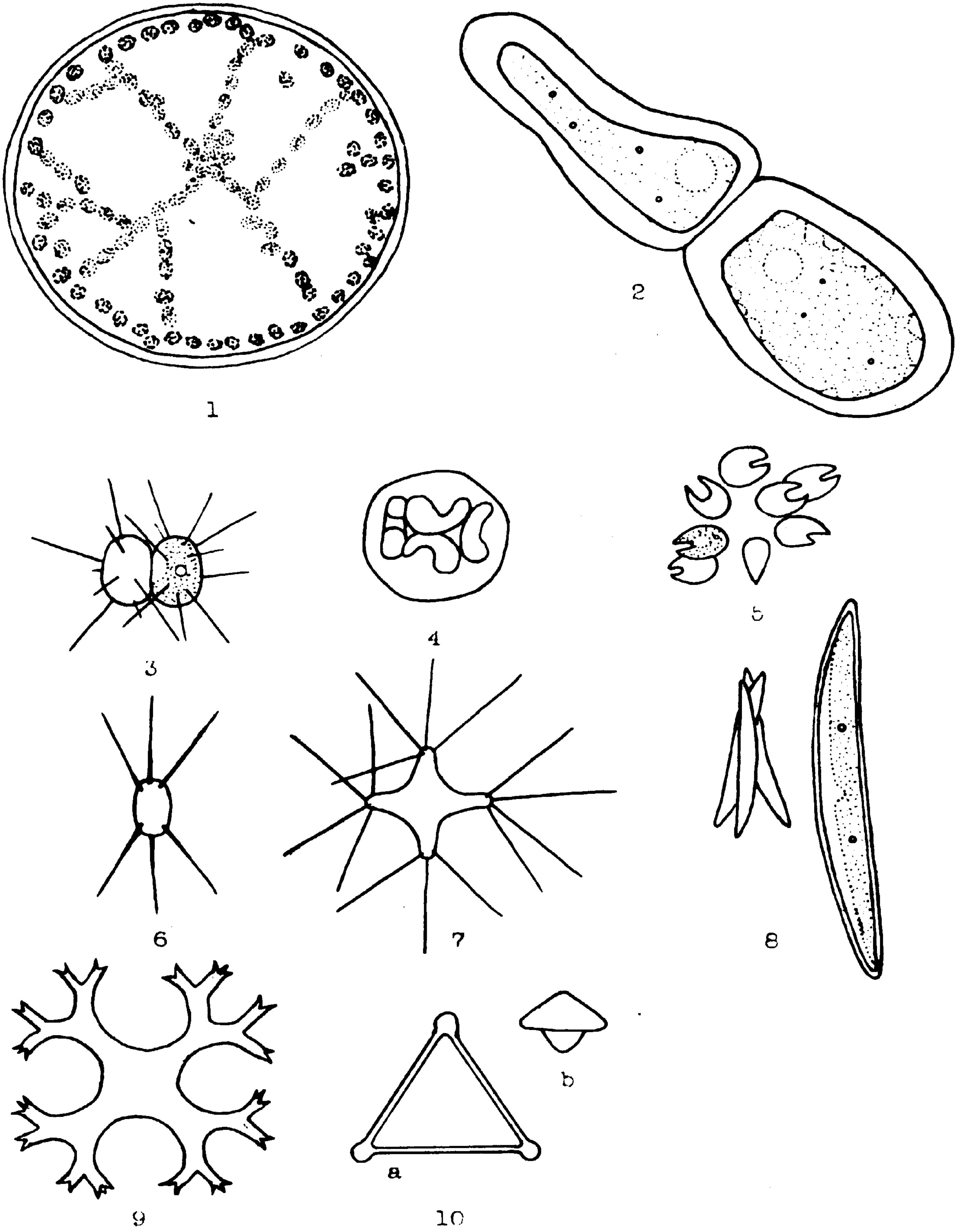
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Plate 15. (scale 1000:1)

Fig. 1.	Nephrocytium ecdysiscepanum West & West
Fig. 2.	Oocystis brevispina sp. nov.
Fig. 3.	Oocystis rupestris Kirch.
Fig. 4.	Oocystis crassa Wittr.
Fig. 5.	Planktosphaeria gelatinosa G. M. Smith
Fig. 6.	Selenastrum Bibrianum Reinsch
Fig. 7.	Treubaria tripendiculata Bernard
Fig. 8.	Trochiscia reticularis (Reinsch)Hansg. (after Prescott)
Fig. 9.	Westella botryoides (W. West)DeWild.
Fig. 10.	Errerella Bornhiemiensis Conrad
Fig. 11.	Micractinium pusillum Fres.

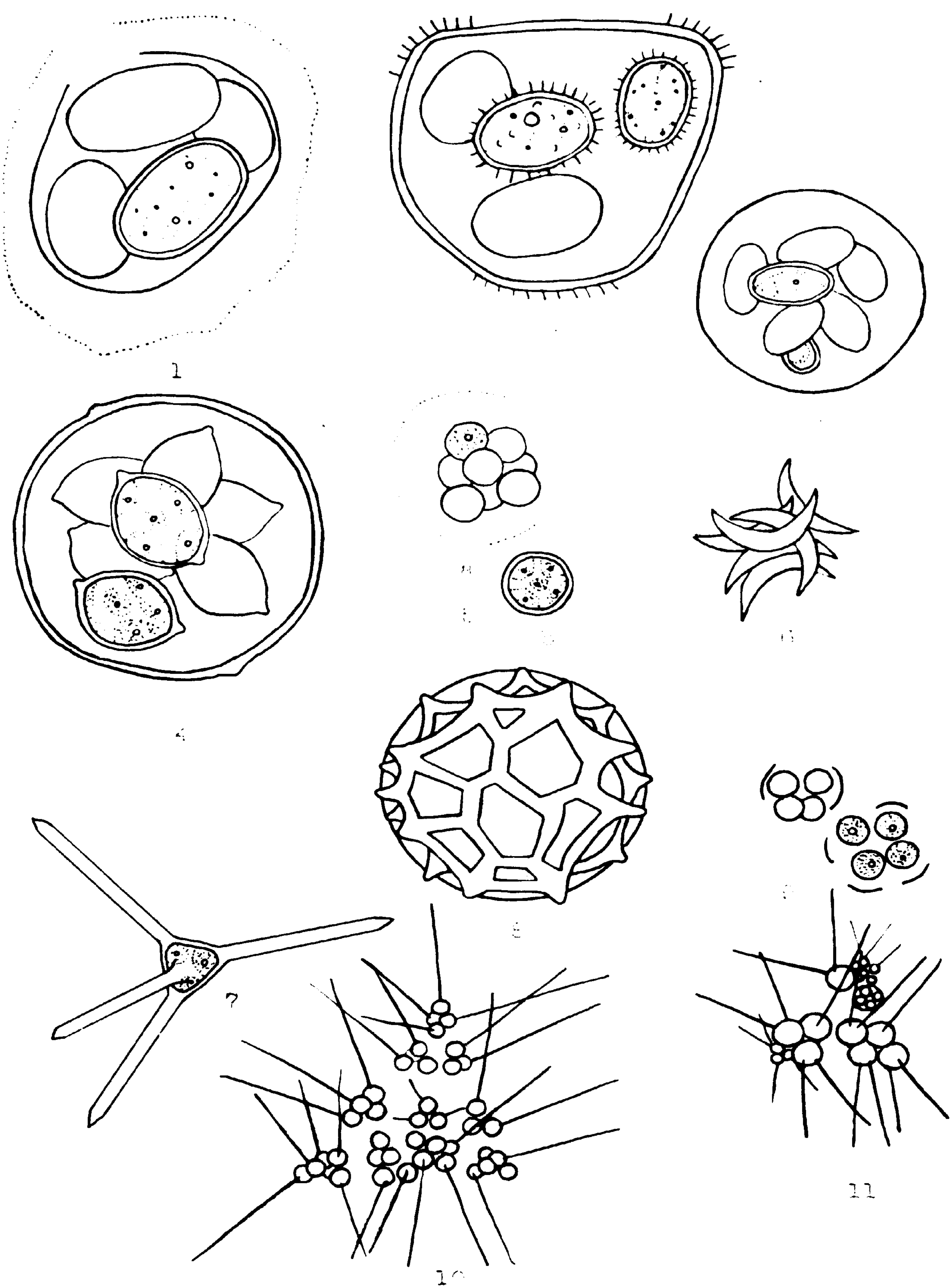
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Plate 16. (scale 1000:1)

Fig. 1.	Actinastrum gracilimum G. M. Smith
Fig. 2.	Actinastrum Hantzschii Lag.
Fig. 3.	Tetrallantos Lagerheimii Teil.
Fig. 4.	Crucigenia apiculata (Lemm.)Schm.
Fig. 5.	Crucigenia Lauterbornii Schm.
Fig. 6.	Tetrastrum staurogeniaeforme (Schm.)Lemm.
Fig. 7.	Scenedesmus acuminatus (Lag.)Chod.
Fig. 8.	Scenedesmus abundans (Kirch.)Chod.
Fig. 9.	Scenedesmus acutiformis Schroed.
Fig. 10.	Scenedesmus denticulatus Lag.
Fig. 11.	Scenedesmus dimorphus (Turp.)Kuetz.
Fig. 12.	Scenedesmus obliquus (Turp.)Kuetz.
Fig. 13.	Scenedesmus opoliensis P. Richt.
Fig. 14.	Scenedesmus arcuatus v. platydiscus G. M. Smith
Fig. 15.	Scenedesmus arcuatus Lemm.

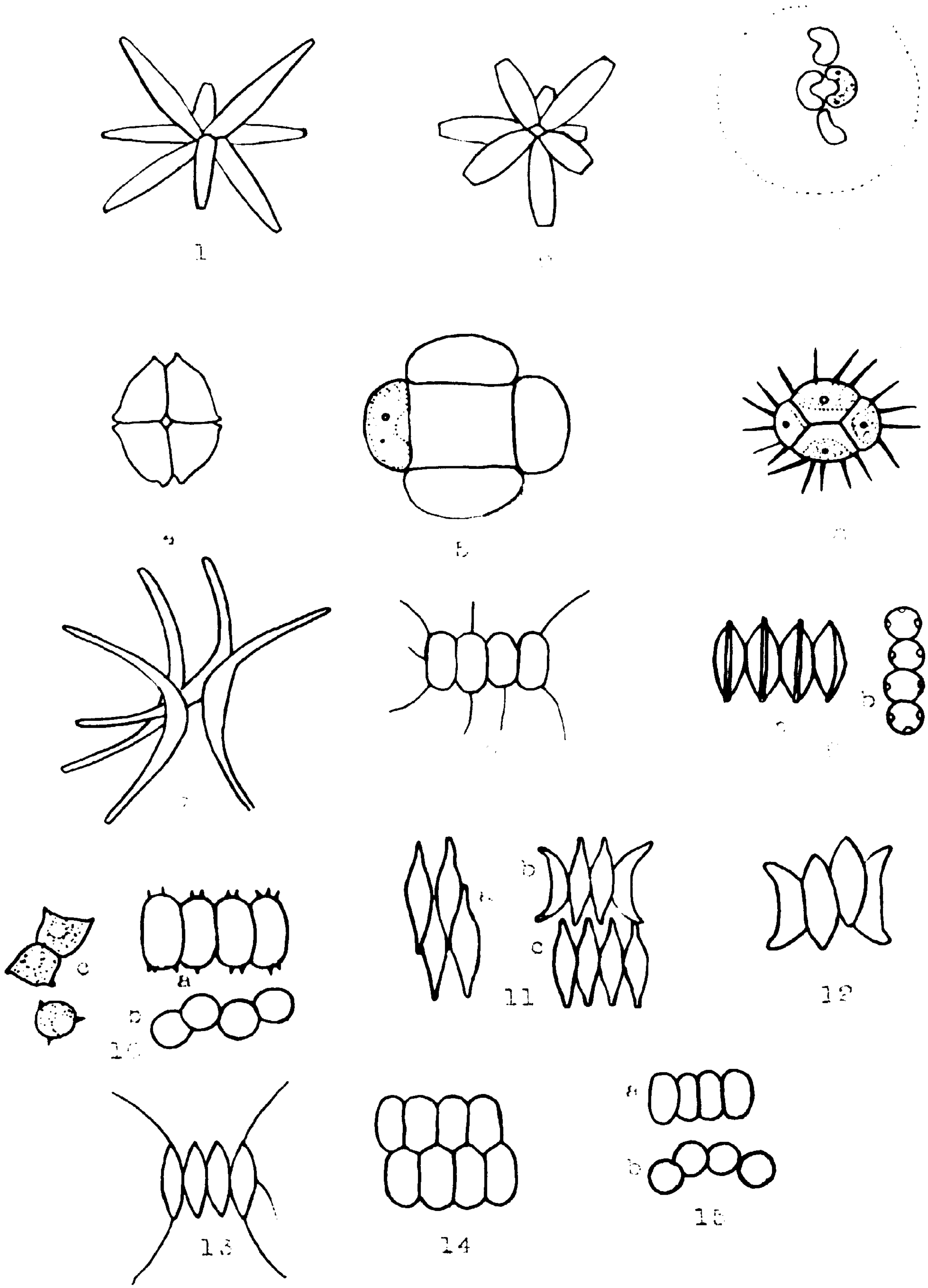

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Plate 17. (scale 1000:1)

Fig. 1.	Bulbochaete pygmaeum Prings
Fig. 2.	Oedogonium cardiacum (Hass.) Wittr.
Fig. 3.	Oedogonium armigerum Hirn
Fig. 4.	Oedogonium crenulatocostatum v. cylindricum (Hirn) Tiff.
Fig. 5.	Oedogonium hians Nordst. & Hirn
Fig. 6.	Oedogonium sphaerico-inconspicuum sp. nov.

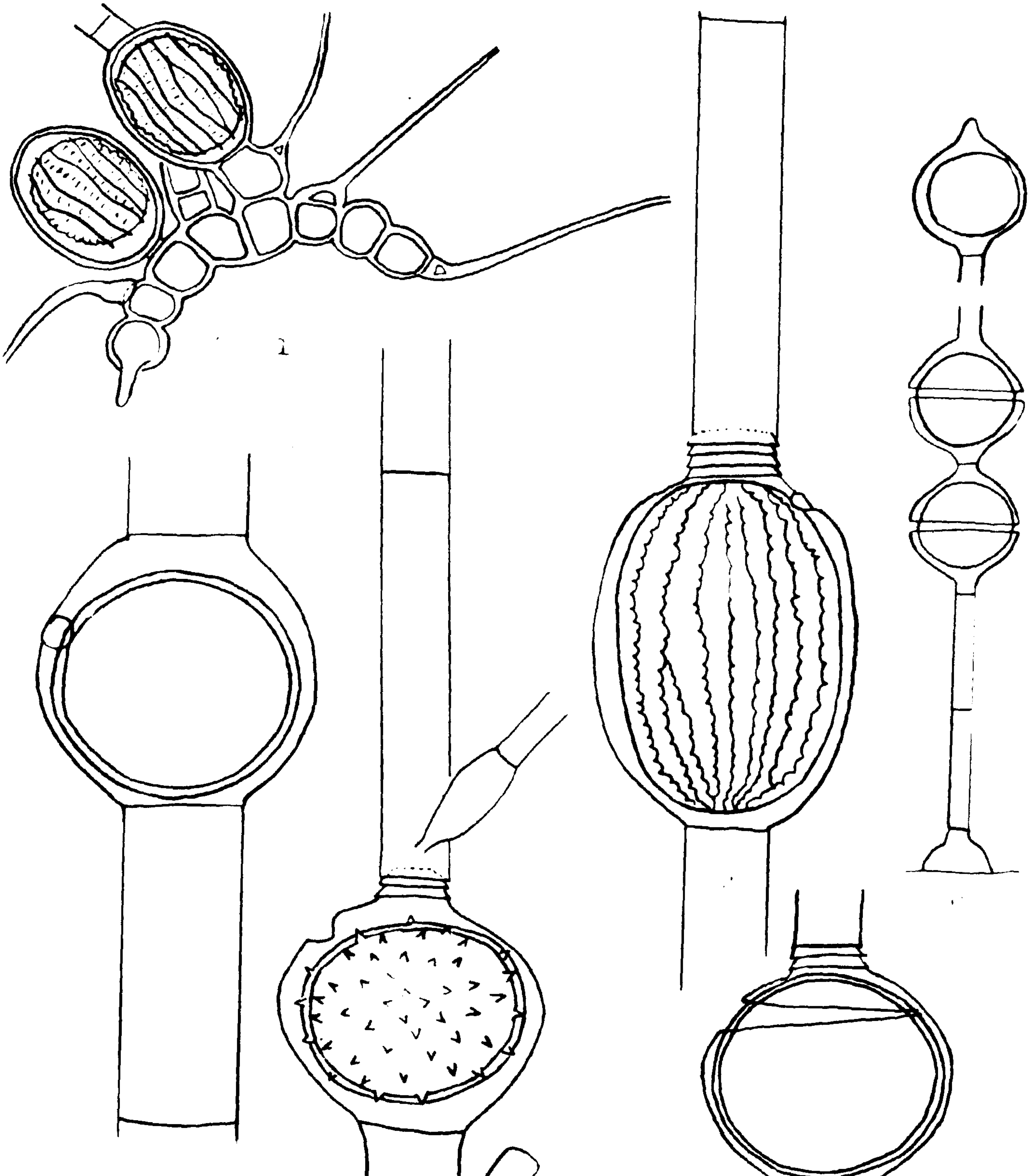
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Plate 18. (scale 250:1)

Fig. 1.	Oedogonium Kurzii v. ovoidum sp. nov.
Fig. 2.	Basicladia chelonum (Col.)Hoff. & Tild.
Fig. 3.	Rhizoclonium fontanum Kuetz. (b. not to scale)
Fig. 4.	Cladophora aegagropila Kuetz.
Fig. 5.	Cladophora crispata (Roth)Kuetz.
Fig. 6.	Cladophora glomerata (L.)Kuetz.

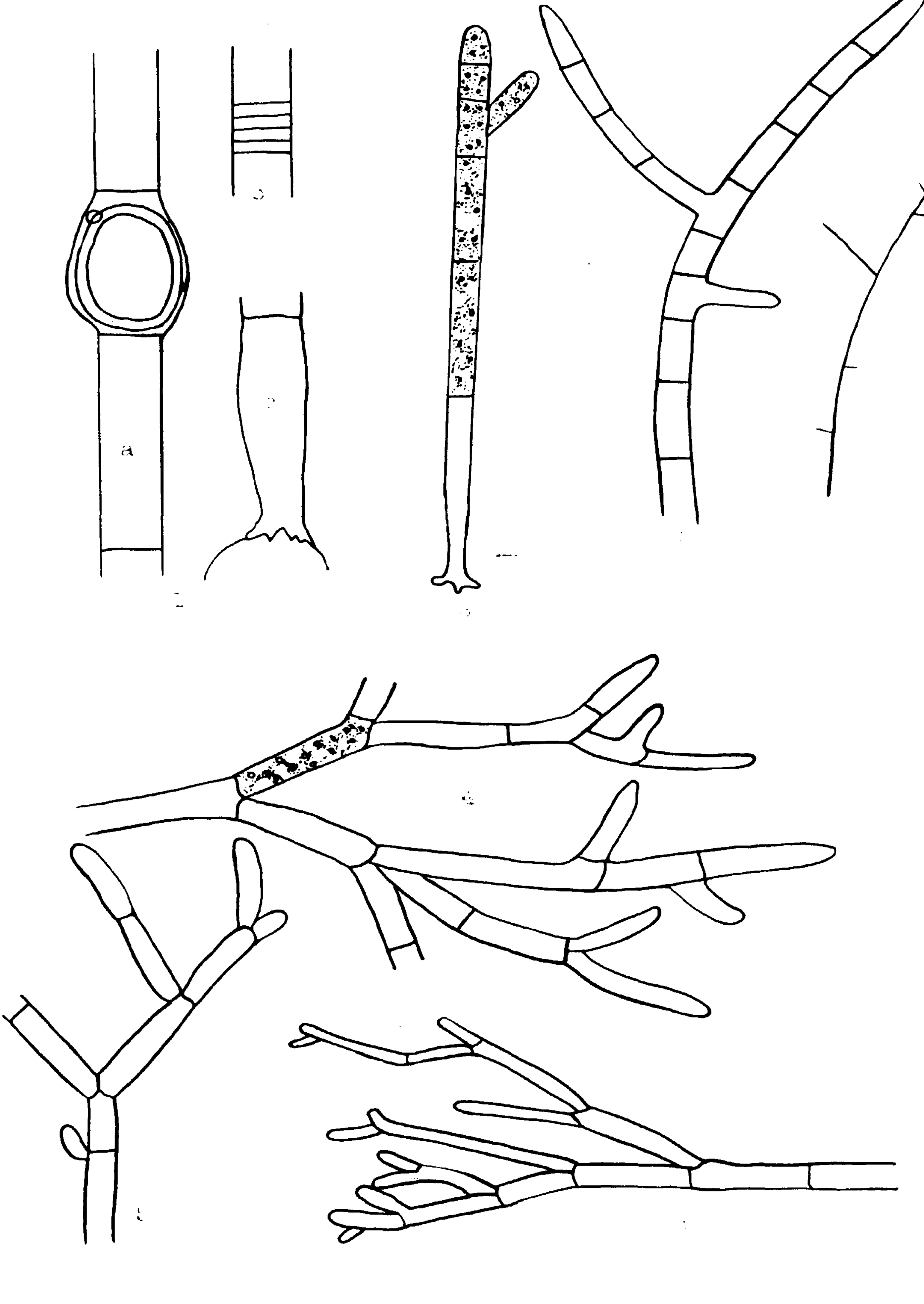
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Plate 19. (scale 125:1)

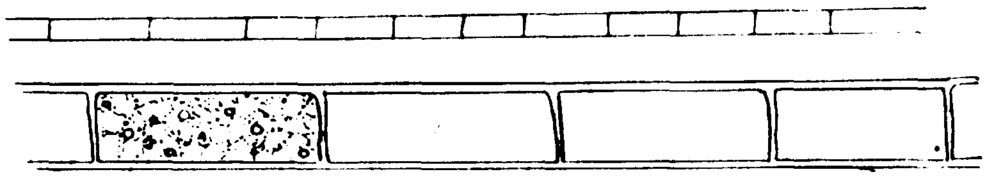
Fig. 1. Rhizoclonium hieroglyphicum (Ag.)Kuetz.

Fig. 2. Rhizoclonium giganteum sp. nov.

Fig. 3. Pithophora Kewensis Wittr.

Fig. 4. Pithophora oedogonia (Mont.)Wittr.

Fig. 5. Sphaeroplea annulina (Roth)Ag.



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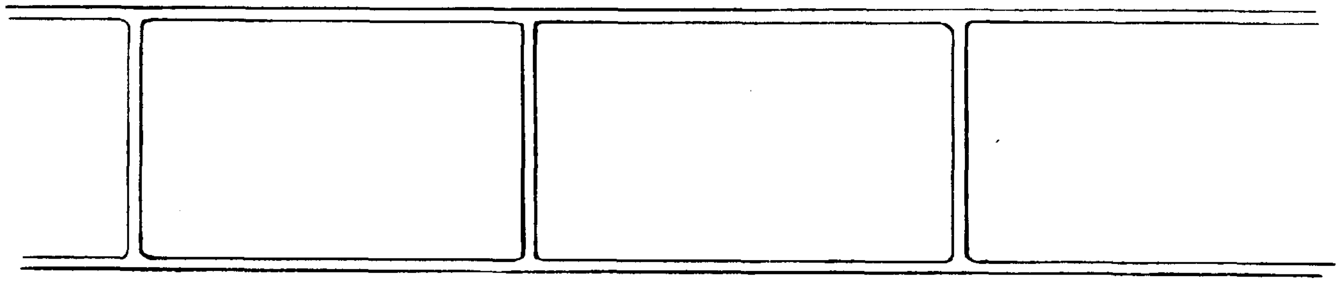

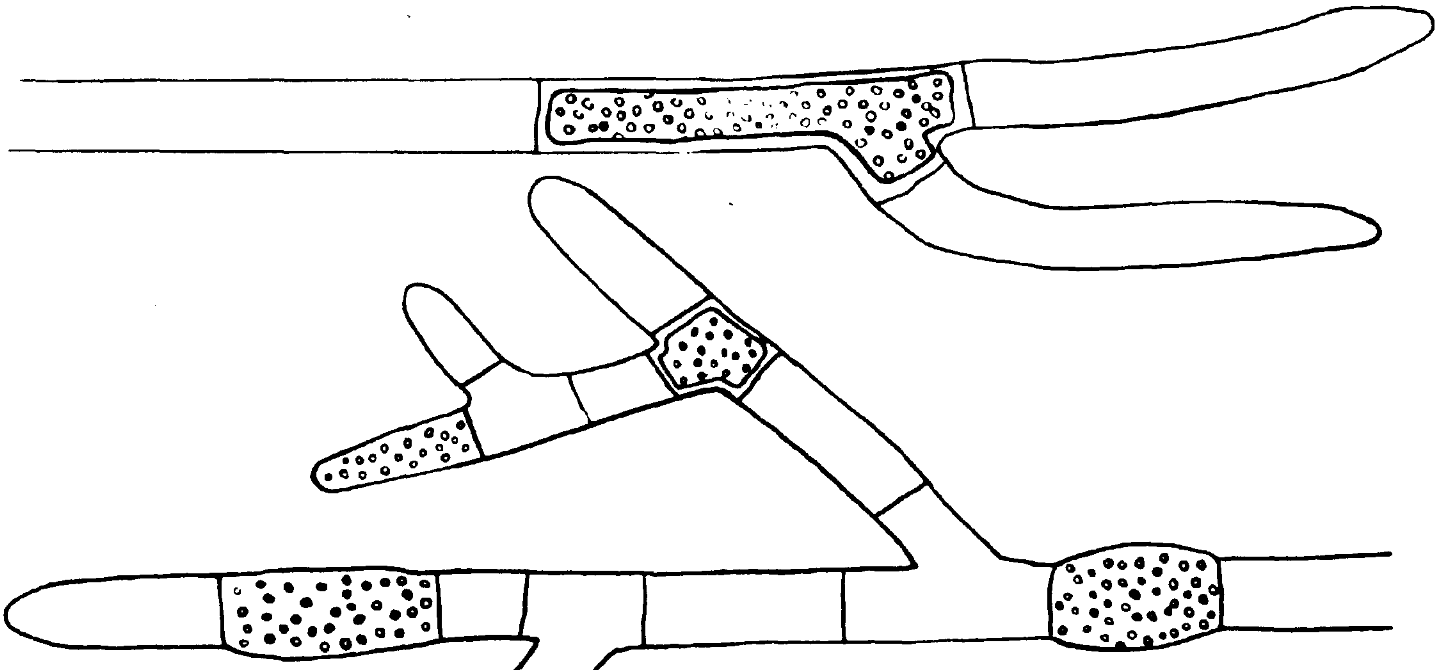

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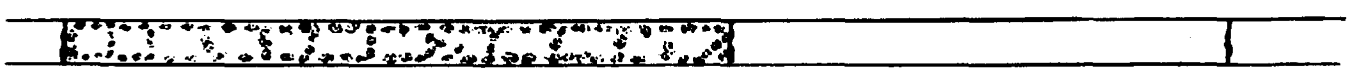
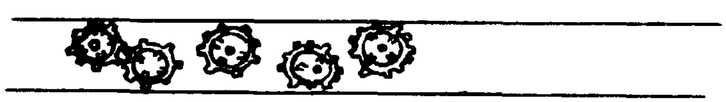




5

Plate 20. (scale 250:1)

Figs. 1, 2.	Phyllosiphon Arisari Kuehn (Fig. 1. X ½, Fig. 2. X 250)
Figs. 3, 4.	Dichotomosiphon tuberosus (A. Braun)Ernst
Fig. 5.	Vaucheria geminata (Vauch.)DeC.

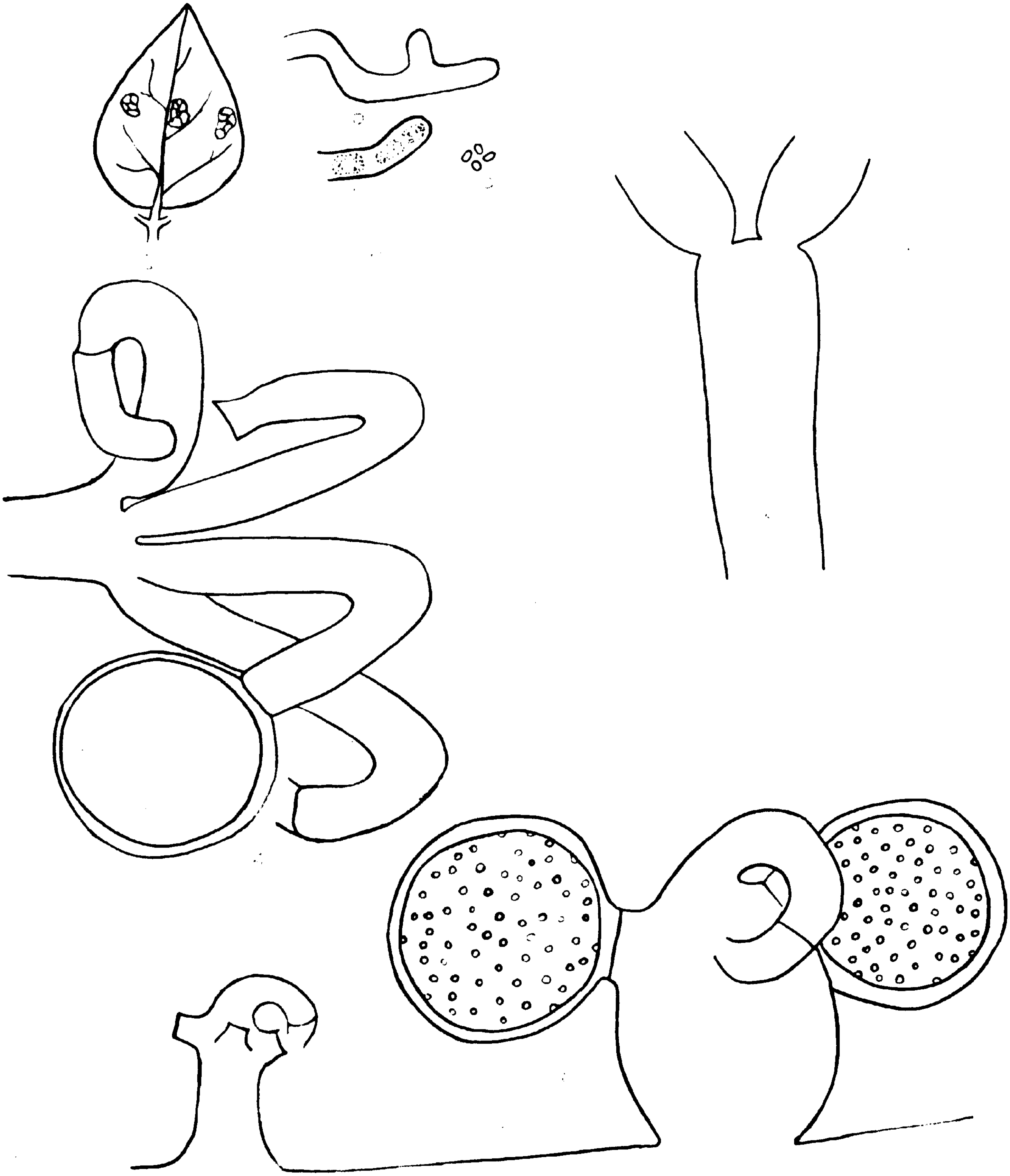


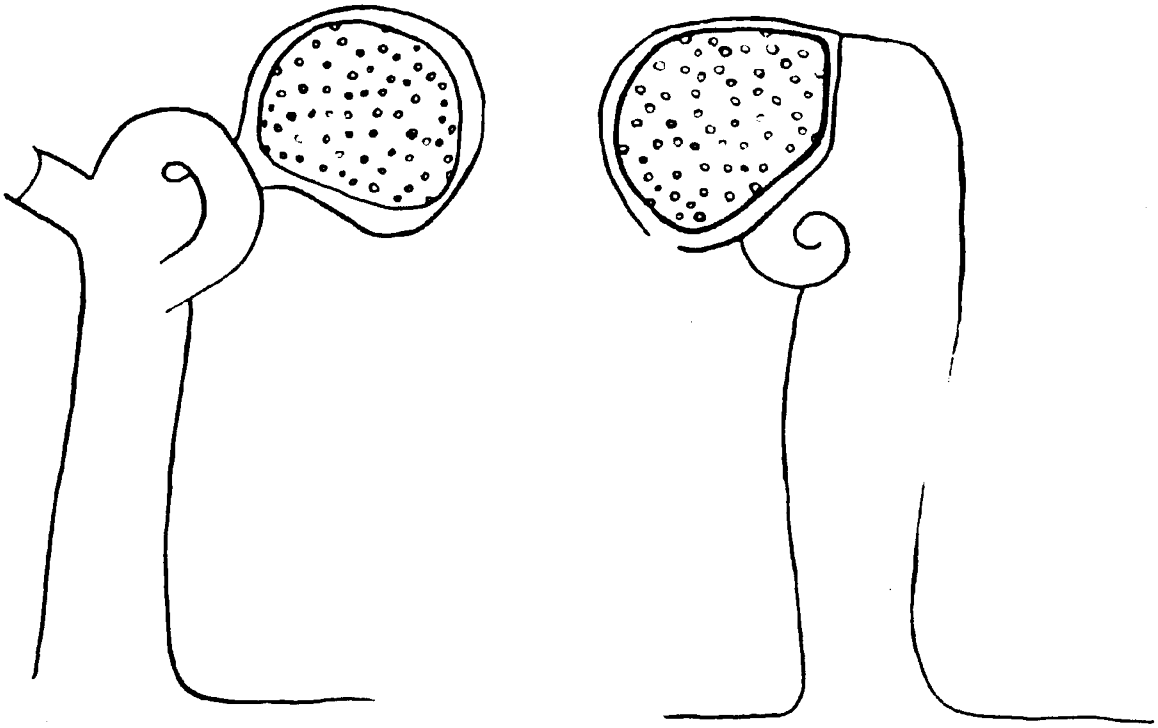
Plate 21. (scale 250:1)

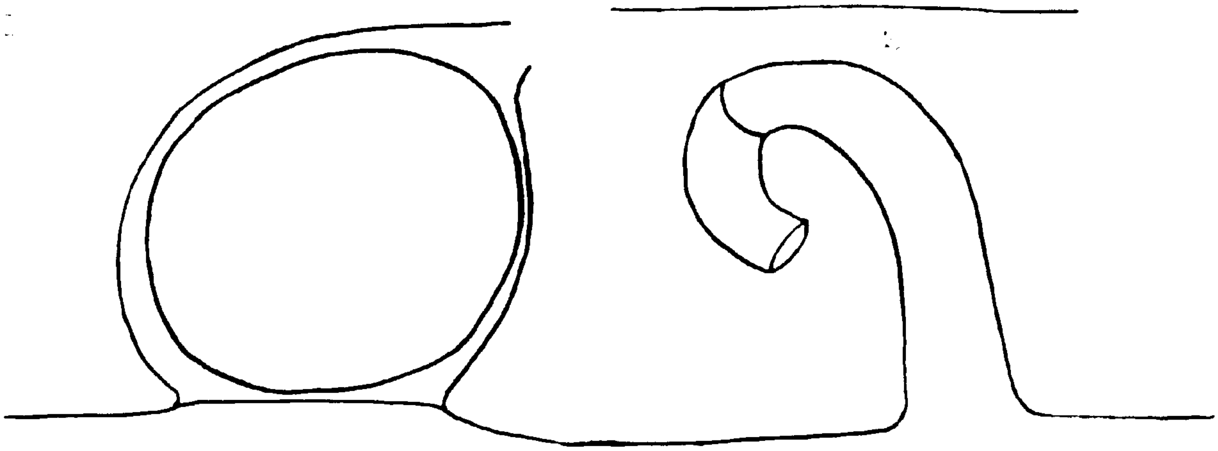
Fig. 1. *Vaucheria hamata* (Vauch.)DeC.

Fig. 2. *Vaucheria terrestris* Lyngb.

Fig. 3. *Vaucheria sessilis* (Vauch.)DeC.

Fig. 4. *Vaucheria* spp., proliferation of abnormal sexual branch





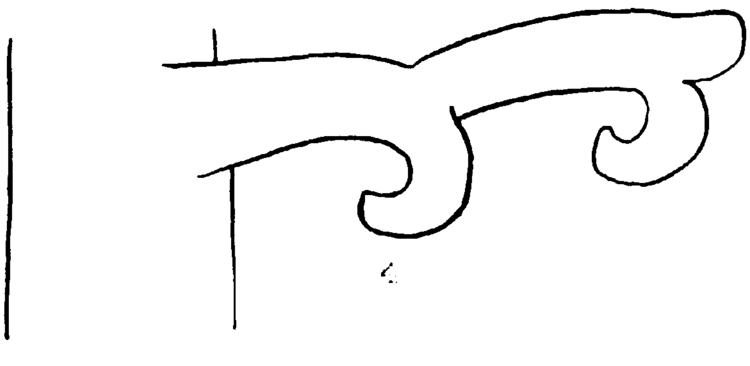


Plate 22. (scale 1000:1)

Fig. 1.	Mougeotia gracilima (Hass.)Wittr.
Figs. 2, 3.	Mougeotia ventricosa (Wittr.)Col.
Fig. 4.	Zygnema insigne (Hass.)Kuetz.
Fig. 5.	Zygogonium ericetorum Kuetz.

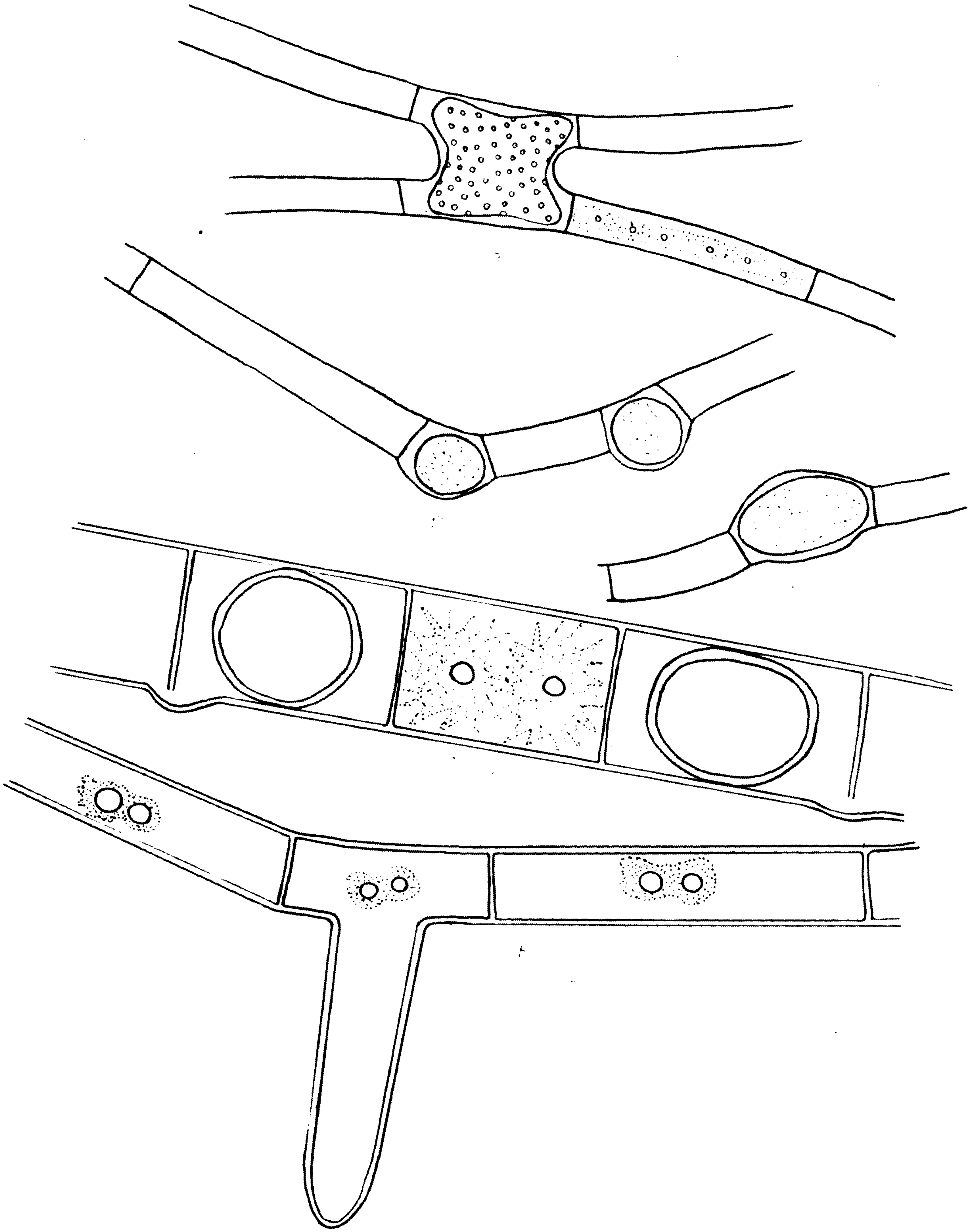
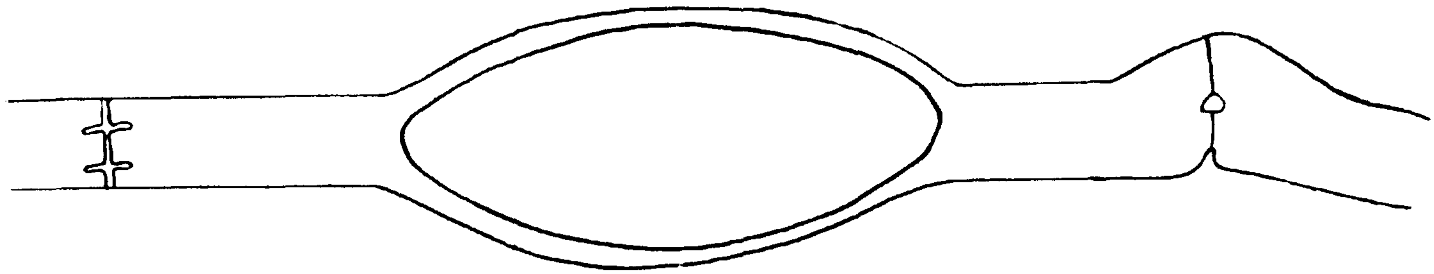


Plate 23. (scale 500:1)

Figs. 1, 2.	Spirogyra Spreeiana Rab.
Figs. 3, 4.	Spirogyra fluviatilis Hilse
Fig. 5.	Sirogonium sticticum Kuetz.



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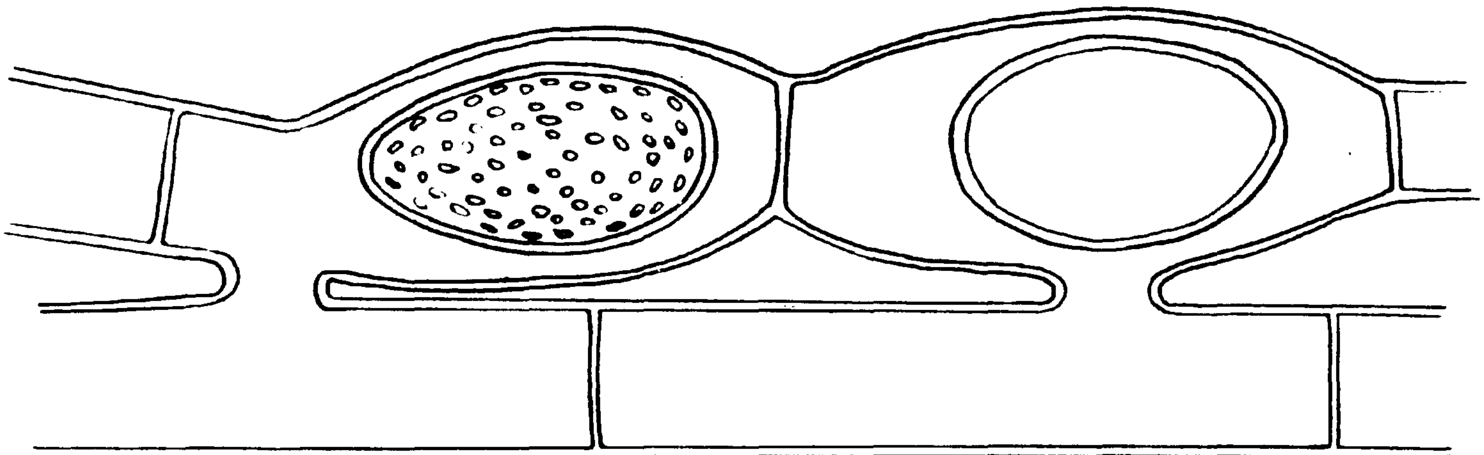

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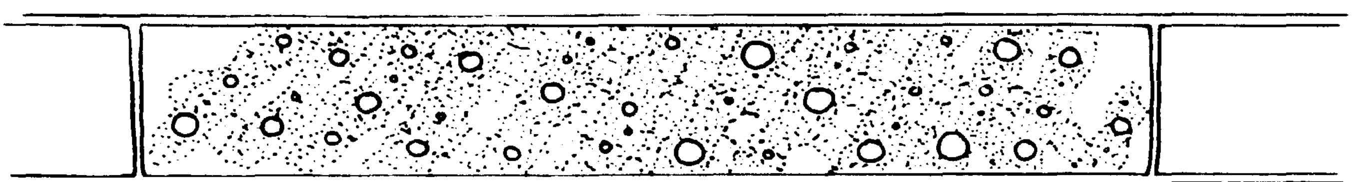

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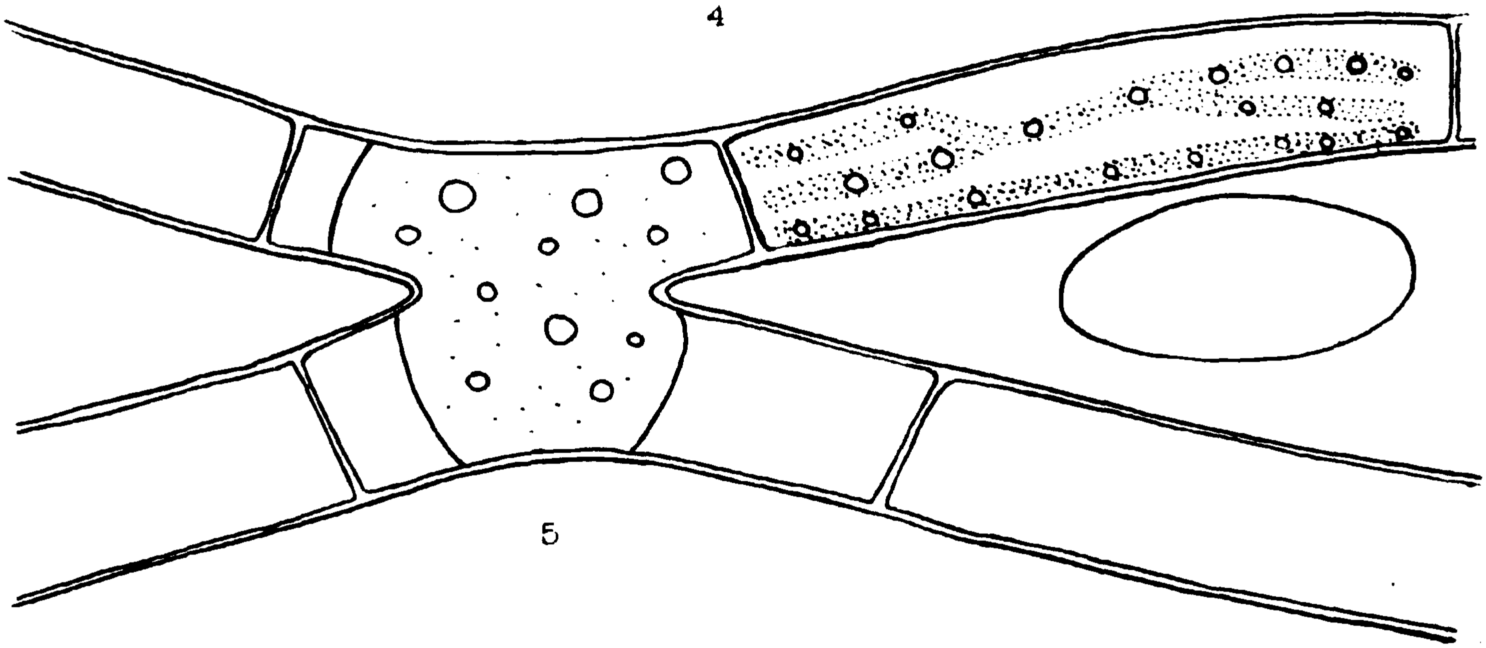

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Plate 24. (scale 1000:1)

Fig. 1.	Cylindrocystis americana West & West
Fig. 2.	Gonatozygon aculeatum Hastings
Fig. 3.	Mesotaenium macrococcum (Kuetz.)Roy
Fig. 4.	Penium spirostriolatum Barker
Fig. 5.	Netrium interruptum (Bréb.)Lutkem.
Fig. 6.	Roya obtusa v. montana Gutw.
Fig. 7.	Netrium digitus v. Naegelii (Bréb.)Krieg.

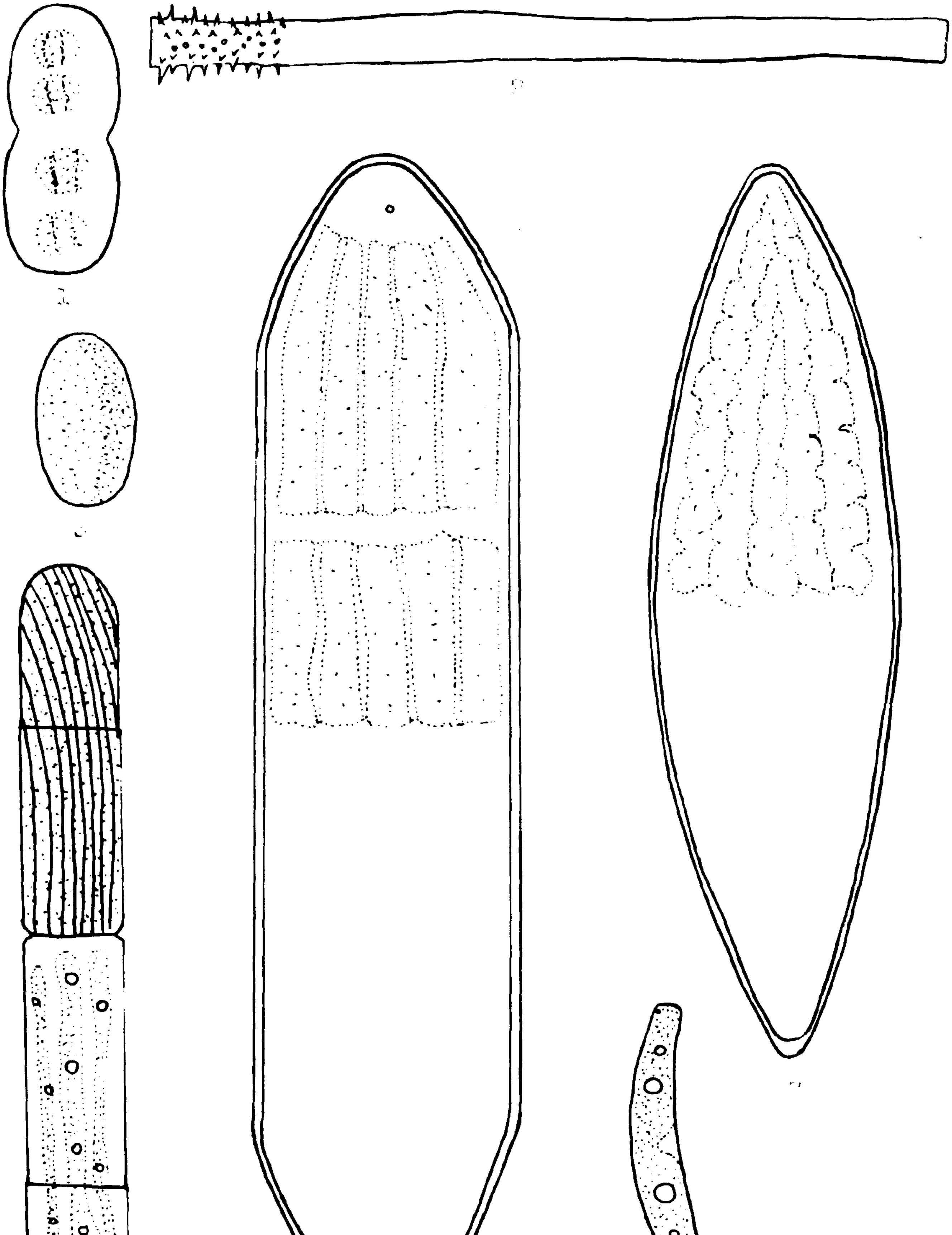

Plate 25. (scale 1000:1)

Fig. 1.	Closterium Dianae Ehr. X 500
Fig. 2.	Closterium Leibleini Kuetz.
Fig. 3.	Closterium ulna Focke
Fig. 4.	Pleurotaenium minutum (Ralfs)Delp.
Fig. 5.	Pleurotaenium trabeculum (Ehr.)Naeg.
Fig. 6.	Desmidium Swartzii Ag.
Fig. 7.	Hyalotheca neglecta Racib.
Fig. 8.	Onychonema laeve Nordst.
Fig. 9.	Arthrodesmus incus v. extensus Anders

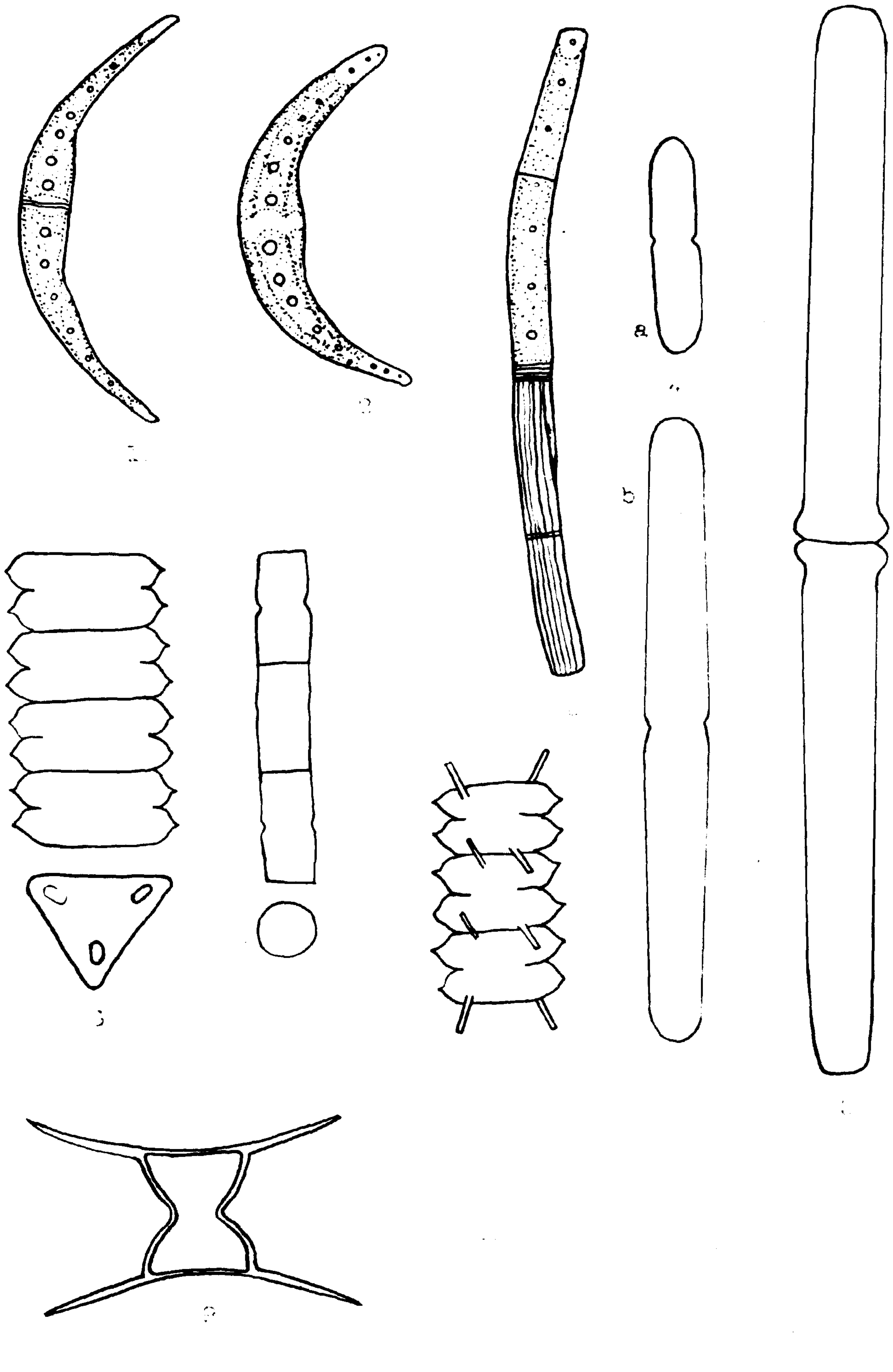
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Plate 26. (scale 1000:1)

Fig. 1.	Cosmarium attenuatum Bréb.
Fig. 2.	Cosmarium biretum Bréb.
Fig. 3.	Cosmarium Miedzyrzecense v. monamazum Groenb.
Fig. 4.	Cosmarium circulare Reinsch
Fig. 5.	Cosmarium rectangulum Reinsch
Fig. 6.	Cosmarium viride (Corda)Josh.
Fig. 7.	Euastrum pinnatum Ralfs X 500
Fig. 8.	Euastrum binale (Turp)Ehr.
Fig. 9.	Euastrum tribulbosum sp. nov.

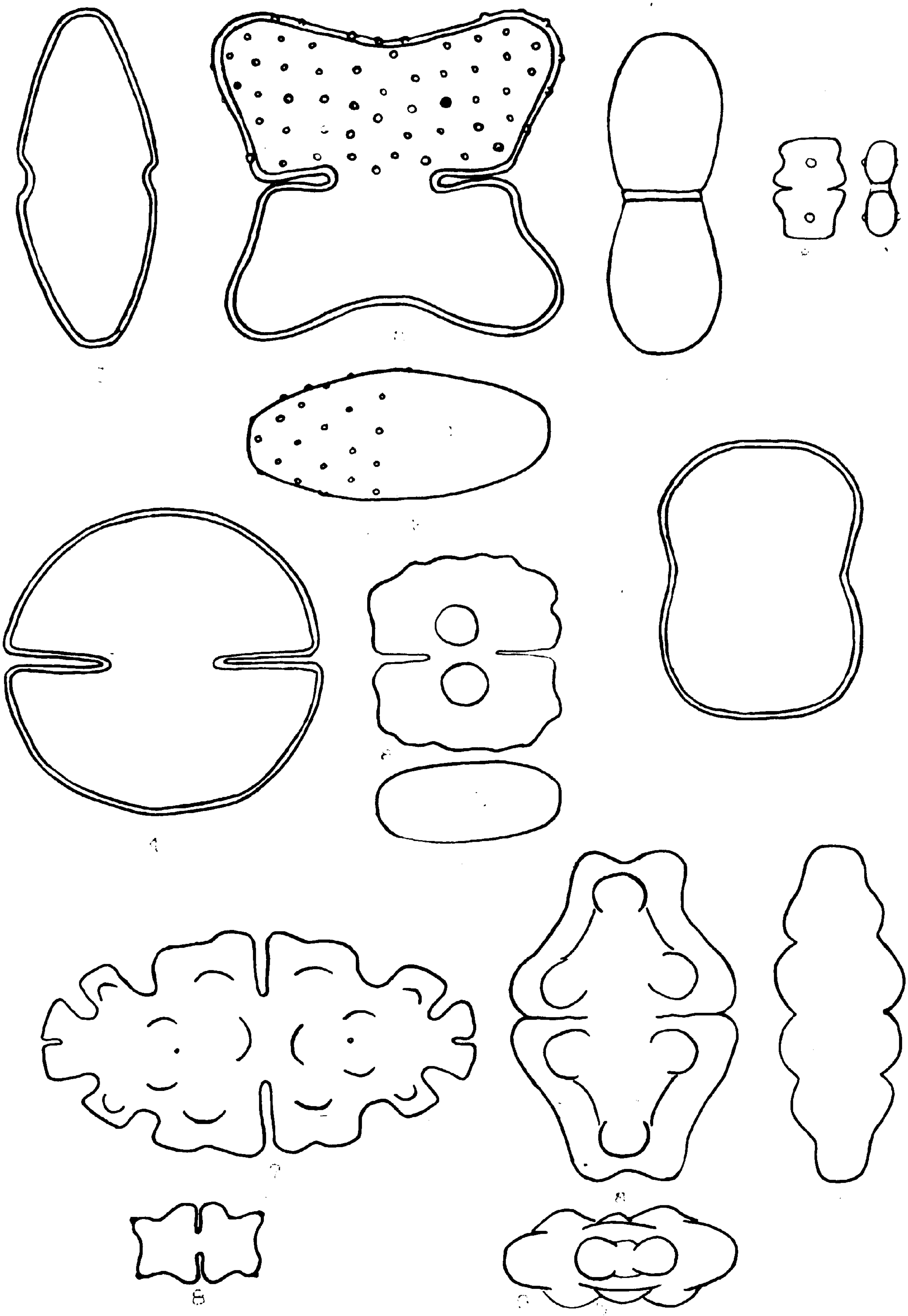

Plate 27. (scale 500:1)

Fig. 1.	Micrasterias americana (Ehr.)Ralfs
Fig. 2.	Micrasterias muricata (Bail.)Ralfs
Fig. 3.	Micrasterias radiata Hass.
Fig. 4.	Staurastrum arctiscon (Ehr.)Lund.
Fig. 5.	Staurastrum alternans Bréb.
Figs. 6, 7.	Staurastrum minnesotense Wolle

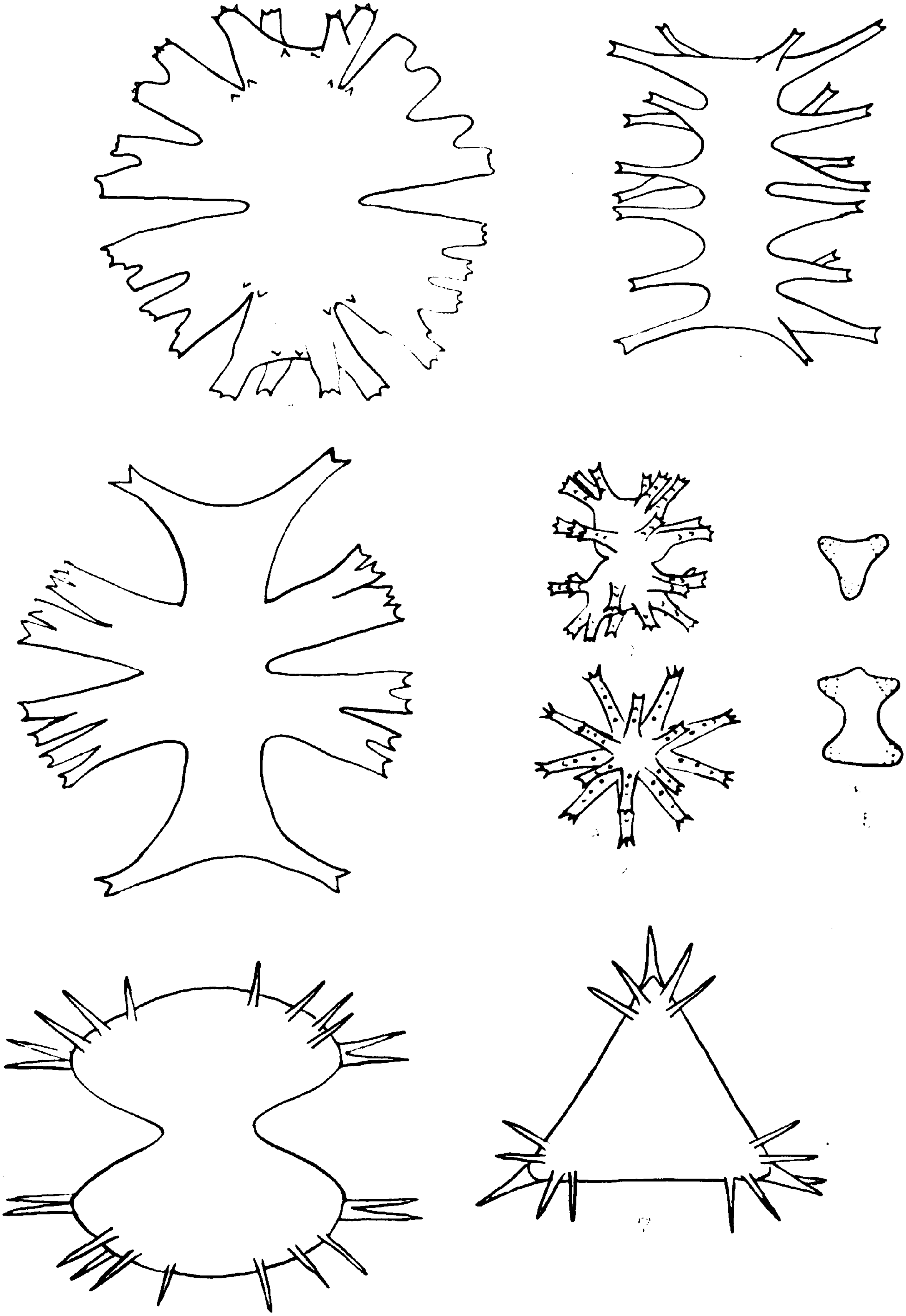

Plate 28. (scale 1000:1)

Fig. 1.	Staurastrum cuspidatum Bréb.
Figs. 2, 3.	Staurastrum furcigerum Bréb.
Fig. 4.	Staurastrum muticum Bréb.
Figs. 5, 6.	Staurastrum setigerum Cleve
Figs. 7, 8.	Xanthidium armatum (Bréb.)Rab. X 500
Fig. 9.	Xanthidium pseudobengalicum Groenb. X 500

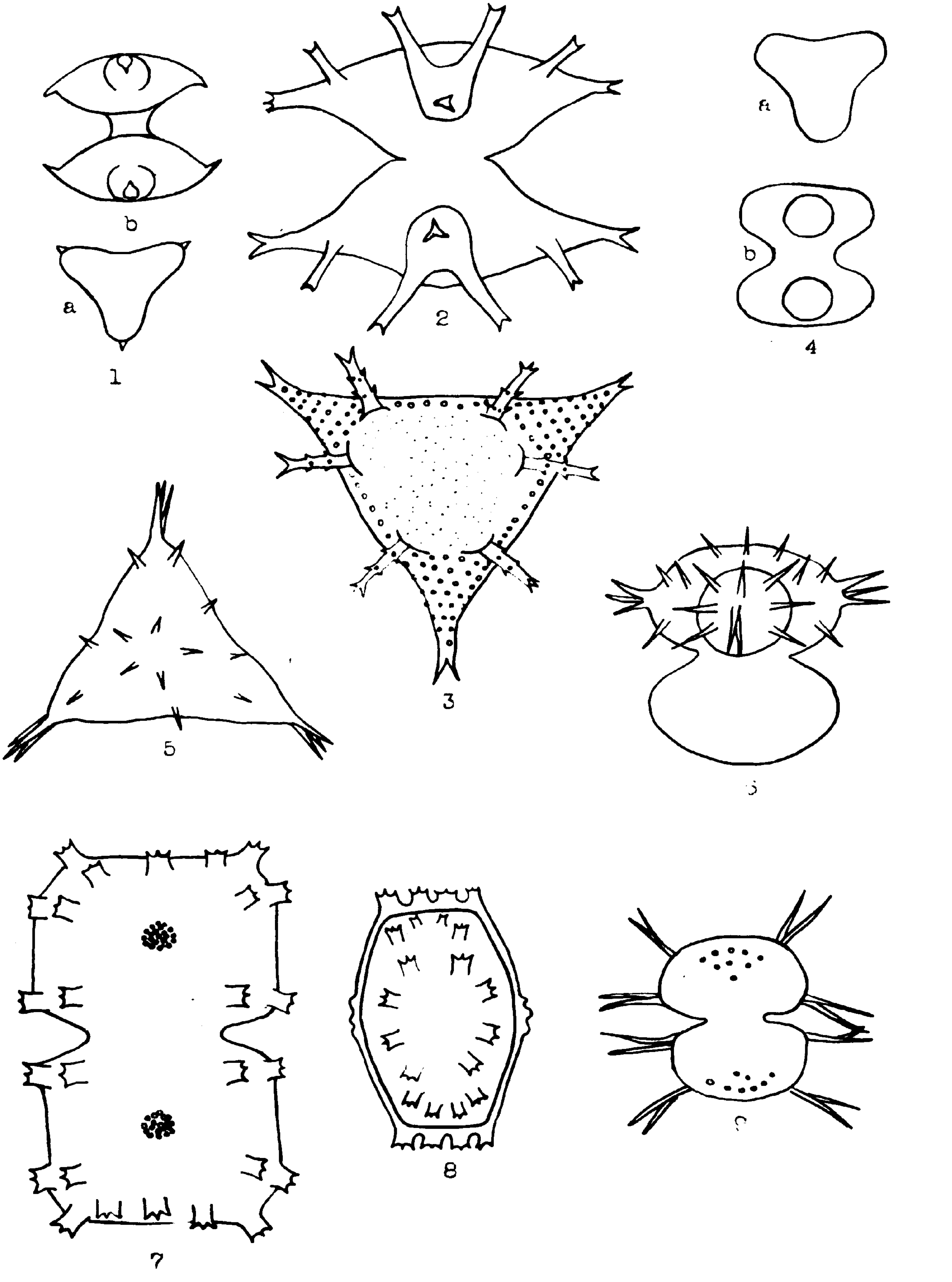

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Plate 29.

Figs. 1-3.	Chara coronata Ziz. (Fig. 1 X 1, Figs. 2, 3 X 10)
Fig. 4.	Chara spp., illustrating monostichous cortication
Fig. 5.	Chara spp., illustrating diplostichous cortication
Fig. 6.	Chara spp., illustrating triplostichous cortication
Fig. 7.	Nitella acuminata subs. glomerata A. Braun (a. X 1, b. (oogonia and antheridium) X 10, c. (oospore) X 10)
Fig. 8.	Tolypella intricata Leonh. (a. X 1, b. (oogonia and antheridium) X 2, c. (oogonium) X 15)

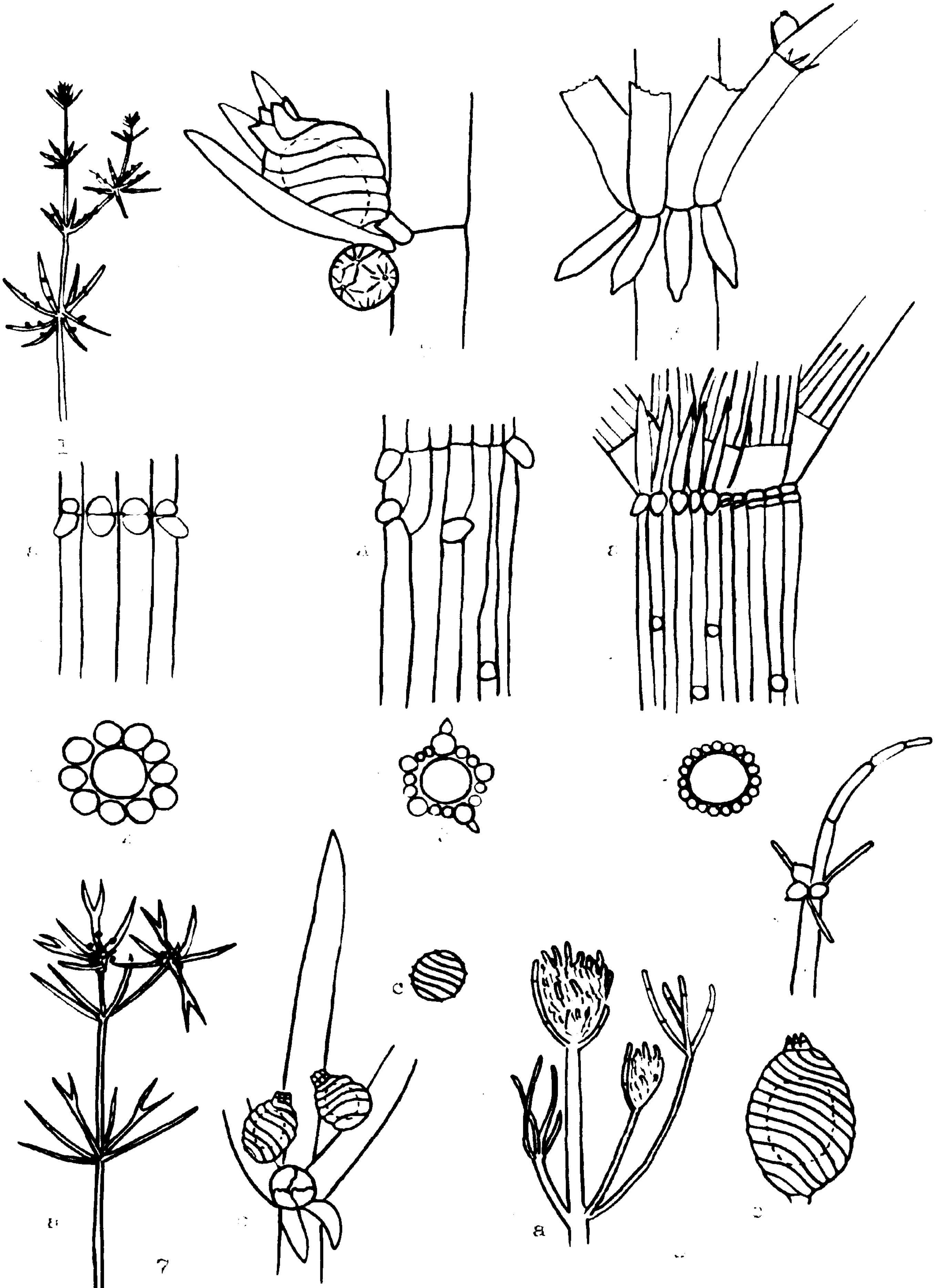
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Plate 30. (scale 1000:1)

Fig. 1.	Cryptoglena pigra Ehr.
Fig. 2.	Euglena pisciformis Klebs
Fig. 3.	Euglenamorpha Hegneri Wenrich
Fig. 4.	Euglena sociabilis Dang.
Figs. 5, 6.	Euglena fusca Klebs (c. with processes greatly enlarged beyond general scale)
Fig. 7.	Euglena antefossa Johns.
Fig. 8.	Lepocinclis ovum (Ehr.)Lemm.
Fig. 9.	Lepocinclis texta (Duj.)Lemm.
Fig. 10.	Phacus pleuronectes (O. F. M.)Duj.
Fig. 11.	Phacus cylindrus Poch.

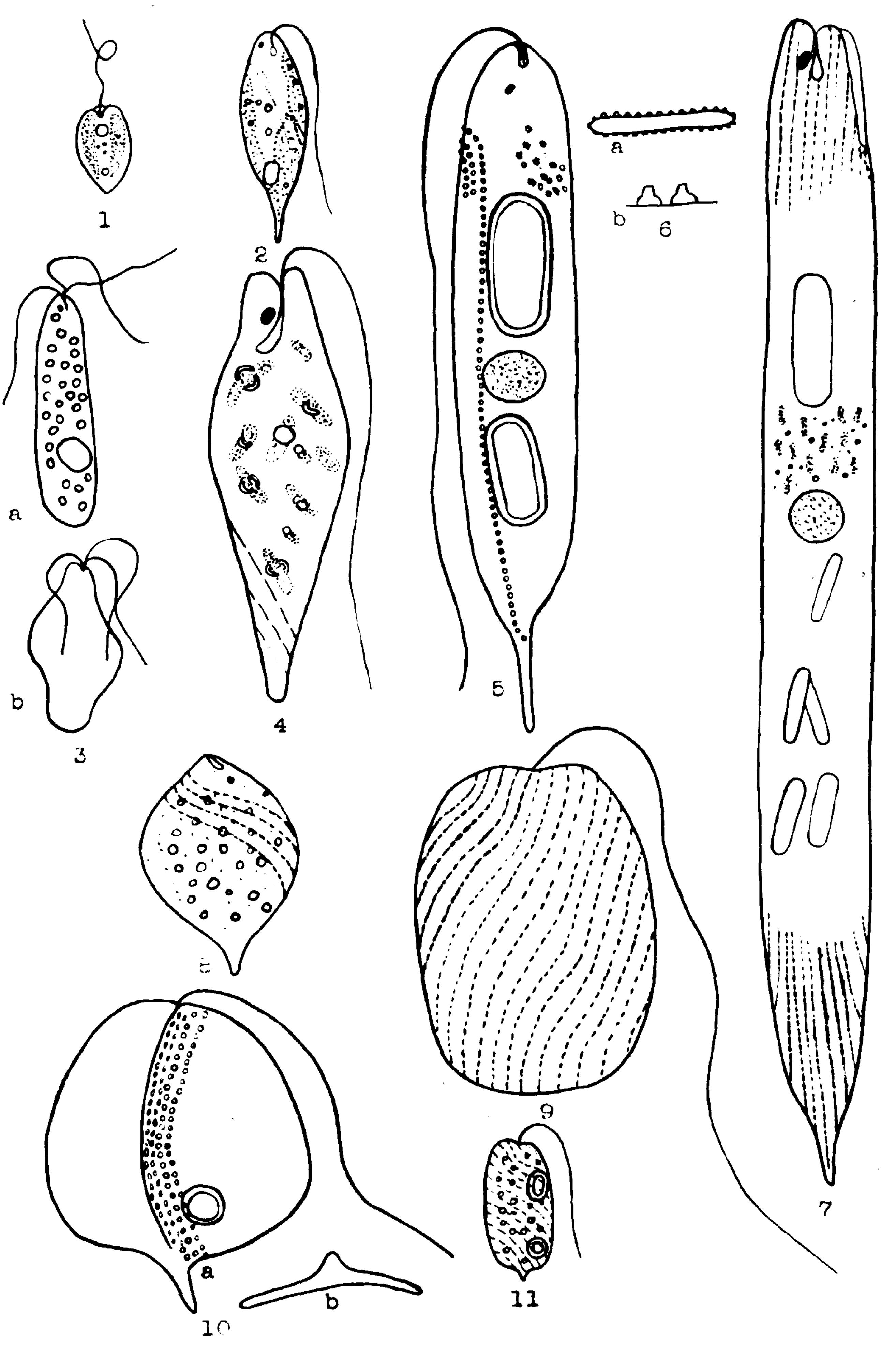
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Plate 31. (scale 1000:1)

Fig. 1.	Trachelomonas abrupta Swir.
Fig. 2.	Trachelomonas acanthostoma (Stokes)Defl.
Fig. 3.	Trachelomonas acanthostoma v. nankinensis Skvor.
Fig. 4.	Trachelomonas allia Drez.
Fig. 5.	Trachelomonas ampuliformis Defl.
Fig. 6.	Trachelomonas atomaria Skvor.
Fig. 7.	Trachelomonas atomaria v. elegans Skvor.
Fig. 8.	Trachelomonas armata (Ehr.)Stein
Fig. 9.	Trachelomonas bacillifera Playf.
Fig. 10.	Trachelomonas Bernardinensis Vischer
Fig. 11.	Trachelomonas bulla (Stein)Defl.
Fig. 12.	Trachelomonas caudata (Ehr.)Stein
Fig. 13.	Trachelomonas Charkowiensis Swir.
Fig. 14.	Trachelomonas conica Playf.
Fig. 15.	Trachelomonas cylindrica v. decolleta Playf.
Fig. 16.	Trachelomonas cylindrica Ehr.
Fig. 17.	Trachelomonas Dangeardii Defl.
Fig. 18.	Trachelomonas dubia (Swir.)Defl.
Fig. 19.	Trachelomonas ensifera (Daday)Defl.
Fig. 20.	Trachelomonas ensifera v. spicata var. nov.
Fig. 21.	Trachelomonas ensifera v. depressa var. nov.
Fig. 22.	Trachelomonas eurystoma v. Klebsii Playf.
Fig. 23.	Trachelomonas hexangulare Defl.

Fig. 24. Trachelomonas hispida v. crenulatocollis (Mask.)Skvor.

Fig. 25. Trachelomonas hispida v. duplex Defl.

Fig. 26. Trachelomonas intermedia Dang.

Fig. 27. Trachelomonas varians Defl.

Fig. 28. Trachelomonas lismorensis Playf.

Fig. 29. Trachelomonas ovalis Daday

Fig. 30. Trachelomonas urceolata Stokes

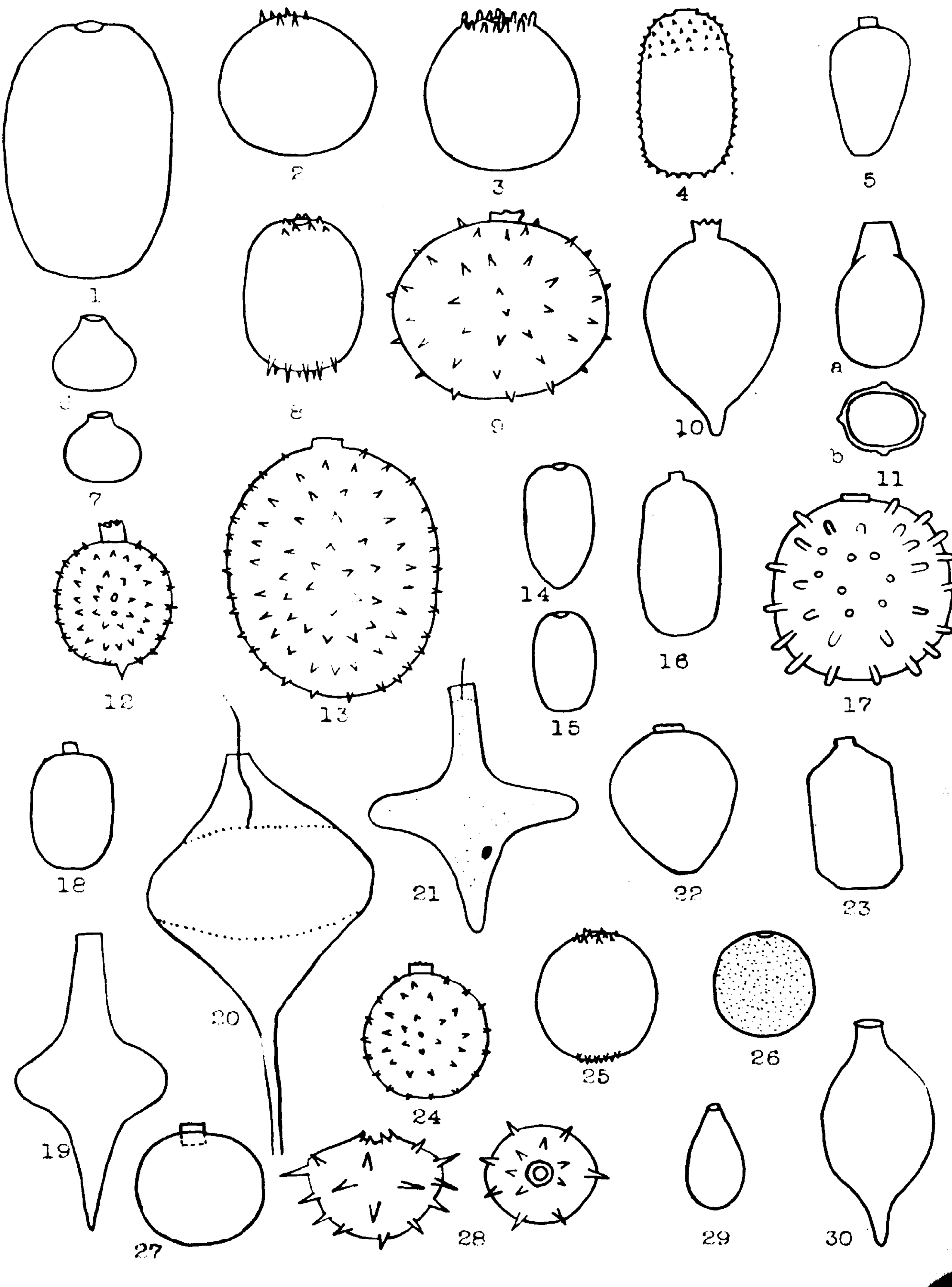
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Plate 32. (scale 1000:1)

Fig. 1.	Astasia lagenula (Schew.)Lemm.
Figs. 2, 3.	Anisonema variabile Klebs
Fig. 4.	Entosiphon sulcatum (Duj.)Stein
Fig. 5.	Euglenopsis minor sp. nov. X 2000
Fig. 6.	Heteronema bifurcata sp. nov.
Fig. 7.	Heteronema longiovalis sp. nov.
Fig. 8.	Jenningsia spp. or Peranema spp. (containing ingested diatoms)
Fig. 9.	Menoidium pellucidum Perty
Figs. 10, 11	Heteronema nebuloglabra sp. nov.
Fig. 12.	Monomastix opisthostigma Scherffel (b. division)
Fig. 13.	Peranema trichophora (Ehr.)Stein (b., c. end types)
Fig. 14.	Petalomonas angusta (Klebs)Lemm.
Fig. 15.	Scytomonas stene sp. nov.
Fig. 16.	Scytomonas ovale sp. nov.
Fig. 17.	Sphenomonas quadrangularis Stein (b. not to scale)
Fig. 18.	Cryptomonas ovata Ehr.
Fig. 19.	Cryptochrysis commutata Pasch.
Fig. 20.	Rhodomonas lacustris Pasch. & Rutt.

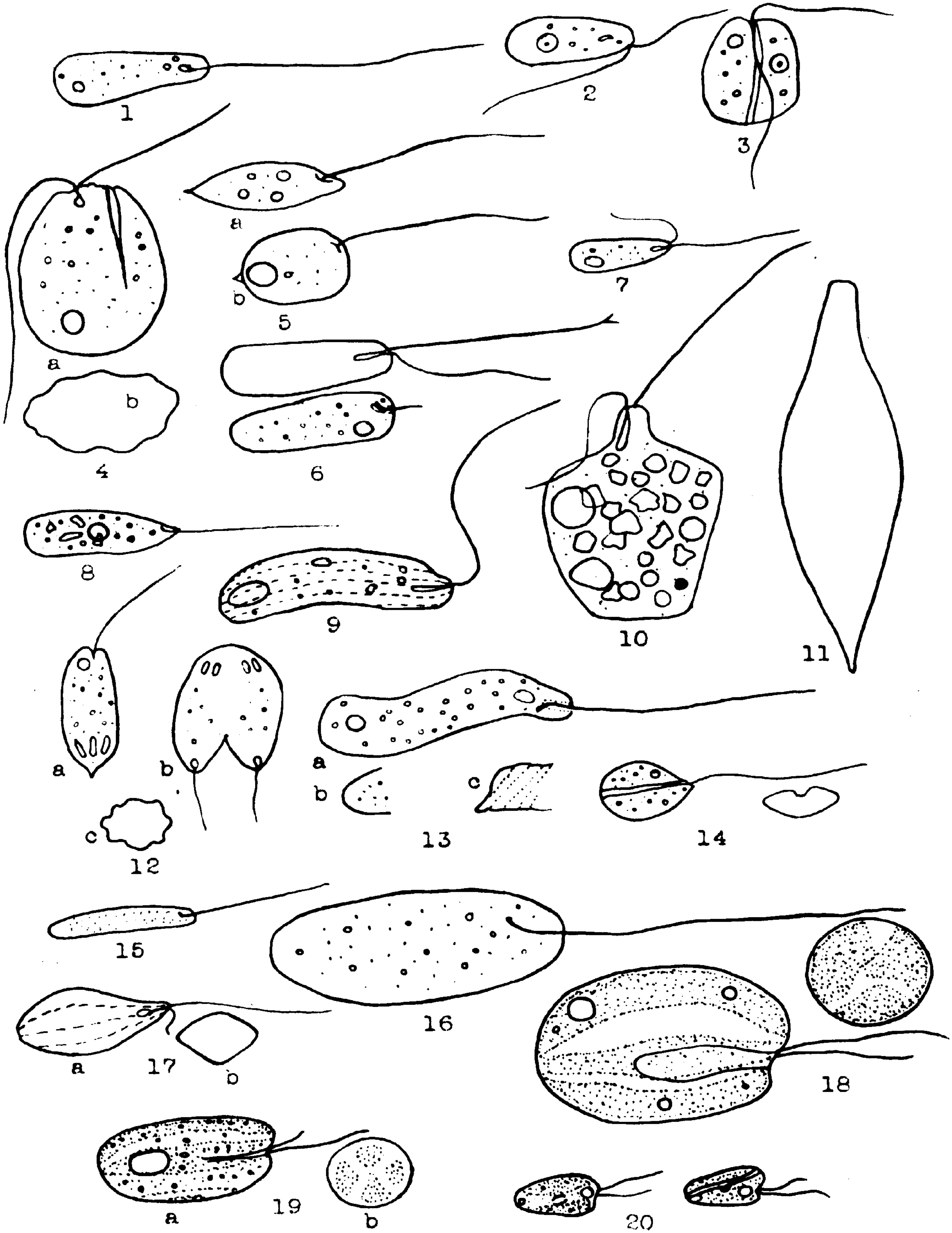

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Plate 33. (scale 1000:1)

Fig. 1.	Cystodinium bataviense Klebs
Fig. 2.	Dinastridium sexangulare Pasch.
Fig. 3.	Gymnodinium neglectum (Schill.)Lind.
Fig. 4.	Hemidinium nasutum Stein
Fig. 5.	Glenodinium oculatum Stein
Fig. 6.	Peridinium Willei Huitf.-Kass
Fig. 7.	Glendodinium quadridens (Stein)Schill.
Fig. 8.	Gonyaulax palustris Lemm.
Fig. 9.	Ceratium hirundinella (O. F. M.)Duj.

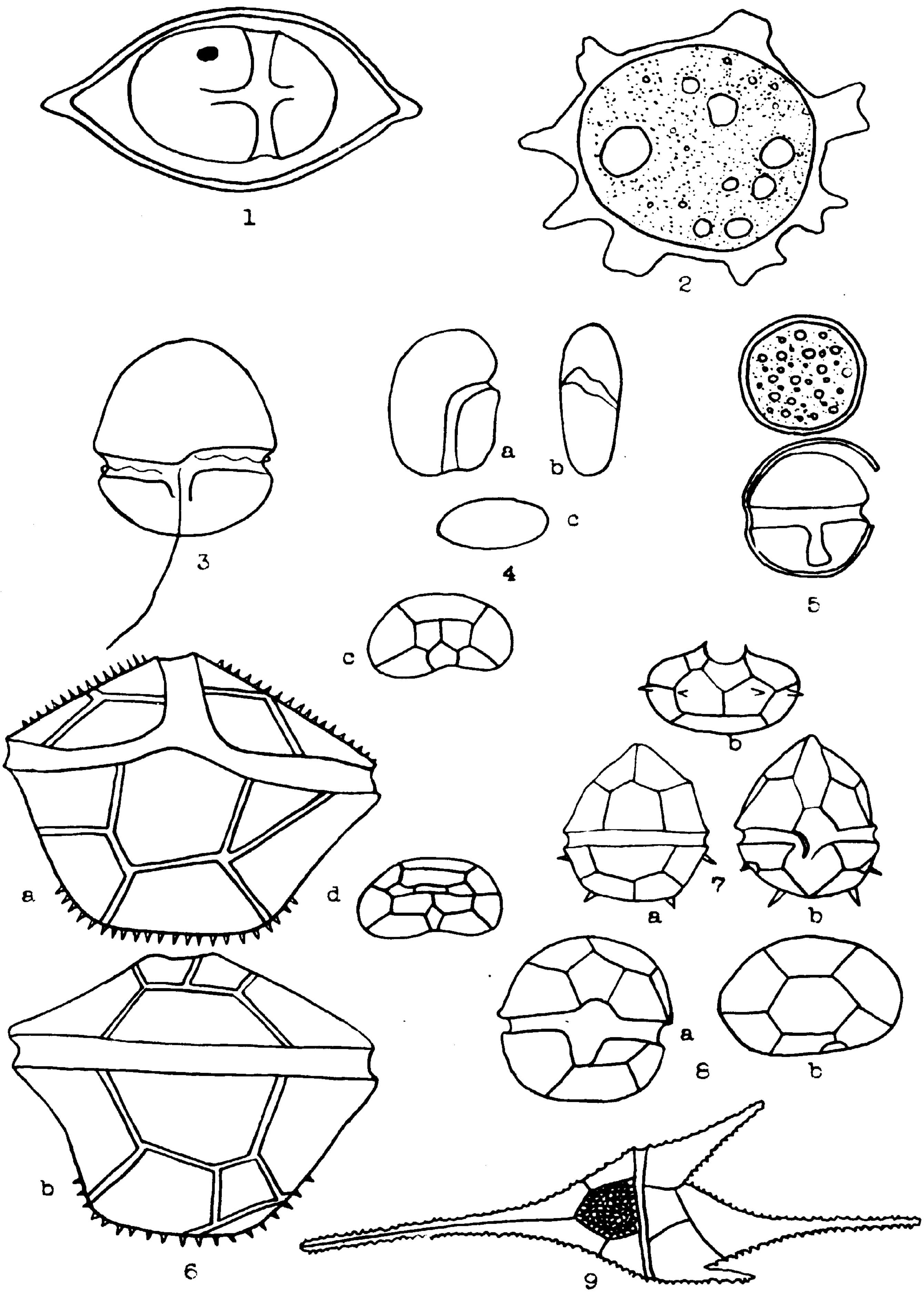
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Plate 34. (scale 1000:1)

Fig. 1.	Chlorobotrys neglecta Pasch. & Geit.
Fig. 2.	Characiopsis gibba Borzi
Fig. 3.	Characiopsis pyriformis Borzi
Fig. 4.	Characiopsis teres Pasch.
Fig. 5.	Ophiocytium arbusculum (A. Braun)Rab.
Fig. 6.	Ophiocytium capitatum Wolle
Fig. 7.	Ophiocytium cocleare A. Braun
Fig. 8.	Ophiocytium parvulum (Perty)A. Braun
Fig. 9.	Centritractus belanophorus (Schm.)Lemm.
Fig. 10.	Tribonema bombycinum (Ag.)Derb. & Sol.
Fig. 11.	Tribonema minus (Wille)Hazen
Fig. 12.	Lagynion Scherffelii Pasch.
Fig. 13.	Mallomonas alpina Pasch. & Rutt.
Fig. 14.	Dinobryon sertularia Ehr.
Fig. 15.	Chromulina ovalis Klebs
Fig. 16.	Chrysococcus asper Lack.
Fig. 17.	Chrysococcus cylindrica Lack. X 2000
Figs. 18, 19.	Chrysococcus hemisphaerica Lack. X 2000
Fig. 20.	Chrysococcus major Lack.
Fig. 21.	Chrysococcus ovalis Lack.
Fig. 22.	Chrysococcus rufescens Klebs

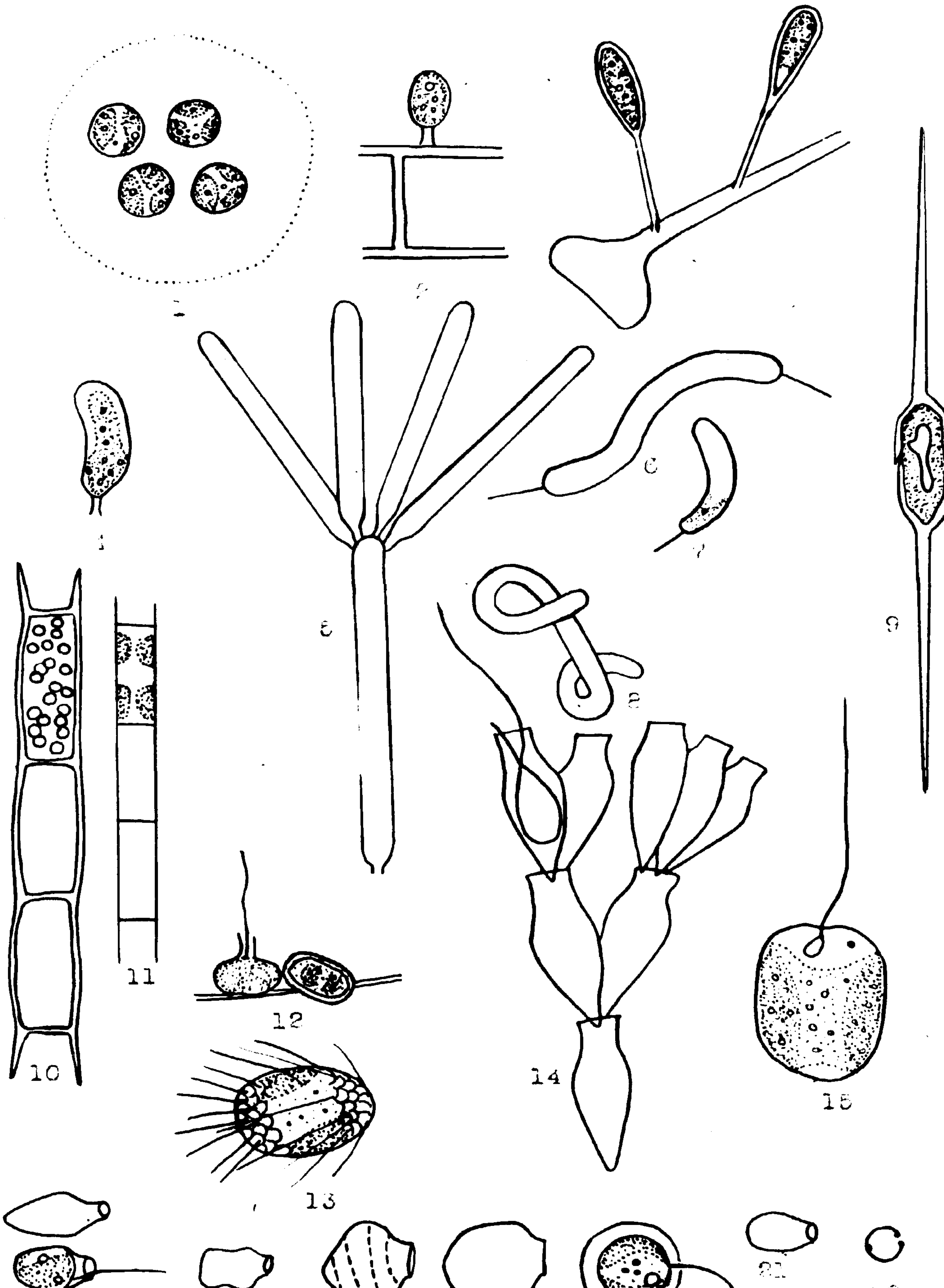

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Plate 35. (scale 1000:1)

Fig. 1.	Botrydium granulatum (L.)Grev. X 50
Fig. 2.	Syncrypta volvox Ehr.
Fig. 3.	Synura uvella Ehr.
Fig. 4.	Uroglenopsis americana (Calkins)Lemm.
Fig. 5.	Uroglena volvox Ehr.
Fig. 6.	Chrysamoeba radians Klebs
Fig. 7.	Rhizochrysis spp.

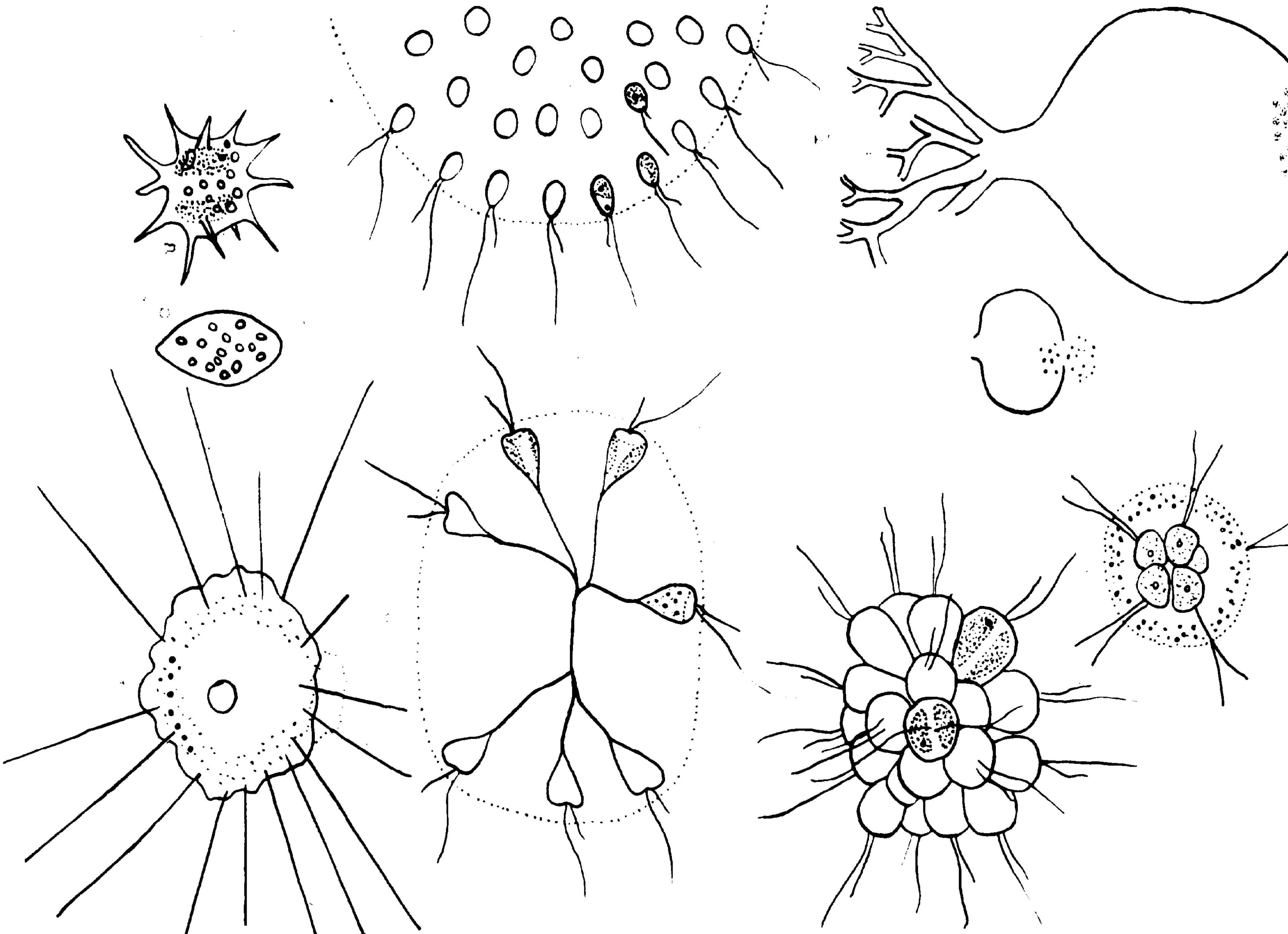

Plate 36. (scale 1000:1)

Fig. 1. Anacystis marginata Menegh.

Fig. 2. Coccochloris peniocystis (Kuetz.)Drou. & Dail.

Fig. 3. Diplocystis aeruginosa (Kuetz.)Trev.
b. about X 100

Fig. 4. Gloeocapsa alpicola (Lyngb.)Born.

Fig. 5. Gloeocapsa membranina (Menegh.)Drou. & Dail.

Fig. 6. Microcrocis geminata (Lag.)Geit.

Fig. 7. Synechococcus aeruginosus Naeg.

Fig. 8. Merismopedia thermalis Kuetz.

Fig. 9. Coelosphaerium Kuetzingianum Naeg.

Fig. 10. Entophysalis Brebissonii (Menegh.)Drou. & Dail.

Fig. 11. Glaucocystis nostochinearum Itzig.

Fig. 12. Gomphosphaeria lacustris Chod.

Fig. 13. Clastidium setigerum Kirch.

Fig. 14. Stichosiphon filamentosus (Ghose)Geit.

Fig. 15. Loefgrenia anomala Gom.

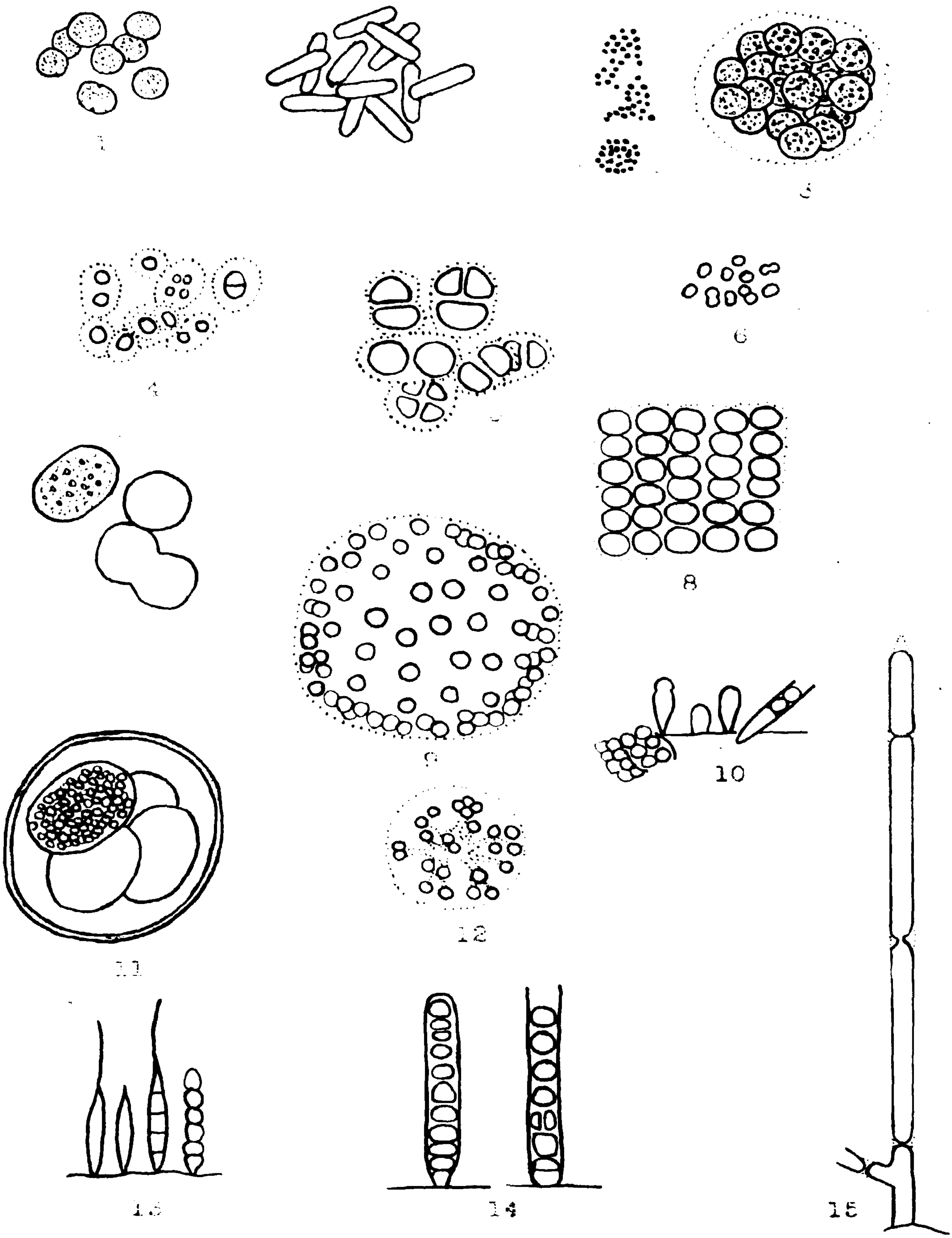

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Plate 37. (scale 1000:1)

Fig. 1.	Arthrospira Jenneri Gom.
Fig. 2.	Lyngbya aestuarii (Mert.)Lieb.
Fig. 3.	Microcoleus paludosus (Kuetz.)Gom.
Fig. 4.	Schizothrix Friesii (Ag.)Gom.
Fig. 5.	Oscillatoria brevis (Kuetz.)Gom.
Fig. 6.	Oscillatoria limosa Ag.
Fig. 7.	Oscillatoria tenuis Ag.
Fig. 8.	Phormidium Retzii Gom.
Fig. 9.	Phormidium uncinatum (Ag.)Gom.
Fig. 10.	Plectonema nostocorum Born.
Fig. 11.	Plectonema Wollei Farl.
Fig. 12.	Porphyrosiphon Notarisii (Menegh.)Kuetz.

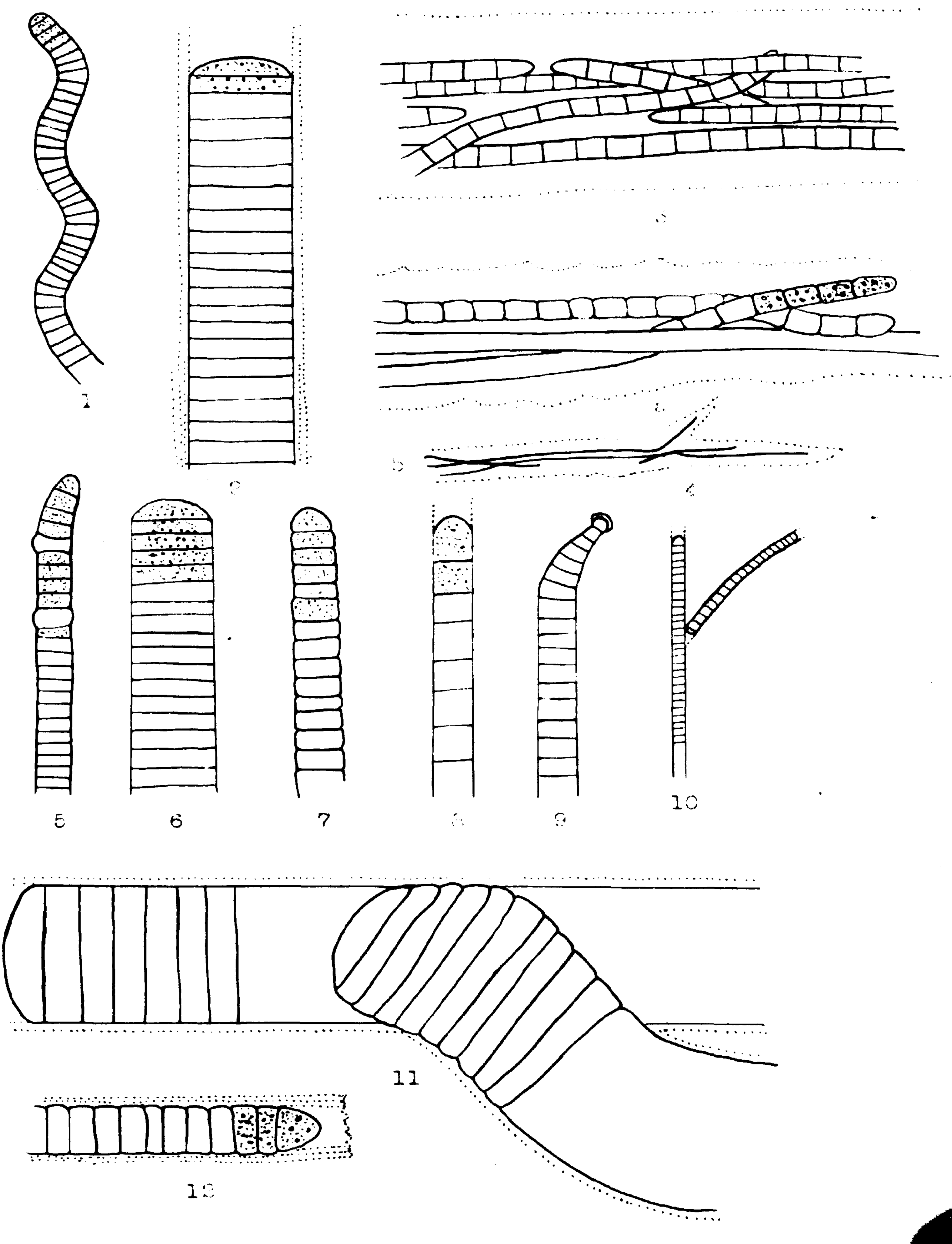
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Plate 38. (scale 1000:1)

Fig. 1.	Spirulina major Kuetz.
Fig. 2.	Spirulina princeps (West & West)G. S. West
Figs. 3, 4.	Symplocamuralis Kuetz. (Fig. 3 X 1)
Fig. 5.	Anabaena flos-aquae (Lyngb.)Bréb.
Fig. 6.	Aphanizomenon flos-aquae (L.)Ralfs (b. X 250)
Fig. 7.	Cylindrospermum catenatum Ralfs
Fig. 8.	Nodularia sphaerocarpa Born. & Flah.
Fig. 9.	Nostoc carneum Ag.
Fig. 10.	Nostoc commune Vauch. (b. X 1)
Fig. 11.	Nostoc microscopicum Carm. (b. X 1)
Fig. 12.	Raphidiopsis curvatus Fritsch & Rich (b. not to scale)

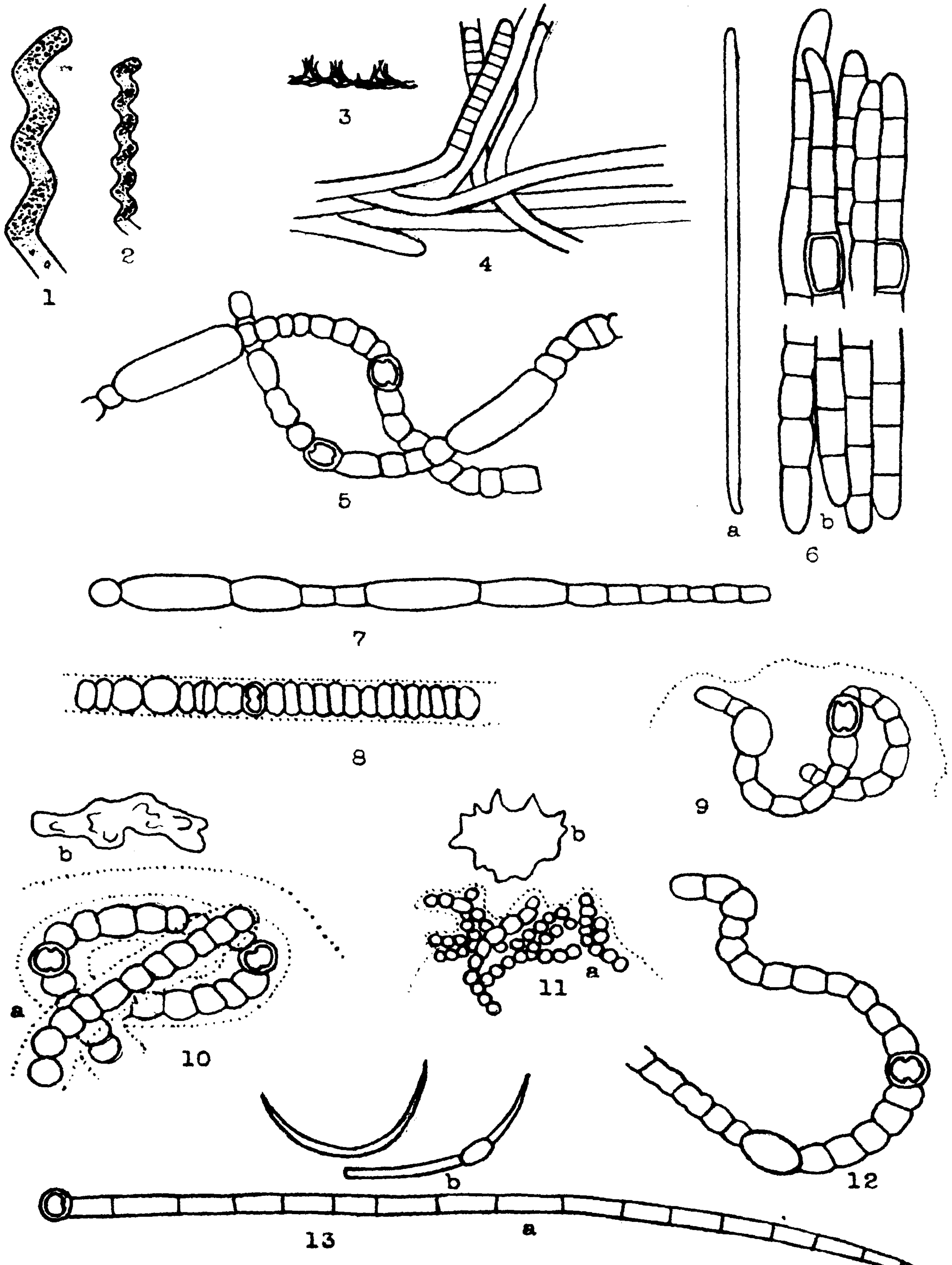
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Plate 39. (scale 1000:1)

Figs. 1-3.	Aulosira implexa Born. & Flah.
Fig. 4.	Desmonema Wrangelii Born. & Flah.
Fig. 5.	Diplocolon Heppii Naeg.
Fig. 6.	Fremyella tenera (Thur.)DeToni
Fig. 7.	Hassallia byssoidea (Berk.)Hass.

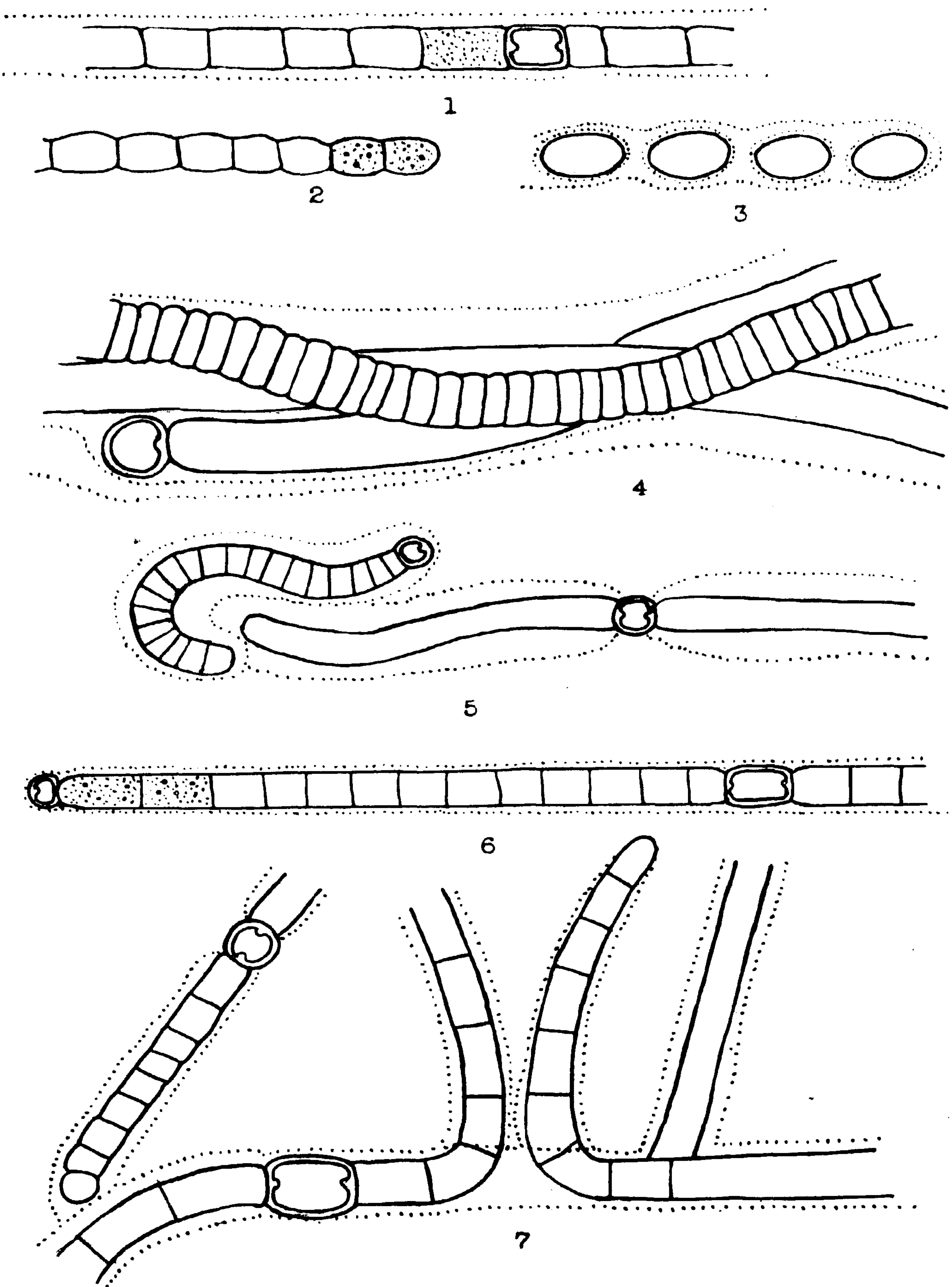

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Plate 40. (scale 1000:1)

Fig. 1. Scytonema alatum (Carm.)Borzi

Fig. 2. Scytonema cincinnatum (Kuetz.)Thur.

Fig. 3. Scytonema figuratum Ag.

Fig. 4. Tolypothrix distorta Kuetz.

Fig. 5. Stigonema hormoides (Kuetz.)Born. & Flah.

Fig. 6. Stigonema mamillosum (Lyngb.)Ag.

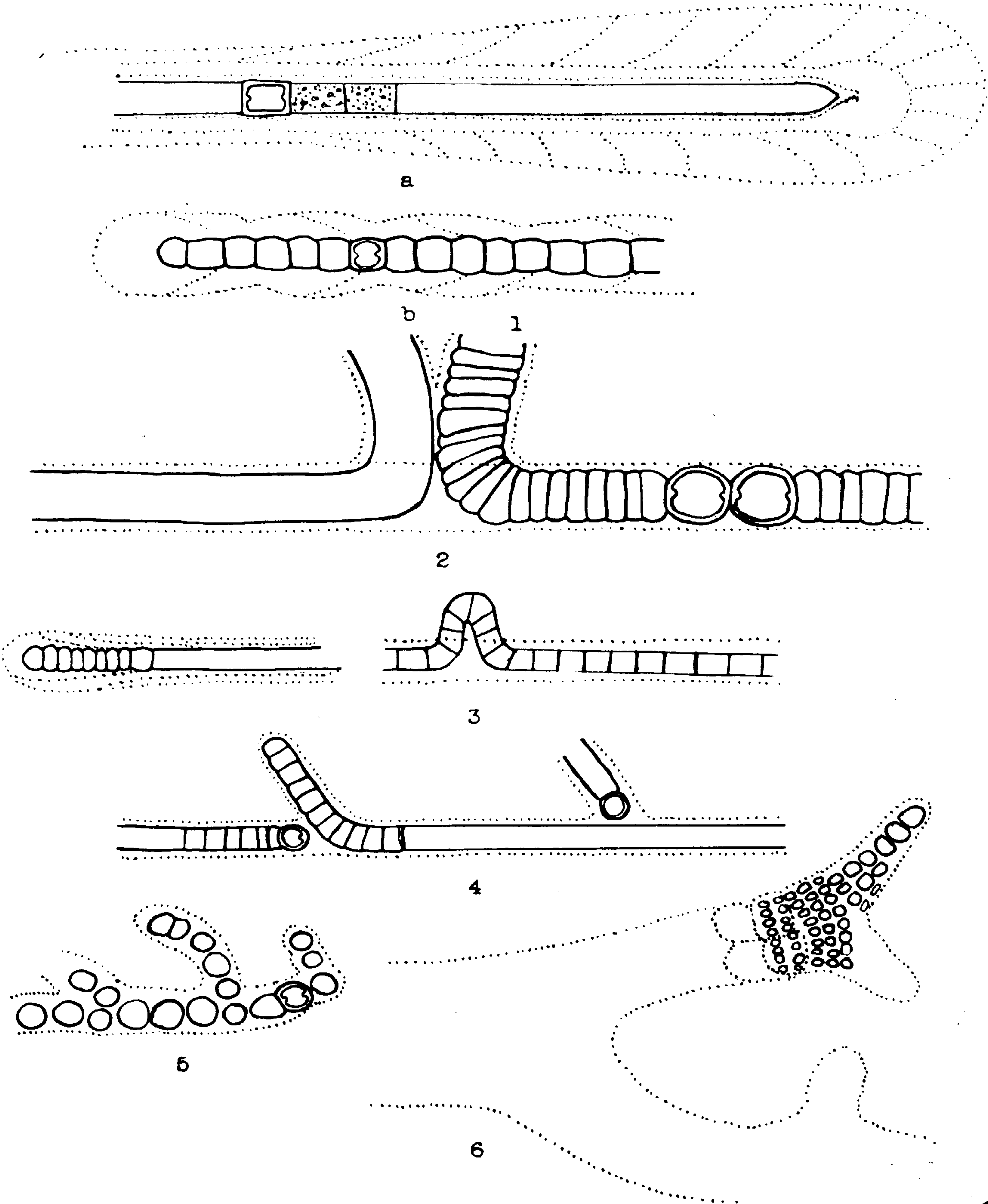

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Plate 41. (scale 1000:1)

Fig. 1.	Fischerella ambigua (Born. & Flah.)Gom.
Fig. 2.	Hapalosiphon intricatus W. West
Fig. 3.	Amphithrix janthina (Mont.)Born. & Flah.
Fig. 4.	Calothrix Juliana (Menegh.)Born. & Flah. (b. not to scale)
Fig. 5.	Calothrix parietina (Naeg.)Thur.
Fig. 6.	Dichothrix Baueriana Born. & Flah.

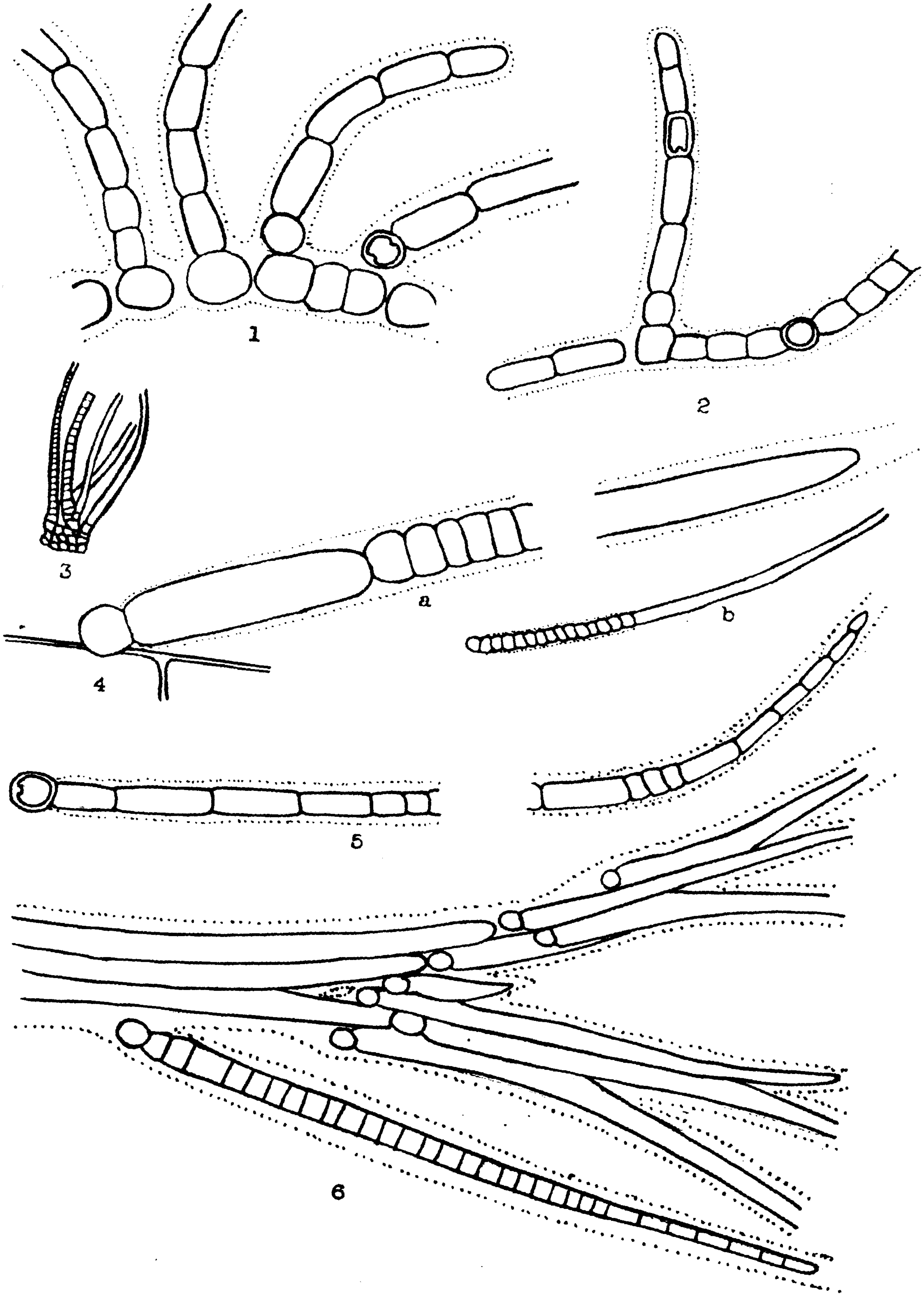
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Plate 42.

Fig. 1. Gloeotrichia pisum (Ag.)Thur. X 1000

Fig. 2. Rivularia dura Roth (a. not scaled, b. X 1000)

Fig. 3. Porphyridium cruenrum Naeg. (a. X 500, b. & c. X 1000)

Fig. 4. Compsopogon coeruleus (Babis)Mont. (a. X 2, b. & c. about X 400)

Fig. 5. Audouinella spp. X 500

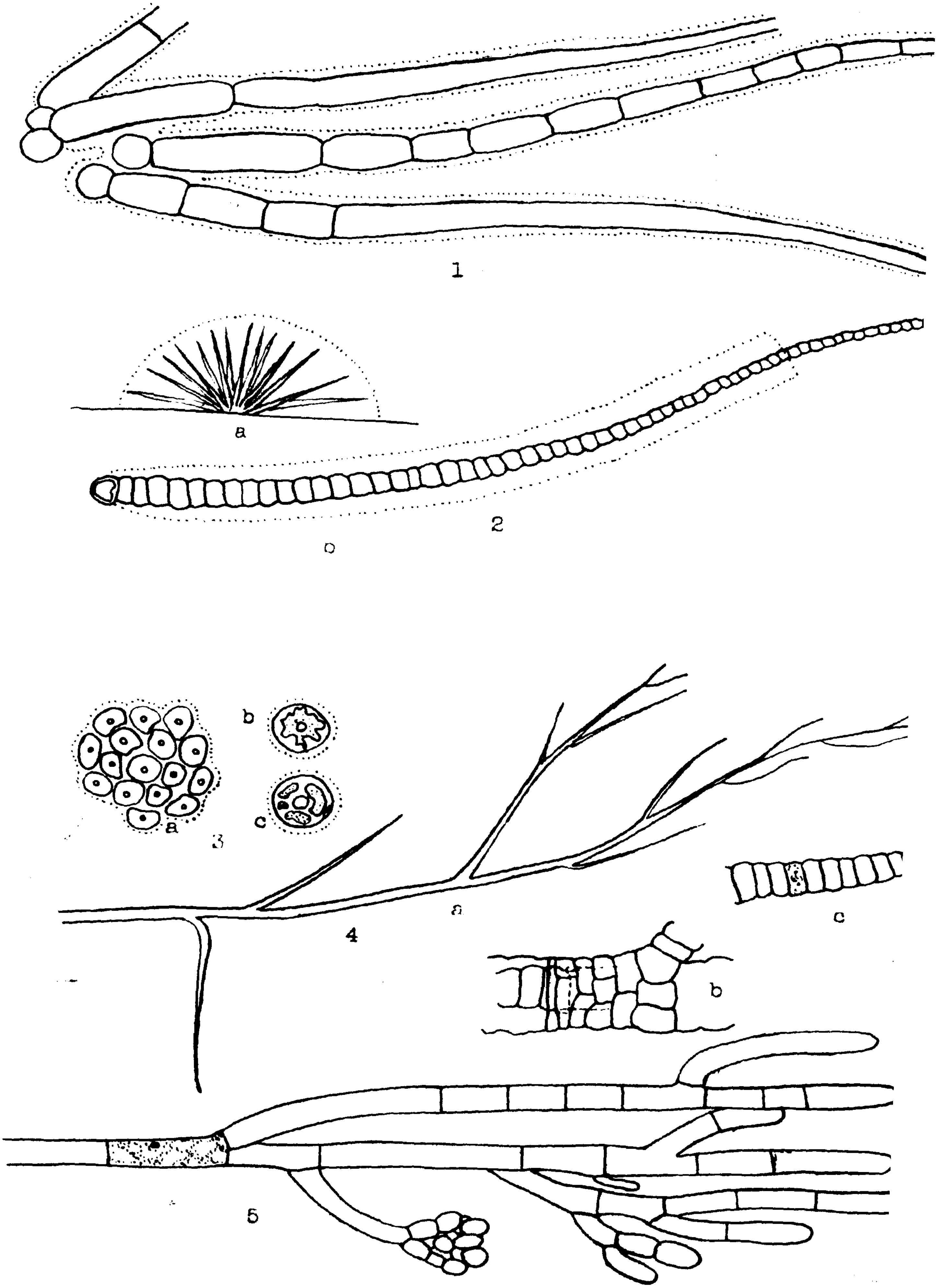
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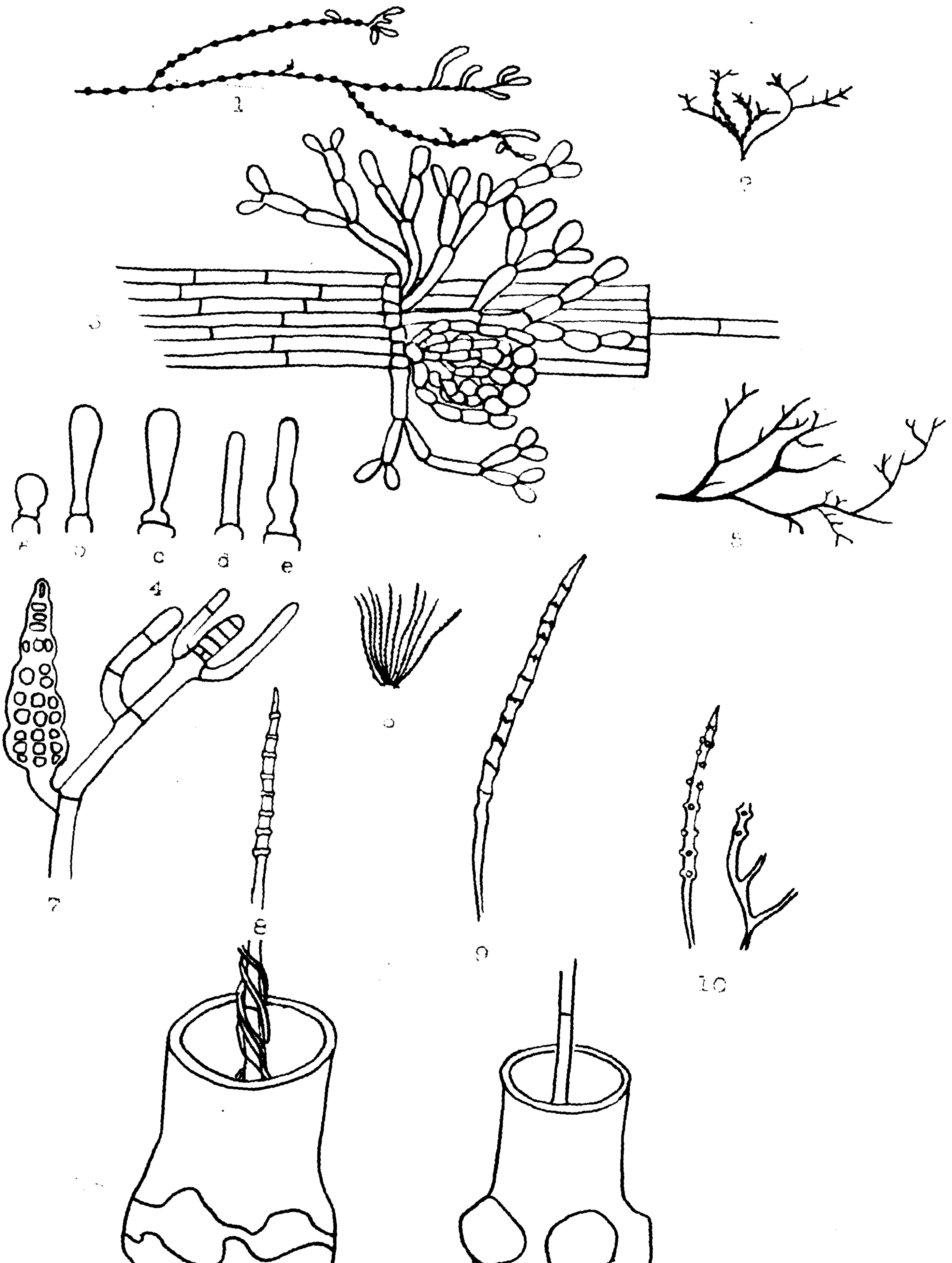
Plate 43.

Figs. 1, 2.	Batrachospermum Boryanum Sir. (1. male, 2. female) X 1
Fig. 3.	Batrachospermum spp., showing carpogone and simplified detail of branch whorl (not to scale)
Fig. 4.	Batrachospermum trichogyne types a. ovoid or elliptic, b. inverted conical, c. clavate, cylindrical, d. urceolate
Fig. 5.	Tuomeya fluviatilis Harvey
Fig. 6.	Lemanea spp. showing growth habit X ½
Fig. 7.	Lemanea pleocarpa (Atk.)Silva, showing young sexual branch arising from chantransial stage X 125
Fig. 8.	Lemanea australis Atk. X 1
Fig. 9.	Lemanea pleocarpa (Atk.)Silva X 1
Fig. 10.	Sacheria fucina (Bory)Sir. X 1
Fig. 11.	Lemanea pleocarpa (Atk.)Silva, semi-diagramatic illustration of axial structure X 25
Fig. 12.	Sacheria fucina (Bory)Sir. X 25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