FAMILY IDENTIFICATION OF LEPIDOPTERA LARVAE WITH REFERENCE TO COMPUTER GENERATED KEYS

Thesis for the Degree of M. S.
MICHIGAN STATE UNIVERSITY
PETER JOHN MARTINAT
1977

ABSTRACT

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By

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An illustrated family key to immature Lepidoptera is developed, and brief diagnostic descriptions for larvae of the suborders and superfamilies are given. General conclusions on taxonomy and identification of immature Lepidoptera are also given in relation to specimens examined. The philosophy and history of key construction is reviewed, and the theoretical advantages of generating identification keys by computer are discussed. The key generating program of Dallwitz (1974) was investigated as an aid in developing the immature Lepidoptera key. The results from use of this program were unsatisfactory, and the reasons for its failure are discussed.

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Entomology

1977

ACKNOWLEDGMENTS

I would like to thank the following curators for the loan of specimens: Suzanne Allyson, Biosystematics Research Institute, Agriculture Canada, Ottawa; Julian P. Donahue, Los Angeles County Museum; J. G. Franclemont, Cornell University; Dale H. Habeck, University of Florida; Ronald W. Hodges, United States National Museum; Roy O. Kendall, San Antonio Texas; Wallace E. LaBerge, Illinois Natural History Survey, Urbana, Illinois; W. H. Lange, University of California, Davis; W. C. McGuffin, Biosystematics Research Institute, Agriculture Canada, Ottawa; L. L. Pechuman, Cornell University; Jerry A. Powell, University of California, Berkeley; and H. R. Wong, Canadian Forestry Service, Edmonton, Alberta.

I would like to thank the following persons for their helpful criticism and advice: Dr. J. G. Franclemont, Cornell University; Dr. Ronald W. Hodges, United States National Museum; Mr. Jim Liebherr, Michigan State University; Mr. Joe Mahar, Michigan State University; and Mr. John Newman, Michigan State University.

Special thanks go to Dr. Roland L. Fischer, Ms. Elaine Hodges, Ms. Marian Mahler, and Ms. Lana Tackett for their help in preparation of the illustrations; to Mr. Ken Dimoff and Mr. Pat Logan for their help in computer programming; and to Dr. M. J. Dallwitz, CSIRO Division of Entomology, Canberra City, Australia, and Dr. Floyd Werner, University of Arizona, for their help in obtaining KEY.

Thanks go to my guidance committee: Dr. Robert Anstey, Dr. Jim Bath, Dr. George Bird, Dr. Richard Merritt, and Dr. Frederick W. Stehr.

Special graditude goes to my major professor, Frederick W. Stehr for his help and persistance, to my girlfriend Debby Ney for her patience and understanding, and to my parents Joseph and Virginia for their support.

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INTRODUCTION

The only currently available family keys to Lepidoptera larvae are those by Fracker (1915), Forbes (1923), Capps (1939), Chu (1949) Gerasimov (1952), and Peterson (1956). Recent advances in taxonomic knowledge of immature Lepidoptera have made these keys inadequate. In addition, they are based on outdated classifications (Comstock 1892, 1918) of the order. The keys by Capps and Chu are incomplete, excluding many Microlepidoptera and less common families. Forbes' key is similar to Fracker's and uses mixed chaetotaxy terminology. Peterson's key, although the most recent, contains many taxa that do not key properly. He also used Fracker's chaetotaxy terminology, now considered outdated (Hinton 1946). Gerasimov's key has only recently been translated from Russian (Gerasimov 1962). It is not generally available, uses a style to which North American workers are unaccustomed, and is based on eastern European fauna.

Recent investigations have made available a number of computer programs which automatically generate identification keys. The advantages of computer generated keys were discussed by Pankhurst (1970b), Morse (1971), Watson & Milne (1972), and Dallwitz (1974). In hopes of developing a more reliable key than Peterson's (1956), and avoiding many of the problems key writers have had, the most recent of these programs, Dallwitz' "KEY" was obtained. The objectives of this research were a) to write a new illustrated family key to Lepidoptera larvae, and b) to investigate KEY as an aid in developing this key.

This investigation is divided into 2 parts. The first is a general systematics section, in which a key, description of characters, diagnostic descriptions of the superfamilies, and observations on identification and taxonomy of immature Lepidoptera are given. The second reviews the historical development of keys, describes KEY, and discusses the results of its use. In conclusions, the results obtained from KEY are compared with the hand written version. The appendices include the classification of the Lepidoptera used in the systematics section, a table comparing the chaetotaxy nomenclatorial systems of different authors, and computer printouts obtained from KEY.

FAMILY SYSTEMATICS OF IMMATURE LEPIDOPTERA

A. METHODS AND PROCEDURE

Character Evaluation

All characters identified in a thorough search of the morphological and taxonomic literature were considered potentially useful, including those used at interspecific, intergeneric, as well as at interfamily levels (Fracker 1915, Heinrich 1916, McIndoo 1919, Jaywickreme 1940, Hinton 1946, 1947, 1952, 1956, Gerasimov 1952, MacKay 1964). Many new characters were added, based on preliminary examinations of larvae.

Measurements were taken of body and head features, such as the fronto-clypeus, labrum, head capsule, length and height of body segments, and distances between setae and ocelli. Sketches and notes were made on qualitative features. After about 300 specimens had been examined, these measurements were delineated into characters and character states such that useful taxonomic information would be obtained from the data. All characters were stated in qualitative terms but were given precise quantitative limits for each state within the character. For example, head shape was defined as the ratio of epicranial length to its greatest width. Four states were delineated as: A, longer than wide (ratio greater than 1.10); B, as long as wide (ratio between 0.90 and 1.10); C, between 0.50 as long as wide to nearly as long as wide (ratio between 0.50 and 0.90); and D, less than half as long as wide (ratio less than 0.50).

Characters were worded in a precise manner. For example, an important character in Peterson's key (1956, Pt. I, p. 69, B18) was:

setae kappa (L2) and eta (L1) remote on abdominal segments; or (B18a) setae kappa and eta adjacent on abdominal segments. This was changed to: L1 closer to the spiracle than it is to L2, or L1 & L2 closer to each other than either is to the spiracle.

An initial list of 65 characters was compiled. Only about half of these proved useful at the family level. Ten characters difficult to delineate into states until all available variation was known were added after all families had been examined. Fifteen more characters were added to 20 families of Microlepidoptera and 10 more to 26 families of Macrolepidoptera for separation of difficult groups in the computer generated key. A list of 100 characters was thus assembled (App. C, p. 99).

Specimen Evaluation

Specimens accompanied by collection locality, date, and biological information were chosen for examination. All specimens were assumed to be correctly identified. Considering the paucity of taxonomic knowledge on immature Lepidoptera, this is a dangerous assumption. However the goal of a key at the family level does not make correct identification to species a critical requirement.

Several assumptions directed the choice of specimens examined. A variable character (with more than 1 state) between species of the same genus will also likely be variable between genera within the family. Therefore, assuming that the classification is good, examination of specimens at the generic level will be sufficient for information on character variability at the family level. In constructing a key to families the genus becomes the OTU (=Operational Taxonomic Unit, Sneath & Sokal 1972). Exceptions are large and complex genera such as *Ethmia*, *Acronycta*, *Euxoa*.

A second assumption was that a flawless key will be made only when larvae of all Lepidoptera genera are available. Given the present paucity of collections, one must take a sampling approach. Specimens were chosen which would show the widest range of biological and morphological diversity within each family.

Poor collections also require critical assumptions on the reliability of taxonomic data. If a family is a natural group (with high overall information content, Sneath & Sokal 1972) then general diagnostic statements can be made about it. Examination of a small percentage of the genera will be sufficient to get most of the diagnostic taxonomic information (what percentage is "sufficient" can not be determined empirically). Examination of additional genera will add decreasing amounts of new information (Fig. 15, curve A). On the other hand, if a family is merely a heterogeneous collection of genera (a "dumping ground"), then general diagnostic statements about the family are difficult, and examination of additional genera will add new information indefinitely (Fig. 15, curve B). If we are aware of the nature of a family (whether it is "natural"), then this argument allows us to make confident statements about a family when only a small number of specimens are available.

B. CHARACTERS USED IN THE KEY

Head. The caterpillar head is a sclerotized capsule with a very large occipital foramen strengthened dorsally by an inverted Y-shaped internal ridge. Hinton's (1947) interpretation of the morphology of the head sutures is used in this thesis. Each anterior arm of the inverted Y-shaped ridge extends to the anterior margin of the head mesad of the dorsal articulation of the mandibles (Figs. 1 & 2). Externally, these arms are represented by the lateral adfrontal sutures. The stem, or midcranial part of the ridge extends to the epicranial notch. This part of the ridge is represented externally by the median adfrontal suture. In early instars the head capsule is shed whole at ecdysis. In later instars the head capsule splits along the dorsal lines of weakness, the ecdysial lines. The area between the ecdysial lines and the adfrontal sutures are the adfrontal areas. The triangular area between the lateral adfrontal sutures is a combined front and clypeus, or fronto-clypeus. Anterior to the fronto-clypeus is the anteclypeus which articulates with the labrum.

The orientation of the mouthparts is usually correlated with the relative lengths of the sutures. In the hypognathous head, typical of the Macrolepidoptera (Fig. 97), the mouthparts are directed downward, perpendicular to the long axis of the body, and the median adfrontal suture is very long relative to the length of the fronto-clypeus (Fig. 77). In the semi-prognathous head, typical of internal feeding Microlepidoptera the mouthparts are directed slightly more forward, at an obtuse angle with the long axis of the body (Fig. 32), and the fronto-clypeus is longer than the median adfrontal suture (Fig. 78). In the prognathous head, typical of leaf miners, the mouthparts are directed forward, parallel to the long axis of the body, and the apex of the fronto-clypeus reaches the epicranial notch, causing disappearance of the median adfrontal suture (Figs. 59, 63, 68). In some leaf miners the severity of morphological change is such that the fronto-clypeus assumes a square or rectangular shape (Figs. 65, 67, 71, 72).

Eyes. Catepillars typically have 6 ocelli on each side of the head, adjacent to the antennal sockets. They are usually arranged with 5 in a semicircle (numbered 1-5 from top to bottom) with the 6th behind the others (Fig. 2). Reductions in the number of ocelli are usually found among leaf-mining families. The Nepticulidae, Eriocraniidae, and Opostegidae have only 1 ocellus on each side. Reductions in number are also found in the Heliozelidae, Oinophilidae and Gracillariidae. Many Prodoxinae, Lyonetiidae, and Tineidae have only 5 ocelli. Variations in the arrangement of ocelli are of 2 sorts. Ocelli 1 & 2 are sometimes close together and separated from the others (many Lyonetiidae, Gracillariidae, Elachistidae, and Tineidae; Fig. 85). Ocellus 5 is sometimes separated from the others as in most Macrolepidoptera (Fig. 88). All 6 ocelli are nearly equal in size, but in the Satyrinae, the 3rd ocellus is about twice as large as the others (Fig. 51).

Head Chaetotaxy. The terminology of the head setae used here is that of Hinton (1946), who named 22 primary setae on each side of the head (Fig. 1 & 2). Four minute setae (V1, V2, V3, G1) and 5 other setae (C1, C2, F1, AF1, AF2) on the frontal areas have not been used for taxonomic purposes. P1 and P2 are caudo-dorsad near the adfrontal sutures. A1, A2, A3, and L1 form a semi-circle cephalo-dorsad of the ocelli. A2 is usually closer to A1 than to A3 and is shorter than A1. A3 is usually closer to L1 than to A2 and is as long as A1. O1, O2, and O3 are closer to the ocelli. O1 is close to and caudad of ocellus 3. O2 is usually caudad of ocellus 1, and O3 is behind ocellus 6. O1 is as short as A2, O2 is usually as long as A1, and O3 is as short as or shorter than O1. SO1, SO2, and SO3 are below the ocelli. SO1 is ventrad of ocelli 5 and 6, SO2 and SO3 are in the genal area near the base of the maxillae.

External Features of the Cuticle. Two types of structures may occur on the body of caterpillars; those associated with setae in origin, and those having an internal cavity connected with the body cavity. The simplest structure is the hair-like seta. Most setae are simple, but in many families plumose, knobbed, disc-like, or spatulate setae are found. A seta arises from a small sclerotized ring-like papilla on the ectocuticle and internally connects with at least one hypodermal cell. A sclerotized area occuring around the base of one or more setae is a pinaculum (Fig. 3, dotted circles). If the pinaculum is distinctly elevated and cone-shaped it is a chalaza (Fig. 53). If the chalaza is a large structure bearing many branching spines or setae, it is a scolus. Secondary setae may be grouped on non-sclerotized fleshy lobes, or flattened disc-like sclerotized verricules or convex sclerotized verrucae. Some structures such as the mid-dorsal horn or tubercle on A8* of sphingidae are thought to be modified setae (Gerasimov 1952). Other structures resembling horns, tubercles, and antlers are found in some Nymphalidae, Notodontidae, and Bombycidae. The anal comb found on many Oecophoridae, Gelechiidae, Tortricidae, Thyatiridae, and Hesperiidae probably originated from modification of cuticular granules (Gerasimov, 1952).

Structures not associated with setae in origin are usually fleshy lobes or protuberances. Eversible glands are found in the Lyonetiidae,

*Standard abbreviations for the pro-, meso, and metathorax are TI, TII, & TIII; and for the abdominal segments A1, A2, A3........A10.

Yponomeutidae, Papilionidae, Lymantriidae, Notodontidae, and Noctuidae. In most groups the gland is cephalad of the prothoracic legs and may secrete noxious defensive fluids (Herrick & Detweiler, 1919), but the Papilionidae have an eversible mid-dorsal Y-shaped gland (osmeteria) on TI, and the Lymantriidae have mid-dorsal glands on A6 & A7. The Danainae and some Papilionidae, Noctuidae, and Geometridae have fleshy lobes on various segments.

Thoracic & Abdominal Setae.

Fracker (1915) distinguished 3 kinds of setae on the bodies of caterpillars. Primary setae are sensory in function and are present in the first and last instars of all but a few families. They are relatively constant in numbers and position throughout the order. Subprimary setae are like primaries in function except they do not appear until after the first molt of the larva. Primaries and subprimaries have been subject to nomenclatorial systems and their presence has been homologized in all groups throughout the order. Slight variations in position and numbers provide many useful taxonomic characters. For purposes of identification, primary and subprimary setae are all referred to as primaries.

Secondary setae are those varying in numbers, size, and position within as well as across taxa and do not appear until after the first instar. They usually occur in one of two patterns: as numerous small setae scattered over the cuticle (Figs. 36, 37, 46, 54); or as dense tufts or pencils on verrucae or verricules. Since primary setae occur on caterpillars throughout the Lepidoptera, their presence is probably a primitive condition (Hinton 1946). The appearance of secondary setae probably happened as an adaptation to an external feeding habit.

Verrucae and verricules usually occur in the same positions as the pinacula of primary setae on other larvae, suggesting that verrucae and verricules are homologous to pinacula. Small secondaries scattered over the cuticle such as are found in the Hesperioidea, Papilionoidea, Saturnioidea, Bombycoidea probably originated from modification of cuticular granules (Gerasimov 1952).

Secondary setae are extremely variable in their presence. Many Tortricidae, Noctuidae, Lyonetiidae, Pterophoridae, and Oinophilidae have spinules (cuticular spines which may represent intermediate conditions in the development of secondary setae). Primaries are obscured by secondaries in most butterfly larvae, but in the Megathymidae primaries stand out above surrounding secondaries. Some Notodontidae, Noctuidae, Ethmiidae, Scythridae, and Pterophoridae have extra setae on primary pinacula. Since confusion might arise whether a structure should be called a pinaculum or a verruca, an arbitrary criterion is used in the key. If 6 or fewer setae are present on a sclerotized area, it is a pinaculum. If more than 6 are present, it is a verruca. Many Cossidae, Noctuoidea and Geometroidea have extra setae in fixed positions remote from the primaries. These setae resemble primaries in size and have occasionally been given names (for example, seta lambda of Fracker, 1915= L4 of McGuffin 1958).

Body Chaetotaxy. Numerous systems for naming the primary setae have been proposed. The most commonly used are those of Dyar (1894), Fracker (1915), Heinrich (1916), Forbes (1923), and Hinton (1946). The systems of Gerasimov (1952) and Mutuura (1956) are less well known (App. B). Hinton's is considered the most reliable in the homologies it suggests and has been adopted by most contemporary workers.

Hinton was the first to recognize 2 kinds of primary setae: microscopic or proprioreceptor (prefixed "M") which, owing to their position, make contact with the segment immediately cephalad to their position; and long tactile setae which function as receptors of external stimuli. Because of their small size, the microscopic setae have little taxonomic value and will not be discussed. The tactile setae are divided into 6 groups based on their location (Fig. 3).

XD Group. Two XD setae are on the cephalic margin of the prothoracic shield. Both are nearly equal in length, are longer than D1, and as long as D2. XD2 is below XD1.

Dorsal (D) Group. Two D setae are usually present on all segments close to the dorsal midline. D1 is shorter than D2. On T1, both are on the prothoracic shield, and D1 is usually dorsad of D2. On TII & TIII, D1 is above D2, and they are usually closer together than D2 is to the next seta below. On A1-8, D1 is cephalad of D2. On A9, D2 is dorsad, caudo-dorsad, or caudad of D1.

Subdorsal (SD) Group. Two SD setae are present on all segments except A9. SD1 is longer than SD2. On TI they are on the prothoracic shield below D1, D2, XD1 and XD2. SD1 is usually ventrad of XD2 and cephalad of SD2. Sometimes (in many Noctuoidea) SD1 and SD2 are very close together and excluded from the prothoracic shield. On TII & TIII, SD1 is ventrad of SD2, and D1, D2, SD2, SD1 from a nearly straight vertical line with D1 & D2 on one pinaculum and SD2 & SD1 on another. On A1-8, SD2 is usually minute and cephalad of the spiracle, and SD1 is usually dorsad of the spiracle. On A9 SD2 is usually absent and SD1 is ventrad of D1.

Lateral (L) Group. Three L setae are usually present on all segments except TI and A9. On TI they are cephalad of the spiracle, usually on a single pinaculum. L1 is the longest, and L2 the next longest. L2 is usually cephalad of L1, and L3 is closest to the spiracle. In many Copromorphoidea, Noctuoidea and Pyraloidea L3 is missing on TI. On TII & TIII L1 is primary, L2 & L3 are subprimary. L3 is caudo-dorsad of L1, and L2 is cephalo-ventrad of L1. L1 & L2 usually share a pinaculum, and L3 has its own. On A1-8 L1 & L2 are close together and ventrad of the spiracle in most Gelechioidea, Tortricoidea, and Pyraloidea, but are far apart with L1 often caudad of the spiracle in most Tineoidea, Yponomeutoidea, Geometroidea, and Noctuoidea. L3 is caudo-ventrad and farther from the spiracle than L1 and L2. On A9 the L group is often unisetose or bisetose. If all 3 are present they are usually arranged vertically with L1 in the middle, and with L3 below L1.

Subventral (SV) Group. The SV group is usually bisetose on TI and unisetose (bisetose in Thyrididae, Pterophoridae, some Tineidae) on TII & TIII. They are dorsad of the coxa and are often on large pinacula. On A1-8, the SV group may be unstable in number, and may vary even on opposite sides of the same segment. In most Microlepidoptera and cutworm-type Macrolepidoptera, the SV group is uni-, bi-, or trisetose on A1, 2, 7 & 8, and trisetose on the basal part of ventral prolegs. In many Ethmiidae, Oecophoridae, Pterophoridae, Scythridae, secondary setae may be present in the SV group. In most external feeding Macrolepidoptera, the ventral prolegs have many secondary setae, while other abdominal segments may have a normal SV group, or an SV verruca. In other families or the SV group may be obscured by numerous secondaries.

Ventral (V) Group. A single V seta is present on all segments. It is nearer to the ventral meson than the SV group. On TI-TIII it is on the underside of the coxa. On A3-6 it is on the underside of the proleg.

Caudal Abdominal Segment. Little taxonomic value has been found in the four pairs of setae on the anal shield. Hinton did not discuss them, but MacKay (1959) homotyped them with setae on A1-9. They are D1, D2, SD1, and SD2. There are usually 9 setae below the transverse anal slit arranged in 3 rows around each caudal proleg. In some Gelechiidae, Cosmopterygidae, Oecophoridae, Ethmiidae, Stenomidae, and Notodontidae, more than 9 setae are present in this area.

Pinacula and verrucae. Pinacula are sometimes named according to the primary setae occuring on them. Seta D1 is on pinaculum D1. If D1 & D2 setae are on a single pinaculum, that pinaculum is D1+D2. Verrucae are also labeled in this manner, since they are modified pinacula. But since many verrucae are fused pinacula, the labelling is simplified. If 2 dorsal verrucae are present, they are D1 and D2, but if only 1 dorsal verruca is present, it is verruca D. But if 2 verrucae of different primary groups are fused (for example the fused D and SD verrucae on TII & TIII in the Arctiidae, Fig. 100) it is the D+SD verruca.

Thoracic Legs. Caterpillars typically have 3 pairs of well sclerotized legs. In many families with specialized habits (leaf miners) legs are rudimentary or lost. Otherwise they are remarkably consistant in structure. The leg consists of a coxa, trochanter, femur, tibia, tarsus, and a distal claw. In the Micropterygidae the coxa, trochanter, and femur are fused and the leg appears 3-segmented. In the other families, the trochanter is little more than a narrow band fused with the femur (Gerasimov 1952) and the leg appears 4-segmented.

Prolegs. Prolegs are paired ventral muscled outgrowths of the body wall. In all suborders except the Zeugloptera, prolegs are primitively present on A3-6 (ventral prolegs) and on A10 (caudal prolegs). A different compliment of prolegs (usually reductions) is thought to be a derived condition (Hinton 1955a). In the Zeugloptera true prolegs occur on A1-8.

Prolegs show a wide range of development. In many leaf-mining and internal-feeding groups they are absent or rudimentary. In the Nepticulidae prolegs are lost, but "ambulatory warts" have evolved on A2-7 (Hinton 1955a). In mature gracillariid larvae, prolegs are lost on A6. The Megalopygidae have pairs of lobes on A2 and A7 which resemble prolegs but lack crochets. The Nolidae lack prolegs on A3. The loss of prolegs in most Geometridae (usually the first 3 pairs) and in some Noctuidae (the first 1 or 2 pairs in the Acontiinae, Lithacodiinae, and Plusiinae) is associated with a specialized means of locomotion called "looping". In the Drepanidae the caudal prolegs are lost, and in many Notodontidae they are lost, rudimentary, or modified to serve as defensive structures.

The proleg consists of 2 parts: a proximal base which bears the SV setae, and a distal planta from which the crochets arise (Figs. 118-123). Contraction of retractor muscles inserted on the planta pulls its center inwards, disengaging the crochets. Turgor pressure pushes the planta out once the muscles are relaxed (Hinton 1955a).

Two kinds of prolegs are found in caterpillars. In the first, found in the Tineoidea, Yponomeutoidea, Cossoidea, Tortricoidea, Gelechioidea, Copromorphoidea, and Pyraloidea the proleg base is little more than a ring encircling the base of the planta (Figs. 118-120). The planta is usually cylindrical and may be almost indistinguishable from the proleg base (Fig. 119), or elongate (many Plutellinae, Glyphipterygidae, Pterophoridae; Fig. 120). In this form of proleg, crochets are usually in transverse bands, a complete or incomplete circle, or a mesopenellipse. The second kind, found in the Zygaenoidea, Papilionoidea, Geometroidea, Saturnioidea, Sphingoidea, and Noctuoidea, the proleg base is elongated and forms the greater part of the proleg (Figs. 121-123). Often it is partially sclerotized and bearing numerous secondary setae (Fig. 122). The planta is reduced to a lobe at the distal end of the proleg base, with the crochets usually in a mesoseries. These 2 kinds of prolegs parallel feeding habits. The first kind is typical of internal-feeding caterpillars (Microlepidoptera), and the second kind is typical of exposed feeders (Macrolepidoptera).

Crochets. Crochets are small hooks arranged in rows or circles around the periphery of the planta. Their development probably began from the enlargment of cuticular granules which gradually assumed the shape of hooks (Gerasimov 1952). The primitive arrangement would thus be large spines arranged in circular multiple rows. This multiserial arrangement is found in the Gracillariidae, Acrolophinae, Yponomeutidae, Hepialidae, Adelinae, Tischeriidae, and Castniidae (Figs. 20, 30). Further specialization led to a reduction in the number of rows to a uniserial circle and differentiation of the size of crochets. If all the crochets in a circle are the same length they are uniordinal (Fig. 6); if 2 alternating lengths occur, they are biordinal (Fig. 7); while 3 alternating lengths are triordinal (Fig. 8).

Circles are often broken into rows, semi-circles, bands, etc. An incomplete circle has a gap in an otherwise continuous row. If the gap occurs on the mesal side, the arrangement is a lateropenellipse. If the gap is on the lateral side, it is a mesopenellipse (Fig. 12). If a circle has a gap on the lateral side and another on the mesal side, then the crochets are in 2 transverse bands (Fig. 5). If a single row of crochets is present, then the arrangement is a single transverse band (Fig. 4). Most arboreal feeders have a single longitudinal row of crochets on the mesal side of the planta, parallel to the meson. If it is a single longitudinal row with crochets of uniform length, it is a homoideous mesoseries. If the crochets in the center of a mesoseries are longer than those at either end (Arctiidae, Ctenuchidae, Pericopidae) then it is a heteroideous mesoseries (Fig. 56). If two longitudinal parallel rows occur, the outer is a lateroseries and the inner is a mesoseries. (Fig. 14).

C. KEY TO FAMILIES

How to Use the Synoptical Key

A synoptical key based on a design by Leenhouts (1966) has been incorporated into the analytical key (couplets 75-88). Included in the synoptical key are 10 families of Gelechioidea and Tortricoidea for which reliable key characters are lacking, making identification difficult. Diagnostically useful characters are arranged as numbered couplets. A couplet begins with the name of the character followed by 2 or more states marked with letters. After each state, abbreviations (example, C=Cosmopterygidae) denote all the taxa for which the state of the character applies. Taxa listed after more than 1 state are those which are variable for the character.

To use the synoptical key, list the taxa (C M W B O E G S T P). Begin with any couplet 75-88 and proceed in any order. Compare the specimen with a character, and select the state which fits best, and cross off the families which are NOT listed. For example, if the specimen has the fronto-clypeus extending to the epicranial notch, or nearly (couplet 75, state A) cross off Blastobasidae, Ethmiidae, Stenomidae, Tortricidae, and Phaloniidae (C M W ~~B~~ O ~~E~~ G ~~S~~ ~~T~~ ~~P~~). Next, proceed to any other couplet and repeat. For example, try couplet 85 (anal comb present or absent). If the specimen has an anal comb, Cosmopterygidae, Momphidae, Walshiidae and Oecophoridae are eliminated, leaving only Gelechiidae, which is most likely the correct family.

If this does not lead to a satisfactory identification (either because all taxa have been crossed off, or more than one remain), a second more tedious approach is possible. This involves tabulation of similarities between the specimen and all the taxa, rather than elimination of taxa. Again, list the taxa. Assume the specimen has the fronto-clypeus extending to the epicranial notch, or nearly (state A). Tally (/) after C M W O G. Assume state A for couplet 76, and tally (/) after C S. Continue in this fashion until the specimen has been compared with all the couplets, then total the number of similarities for each taxon on the list. The taxon with the greatest number of similarities is most likely the correct one.

The couplets leading to the synoptical key (55, 70, 71, 72, 73, 74) use reliable characters which help narrow down the list of possibilities. If directed to the synoptical key, begin with the list of taxa at the couplet leading to it. For example, if at couplet 70, your specimen has an anal comb you can begin the synoptical key with all but Tortricidae and Gelechiidae crossed off your list. The list of possibilities will have been narrowed to 4 or fewer by all couplets except 74, before entering the synoptical key.

Due to a lack of good characters and to unstable family definitions (especially in the Gelechioidea), even the synoptical key will not guarantee a correct identification. The greatest difficulty will be in separating tortricids and phaloniids; gelechiids, ethmiids and oecophorids; and cosmopterygids, momphids, and walshiids.

FAMILY KEY TO LEPIDOPTERA LARVAE

* = Rare group, not likely to be collected.

1. Antennae nearly as long as width of the head, and inserted above the ocelli (Fig. 23); setae modified as thick bulbous scales (Fig. 21); prolegs present on A1-8 (Fig. 22; mature larvae less than 5 mm.; slug-like, found in mosses, liverworts, and lichens, or in litter and duff)............................MICROPTERYGIDAE*

   Antennae much shorter than width of the head, and inserted between the ocelli (if present) and the base of the mandibles (Fig. 1); setae not modified as above; complement of prolegs never as above.....................2

2(1). External parasitoids on Fulgoroidea and other Homoptera; primary setae absent; body stout, cyphosomatic, with head retracted into prothorax; thoracic legs present but rudimentary; prolegs absent, but uniordinal crochets arranged in a complete circle are present on A3-6, 10 (Fig. 42) (mature larvae 5 mm. or less) ....EPIPYROPIDAE*

   Never external parasitoids on Fulgoroidea or other Homoptera; primary setae present or absent; not exactly fitting combination of other characters..........................3

3(2). Crochets present on at least 1 segment of A1-9..............4

   Crochets absent on all abdominal segments, or present only on A10 (irregularly spaced spines may be present on prolegs)..5

4(3). Crochets absent on A10....................................16

   Crochets present on A10....................................18

5(3). Segmented sclerotized thoracic legs absent..................6

   Segmented sclerotized thoracic legs present................13

6(5). Fronto-clypeus rectangular, circular, or trapezoidal in shape; apex rounded or open (Figs. 59, 65, 67, 69, 74)....7

   Fronto-clypeus more triangular or pentagonal in shape; apex ending in a more acute angle, never open (Figs. 61, 63, 68)..11

7(6). Head poorly sclerotized and narrower than prothorax; mouthparts (mandibles, labrum, labium) non-functional or rudimentary (Fig. 74); head not conspicuously dorso-ventrally flattened; all primary setae minute or absent; (4th instar Phyllocnistes) (part) GRACILLARIIDAE*
Head well sclerotized and nearly as wide as prothorax; mouthparts well developed and functional; head usually dorso-ventrally flattened; with at least a few primary setae conspicuous....................................8

8(7). Fronto-clypeus much less than 2X as high as wide, never wider behind than in front (Figs. 67, 69) body cylindrical; prolegs, if well developed, present on A2-7; TII & TIII usually with pairs of ventral fleshy lobes (Fig. 27; miners in leaves, bark, or fruits, or forming galls in twigs or petioles)............NEPTICULIDAE*
Fronto-clypeus at least 2X as high as wide, may be wider behind than in front (Figs. 59, 71, 72, 73); compliment of prolegs not as above; lobes on thoracic segments present or absent....................................9

9(8). Fronto-clypeus closed behind (Fig. 59); head usually prognathous and extremely dorso-ventrally flattened, but not greatly modified and never with sclerotized lateral ridges or apodemes; head widest between anterior and posterior ends (leaf miners) ....(part) TISCHERIIDAE*
Fronto-clypeus open behind (Figs. 71, 72, 73); head greatly modified, with sclerotized ventral, lateral, and dorsal ridges, and usually with a pair of sclerotized apodemes extending caudad into prothorax; head either rectangular in shape or widest near posterior end 10

10(9). Body long and slender, about 10X longer than wide; TII & TIII each with a pair of ventral fleshy lobes; setae long and conspicuous, and arranged in vertical rows on A1-8; labrum as wide as fronto-clypeus, and mouthparts not extremely modified (Fig. 72; stem borers)...OPOSTEGIDAE*
Body not long and slender, less than 10X longer than wide, usually dorso-ventrally flattened with prominent lateral lobes; TII & TIII without ventral fleshy lobes; setae minute or obscure; labrum much wider than fronto-clypeus, and mouthparts extremely modified for sap-feeding (Figs. 71, 73; leaf miners) ....(1st & 2nd instars) GRACILLARIIDAE

11(6). Body swollen, cyphosomatic; head with 3 ocelli on each side; prolegs absent (borers in flowers of Yucca) ....(part) PRODOXINAE
Body not swollen, more cylindrical or dorso-ventrally flattened; head with fewer than 3 ocelli on each side; prolegs present or absent....................................12

12(11). Ecdysial lines joining anterior margin of head well laterad of adfrontal suture and including the antennae within the adfrontal areas (Fig. 68); head with a single ocellus on each side (Fig. 70; leaf miners)...ERIOCRANIIDAE*
Ecdysial lines inconspicuous or joining anterior margin of head between antennae and adrontal sutures and excluding the antennae from the adfrontal areas (Fig. 61); head with 2 ocelli on each side (Fig. 62; leaf miners with pupation in an oval case cut from the leaf at the end of the mine).......................HELIOZELIDAE

13(5). Numerous secondary setae, prominent urticating scoli, or long hairy protuberances usually present; sucker-like structures usually present on ventral surface of abdominal segments (external feeders on deciduous trees)...................................LIMACODIDAE
Secondary setae and scoli absent; sucker-like structures absent on ventral surface of abdominal segments 14

14(13). Prolegs present on A3-6 (rudimentary on A10); ventral part of prolegs covered with spines (not true crochets); head not retracted into prothorax; mature larvae 50 mm. or more (borers in stems of banana; tropical & subtropical)........................CASTNIIDAE*
Prolegs and spines absent on all abdominal segments; head may be retracted into prothorax; mature larvae less than 15 mm. in length.............................15

15(14). Body with prominent fleshy lobes; all setae minute or absent (tropical & subtropical external feeders on deciduous trees).............. .... DALCERIDAE*
Body without prominent fleshy lobes; most setae minute but visible (borers in stems, flowers, seeds of Yucca).................................(part) PRODOXINAE

16(4). All prolegs rudimentary or absent; crochets on A3-6 in multiserial transverse rows; secondary setae absent (very small larvae, internal feeders in leaves, needles, flowers, seeds) ....(Nematois sp.) ADELINAE*
Only caudal prolegs rudimentary or absent, ventral prolegs well developed; crochets on ventral prolegs in a mesoseries; secondary setae present at least on prolegs (large larvae, external feeders on deciduous trees and shrubs) 17

17(16). Crochets in a uniordinal or biordinal mesoseries plus a uniordinal lateroseries (Fig. 14); anal shield usually modified into a spinose caudo-projecting elongate process ....DREPANIDAE
Crochets in a uniordinal mesoseries only, no latero-series present; anal shield never modified into a caudo-projecting process (although rudimentary caudal prolegs may be caudo-projecting..(part) NOTODONTIDAE

18(4). Segmented sclerotized legs absent on all thoracic segments (ventral fleshy lobes may be present); head prognathous and extremely dorso-ventrally flattened (Fig. 59).....................(part) TISCHERIIDAE*
Segmented sclerotized legs present on at least 1 thoracic segment; head prognathous or not................19

19(18). Well developed crochet-bearing prolegs present only on A3-5 & 10 (absent on A6); ocelli 1 & 2 close together and separated from 3, 4 & 5; distance between ocelli 2 & 3 at least 3x the distance between ocelli 1 & 2 (Fig. 85; external feeders on foliage, may construct folded or rolled leaf shelter) ....(most late instars) GRACILLARIIDAE
Prolegs present at least on A6 or rudimentary on all abdominal segments; arrangement of ocelli variable.......20

20(19). A6 with 7 or fewer setae on each side below the top edge of the spiracle (Fig. 3; L1, L2, L3, SV1, SV2, SV3, V1, (MV3 usually too minute to see easily)) (spinules may be present on cuticle, if they are large and resemble secondary setae, try also couplet 111)..23

A6 with more than 7 setae on each side below the top edge of the spiracle (be sure to count L1 which may be caudad of the spiracle) 21

21(20). At least some secondary setae grouped on verrucae or verricules, or scoli present; if verrucae or verricules resemble pinacula, then with 7 or more setae on each (Figs. 55, 57, 58, 99-102)...............................94

No secondary setae grouped on verrucae or verricules, and scoli absent, if pinacula are present, then always with 6 or fewer setae on each 22

22(21). A3 with no more than 5 setae on each side above the spiracle; if more than 5 are present (a few Pterophoridae, Cossidae, Scythridae, Notodontidae, Dioptidae), the extra setae are usually on primary pinacula (D1, D2, or SD1) and are usually nearly as large as the primary setae 129

A3 with more than 5 setae on each side above the spiracle, usually many more; if primary setae or pinacula are evident, then most of the setae are off the pinacula, and are usually much shorter than the primary setae or other setae on the pinacula (Figs. 37, 41, 54) 111

23(20). Crochets on ventral prolegs in a circle, latero-penellipse, mesopenellipse, transverse bands, or reduced in number, never in a mesoseries; if arranged as a mesopenellipse the gap free of crochets is usually distinctly less than 1/3 the circumference of projected circle; also, the entire series of crochets on each caudal proleg is more nearly perpendicular than parallel to the meson (Figs. 5, 6, 8, 12).......24

Crochets on ventral prolegs in a mesoseries or pseudo-circle, never in a lateropenellipse; if a mesoseries resembles a mesopenellipse (some Noctuidae, Epiplemidae, Ethmiidae, and Pterophoridae), then the gap free of crochets is equal to or greater than 1/3 the circumference of the projected circle; also the entire series of crochets on each caudal proleg is more nearly parallel than perpendicular to the meson (Figs. 11, 56) 89

24(23). Crochets uniordinal (Fig. 6)............................ 25

Crochets biordinal or triordinal (Figs. 7, 8)............. 60

25(24). TI with L (prespiracular) group unisetose or bisetose......26

TI with L (prespiracular) group trisetose 32

26(25). TII & TIII with the SV group bisetose, and with L3 absent; head with O1 usually between ocelli 2 & 3 or more cephalad than 2 & 3 (Fig. 87; leaf rollers and stem borers of cruciferous and other plants).... THYRIDIDAE*

TII & TIII with the SV group unisetose, and with L3 present; head with O1 usually caudad of ocelli 2 & 3 (Fig. 84) 27

27(26). A9 with D1 closer to SD1 than to D2 (D1 and SD1 often on the same pinaculum), distance between D1 and D2 at least 3x distance between D1 and SD1 (Fig. 117)..........28

A9 with D1 more equidistant between SD1 and D2 or closer to D2 (D1 and SD1 never on the same pinaculum) (Fig. 113)...30

28(27). A8 with SD1 cephalad or cephalo-dorsad of the spiracle (Fig. 111); TI with SD2 almost directly dorsad of SD1 (Fig. 96; fruits, flowers, seeds of Umbelliferae) ....EPERMENIIDAE
A8 with SD1 more nearly dorsad of the spiracle (Fig. 110); TI with SD2 caudad of SD1 (Fig. 95)................29

29(28). Spiracles on A8 closer to the dorso-meson than spiracles on preceeding abdominal segments, and caudo-projecting (Fig. 108).............(Machlotica) GLYPHIPTERYGIDAE*
Spiracles on A8 on the same level as spiracles on preceeding abdominal segments and never caudo-projecting (Glaphyrinae, inquilines in nests of social Hymenoptera; Schoenobiinae, borers in stems and roots of grasses; Chrysauginae, feeders in pods of trumpet-creeper; and Crambinae, feeders in roots and stems of grasses).........................(part) PYRALIDAE

30(27). Distance between ocelli 2 & 3 at least 3x the distance between ocelli 1 & 2 (Fig. 85); A1-7 with L1 caudad of the spiracle and as close or closer to the spiracle than it is to L2 (Fig. 105; fungus feeders) ....(Scardiinae) TINEIDAE
Distance between ocelli 2 & 3 less than 3x the distance between ocelli 1 & 2; A1-7 with L1 below the spiracle and closer to L2 than L1 is to the spiracle or L2 absent (Fig. 3)...................................31

31(30). TI with SD2 almost dorsad of SD1 (Fig. 96); L2 & L3 on TII & TIII, and L2 on A1-8 may be absent (needle miners on pine) ....(Ocnerostoma) YPONOMEUTIDAE*
TI with SD2 more nearly caudad of SD1 (Fig. 95); all L setae on TII, TIII, and A1-8 present (in stems, fruits, flowers of Compositae and honeysuckle, often producing galls).................................ALUCITIDAE*

32(25). Crochets biserial or multiserial, or with a single row of well developed crochets plus many rows of smaller crochets or spines encircling the row of large crochets (Figs. 20, 30)..................................33
Crochets uniserial, no spines present on prolegs...........37

33(32). TI with the spiracle included on the L pinaculum (which may be continuous with the prothoracic shield; Fig. 26) (on clover and in roots of grasses, may construct silken galleries and webs) ....(Acrolophinae, a few Tineinae) TINEIDAE

TI with the spiracle excluded from the L pinaculum or all pinacula indistinct................................34

34(33). A3 with L1 and L2 equally distant from the spiracle (Fig. 103); head with O1 closer to ocellus 3 than to ocellus 2 (Fig. 90); crochets biserial, with the inner row in an incomplete circle, sometimes resembling a mesopenellipse, and the outer row in a complete circle (Fig. 76).................(part) PLUTELLINAE

A3 with L1 closer to the spiracle than L2 (Fig. 105); head with O1 equidistant between ocelli 1 & 2, or closer to ocellus 2; crochets biserial or multiserial, usually in complete circles.......................35

35(34). TII & TIII with the SV group bisetose; prothoracic shield indistinct; body irregularly patterned with brown spots (leaf folders and tiers)..(Atteva) YPONOMEUTINAE

TII & TIII with the SV group unisetose; prothoracic shield variable; body without distinct patterns...........36

36(35). A8 with the SV group bisetose; antenna with 3rd segment no longer than 2nd segment (leaf folders) ....(Zelleria) ARGYRESTHIINAE

A8 with the SV group unisetose, antenna with 3rd segment conspicuously longer than 2nd segment (borers in stems, twigs, flowers, fruits; and leaf folders) ....(part) YPONOMEUTINAE

37(32). Crochets in transverse bands (Figs. 4,5) or reduced in number (less than 5 on a proleg), if arranged as a semicircle around the perifery of the proleg, then the gap free of crochets is greater than 1/2 the circumference of the projected circle....................38

Crochets in a complete or incomplete circle, if incomplete then the gap free of crochets is less than 1/2 the circumference of the projected circle 45

38(37). TI with legs absent or conspicuously smaller than legs on TII & TIII; head prognathous, dorso-ventrally flattened, elongate; A3-6 with D1 or both D setae minute or missing; crochets on caudal half of proleg only (a "caudoseries"), 1 or 2 crochets on cephalic part may be present (leaf miners on grasses and sedges..............(Cosmiotes, Dicranactetes) ELACHISTIDAE*

TI with legs never absent or reduced in size; head semi-prognathous or hypognathous, not extremely dorso-ventrally flattened; A3-6 with both D setae present and conspicuous; crochet arrangement variable..39

39(38). Ocelli 3, 4, & 5 not equally spaced, distance between 4 & 5 at least 2x the diameter of 4, and distance between 3 & 4 usually equal to or less than the diameter of 4 (Fig. 88); TII & TIII with L1 equidistant between L2 & L3, or L1 closer to L3; crochets in 2 transverse bands or a complete ellipse......40

Ocelli 3, 4 & 5 more equally spaced, distance between all 3 ocelli less than 2x the diameter of 4 (Fig. 85); TII & TIII with L1 closer to L2 than to L3; crochet arrangement variable 41

40(39). TI with SD2 almost dorsad of SD1 and usually as close to XD2 as to SD1 (Fig. 96); A9 with D1 closer to SD1 than to D2; D1 often on the same pinaculum with SD1 (Fig. 117; borers in roots, trunks, branches of trees and shrubs, or in stems and roots of herbaceous plants)..SESIIDAE

TI with SD2 more nearly caudad of SD1 and never as close to SD2 as to SD1 (Fig. 95); A9 with D1 closer to D2 than to SD1 or equidistant between them; D1 & SD1 never on the same pinaculum (Fig. 113); (prothoracic shield sometimes elevated and bearing a roughened caudal area (cornicula); borers in structural wood, shrubs, trees, rotten logs) ....(part) COSSIDAE

41(39). A3 with L1 & L2 as far as from each other or farther than either is from the spiracle; L1 usually caudad of the spiracle (Fig. 104)..................................42

A3 with L1 & L2 closer to each other than either is to the spiracle; L1 ventrad or caudo-ventrad of the spiracle (Fig. 3).......................................43

42(41). Prolegs absent or rudimentary; crochets in a single transverse band with up to 12 crochets in a band (Fig. 4); ocellus 6 present; setae at distal end of tarsi not spatulate (construct flat oval cases from maple leaves)..................(Paraclemensia) INCURVARIIDAE

Prolegs well developed; crochets in 2 transverse bands, with never more than 8 crochets in a band; ocellus 6 usually missing; setae at distal end of tarsi usually spatulate (early instars form serpentine mines, later instars are external skeletonizers) ....(Bucculatrix) LYONETIIDAE

43(41). Abdominal spiracles and SD2 encircled by dark sclerotized spots; from 1 to 14 crochets arranged in a lateroseries (borers in stems of wheat and other grasses).................................. OCHSENHEIMERIIDAE*

Abdominal spiracles and SD2 without dark sclerotized spots; less than 5 crochets in transverse bands on each proleg...44

44(43). A10 with crochets divided by a gap into 2 groups (Fig. 13); prolegs well developed on A3-6 & 10 (varied habits)..................................(part) GELECHIIDAE

A10 with crochets never divided by a gap into 2 groups; all prolegs rudimentary (construct portable cases and mine or feed externally on leaves, flowers, fruits, seeds..........................(part) COLEOPHORIDAE

45(37). TII & TIII with SV group bisetose..........................46

TII & TIII with SV group unisetose..........................47

46(45). Prothoracic shield including the L (prespiracular) group and the spiracle (Fig. 26); all 6 ocelli present and easily visible, and with ocelli 1-5 evenly spaced; thoracic legs large and heavily sclerotized (polyphagous feeders constructing portable bags)..........PSYCHIDAE

Prothoracic shield excluding the L group and the spiracle which are often on their own well-sclerotized pinaculum; usually with at least 3, sometimes all 6 ocelli missing; if more than 3 are present, then 1 & 2 are conspicuously separated from 3, 4 & 5 (Fig. 85); thoracic legs not conspicuously large (feeders on dried animal and vegetable matter, sometimes constructing cases)........................(Tineinae) TINEIDAE

47(46). A3 with L1 or L2 closer to the spiracle than L1 and L2 are to each other (Fig. 105), or distances equal (Fig. 103), or L2 absent..48

A3 with L1 & L2 closer to each other than either is to the spiracle (Fig. 3)..................................52

48(47) With fewer than 5 ocelli present on each side of the head 49

With at least 5 ocelli present on each side of the head.....50

49(48). A3 with SD2 almost as large as SD1 and with L1 much closer to the spiracle than L2; body elongate and covered with minute spinules arranged in vertical rows; (scavengers, may construct silk galleries in fungus)...(1 species in U.S., Oinophila v-flava) OINOPHILIDAE*

A3 with SD2 much smaller than SD1 and with L1 & L2 more nearly equidistant from the spiracle (Fig. 103); body not fitting above description (mostly feeders in fungus or decaying wood, occasionally found in dried food products)...............(part, Nemapogoninae) TINEIDAE

50(48). Ocelli 2 & 3 farther apart than ocelli 1 & 2, distance between 2 & 3 at least 3x distance between 1 & 2 (Fig. 85); A3 with L1 more caudad than ventrad of the spiracle (Fig. 105)...........(part, Nemapogoninae) TINEIDAE

Ocelli 1,2, 3 more evenly spaced, distance between 2 & 3 less than 3x distance between 1 & 2; A3 with L1 ventrad or caudo-ventrad of the spiracle (Fig. 103) 51

51(50). A3 with L2 absent; thoracic legs with the claw elongate, narrow, not recurved at tip; prolegs on A3 smaller and farther apart than those on A4-6 (leaf miners) ....(Bedellia) LYONETIIDAE
A3 with L2 present; thoracic legs with the claw short and conspicuously recurved at tip; prolegs not as above (varied habits, may form tube-like shelters on foliage)..............(Plutellinae, part) YPONOMEUTIDAE

52(47). Distance between coxae on TIII greater than 1.5x the width of the coxa base 53
Distance between coxae on TIII less than 1.5x the width of the coxa base 56

53(52). Fronto-clypeus open behind (Fig. 65); ocelli difficult to count but head appearing to have 2 dark "eyespots" on each side of the head (Fig. 66; leaf miners) ....(part) LYONETIIDAE
Fronto-clypeus closed behind; ocelli easy to count, with at least 5 on each side of the head..................54

54(53). A3 with D1 & D2 adjacent, distance between the two D1 setae at least 4x distance between D1 & D2 (Fig. 109; leaf miners).......................(Lampronia) INCURVARIIDAE*
A3 with D1 & D2 farther apart, distance between the two D1 setae less than 4x distance between D1 & D2............55

55(54). Ventral side of TI without darkened sclerotized spots (leaf miners of Cosmopterygidae and Momphidae, Cosmopteryx, Aeaea, etc.; and cosmopterygid borers in stems and seeds of cattail); may be impossible to key further)............(synoptical key) 75-88
Ventral side of TI with darkened sclerotized spots ....(Coelopoeta) ELACHISTIDAE*

56(52). Ocelli 2 & 3 farther apart than ocelli 1 & 2, distance between 2 & 3 at least 3x distance between 1 & 2 (Fig. 85)...57
Ocelli 1, 2, & 3 more evenly spaced, distance between 2 & 3 less than 3x distance between 1 & 2................58

57(56). Head prognathous, dorso-ventrally flattened; ocellus 6 about as far from ocelli 3, 4, & 5 as it is from ocelli 1 & 2 (Fig. 75); A9 with D1 closer to SD1 than to D2 or equidistant between SD1 and D2; D1 and D2 never on the same pinaculum (leaf miners) ....(Lyonetia) LYONETIIDAE

Head semi-prognathous or hypognathous, not conspicuously dorso-ventrally flattened; ocellus 6 much closer to ocelli 3, 4, & 5 than to ocelli 1 & 2; A9 with D1 & D2 closer to each other than either is to SD1, and sometimes on a single pinaculum (Fig. 113; web spinners and stem borers on various hosts) ....(Heliodines) HELIODINIDAE*

58(56). Prolegs elongate, peglike, at least 3x longer than wide (Fig. 9)..59

Prolegs not conspicuously elongate, less than 3x longer than wide 64

59(58) Tarsi conspicuously slender and elongate (Fig. 94); head with setae A1, A2 & A3 forming an obtuse angle (Fig. 89); A9 with D1 usually missing, and with SD1 without the usual seta base or pinaculum, but with a sclerotized ring around the seta base (Fig. 92); SD2 absent on A9; (skeletonizers in rolled, folded, or webbed leaves)......................(part) GLYPHIPTERYGIDAE

Tarsi not conspicuously slender and elongate; head with setae A1, A2 & A3 forming an acute angle (Fig. 86); A9 with D1 always present, and SD1 not modified as above; SD2 sometimes present on A9 (found on Persea) ....(Urodus) YPONOMEUTIDAE

60(24). TI with L (prespiracular) group unisetose or bisetose.......61

TI with L (prespiracular) group trisetose..................63

61(60). TII & TIII with SV group bisetose; A1-8 with deep folds below the spiracles; most setae on chalazae ....(Lactura) YPONOMEUTIDAE*

TII & TIII with SV group unisetose; not fitting combination of other characters...............................62

62(61). A8 with SD1 cephalad of the spiracle (Fig. 111); A9 with D1 nearly equidistant between SD1 & D2 (Fig. 115) (1 species, southeastern U.S.) ....HYBLAEIDAE*
A8 with SD1 more nearly dorsad than cephalad of the spiracle (Fig. 110); A9 with D1 usually closer to SD1 than to D2 (Fig. 117) (abundant, widespread, varied habits)....................................(most) PYRALIDAE

63(60). Prothoracic shield including the L (prespiracular) group ....(Paraprays) GLYPHIPTERYGIDAE
Prothoracic shield excluding L (prespiracular) group, which is often on its own well sclerotized pinaculum......64

64(63). A1-7 with L1 & L2 distinctly cephalad of the spiracle, usually farther cephalad than D1; body elongate...........65
A1-7 with L1 & L2 more ventrad of the spiracle, never farther cephalad than D1; body variable...................66

65(64). A10 with 9 or fewer setae on each side below the transverse anal slit (including the proleg).............(Symmoca) SYMMOCIDAE*
A10 with 10 or more setae on each side below the transverse anal slit (including the proleg).............(a few) GELECHIIDAE

66(64). TII & TIII with L1 equidistant between L2 & L3, or closer to L3, or L3 absent; prothoracic shield usually elevated, bearing a roughened caudal area (cornicula); A8 with spiracle often distinctly near the caudal margin of the segment (mature larvae may exceed 50 mm.; borers in wood, roots, stems)........(part) COSSIDAE
TII & TIII with L1 closer to L2 than to L3; prothoracic shield never elevated or bearing cornicula; A8 with spiracle usually located near the center of the segment, or only slightly caudad of center..................67

67(66). A10 prolegs with crochets divided by a gap into two groups, forming a broken row (Fig. 13)....................68
A10 prolegs with crochets in a continuous row, not divided by a gap...69

68(67). A3-6 with crochets interrupted on mesal side by a lobe, forming a lateropenellipse; A8 with SD1 cephalad of the spiracle (Fig. 111) ....(Setiostoma) STENOMIDAE

A3-6 with crochets usually in a complete circle, A8 with SD1 more nearly dorsad of the spiracle (Fig. 110)

(leaf rollers, leaf tiers, leaf miners, gall makers, or in stored products)....................(part) GELECHIIDAE

69(67). A9 with L group trisetose, arranged in a nearly horizontal line and with SD1 closer to L group than to D1 (Fig. 114; primarily foliage feeders on oak) ....(Antaeotrichia) STENOMIDAE

A9 with L group variable in number, but if more than 1 is present, they are never arranged in a horizontal line, SD1 variable in position............................70

70(69) A9 with D1 closer to SD1 than to D2 (Fig. 117), and with the D2 setae on a common mid-dorsal pinaculum or closer to each other than each is to its associated D1 (Fig. 112); (leaf rollers, leaf folders, borers in fruits, seeds, stems, a few webworms; most TORTRICIDAE, PHALONIIDAE, may be impossible to key further..............................(synoptical key) 75-88

A9 with D1 more nearly equidistant between SD1 and D2, or closer to D2 (Fig. 113), and with the D2 setae rarely on a common mid-dorsal pinaculum, or closer to D1 than they are to each other...........................71

71(70). Anal comb present (many TORTRICIDAE, GELECHIIDAE) ....(synoptical key) 75-88

Anal comb absent..72

72(71). A9 with 3-20 setae in the SV group (many OECOPHORIDAE, ETHMIIDAE, may be impossible to key further ....(synoptical key) 75-88

A9 with not more than 2 setae in SV group..................73

73(72). A10 with more than 9 setae on each side below the transverse anal slit (including the proleg) many COSMOPTERYGIDAE, OECOPHORIDAE, ETHMIIDAE, GELECHIIDAE, may be impossible to key further ....(synoptical key) 75-88

A10 with 9 or fewer setae on each side below the transverse anal slit (including the proleg)...............74

74(73). Seta SD1 on A1-8 with a sclerotized semi-circular ring encircling its base (Fig. 93); ocelli 3 & 4 almost touching, closer to each other than either is to nearby ocelli (Fig. 35).................(most) BLASTOBASIDAE

Without the above combination of characters:

(many) COSMOPTERYGIDAE (C)
(many) MOMPHIDAE (M)
(many) WALSHIIDAE (W)
(few) BLASTOBASIDAE (B)
(many) OECOPHORIDAE (O)
(very few) ETHMIIDAE (E)
(many) GELECHIIDAE (G)
(few) STENOMIDAE (S)
(very few) TORTRICIDAE (T)
(very few) PHALONIIDAE (P)*

(May be impossible to key further)....(synoptical key) 75-88

75. (55, 70, 71, 72, 73, 74). Fronto-clypeus:

a- extends all the way to the epicranial notch, or nearly (Fig. 79).....	.C.M.W. .O. .G. . . .
b- extends 1/2 to 3/4 to the epicranial notch (Fig. 78).................	.C.M.W.B.O.E.G.S.T.P.
c- extends less than 1/2 to the epicranial notch (Fig. 77)............	. .M.W.B. .E. .S. . .

76. Ocelli 4 & 5:

a- farther apart than ocelli 3 & 4, distance between 4 & 5 at least 2x distance between 3 & 4 (Fig. 88)...	.C. . . . . . . .S. . .
b- not farther apart than ocelli 3 & 4; 3, 4, & 5 more evenly spaced ...	.C.M.W.B.O.E.G.S.T.P.

77. Seta A2 on head:
a- closer to A1 than to A3 (Fig. 89).. .C.M.W.B.O.E.G.S.T.P.
b- equidistant, or nearly, between A1 & A3 (Fig. 91).................... .C.M.W. . .E.G. .T.P.
c- closer to A3 than to A1 (Fig. 84).. . . . . . . .G. . . .

78. Seta A3 on head:
a- closer to A2 than to L1 (Fig. 84).. . .M. . . . .G. . . .
b- equidistant between A2 & L1 (Fig. 91) .... .C.M.W. .O.E.G. .T.P.
c- closer to L1 than to A2 (Fig. 89).. .C.M. .B.O.E.G.S.T.P.

79. Distance between TIII coxae:
a- greater than 1.5x the width of a coxa............................. .C. .W. . . .G. . . .
b- less than or equal to 1.5x the width of a coxa................... .C.M.W.B.O.E.G.S.T.P.

80. A8 with seta SD1:
a- more nearly dorsad than cephalad of spiracle (Fig. 110)............. .C.M.W.B.O.E.G.S.T. .
b- more nearly cephalad than dorsad of the spiracle (Fig. 111)........... .C. . . .O. .G.S.T.P.

81. A9 with seta D2:
a- more nearly dorsad that caudal of D1 (Fig. 110)..................... .C.M.W. .O. .G.S.T.P.
b- dorso-caudad of D1 (Fig. 114)....... .C.M. .B.O.E. .S.T. .
c- more nearly caudad than dorsad of D1 (Fig. 115)..................... . . . . . .E. . . . .

82. A9 with L group:
a- unisetose .... .C.M.W. . . . .
b- bisetose .... .C.M.W. . . .G. .T.P.
c- trisetose .... .C.M. .B.O.E.G.S.T.P.

83. A9 with L1 & L2:

a- very close together, distance between L1 and next seta below (either L3 or SV1) at least 3x distance between L1 & L2 (Fig. 117)... .C.M. . .O.E.G. .T.P.

b- farther apart, distance between L1 and next seta below (L3 or SV1) equal to or greater than distance between L1 & L2 (Fig. 115)... . .M. .B. . .G.S.T.P.

84. A9 with L setae (if less than 3, go to 85):

a- all 3 close together, distance between any 2 L not more than 1/3 distance between any L and SD or any L and SV (Fig. 113)............ . . . . . . .G.S.T.P.

b- all 3 farther apart, distance between any 2 L greater than 1/3 distance between any L and SD or any L and SV (Fig. 115)......... .C.M.W.B.O.E.G.S.T. .

85. Anal comb:

a- present.......................... . . . . . . .G. .T.P.

b- absent........................... .C.M.W.B.O.E.G.S.T.P.

86. Crochets:

a- uniordinal........................ .C.M.W.B.O. .G. .T.P.

b- biordinal or triordinal........... .C.M. .B.O.E.G.S.T.P.

87. Crochets on A3-6 arranged:

a- in transverse bands............... .C. . . . . .G. . . .

b- in a lateropenellipse............. . .M. . . . .G. . . .

c- in a mesopenellipse .... .C. . . . .E.G.S. . .

d- in a complete circle .... .C.M.W.B.O.E.G.S.T.P.

88. Spiracles:

a- circular.......................... .C.M.W.B.O. .G. .T.P.

b- elliptical .... .C. .W.B.O.E. .S. . .

89(23). TI with L group unisetose or bisetose......................90
TI with L group trisetose...................................92

90(89). A5 with prolegs absent or conspicuously smaller than A6 prolegs (loopers; exposed feeders on foliage of deciduous plants)........................(part) GEOMETRIDAE
A5 prolegs as large as A6 prolegs...........................91

91(90). Transversely striped and spotted black by large contrasting pinacula or chalazae; A8 gibbose (humped); no conspicuous granules or spinules present on cuticle (external feeders on grape, virginia creeper, etc.)..AGARISTIDAE
May be longitudinally or transversely striped; if transversely striped A8 is not gibbose, and prominent chalazae are absent; conspicuous spinules or granules often present on cuticle (mostly external feeders, a few subterranean)................(part) NOCTUIDAE

92(89). A3 with L1 or L2 closer to the spiracle than to each other, or distances equal (Figs. 103, 105); crochets uniordinal.................(many Plutellinae) YPOMONEUTIDAE
A3 with L1 & L2 closer to each other than either is to the spiracle; crochets uniordinal, biordinal, or triordinal...93

93(92). TII & TIII with SV group unisetose; prolegs usually not conspicuously elongate; cuticle without spinules resembling secondary setae; (feeders in a web in flowers and on leaves of Hydrophyllaceae and Boraginaceae)...........................(a few) ETHMIIDAE
TII & TIII with SV group at least bisetose; prolegs elongate, peglike (Fig. 120); cuticle usually with numerous conspicuous spinules which may resemble small secondary setae (leaf tiers, folders, skeletonizers, or stem borers).................(part) PTEROPHORIDAE

94(21). A2 and A7 with pairs of ventral lobes resembling prolegs but lacking crochets; head retracted into prothorax; setae long, hairlike, in dense tufts (foliage feeders on shrubs and trees)..................MEGALOPYGIDAE
A2 and A7 without conspicuous ventral lobes; head retracted or not; secondary setae variable................95

95(94). Prolegs and crochets absent on A3 (mature larvae not more than 20 mm., feeders on foliage of various hosts, constructing a weak shelter formed from a folded leaf or webbed terminals)....................NOLIDAE*
Prolegs and crochets present on A3..........................96

96(95). Crochets uniordinal.......................................97
Crochets biordinal or triordinal............................104

97(96). Crochets in a heteroideous mesoseries (Fig. 56).............98
Crochets in a homoideous mesoseries (Fig. 11)..............100

98(97). TII & TIII with at least 4 verrucae between coxa and mid-dorsal line (SD and D verrucae separated, Fig. 99), (foliage feeders on wide variety of plants, favoring herbaceous plants).............................. ARCTIIDAE
TII & TIII with only 3 verrucae between coxa and mid-dorsal line (SD and D verrucae fused, Fig. 100).......99

99(98). A7 with verruca L1 the same distance or only slightly farther from spiracle as the same verruca on A1-6; distance from spiracle to verruca on A1-7 usually not more than the diameter of the verruca (Fig. 101), (mostly feeders on grasses, lichens, oleander)...CTENUCHIDAE
A7 with verruca L1 distinctly farther from spiracle than L1 on A1-6; distance between spiracle and L1 on A7 usually greater than the diameter of the verruca (Fig. 102); known hosts include _Beaucarnea_, bluebell)..........................PERICOPIDAE*

100(97). Spiracles small, more nearly circular than elliptical......101
Spiracles large, elliptical..............................102

101(100). A3 with verricules, 4 per side (D, SD, L, SV), and usually with more than 12 setae on a verricule; crochets in a mesoseries on a lobate planta (Fig. 122); skeletonizers on deciduous plants including viriginia-creeper and grape)............................ZYGAENIDAE

A3 with verrucae, at least 6 per side (D1, D2, SD, at least 2 L, and 1 SV), and usually with not more than 12 setae on a verruca; crochets usually in a meso-penellipse on an elongate planta (Fig. 120) ....(part) PTEROPHORIDAE

102(100). Dorsal meson of A7 (and sometimes A6) with an eversible gland; secondary setae usually in tufts of different lengths and density on verrucae; often with mid-dorsal pencils on A1-4, (feeders on deciduous trees, many are forest defoliators)..................LYMANTRIIDAE

Dorsal meson never with an eversible gland; secondary setae variable, if on verrucae, then tufts usually of similar length; mid-dorsal pencils never present on A1-4...103

103(102). Labral notch shallow, extending less than 1/2 the distance to the base of the labrum (Fig. 80); spinules never conspicuous on cuticle; (feeders on plantain, dandelion).........................(Holomelina) ARCTIIDAE

Labral notch usually deeper, extending at least 1/2 the distance to the hase of the labrum (Fig. 81); spinules usually conspicuous on cuticle; (general feeders on deciduous and evergreen foliage) ....(many Acronyctinae, Pantheinae) NOCTUIDAE

104(96). TI with a mid-dorsal osmeterium (osmeteria may be inverted into prothorax: look for elongated transverse mid-dorsal slit on anterior part of thorax) ....(a few) PAPILIONIDAE

TI without an osmeterium.................................105

105(104). A8 with at least 1 mid-dorsal horn, scolus, chalaza, tubercle, or verruca.................................106

A8 without a mid-dorsal horn, scolus, chalaza, tubercle, or verruca.................................108

106(105). A7 (and usually A1-6) with a mid-dorsal scolus; a ventral prothoracic gland usually present; crochets usually triordinal (feeders on wide variety of herbaceous and woody plants)..........................(most) NYMPHALINAE
A7 (and A1-6) without a mid-dorsal scolus; ventral prothoracic gland absent; crochets biordinal..............107

107(106). A9 with a mid-dorsal scolus or tubercle
................................(Hemileucinae) SATURNIIDAE
A9 without a mid-dorsal scolus or tubercle
................................(Saturniinae) SATURNIIDAE

108(105). Scoli present; verrucae, verricules, and pinacula usually absent...109
Scoli absent; either verrucae, verricules, or pinacula present..110

109(108). A9 with a mid-dorsal scolus; dorsal scoli on TII (*Anisota*, *Dryocampa*) or on TII & TIII (other genera) much longer than scoli on abdominal segments (feeders on deciduous trees and shrubs)..............(Citheroniinae) SATURNIIDAE
A9 without a mid-dorsal scolus; dorsal scoli on TII & TIII if present, not conspicuously longer than abdominal scoli (feeders on herbaceous & deciduous plants)
....(part) NYMPHALINAE

110(108). Row of crochets interrupted or reduced in size near center by a lobe (Fig. 10); A3 with 2 distinct verrucae ....(Riodininae) LYCAENIDAE*
Row of crochets not interrupted, no lobe present on prolegs; A3 with more than 2 verrucae which may resemble pinacula or may be obscured by numerous long secondary setae.................................128

111(22). Planta cylindrical and elongate (Figs. 37, 120); mature larvae small, rarely over 20 mm........................112
Planta never cylindrical, either rudimentary or reduced to a lobe at the distal end of the proleg base (Figs. 54, 122); mature larvae usually over 20 mm..............113

112(111). Thoracic segments with SV setae always conspicuous and larger than surrounding secondary setae, and bisetose on TII & TIII; (stem borers or foliage feeders within a webbed mass)........................(part) PTEROPHORIDAE
Thoracic segments either with SV setae obscured by numerous secondary setae of same length, or if SV setae are conspicuous then they are unisetose on TII & TIII (Fig. 36); (fruits, stems, berries of apple, hawthorne, _Aronia_, or seed pods of _Croton_)..................................BLASTODACNIDAE

113(111). Crochets in a complete circle, or with 1 or 2 small gaps in an otherwise continuous row (gaps always less than 1/3 the circumference of the projected circle).....114
Crochets in a mesoseries or a mesoseries plus a lateroseries; if a mesoseries resembles a mesopenellipse, then the gap free of crochets is at least 1/3 the circumference of the projected circle (a few widely spaced isolated crochets may be present on the lateral side of the proleg)............................115

114(113). Head distinctly larger than prothorax in profile (Fig. 49); anal comb usually present (Fig. 48) (mature larvae usually less than 40 mm., external feeders on grasses, herbacious plants, usually constructing shelters)........................HESPERIIDAE
Head equal to or smaller than prothorax in profile; anal comb absent (mature larvae large, 50 mm. or more, borers in _Yucca_ stems and leaves; southwestern U.S.)................................MEGATHYMIDAE*

115(113). Ocelli 1, 2, 3, grouped together with ocellus 3 about 2x larger than the others, and with 4, 5 & 6 spaced farther apart (Fig. 51); anal plate usually bifurcate at tip (Fig. 50); mandibles usually thick, quadrate, lacking teeth, but with ventral sharp cutting edges (external feeders on grasses) ....(Satyrinae) NYMPHALIDAE

Ocelli not arranged as above, and ocellus 3 not conspicuously larger than others; anal plate not bifurcate; mandibles not modified as above..............116

116(115). Crochets uniordinal...117

Crochets biordinal or triordinal...........................118

117(116). Labral notch deep, v-shaped, and usually continued as a groove to the base of the labrum (Fig. 82); caudal prolegs usually smaller than ventral prolegs, and may be without crochets ....(Melalopha, Ichthyura, Datana) NOTODONTIDAE

Labral notch u-shaped with parallel sides, and never continued as a groove to the base of the labrum (Fig. 81); caudal prolegs never conspicuously smaller than ventral prolegs, and always with crochets ....(many Acronyctinae, Hadeniinae) NOCTUIDAE

118(116). Long fleshy filaments or osmeteria present (osmeteria may be inverted into prothorax: look for elongated transverse mid-dorsal slit on anterior part of prothorax)......................................119

Filaments and osmeteria absent; no mid-dorsal slit present on anterior part of prothorax..................122

119(118). TII with at least one pair of long fleshy filaments; osmeterium present or absent; a lateroseries of crochets never present..................................120

TII without fleshy filaments; osmeterium always present on TI; a lateroseries of crochets sometimes present..121

120(119). Larva with transverse black and green stripes on all segments and head; osmeterium absent; lateral and subventral lobes or filaments on abdominal segments absent; all pairs of filaments dorsal or subdorsal in position (feeders on milkweed, oleander, fig, and other plants)....................(Danainae) NYMPHALIDAE
Larvae black with dorsal rows of white spots; osmeterium present; with long lateral filaments on thoracic segments and smaller lateral and subventral filaments on abdominal segments (feeders on pipe-vine)...........................(Battus) PAPILIONIDAE

121(119). Thoracic and abdominal segments with pinacula in the positions of primary setae with each pinaculum bearing 4 to 6 short setae; larva black with dorsal and subdorsal rows of white spots (feeders on violet, stonecrop, Sempervivum, occurs in Alaska and mountainous regions of western North America) ....(Parnassius) PAPILIONIDAE*
All segments lacking pinacula; coloration variable, may be aposematic or cryptic (wide variety of hosts, wide distribution....................(Papilio) PAPILIONIDAE

122(118). A8 with at least one mid-dorsal horn, chalaza, tubercle, or scar...123
A8 without a mid-dorsal horn, chalaza, tubercle, or scar...124

123(122). Abdominal segments divided into 6 to 8 annulets (folds) (Figs. 49, 54); distances between bases of prolegs usually no greater than length of each mesoseries of crochets (hornworms, variety of hosts) ....(part) SPHINGIDAE
Segments not divided into 6 to 8 annulets; distance between bases of prolegs greater than length of each mesoseries (domestic silkworms)...........BOMBYCIDAE*

124(122). Segments divided into 6 to 8 annulets (Figs. 49, 54)......125
Segments not divided into 6 to 8 annulets.................126

125(124). Head equal to or larger than prothorax in profile; anal comb usually present; most setae on chalazae (Fig. 53; many hosts but favor Cruciferae and Leguminoseae)......................PIERIDAE

Head smaller than prothorax in profile; anal comb never present; setae rarely on chalazae (head sometimes triangular in shape with a conical epicranium; variety of hosts)...............(part) SPHINGIDAE

126(124). Secondary setae short, stiff, bristle-like; if primaries are present, then secondaries always shorter than primaries..127

Secondary setae long, flexible, usually obscuring primaries..128

127(126). Row of crochets reduced in size or interrupted near center by a conspicuous fleshy pad (Fig. 10); head smaller than prothorax and retractible (external feeders on foliage, myrmecophilous, or predaceous on Homoptera)..................................LYCAENIDAE

Row of crochets not interrupted by a fleshy pad; head not retractible (1 widespread species, _Libythea bachmani_ Kirtland, hosts are hackberry, _Symphoricarpos occidentalis_)...................LIBYTHEIDAE*

128 (126, 110). A2-8 and sometimes TII & TIII with mid-dorsal tufts of dark setae (feeders on deciduous trees and shrubs; only 2 genera in U.S., _Ocleclostera_, _Apatelodes_) ....APATELODIDAE

With no-mid-dorsal tufts of setae on any segment (general deciduous feeders, may feed gregariously in tents).................................LASIOCAMPIDAE

129(22). A6 with the proleg base (the part bearing the SV group) extensively developed, forming the greater part of the proleg; planta usually modified as a lobe at the distal end of the basal part, never cylindrical or rudimentary (Figs. 121, 122, 123); crochets usually in a mesoseries (external-feeding and cutworm-type Macrolepidoptera).....................130
A6 with the proleg base (the part bearing the SV group) flat or rudimentary, not forming the greater part of the proleg; planta rudimentary or cylindrical (Figs. 118, 119, 120); crochets in a complete circle, mesopenellipse, or transverse bands (mostly internal-feeding Microlepidoptera)........138

130(129). L1 (seta or pinaculum) farther from the spiracle on A7 than on A1-6, or with L1 on A1-6 caudad of the spiracle and L1 on A7 caudo-ventrad of the spiracle (Fig. 106); T1 with SD1 usually thinner and shorter than SD2..131
L1 (seta or pinaculum) nearly the same distance from the spiracle and in the same position on segments A1-7; T1 with SD1 never thinner or shorter than SD2, usually larger than SD2.................................135

131(130). TI with SD1 & SD2 very close together and excluded from the prothoracic shield (Fig. 97) (SD setae may be on their own pinaculum which may also have a few extra setae).......................................132
TI with SD1 & SD2 included on the prothoracic shield......134

132(131). A10 with 1 to 4 extra setae near the anterior margin of the segment and located approximately as high as as SD1 on A9 (Fig. 116); labral notch usually acute, v-shaped, and continued as a groove to the base of the labrum (Fig. 82)...........................133
A10 with no setae near the anterior margin of the segment (setae confined to prolegs and anal shield); labral notch never v-shaped or continued as a groove to the base of the labrum...(a few Acronyctinae) NOCTUIDAE

133(132). Caudal prolegs often modified into caudo-projecting processes, or smaller than ventral prolegs (reliable charcters separating dioptids and notodontids are lacking, check descriptions); family of widespread distribution and many common species, some are forest defoliators.............(part) NOTODONTIDAE
Caudal prolegs never modified as above, and rarely smaller than ventral prolegs; distribution confined to California and southwestern U.S., 1 common species, the California oakworm (Phryganidia californica), and a few (?) rare species..........DIOPTIDAE*

134(131). Crochets in a homoideous mesoseries; TII & TIII with L1, L2, & L3 on a single large pinaculum (Fig. 98) ....(Lithosiinae, Hypoprepia) ARCTIIDAE
Crochets in a heteroideous mesoseries; TII & TIII with L1 & L2 on a single pinaculum, and L3 on a separate weak pinaculum ....(Utetheisa) ARCTIIDAE

135(130). Prolegs bearing a complete set of crochets present only on A6 & A10, if prolegs are present on A3-5, then they are smaller and have fewer crochets than the prolegs on A6 ("loopers," external feeders on deciduous foliage........................(most) GEOMETRIDAE
Prolegs bearing a complete set of crochets present on A3-6 & 10 and all nearly equal in size..................136

136(135). Thoracic segments with more than 2 setae on each SV pinaculum; A3 with 2 to 3 extra setae caudad of the spiracles, and with 3 to 7 setae on the L pinaculum, just above the proleg......................(Doa) DIOPTIDAE
Thoracic segments with no more than 2 setae on each SV pinaculum; other extra setae not located in positions as above or not as numerous as above...................137

137(136). TI with SD1 & SD2 excluded from the prothoracic shield; A3 with more than 4 setae between spiracle and proleg (feeders on deciduous foliage, may construct loose folded leaf shelter)..............THYATIRIDAE*
TI with SD & SD2 included on the prothoracic shield; A3 with only 4 setae between spiracle and proleg (L1, L2, L3, L4) (feeders on Vibernum, honeysuckle; construct webs in early instars).......EPIPLEMIDAE

138(129). Crochets in a biserial or multiserial complete circle (Fig. 20; borers in roots, stalks, stems) ....HEPIALIDAE*
Crochets in a uniserial complete or incomplete circle.....139

139(138). Ocelli 4 & 5 farther apart than ocelli 3 & 4 (Fig. 88), distance between 4 & 5 usually much greater than the diameter of ocellus 4...............................140
Ocelli 4 & 5 not conspicuously farther apart than ocelli 3 & 4 (Fig. 85), distances between 3, 4, & 5 usually equal to or less than the diameter of ocellus 4...141

140(139). TI with L group bisetose; TII & TIII with L1 closer to L2 than to L3 (4 species in southern U.S., late instars construct portable cases of leaves and silk)...MIMALLONIDAE*
TI with L group trisetose; TII & TIII with L1 equidistant between L2 & L3, or closer to L3, or L3 absent (widely distributed, borers in wood, roots, stems)..................................(part) COSSIDAE

141(139). Crochets uniordinal.......................................142
Crochets biordinal or triordinal..........................144

142(141). TI with L group bisetose; A8 with the spiracle closer to the dorsal midline than the spiracles on A1-7 (Fig. 108); submentum with paired flaps or protuberances on caudal half (may be difficult to see) (within fruits of hawthorn, barberry, wintergreen) ....CARPOSINIDAE*
TI with L group trisetose; A8 with spiracle usually as far from the dorsal midline as spiracles on A1-7; submentum never with paired flaps or protuberances......143

143(142). TII & TIII with SV group bisetose; prolegs often longer than wide (Fig. 120)...........(part) PTEROPHORIDAE
TII & TIII with SV group unisetose; proleg usually shorter than wide; (miners and webbers on Sphacele, Lantana)..........................(Anoncia) COSMOPTERYGIDAE*

144(141). SD1 on A1-7 with its base set in a conspicuous pale area, ringed with dark brown (Fig. 92); SD1 on A8 usually thinner than SD1 on A1-7; prothoracic shield, D, SD, and L pinacula often with secondary setae (miners in grasses and webspinners in flower heads of thistle)..SCYTHRIDAE

SD1 on A1-7 with its base not modified as above, but sometimes on a well sclerotized pinaculum; SD1 on A8 not thinner than SD1 on A1-7; prothoracic shield, D, SD, and L pinacula never with secondary setae ....(part) ETHMIIDAE

D. DIAGNOSTICS OF THE SUPERFAMILIES AND TAXONOMIC OBSERVATIONS

Most of the problems with older suborder groupings of the Lepidoptera (Comstock 1892, Tillyard 1926, Meyrick 1895) have been reviewed by Hinton (1946) and Common (1970, 1975). The new system recognizes 5 suborders, based on all stages of development: the Zeugloptera (Micropterygoidea), Dacnonypha (Eriocranioidea), Monotrysia (Nepticuloidea, Incurvarioidea), Exoporia (Hepialoidea), and Ditrysia (the rest of the Lepidoptera, 16 superfamilies). At the family and subfamily levels, arrangements differing from those found in Forbes (1923), McDunnough (1938, 1939), and Peterson (1956) are based on more recent literature. These changes are discussed briefly.

Suborder Zeugloptera

Based on larval characters some workers believe the Micropterygidae should be excluded from the Lepidoptera. Hinton (1958) listed 12 attributes of micropterygid larvae which separate them from all other Lepidoptera. The most important are: a) the head lacks ecdysial lines, b) a distinct spinneret is absent, c) thoracic legs with fused coxa, trochanter, and femur, d) abdominal prolegs lack muscles, e) functional metathoracic spiracles are present, f) the chaetotaxy and structure of the setae are quite different from the rest of Lepidoptera. The Zeugloptera are thought to be more archaic than the Lepidoptera and the Trichoptera, and if they are to be included in the Lepidoptera, the Trichoptera must also be included (Hinton, 1946). However, on the basis of pupal and adult morphology, there are no grounds for separating the Zeugloptera from the Lepidoptera (Common 1975).

Suborder Dacnonypha

The Dacnonypha was proposed by Hinton (1946) to include the Eriocraniidae, Neopseustidae (exotic), and the Mnesarchaeidae (exotic). Characters distinguishing them from all other Lepidoptera are: larva with ecdysial lines joining anterior margin of the head behind the antennae such that the antennae and seta A1 are included in the adfrontal area, and body apodous (without legs & prolegs); pupa exarate (with free and movable appendages) and decticous (with functional mandibles); adult with homoneurous venation, aculei present, wings coupled with fibula, and females with a single genital opening (monotrysian).

Suborder Monotrysia

The Monotrysia was first proposed by Borner (1939) to include all Lepidoptera with a single genital opening: the Micropterygidae, all Homoneura, and a few Heteroneura. Hinton included the Hepialoidea, Nepticuloidea, and the Incurvarioidea in the suborder, and excluded the Zeugloptera and Dacnonypha. Common (1975) pointed out important differences between the 3 superfamilies included in the suborder by Hinton and objected to their close association. He proposed a new suborder for the Hepialoidea based mainly on the recent discovery of 2 genital openings in the females.

Distinguishing characters of the Monotrysia are: larva with ecdysial lines joining anterior margins of the head excluding the antennae and A1 from the adfrontal areas, and body apodous or with both legs and prolegs; pupa incomplete obtect, and adecticous; adult with heteroneurous or reduced (Nepticuloidea) venation, aculei present, wings coupled with a frenulum (Incurvarioidea) or with a frenulum & jugum (Nepticuloidea), females with a single genital opening.

Incurvarioidea

Forbes (1923) was the first to group the Prodoxinae, Adelinae, and Incurvariinae in one family, the Incurvariidae. Based on adult characters Davis (1967) raised the Adelinae to family, and left the Incurvariinae and Prodoxinae in the Incurvariidae. He thought of the Prodoxinae as a New World specialization derived from some primitive extinct incurvariine. Common (1970) raised the Prodoxinae to family rank and left the Incurvariinae and Adelinae as subfamilies of the Incurvariidae.

On the basis of larval characters, Common's arrangement is supported here. The Incurvariinae and Adelinae share many larval characters. On TI both have XD1 and D1 close together and minute, while SD1, XD2, and SD2 are close together and large. Both subfamilies have large lightly sclerotized dorsal and ventral areas on the thoracic segments. On A1-8, L1 and L2 are caudad of the spiracle with L2 closer to the spiracle than L1. Most genera have at least rudimentary prolegs with corchets in transverse bands. Both groups show a preference for a leaf mining or flower boring habit, and many construct cases. The Prodoxinae in contrast, usually have most primary setae minute. On TI SD2 is dorsad of SD1 and both are closer together than either is to XD2. The Prodoxinae also lack large dorsal and ventral sclerotized areas on TI-III. Thoracic legs are very small or absent, and both crochets and prolegs are entirely lacking. Lastly, the Prodoxinae are restricted to feeding in Yucca, and as Davis suggests, are probably closely associated with the evolution of that group.

Nepticuloidea

The Opostegidae are specialized stem miners whose taxonomic affinities have been in dispute. Forbes (1923) placed them in the Tineoidea near the Lyonetiidae and Gracillariidae. Common (1970) placed them in the Nepticuloidea, probably based on the presence of a single genital opening in the females. Heinrich (1918) pointed out unique morphological features of Opostega larval head capsules, and argued that many trends carried to extreme in Opostega are also found in Nepticula, Ectoedemia (Nepticulidae), Tischeria (Tischeriidae), Leucopterygidae, (=Lyonetiidae) and that Brenthia, Bedellia (Lyonetiidae), Gracillariidae, and Bucculatrigidae (=Lyonetiidae in part) represent morphological trends in other directions.

Suborder Exoporia

This suborder consists only of the Hepialoidea (Common 1975). Distinguishing characters of the suborder are: larva with antennae and A1 excluded from the adfrontal areas with thoracic legs and prolegs on A3-6 & 10; pupa advanced incomplete obtect and adecticous; adult with homoneurous venation, aculei present, wings coupled with a jugum and female genitalia intermediate between monotrysian and ditrysian (exoporian).

In addition, the Hepialoidea can be distinguished from the Ditrysia by chaetotaxy. The XD, D, SD, and L setae on TI are on a single large prothoracic shield; microscopic setae MD1, MSD1 & MSD2 on TII & TIII and MV3 on A1-8 are nearly as large as the tactile primary setae; the SD group on A9 is bisetose, and crochets are biserial or multiserial.

Suborder Ditrysia

Distinguishing characters of the Ditrysia are: larva with antennae and A1 excluded from the adfrontal areas, thoracic legs and prolegs (on A3-6 & 10) usually present; pupa usually complete obtect (with appendages glued to the body) and adecticous; adult with heteroneurous venation, aculei restricted or absent, wings coupled with a frenulum or a frenulum plus a reduced jugum (more primitive groups), and females with 2 genital openings (ditrysian).

Features of Ditrysian chaetotaxy which distinguish them from the Exoporia are: the L group on TI usually excluded from the prothoracic shield, all microscopic setae minute, the SD group on A9 usually unisetose, and secondary setae often present. Crochets are usually uniserial.

Tineoidea

Important characters in recognizing a tineoid larva are: Ocelli reduced in numbers or in 2 distinct groups with 1 & 2 separated from 3, 4, & 5. TI with the L (prespiracular) pinaculum encircling the spiracle, and sometimes joined to the prothoracic shield. L1 & L2 on A1-8 far apart, SD2 on A1-8 nearly as large as SD1 (Tineidae, Oinophilidae). Crochets sometimes multiserial (Acrolophinae). The relationships among the 6 families in North America are unclear. The Tineidae seem to be the most generalized group. The Gracillariidae, Ochsenheimeriidae, Oinophilidae, and Psychidae, are relatively specialized groups which may have been derived from tineid ancestors (Brock 1971). The Lyonetiidae are thought to be a heterogeneous collection of genera (Forbes 1923, Common 1970).

MacKay (1972) put Bucculatrix in a separate family, the Bucculatrigidae, on the grounds that L1 & L2 on A1-8 are far apart, whereas they are closer together in other lyonetiid genera. This character she considered "of family status". Examination of other lyonetiid genera showed this character to be more variable than she implied. Bucculatrix larvae are admittedly unusual in appearance, but they have few consistant distinguishing characters. In Lyonetia L1 and L2 are as far apart as in Bucculatrix, and in Bedellia L2 is missing. Bucculatrix may merely represent an extreme development of a

specialized larval type. According to Forbes (1923) there are no important differences between adults of Bucculatrix and other lyonetiid genera.

Hinton (1955b, 1956) recognized four subfamilies of Tineidae, and his arrangement is followed here: Acrolophinae (mainly West Indian), Scardiinae (mainly Palearctic), Nemapogoninae (cosmopolitan), and Tineinae (cosmopolitan). Many authors, including Peterson (1956) and McDunnough (1936) gave the Acrolophinae family status.

Yponomeutoidea

That the Yponomeutoidea is a heterogeneous collection of families and genera has been admitted by nearly everybody and is supported by examination of the larvae. Of the 6 families occuring in North America (no larvae of Douglasiidae were available), only the Sesiidae and Glyphipterygidae are reasonably consistant in their characters. Too few larvae of Epermeniidae and Heliodinidae were available for assessment of their relationship to other groups in the superfamily.

Consequently, larvae of the Yponomeutoidea are difficult to characterize. In many Argyresthiinae, Sesiidae, Epermeniidae, and Heliodinidae, SD2 is dorsad of SD1 on TI. The L group on TI is trisetose in most families but bisetose in the Epermeniidae. L1 & L2 are far apart on A1-8 in the Plutellinae, Yponomeutinae, and Epermeniidae, but close together in other groups. Elongate planta and tarsi are found in some Plutellinae and most Glyphipterygidae. Crochets are usually uniserial but are multiserial in some Plutellinae and Yponomeutinae.

The taxonomic affinities among genera of the Yponomeutoidae are confusing. The treatment in the key follows that of Forbes (1923) and Hodges (1971) who recognize 3 subfamilies: the Yponomeutinae consisting of the American genera Yponomeuta, Atteva, Lactura, Swammerdamia, Podiasa, Ocnerostoma, Xyrosaris, Eucatagma, Orinympha; the Plutellinae consisting of Plutella, Prays, Acrolepia, Plinioca, Euceratia, Abebaea, Trachoma, Harpipteryx, Cerostoma, Melitinympha; and the Argyresthiinae consisting of Argyresthia and Zelleria. Examination of available larvae suggested a different grouping of these genera. Atteva, Swammerdamia, Yponomeuta, and Zelleria formed one group with many shared characters, and Abebaea, Cerostoma, Acrolepia, and Plutella formed another. Argyresthia and Zelleria (the only 2 genera of Argyresthiinae) shared few characters, but Argyresthia and Acrolepia shared many. Prays shared a greater number of characters with Atteva, Swammerdamia, etc., than it did with Abebaea, Cerostoma, etc., but did not fit well into either group. Lactura shared very few characters with any of the above genera, and does not resemble any other yponomeutoid.

Castnioidea

The Castnioidea is a primitive tropical & subtropical group often thought to be ancestors of the Papilionoidea (Ehrlich 1958). Others associate them with the Tortricoidea and Cossoidea based on adult characters (Brock 1971). Larvae of the Castnioidea can be distinguished from the similar Cossoidea by their possession of irregular rows of spines rather than true crochets as in the Cossoidea.

These spines may be an intermediate condition in the development of crochets.

Cossoidea

The Cossoidea is usually regarded as one of the more primitive Ditrysian superfamilies. The venation of the adults suggests a relationship to some of the more primitive Tineoidea, but larval chaetotaxy and male genitalia suggest a relationship to the Tortricoidea (Common 1970). Important characters in recognizing a cossoid are: Ocelli 1-4 evenly spaced in a semi-circle with 5 conspicuously separated from 1-4. TI with the L group trisetose. A1-8 with L1 & L2 close together below the spiracle. Crochets are uni-, bi-, or triordinal in a transverse ellipse sometimes broken at either end. A cossoid larva sometimes has features associated with the wood-boring habit, including roughened dorsal areas (cornicula) on the prothoracic shield, and large caudo-projecting spiracles on A8.

Tortricoidea

Important characters in recognizing a tortricoid larva are: Anal comb often present on A10. A8 with SD1 usually cephalad of the spiracle. A9 with D2 usually dorsad or dorso-caudad of D1 and with the D2 setae often on a single pinaculum closer to each other than either is to its associated D1. Prespiracular group on T1 trisetose. L1 & L2 on A1-8 close together below the spiracle. Crochets uniordinal, biordinal, or triordinal, and arranged in a complete circle.

Although larvae of the Tortricoidea are usually easy to recognize, groups within the superfamily are barely separable. Neither MacKay (1959, 1962) nor Powell (1964) could find larval characters that would separate the tortricines, olethreutines, sparganothines, and phaloniids. Larval characters given in Forbes (1923) as points of distinction between the Tortricidae and Phaloniidae were: setae L1 & L2 (iv & v) on A1-8 obliquely or vertically placed in the Tortricidae but forming a horizontal line in the Phaloniidae; the SV group on A7 bisetose or trisetose in the Tortricidae, but unisetose in the Phaloniidae; and crochets multiordinal in Tortricidae, but uniordinal in the Phaloniidae. None of these differences were found to hold in the specimens examined. MacKay (1959) included two phaloniid genera, Phalonia and Hysterosia in her key to olethreutine genera because of their similarity. Possibly the Phaloniidae are not deserving of family rank.

Gelechioidea

Important characters in recognizing a gelechioid larva are: Head usually semi-prognathous (prognathous in some Elachistidae). TI with prespiracular group usually trisetose. A1-8 with L1 & L2 close together. A8 with SD1 usually dorsad of the spiracle. Crochets uniordinal, biordinal or triordinal, usually arranged in a complete circle, but may be in a mesopenellipse (some Ethmiidae, Gelechiidae, Blastodacnidae), a lateropenellipse (some Stenomidae), or in transverse bands (most Coleophoridae, some Gelechiidae). Anal comb present only in some Gelechiidae. Secondary setae sometimes present on the prothoracic shield and other pinacula (Scythridae), as extra setae in the SV group on abdominal segments (many Oecophoridae, Gelechiidae, most Ethmiidae), or as numerous tiny setae evenly distributed over the cuticle (Blastodacnidae).

Definitions and limits for many gelechioid families are far from settled. Works relied on for clarification were those of Hodges (1962, 1964, 1966, 1969, 1971, 1974), Duckworth (1964, 1973), and Powell (1973).

The Cosmopterygidae, Momphidae, and Walshiidae cannot be separated on the basis of larval characters. Specialized larval types were found only among a few leaf mining genera (Cosmopteryx, Aeaea, Perimede). Among other genera, few meaningful statements can be made about possible affinities. In the Momphidae, Batrachedra, Mompha, Chrysoclista, and Cystioecetes are similar larval types and share some characters, while Homaledra is very different and superficially resembles some Yponomeutidae.

The Coleophoridae and Elachistidae appear to be specialized groups and are among the easiest gelechioids to recognize. The Coleophoridae construct portable cases and feed either as leaf miners or externally on foliage. Morphological specializations were consistant in the species examined. The Elachistidae are miners, mostly in grasses and sedges and share consistant morphological specializations associated with the leaf mining habit. Of the adults, Braun (1948) says they have a "common aspect which assists in placing them in the family."

Although the erection of the Blastodacnidae is relatively recent, I have been unable to find its original author or definition. Hodges

(1962) referred to "Blastodacna and its allies" as a well marked group within the Momphidae but failed to mention which other genera are "allies". Clarke (1962, 1964, 1965) also failed to explain the source of the name. No earlier references to the family were found. Blastodacnid larvae are unique gelechioids in their possession of numerous small secondary setae scattered over the cuticle. This single character separates blastodacnid larvae from other closely related groups (Walshiidae, Momphidae).

Five blastobasid genera were available, (Blastobasis, Eubolepia, Valentinia, Holocera, Zenodochum), and they shared the following combination of characters: presence of a sclerotized semi-circular ring around SD1 on A1-7, (Fig. 93) SD1 on A8 thin and hairlike, ocelli 3 and 4 nearly touching and closer together than adjacent ocelli (Fig. 35), the L group on A9 trisetose with L1 & L2 on a common pinaculum (Fig. 34), A9 with SD1 pinaculum smaller than the other pinacula. The similarities among these genera suggest that Blastobasidae is a valid family.

MacKay's (1972) contention that the Scythridae are nothing more than a specialized group in the Blastobasidae is supported by larval characters. The presence of the sclerotized ring around SD1 on A1-7, the thin, hair-like SD1 on A8, and the relative positions of the L setae on A9 are all characters which most scythrids share with blastobasids. Powell(1976) agreed with MacKay, but stressed the inconsistancy of the characters.

Many Oecophoridae, Ethmiidae and Stenomidae cannot be separated by larval characters. Most of the characters by which ethmiid larvae have been distinguished from oecophorids by past authors are unreliable. Powell (1973) retained the family level for ethmiids "merely for convenience" and suggested they will be permanently placed in the Oecophoridae when the world fauna is better known. Some stenomid genera have unique sets of larval characters (Antaeotrichia, Setiostoma) but other genera may be impossible to distinguish from some Oecophoridae. Perhaps the Stenomidae should also be included in the Oecophoridae.

A single symmocid, Symmoca signatella H.-S., was examined. Although Symmoca is unusual in its appearance, several gelechiids (Stoeberhinus, Autosticha) were very similar and shared with Symmoca a modified seta base around SD1 on A1-8 (Fig. 92). Common (1970) is possibly correct in placing Symmoca in the Gelechiidae.

Copromorphoidea

Meyrick (1928) was the first to place the Carposinidae, Alucitidae and Copromorphidae (palearctic) in a single superfamily, the Copromorphoidea. Although this arrangement has been followed by most recent authors (Common 1970, Munroe 1972, Hodges 1971), the systematic position of the 3 families is in doubt. On larval characters there is little to support the close association of at least the Carposinidae and Alucitidae. Other than a bisetose L group on TI the families bear little resemblence to each other in terms of separation from other superfamilies.

Pyraloidea

Important characters in recognizing a pyraloid larva are: Head never prognathous or highly modified for leaf-mining. Prespiracular group bisetose (trisetose in Pterophoridae). The SV groups unisetose on TII & TIII (bisetose in Thyrididae). L1 & L2 on A1-8 close together and below the spiracle. SD1 on A8 above the spiracle (cephalad of the spiracle in Hyblaeidae). Biordinal or triordinal crochets arranged in a complete circle (usually a mesopenellipse in Pterophoridae). Secondary setae absent (present in Pterophoridae).

Both Common (1970) and Munroe (1972) stressed important differences among the families of the Pyraloidea: "The presence of tympanic organs (in the adults) sharply divides the Pyralidae from the other families, and neither the Pterophoridae nor the Thyrididae regularly possess any of the main characters that distinguish the Pyralidae from other lepidopterous families" (Munroe, 1972). Brock (1971) excluded the Hyblaeidae (a small mostly tropical group) from the Pyraloidea. Other authors have placed them in the Noctuidae. The Pterophoridae have certain characters in common with the pyralidae but due to their unusual adult morphology, have been placed in a separate superfamily (Brock 1971, Common 1970). Only the Thyrididae seem to be reasonably closely related to the Pyralidae.

A superfamily rank for the Pterophoridae is partially supported by larval characters. Their possession of numerous secondary setae on primary pinacula separates them from all other Pyraloidea. Most Pterophoridae have elongate prolegs with uniordinal crochets arranged in a mesopenellipse. Also, in pterophorids where primary setae are not obscured by the secondaries the L groups on TI and A9 are trisetose. In contrast, the Hyblaeidae, Pyralidae, and Thyrididae have the prespiracular group on TI bisetose, have biordinal or triordinal crochets arranged in a complete circle, and commonly have 1 or 2 L setae missing on A9.

Zygaenoidea

The Zygaenoidea is a collection of specialized larval types. There is a superficial resemblance between the Zygaenidae, Megalopygidae, and the Limacodidae, but each family has its unique set of larval characters. The Megalopygidae and Zygaenidae both have tufts of setae on verricules, a similar arrangement of ocelli, retractile heads, and tubercles near the abdominal spiracles. But they differ in arrangement and number of verricules. The Zygaenidae have lobate plantae resembling the type found in Noctuoidea, whereas the Megalopygidae have plantae and crochet rows divided by a deep fold. The Megalopygidae have pairs of ventral lobes on A2 and A7 which resemble extra pairs of prolegs. The Limacodidae have retractile heads, but otherwise do not resemble the other families. In place of verricules, they often have urticating scoli. In place of prolegs and crochets, they have suckerlike discs. Epipyropid larvae are specialized ectoparasitoids of planthoppers (Fulgoroidea), and do not resemble any other Zygaenoidea.

The Zygaenoidea may be nothing more than a heterogeneous collection of primitive ditrysian groups which developed the external feeding habit early (Forbes 1923). Brock (1971) pointed out the primitive nature of the adult zygaenoid morphology and placed the Limacodidae, Megalopygidae, and Dalceridae (a tropical group) in the Cossoidea, and the Epipyropidae in the Tineoidea, leaving only the Zygaenidae in the superfamily. His splitting of the superfamily is supported by larval characters.

Hesperioidea, Papilionoidea

The butterflies provide a good example of a progression towards an external feeding habit. Megathymid larvae bore in stems and roots of Yucca. Hesperiid larvae live in rolled or folded leaves or in a nest of several leaves. All the Papilionoidea are exposed feeders in the larval stage. Many Lycaenidae, the most specialized group of butterflies, have adopted unusual feeding habits including predation and symbiotic relations with ants. Structural changes have paralleled this progression in feeding behavior. Megathymid larvae are pale in color and although secondary setae are present, the primaries are not obscured. Hesperiid larvae are cryptically colored, and secondary setae usually obscure the primaries. Crochets in the Hesperioidea are arranged in a complete or nearly complete circle as in most internal feeding Microlepidoptera. All the Papilionoidea share with the Hesperioidea a similar pattern of secondary setation. But radiation in adaptive strategies for external feeding has occured. Papilionid larvae have developed defensive glands (osmeteria) and striking color patterns, some cryptic, others aposematic. Pierid larvae, mostly herbaceous feeders, have adopted cryptic coloration. Nymphalid larvae have adopted a variety of defense mechanisms: aposematic coloration in the Danainae, cryptic coloration in the Satyrinae, defensive spines, barbs, etc. in the Nymphalinae. Lycaenid larvae show many specialized characters including a retractible head, lobate planta, and a fusiform body shape. Crochets in the Papilionoidea are arranged in a mesoseries (sometimes a mesopenellipse in the Papilionidae), a clear adaptation to crawling about on twigs and leaves.

The classification of the Papilionoidea used in the key is that of Ehrlich (1958) who recognized five families of butterflies: Pieridae, Papilionidae, Nymphalidae, Libytheidae, and Lycaenidae. The Parnasiidae and Riodinidae were reduced to subfamilies, under Papilionidae and Lycaenidae respectively. The Danaidae and Satyridae were similarly treated under Nymphalidae.

Geometroidea

Important characters in recognizing a geometroid larva are: Head hypognathous. Secondary setae usually present either on the prolegs (Geometridae, Drepanidae), or as extra setae in fixed positions (Geometridae, Epiplemidae, Thyatiridae), or as numerous small setae evenly distributed over the cuticle (Drepanidae). SD1 & SD2 included on the prothoracic shield (excluded in the Thyatiridae). Prespiracular group bisetose on TI (trisetose in Thyatiridae). SV group bisetose on TII & TIII (unisetose in Geometridae). A1-8 with L1 & L2 far apart, with L4 present, and usually with extra SV setae. A9 with L group unisetose. Prolegs usually present on A3-6 & 10 but absent on A10 in Drepanidae and absent on A3-5 in most Geometridae. Crochets biordinal or triordinal, and arranged in a mesoseries.

Mimallonoidea

Franclemont (1973) excluded the tropical American Mimallonidae from the Bombycoidea and erected a new superfamily. The combination of a bisetose prespiracular group, a complete circle of crochets, and secondary setae confined to the SV group on A1-8 will distinguish the few mimallonids occuring in our area from the Bombycoidea.

Bombycoidea

Important characters in recognizing a bombycoid are: Head hypognathous. Secondary setae always present and profusely covering the body. In the Lasiocampidae and Apateloididae setae are as long or longer than primaries, but of irregular length. In the Saturniidae and Bombycidae, setae are usually very small and short. Primary setae are almost always obscured, and secondaries are never grouped in dense tufts on verrucae, or in pencils (except Apatelodidae). Chalazae and scoli, often profusely branched and bearing urticating spines are sometimes present (Saturniidae). Crochets are biordinal or triordinal and arranged in a mesoseries.

The Saturniidae have often been given superfamily rank, as the Saturnioidea, but the arrangement used in the key is that of Ferguson (1971). The three subfamilies of Saturniidae that occur in North America, the Saturniinae, Hemileucinae, and Citheroniinae, are very distinct and have sometimes been treated as families.

Larvae of the Lasiocampidae and Apatelodidae (only 2 genera of the latter occur in the United States; Apatelodes and Ocleclostera) are very similar. The only reliable character separating them is the presence of mid-dorsal tufts of secondary setae on abdominal segments in the Apatelodidae.

Sphingoidea

A single family, the Sphingidae, comprise the Sphingoidea. Larvae can be recognized by the following: Head hypognathous. Secondary setae numerous but small, often on tiny chalazae. Scoli, pinacula, and verrucae absent. Primary setae are usually missing, but often SD1 and L1 on A1-8 are present. If L2 is also present on A1-8, then L1 & L2 are close together below the spiracle. All but 1 genus (Lapara) have a mid-dorsal horn or tubercle on A8. Biordinal crochets are arranged in a mesoseries.

Noctuoidea

Important characters in recognizing a noctuoid larva are: Head hypognathous. Secondary setae absent in cutworm-type noctuids. In the Lymantriidae, Arctiidae, Ctenuchidae, Pericopidae, and Nolidae, secondaries are present on verrucae in primary positions: D, SD, (or D+SD fused), L, and SV on the thoracic segments; and D1, D2, SD, L1, L2, L3, SV & V on the abdominal segments. Verruca L1 is caudad of the spiracle on A1-6 & 8, but usually caudo-ventrad of the spiracle or fused with L2 on A7. In the Notodontidae and Dioptidae, secondary are always present on the prolegs and usually in fixed positions elsewhere. Many Notodontidae and Lymantriidae and a few Noctuidae may be profusely hairy and lacking verrucae. Horns and scoli are never present, although dorsal humps or gibbosites are present in some Notodontidae.

In groups where the primaries are conspicuous, the following arrangements are diagnostic: SD1 & SD2 on TI close together and excluded from the prothoracic shield, with SD1 often thinner and smaller than SD2. Prespiracular group bisetose on TI. SV group unisetose on TII & TIII. L1 & L2 far apart on A1-8 with L4 present in most Notodontidae, and Dioptidae. On A7, L1 is farther from the spiracle and closer to L2 than on the preceeding abdominal segments. The L group is unisetose on A9. Crochets usually uniordinal (a few biordinal) and arranged in a mesoseries. In the Ctenuchidae, Pericopidae and most Arctiidae crochets are in a heteroideous mesoseries. Prolegs are usually present on A3-6 & 10, but may be reduced or absent on A10 in some Notodontidae, reduced or absent on A3 & A4 in some Noctuidae, and absent on A3 in all Nolidae.

The Ctenuchidae, Pericopidae, and Arctiidae share many important characters including the presence of secondary setae on verrucae and heteroideous crochets on a lobate planta (Fig. 56). The Ctenuchidae and Pericopidae are possibly nothing more than specialized groups within the Arctiidae. A number of arctiid genera (most notably Utetheisa, Hypoprepia, Holomelina differ more from the rest of the Arctiidae than do the Pericopidae and Ctenuchidae.

Based on available larvae, the validity of the Dioptidae as a family is questioned here. A single species, Phryganidia californica (Packard) occurs in the United States (Borror & DeLong 1971), and it has many characters in common with the Notodontidae, including a v-shaped labral notch with a groove extending to the base of the labrum (Fig. 82). Another specimen from the USNM collected in Arizona, and identified as a dioptid by H. W. Capps has all these features plus reduced A10 prolegs, a common feature of many notodontids. Clearly the Dioptidae and Notodontidae are very close, if indeed they are separate families.

Larvae of Doa ampla Grote are very unusual and difficult to associate with any family. Although they undoubtedly belong in the Noctuoidea, they have been placed in the Lymantriidae (Holland 1903), the Pericopidae (McDunnough 1938), and the Dioptidae (Forbes 1948).

A COMPUTER GENERATED KEY

A. HISTORICAL DEVELOPMENT OF KEYS

As with many biological ideas, the germs of the development of keys can be found in the thinking of Aristotle (Voss, 1962). His attempts at classification used dichotomous characters, and exemplified the type of analysis found in modern keys. In the works of the 17th century naturalists Morison, Ray, and Rivinius, there are diagrams which might be considered the first analytical keys, but an identification key of a modern type did not appear until Lamarck (1778) in his Flore Francaise. Lamarck differed from his predecessors in that he recognized the artificial nature of keys. As Bather (1927) stated:

> "A key is not a classification, but a method of analysis. This idea was first explicitly brought forth by Lamarck at the very beginning of his career. Having asserted that every species of French plant could be more readily determined by a purely arbitrary analytic key than by the Linnaean system with its mixture of supposed reality and ordered arbitrariness, he was challenged to produce such a key and he did this within twelve months."

There have been few innovations in the mechanics of key writing since Lamarck. Apart from the bracketed (parallel) style of zoologists, and the indented style of botanists, taxonomists have been reluctant to explore new schemes of identification.

Leenhouts (1966) identified two major types of keys, and discussed their advantages and disadvantages. In the "analytical" key the first couplet divides all the taxa into two or more groups. The user begins with the first couplet and chooses between two or more states, directing him to further couplets, until an endpoint is reached. Although analytical keys are commonly used, they have major disadvantages. They inadequately handle variable or incompletely known taxa, and are difficult to construct, revise, and edit. They force the user to follow a predetermined pathway with pre-chosen characters, making mutual comparison between taxa difficult. Advantages of analytical keys include ease of use and publication.

In the second kind, "synoptical" keys, all taxa are divided over the different states under every couplet. The user can begin with any character and continue choosing characters in any order, reducing with each step the number of taxa until only one remains. The basic synoptical key is a table or data matrix, with enumeration of taxa on the left and of characters on the top. Each taxon has its own line, each character its own column. Advantages of synoptical keys are: 1) one can make use of every character making each identification more certain; 2) they are easy to construct; and 3) mutual comparison between taxa using the same character is easier. Disadvantages are: 1) their use is limited by large numbers of taxa; 2) they are difficult to publish.

Leenhouts concluded that synoptical keys are more reliable than analytical keys. He proposed a new style for synoptical keys, eliminating their major disadvantage, that of publication difficulty (see synoptical key, p. 34).

Other alternatives to analytical keys are those by Ogden (1943), Nobles (1965), Archbald (1967), Duke (1969), Hansen & Rahn (1969), and Morse (1971, 1974). Ogden developed a synoptical key in which taxa and characters are given in coded form. His system is cumbersome, requiring 9 pages to sort 8 taxa. Nobles provided a key in which characters are codified per taxon as a formula. If several taxa share the same formula each is given the same set of additional characters. Archbald, Hansen & Rahn and Duke provided characters and taxa on punched cards which can be sorted in any fashion by the user.

Morse (1971) distinguished between "polyclaves" and "algorithms". A polyclave is similar to a synoptical key. An algorithm is an exact identification procedure such as a classical style key. Morse (1974) developed a computerized "polythetic" polyclave interactive program in which a "variability limit" sets a threshold in the accumulation of differences between specimen and taxon. A taxon is not eliminated from the list of possible taxa until the threshold is exceeded. Polyclave identification programs with on-line interaction are powerful identification tools, provided that such equipment is available.

Important theoretical discussions of specimen identification are those of Metcalf (1954) and Osborne (1963). Metcalf discussed principles of style that should be followed in key construction. Couplets should be stated in simple, direct, mutually exclusive pairs. They should also be dichotomous, with the first member stated in the positive, and the second in the parallel negative of the first. Keys should be constructed so they can be used backwards as well as forwards, by inserting before each couplet the number of the immediately preceeding couplet in the pathway. Osborne discussed statistical aspects of dichotomous keys and proved that the probability of error almost always increases if a key is made longer, and that the shortest key is the most symmetrical (achieved by each couplet dividing taxa into equal sub-groups). He concluded that the probability of correct identification in a key is directly affected by its shape and length.

Early attempts to use computers in the construction of keys are those of Moller (1962) and Niemala, et. al. (1968). Moller developed a statistical theory for writing a key to polythetic taxa for maximum probability of correct identification. Niemala et. al. described a system for choosing a key based on a "matrix-reduction and monothetic-divisive algorithm" (Morse 1971). These programs require complete sets of binary characters, and produce keys in numerical form only.

More recent key construction programs (Morse 1968, 1971, 1974; Hall 1970; Pankhurst 1970b; Dallwitz 1974) employ "concise recursive algorithms" (Morse 1971) for key construction. They work on a simple principle: A group of taxa is divided by an appropriate character into two or more subgroups, each of which is further divided by other characters, until every taxon is distinguished from all others. A separate key is constructed for each subgroup as it is created. Hall's program sets thresholds which must be exceeded before a "test" (=couplet) is allowed to participate in the key. Thresholds are set by desirable features of a key which the program seeks to optimize. First, only characters with high "ease of observation" values are allowed to participate in a couplet. Next, cycles for finding a suitable couplet are run first for single characters, then for combinations of two, followed by combinations of three. If a simple couplet is found (one which uses just one character), the program does not search for character combinations. Simple couplets are favored, but more complex ones are used where needed. The program makes the most symmetrical key possible by favoring even numbers of taxa in subdivisions (Osborne 1963). It also provides rapid routes to the more common taxa by allowing the user to duplicate data sets for these taxa. Drawbacks of Hall's program are that it uses quantitative data only and prints the key in a numeric form which must be rewritten before use. Morse's program is similar, but prints a key in a form which needs additional characters, rephrasing, and other editorial changes before it is ready to use. Morse's algorithm is based on theoretical considerations of Gyllenberg (1963) as well as those of Osborne and Moller. It uses dichotomous characters only, but also allows characters to be coded as variable or inapplicable.

Pankhurst (1970b) developed the first program that printed keys in a ready-to-use form. His algorithm differed from those of Hall and Morse in the use of "character-convenience blocks" and his employment of the "attribute-value" (character - character state) rather than a hierarchical couplet concept (Morse 1971). Pankhurst's program has many desirable features. It allows for multi-state as well as binary characters. Characters can be weighed with respect to reliability. The program prints both a conventional key (bracketed or indented) and the data matrix. The maximum number of characters to be used in a couplet can be specified by the user. Unknown or missing characters are allowed. All remaining distinctive characters are automatically printed at the end of a pathway. A variety of botanical keys have been constructed using Pankhurst's program (Pankhurst 1970a, Watson & Milne 1972). These keys used over 50% fewer characters and were 10% to 20% shorter than hand made versions.

A recent program (Dallwitz 1974) has further advantages over those of Hall, Morse, and Pankhurst. A number of parameters controlling different aspects of key generation are included in his algorithm. These allow variation of strategy producing different kinds of keys with the same data. The parameters control the weight given to reliability of characters, abundance of taxa, how the program handles intra-taxon variability, how often characters are re-used, and the maximum number of characters allowed in a couplet. Provisions are provided for masking both taxa and characters, making production of special-purpose keys possible from subsets of the data. A user can also pre-set the position of any character in the key. The output includes a list of characters and their states (App. C, p. 99), a data matrix (App. D, p. 102), a tabular key resembling a tree diagram (a diagrammatic representation of the key which helps the user assess the structure of the key) (App. E, p. 108), and a conventional bracketed key (App. F, p. 113).

A major advantage of Dallwitz' program is its low cost and high speed. A tabular key to 145 Australian grass genera was produced from 433 items (data sets) and 120 characters in 80 seconds of computer time at a cost of $5.00. Printing a conventional key took 25 seconds more and cost $2.00 more.

B. DESCRIPTION OF PROGRAM KEY

The purpose of an identification is to assign any individual to its taxon. KEY (Dallwitz, 1974) groups individuals into two types of class; a taxon (class of individuals with the same name), and item (class of individuals with identically coded descriptions). A taxon may include more than one item because of variation within the taxon.

The program user provides a list of characters and character-states, and a table giving the taxa corresponding to the items (App. C, p. 99). Missing values may be interpreted as not applicable or variable. The user may also provide estimates of the costs of using the characters and of the relative abundances of the items. The "cost" of a character is a combination of its probability of error and the effort in its use. Errors may arise because of misinterpretation or misjudgment by the user of the key, or because intra-taxon variability has not been completely accounted for.

KEY minimizes the average cost of an identification by assuming that character costs are additive, and that the frequency with which an item will need to be identified is proportional to its abundance. The character selection algorithm used in KEY is an estimate of the average cost of an identification. It selects a character with low cost and divides the taxa into two or more subgroups. Each subgroup is then subdivided by other characters. This continues until each subgroup contains only one taxon, or until no suitable character is found.

Options which allow control over key generation are the presetting of characters to be used in any position in the key (desirable since KEY may not necessarily use characters in a preferred order), masking of both characters and taxa allowing production of special-purpose keys from subsets of the data, and manipulation of 5 parameters (RBASE, ABASE, REUSE, VARYWT, NCONF) which optimize different aspects of key generation.

RBASE controls the weight given to cost indices. If RBASE=1, all characters have equal cost, and reliability indices do not influence formation of the key. If RBASE=2, a more reliable character will be used over a less reliable character. The effect of RBASE on the length of a key is such that if RBASE=1, a short key using less reliable characters will result, and if RBASE > 1, a longer key using more reliable characters will result.

ABASE controls the effect of the abundance indices on the structure of the key. If ABASE is large, abundant taxa will tend to key out early.

REUSE controls how often a character is used. If REUSE=1, a character is not likely to be used again, but if REUSE > 1, the character will more likely be used later in the key.

VARYWT determines the treatment of intra-taxon variability. A variable character can be coded as "V" or as a dash (-). If the absolute value of VARYWT is 1, there is no special penalty for characters with intra-taxon variability. If VARYWT=0, such characters will not be used for decisions involving the variable taxa, and each taxon name will appear only once in the key. Intermediate values of VARYWT have effects between these extremes. Unknown values (dash, blank, or dot on the taxon cards) are treated as not applicable if VARYWT is positive and variable if VARYWT is negative.

NCONF is the maximum number of confirmatory characters to be sought for each main character. If NCONF=0, couplets will use only a single character. If NCONF=1, 2, or 3, multiple character couplets will appear.

The printout consists of the list of characters and their states and the reliability index (App. C, p. 99), the list of taxa and abundance indices and the data matrix (App. D, p. 102), the key in tabular form with the sequence in which characters were used in consecutive vertical columns (App. E, p. 108), a list of characters in the order they were used in the key, and the bracketed key (App. F, p. 113).

Seven taxa arranged in a vertical column, and 5 characters arranged in a horizontal column are used as an example of how the program might run (Table 2, p. 79). The state each taxon manifests for each character is given in its adjacent horizontal column. Character 1 (C1) has 4 states: A, B, C, & D; C2 has 4 states; C3 has 3 states; C4 has 2 states; C5 has 4 states. In a tabular key, taxa are arranged on the left in the order they are sorted, and the characters in vertical columns in the order they are used (Table 3, p. 80). The same key is shown in the bracketed style (Table 4, p. 80). The characters are given reliability indices, with C4 the most reliable (9), and C3 the least (1). For simplicity, taxa were not given abundance indices.

Character 4 has high reliability, and best divides the 7 taxa into equal subgroups; and is chosen for the first couplet. Since VARYWT=1, Taxon 4 appears in each subgroup (Table 3,column 1) and keys out twice (Table 4, couplets 4 & 5). If VARYWT were set at 0 another character would be chosen for the first couplet. Both C1 and C2 divide taxa 1 and 4 into equal sub-groups, but C1 is chosen for its higher reliability (Table 3, column 2; Table 4 couplet 2). Only C3 can separate taxa 1 & 2, so it is chosen despite its low reliability (Table 3, column 3; Table 4,couplet 3). The program allowes for multi-state couplets, as shown in the choice of C1 to separate taxa 4 to 7 (Table 3, column 2; Table 4, couplet 5).

TABLE 1.

Five characters with states in coded form and reliability indices to illustrate operation of KEY.

1. (8) Character 1 (=C1)
   A.
   B.
   C.
   D.

2. (5) Character 2 (=C2)
   A.
   B.
   C.

3. (1). Character 3 (=C3)
   A.
   B.
   C.

4. (9). Character 4 (=C4)
   A.
   B.

5. (4). Character 5
   A.
   B.
   C.
   D.

TABLE 2.

Imaginary data with 7 taxa (=T1-T7) and the 5 characters from Table 1, to illustrate operation of KEY. Characters listed in row along the top, and taxa listed in the left vertical column.

	C1	C2	C3	C4	C5
T1	A	A	B	A	A
T2	A	A	C	A	A
T3	B	B	C	A	B
T4	B	B	A	V	C
T5	B	C	A	B	B
T6	C	C	B	B	C
T7	D	A	C	B	D

TABLE 3.

Tabular key using data from Table 2 illustrating operation of KEY. Seven taxa (T1-T7) listed in the left vertical column with characters (C1-C5) and states arranged in the order they are used in 3 vertical columns from left to right. RBASE = 2, REUSE 1, VARYWT = 1, NCONF = 0.

	1	2	3
T1	C4-A	C1-A	C3-B
T2	C4-A	C1-A	C3-C
T3	C4-A	C1-B	C5-B
T4	C4-A	C1-B	C5-C
T4	C4-B	C1-B	C2-B
T5	C4-B	C1-B	C2-C
T6	C4-B	C1-C	
T7	C4-B	C1-D	

TABLE 4.

Same key as in Table 3 , in the bracketed style, with characters, states, (C1-C5), and taxa (T1-T7) in coded form.

1(0). C4-A 2
C4-B 5

2(1). C1-A 3
C1-B 4

3(2). C3-B T1
C3-C T2

4(2). C4-B T3
C4-C T4

5(1). C1-B 6
C1-C T6
C1-D T7

6(5). C2-B T4
C2-C T5

C. IMPLEMENTATION OF KEY

KEY is written in Fortran and contains 1300 statements and 34 subroutines. The last program run (App. E & F, pp. 108, 113) took about 20 seconds of computer time at a cost of less than $10.000.

A list of characters and character states (App. C, p. 99) and a matrix giving the taxa corresponding to the items and the states of the characters for the items (App. D, p. 102) were punched on IBM cards. Missing values were recorded as a dot (.), and inapplicable states as a dash (-). Abundance indices were provided (App. C, p. 99) based on the number of genera in each family in North America. Nine is an abundant taxon (Noctuidae), 1 is a rare taxon (Micropterygidae). Reliability indices for the characters were based partly on the data collected and partly on experience in using the characters in previous keys.

Three hundred-fifty individuals were initially examined and the states of 90 characters determined for each. Initially all characters that varied (had different states within a family) were recorded as inapplicable for that family. During first runs of the program, the error diagnostic "key incomplete, more information needed" appeared (App. F, p. 113). This was an expected result, and additional characters and items were added for the unseparated taxa.

D. RESULTS

Based on data collected for the chosen characters, KEY did not produce satisfactory results. Over a dozen keys were generated with the program, the last of which (App. E & F, pp. 103, 113) was used as a structure for developing the hand-written key in the thesis.

Allocating the correct amount of storage space for key generation was frustrating and time consuming. Each new key was tested with correctly identified specimens. When inadequacies were discovered, new taxa, new items, more characters and more data were added. This necessitated revising the parameters every time the program was run. In later runs the data set was large enough to exceed the storage capacity of the program. The families were then divided into four groups, based on character 71 (App. C, p. 99). Each group was then run separately producing four different keys (Part A, pp. 108, 113; Part B, pp. 110, 117 ; Part C, pp. 111, 118; Part D, pp. 112, 119).

Even in the last run of the program the results were poor. For example, many taxa keyed out twice in the same couplet (couplets 5, 6, 25, p. 113; 60, p. 114). The Notodontidae key out in 29 different places, the Noctuidae in 36. Much editing and rewriting would be necessary to eliminate these worthless couplets.

For large taxa such as Noctuidae attempts were made to account for all possible combinations of variable characters even if certain combinations were unknown to actually exist. This resulted in an exponential increase in the number of places a taxon would key out, as the program generated new items. For example, some noctuids may have scoli others may not, some lack secondary setae, some have setae on verrucae, others have setae scattered over the cuticle, and others a few secondary setae in fixed positions. Some noctuids have uniordinal crochets, others have biordinal. If one were to take into account all possible combinations of the different states of these characters, noctuids would have to key out in at least 2x4x2=16 different places.

When more specimens of variable taxa were examined, many endpoints in the key were found to represent non-existant combinations of characters for the taxon. These were eliminated from the hand-written key. The combined 4 parts of the computer key has 181 couplets, whereas the hand-written key has only 144 couplets.

In some couplets as many as 3 confirmatory characters were printed in addition to the first character (couplet 38, p. 114). Since these couplets would be a cumbersome task to any key user, their value was questioned. When tested with specimens, few were found to fit all four characters. These couplets would therefore be misleading, and would have to be deleted or shortened.

First runs of the program had absurdly large clumps of unseparated taxa. Most of these were eliminated or reduced in size, but in last runs, no manipulation of parameters or addition of new information would eliminate them (couplets 25 & 28, p. 113; 79, p. 115; 23, p. 117). These problems also would be solved only by editing and re-writing.

IV. CONCLUSIONS

There is probably no shortcut for producing a reliable key. The method requires time consuming examination and re-examination of specimens to find appropriate characters and testing the key as it is being written. Making corrections or adding new taxa and characters may necessitate the complete redesigning of a large and complicated key.

A critical problem with classical keys is that they rely too heavily on a few diagnostic characters for recognition of taxa; that is, they are monothetic in concept. If taxa are polythetic, on the other hand, no single character or small combination of characters will be sufficient for assigning a specimen to its right taxon (Sneath & Sokal, 1973). This difference in concept between keys and taxa makes keys as identification tools extremely sensitive to single errors on the part of users.

For all its sophistication, KEY produces a classical type key and does not solve their basic problems. The theoretical aspects of key construction (Osborne 1963) implemented in KEY are probably valid but are overidden by other considerations when writing a key. The overall probability of correct identification, for example, depends less on the structure of the key, than on the stability of the taxa, careful wording of the couplets, and careful choice of characters. Even the editing advantages of KEY were exaggerated in the literature. Addition of geographical and biological information, and rewording of awkward couplets would have necessitated rewriting, even if a satisfactory key had been obtained. Lastly, time wasted in getting the program to work properly would have been used more profitably in testing the key against additional specimens.

When using computer methods in identification, it seems too easy to forget that one is dealing with biological organisms, and that both taxa (at least above species) and characters are artificial constructs. For example, KEY requires rigid pre-determination of characters and their states. Although this seems desirable as an unbiased test of characters, it was a constant source of trouble. Of 100 characters given to KEY (App. C, p. 99), most were found to be useless or misleading when new specimens were tested with the key. Fewer than 40 characters were used in their original form in the hand-written key. Many others had to be rewritten or delineated into states differently before they would work. Continued use of the program would have necessitated tedious changes in the data matrix and character list to keep up with changing ideas of character reliability.

KEY requires a large amount of taxonomic data before the program is run. It behoves the user to supply useful data, but there is no way of knowing this until a key produced with the program is tested with specimens. When constructing a hand-written key, on the other hand, one gathers data only as they are needed.

Leenhouts' (1966) design for a synoptical key is probably the best solution to the problems of key construction short of on-line interactive programs (Morse 1974). Its polyclave nature makes identification quick, easy, and reliable. Its flexibility allows one to add or delete characters, data, or taxa without difficult rewriting or restructuring. Extensive use of Leenhouts' design would greatly improve any identification scheme.

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APPENDICES

APPENDIX A

CLASSIFICATION OF THE LEPIDOPTERA

Suborder ZEUGLOPTERA
  MICROPTERYGOIDEA
    Micropterygidae (=Eriocephalidae; formerly part of Jugatae, Homoneura)

Suborder DACNONYPHA
  ERIOCRANIOIDEA
    Eriocraniidae (formerly part of Jugatae, Homoneura)

Suborder MONOTRYSIA
  NEPTICULOIDEA
    Nepticulidae (=Stigmellidae)
    Opostegidae (formerly part of Tineidae)
  INCURVARIOIDEA
    Incurvariidae
      Incurvariinae
      Adelinae
      Prodoxinae
    Heliozelidae
    Tischeriidae (formerly part of Tineidae)

Suborder EXOPORIA (formerly part of Monotrysia)
  HEPIALOIDEA
    Hepialidae (formerly part of Jugatae, Homoneura)

Suborder DITRYSIA
  TINEOIDEA
    Tineidae (includes Amydriidae, Setomorphidae, Acrolophidae)
      Acrolophinae (=Anaphorinae, Psychidae, in part)
      Scardiinae
      Nemapogoninae
      Tineinae
    Psychidae (includes Talaeporiidae)
    Oschenheimeriidae
    Oinophilidae (=Oenophilidae)

TINEOIDEA (continued)
- Lyonetiidae (=Tineidae in part; includes Bucculatrigidae, Leucopterygidae)
- Gracillariidae (=Gracilariidae, Lithocolletidae, Tineidae in part; includes Phyllocnistidae)

YPONOMEUTOIDEA
- Yponomeutidae (=Hyponomeutidae; includes Plutellidae, Argyresthiidae, Acrolepiidae; excludes Scythridae)
  - Yponomeutinae
  - Plutellinae (=Acrolepiidae)
  - Argyresthiinae
- Heliodinidae (=Tinaegeriidae; Elachistidae in part, Lavernidae in part)
- Epermeniidae
- Sesiidae (=Aegeriidae, Sphingidae in part)
- Glyphipterygidae (=Hemerophilidae, Yponomeutidae in part; includes Hypertrophinae, Choreutidae)
- Douglasiidae (=Glyphipterygidae in part, Elachistidae in part) (no larval specimens were available for inclusion in the key)

CASTNIOIDEA
- Castniidae (includes Neocastniidae, Tascinidae)

COSSOIDEA
- Cossidae (=Zeuzeridae; includes Ratardidae, Metarbelidae, Hypoptidae, Zeuzeridae)

TORTRICOIDEA
- Tortricidae (includes Eucosomidae, Grapholithidae, Epiblemidae, Sparganothidae, Oecophoridae)
- Phaloniidae (=Conchylidae, Tortricidae in part)

GELECHIOIDEA
- Elachistidae (=Cycnodiidae in part; included in former Lavernidae)
- Coleophoridae
- Cosmopterygidae (part of former Lavernidae)
- Momphidae (part of former Lavernidae)
- Walshiidae (part of former Lavernidae)
- Blastodacnidae (formerly part of Momphidae)
- Blastobasidae (=Gelechiidae in part)
- Scythridae (=Scythrididae, Blastobasidae in part; formerly part of Yponomeutidae)
- Oecophoridae (=Gelechiidae in part; includes Depressariidae, Metachandidae)
- Ethmiidae (=Oecophoridae in part)
- Stenomidae (=Stenomatidae, Xylorictidae, Uzuchidae)
- Gelechiidae
- Symmocidae (=Gelechiidae in part)

COPROMORPHOIDEA
- Alucitidae (=Orneodidae, Pterophoridae in part)
- Carposinidae (=Tortricidae in part)

PYRALOIDEA
- Hyblaeidae (formerly part of Noctuidae)
- Thyrididae (=Thyridae, Sphingidae in part; includes Argyrotypidae)
- Pyralidae (=Pyralididae; includes Pyraustidae, Phycitidae (=Phycidae), Crambidae, Crysaugidae, Nymphulidae, Epipaschiidae, Galleriidae)
- Pterophoridae (includes Agdistidae; excludes Alucitidae)

ZYGAENOIDEA (=Psychodoidea)
- Zygaenidae (=Pyromorphidae, Anthroceridae in part, Sphingidae in part)
- Megalopygidae (=Lagoidae, Liparidae in part)
- Epipyropidae
- Limacodidae (=Eucleidae, Cochlidiidae, includes Chrysopolomidae)
- Dalceridae

HESPERIOIDEA (formerly part of Rhopalocera)
- Hesperiidae (excludes Megathymidae)
- Megathymidae (=Hesperiidae in part)

PAPILIONOIDEA (formerly part of Rhopalocera)
- Papilionidae (includes Parnasiidae)
- Pieridae (=Asciidae)
- Nymphalidae (=Aegyreidae; includes Danaidae, Satyridae, Heliconiidae; excludes Libytheidae)
  - Danainae (=Lymnadidae, Euploeinae; includes Ithomiidae)
  - Satyrinae (=Agapetidae)
  - Nymphalinae (includes Heliconiidae)
- Libytheidae
- Lycaenidae (=Cupidinidae, Ruralidae; includes Riodinidae)
  - Lycaeninae
  - Riodininae (=Erycinidae, Lemoniidae, Nemerobiidae)

GEOMETROIDEA (=Uranioidea in part)
- Geometridae
- Drepanidae (=Drepanulidae, Platypterygidae; formerly part of Drepanoidea; includes Auzatidae)
- Thyatiridae (=Cymatophoridae; formerly part of Drepanoidea)
- Epiplemidae (formerly part of Uranioidea)

MIMALLONOIDEA
- Mimallonidae (=Lacosomidae, Cicinnidae; formerly part of Psychidae, Uranioidea, Bombycoidea, Drepanulidae)

BOMBYCOIDEA (=Lasiocampina)
- Saturniidae (=Saturnioidea; includes Citheriniidae, Hemileucidae)
  - Saturniinae
  - Hemileucinae
  - Citheroniinae
- Bombycidae
- Lasiocampidae (=Eupterotidae, Bombycidae, Lachneidae, Notodontidae in part)
- Apatelodidae (=Zanolidae, Eupterodidae; formerly part of Notodontidae)

SPHINGOIDEA
- Sphingidae (=Smerinthidae)

NOCTUOIDEA
- Dioptidae (includes Doa)
- Notodontidae (=Ceruridae)
- Lymantriidae (=Liparidae)
- Arctiidae (includes Lithosiidae)
- Ctenuchidae (=Amatidae, Syntomidae, Euchromoodae)
- Pericopidae (includes Hypsidae)
- Nolidae (=Noctuidae in part)
- Agaristidae (=Noctuidae in part)
- Noctuidae (=Phalaenidae, Nolidae in part; includes Agrotidae, Acronyctidae, Plusiidae; excludes Nolidae, Hyblaeidae)

APPENDIX B. NOMENCLATORIAL SYSTEMS FOR PRIMARY SETAE (TI)

Hinton (1946)	Mutuura (1956)	Gerasimov (1935) Hepialidae	Gerasimov (1935) Others	Forbes (1923)	Heinrich (1916)	Fracker (1915) Jugatae	Fracker (1915) Frenatae	Dyar (1895)
Tactile								
XD1	ST2	IX	X	alpha	Ia	gamma	alpha	ia
XD2	ST1	IIIa	IX	gamma	Ib	epsilon	gamma	ib
D1	PT3	X	I	beta	IIa	alpha	beta	iia
D2	PT2	I	II	delta	IIb	beta	delta	iib
SD1	PT4	Il	IIIa	epsilon	Ic	rho	epsilon	ic
SD2	PT1	III	III	rho	IIc	delta	rho	iic
L1	PN3	V	IV	kappa	IV	eta	kappa	iv
L2	PN1	IV	V	eta	V	kappa	eta	v
L3	PN2	VI	VI	theta	III	theta	theta	iii
SV1	C1	VIIa	VIIa	pi	VI	pi	pi	via
SV2	C2	VIIb	VIIb	nu	VI	nu	nu	vib
V1	S1	VIII	VIII	sigma	VIII	sigma	sigma	viii
Proprio-receptor								
MXD1	PMT1	-	Xa	-	-	-	-	-
MV2	MC1	VIIc	VIIc	-	VII	tau	-	-
MV3	MC2	VIId	VIId	-	-	phi	-	-

APPENDIX B (CONTINUED) NOMENCLATORIAL SYSTEMS FOR PRIMARY SETAE (TII & TIII)

Hinton (1946)	Mutuura (1956)	Gerasimov (1935) Hepialidae	Gerasimov (1935) Others	Forbes (1923)	Heinrich (1916)	Fracker (1915) Jugatae	Fracker (1915) Frenatae	Dyar (1895)
Tactile								
D1	T2	I	I	ia	Ia	alpha	alpha	ia
D2	T1	II	II	ib	Ib	beta	beta	ib
SD1	ST1	III	III	iib	IIb	rho	rho	iib
SD2	ST2	IIIa	IIIa	iia	IIa	delta	epsilon	iia
L1	PN1, SC2	V	IV	iv	IV	kappa	kappa	iv
L2	PN3, SC1	IV	V	v	V	epsilon	eta	v
L3	PN2	VI	VI	iii	III	theta	theta	iii
SV1	C1	VIIa	VIIa	vii	VI	pi	pi	vi
SV2	C2	-	-	-	-	-	-	-
V1	S1	VIII	VIII	viii	VIII	sigma	sigma	viii
Proprio-receptor								
MD1	MT1	Xa	Xa	x	-	gamma	-	-
MD2	MT2	Xb	Xb	-	-	-	-	-
MSD1	MT3	IXa	IXa	x	-	gamma	-	-
MSD2	MT4	IXb	IXb	x	-	gamma	-	-
MV1	MS1	VIIb	VIIb	vii	VI	nu	-	-
MV2	MC1	VIIc	VIIc	ix	VII	tau	-	-
MV3	MC2	VIId	VIId	-	-	omega	omega	-

APPENDIX B (CONTINUED) NOMENCLATORIAL SYSTEMS FOR PRIMARY SETAE (A1-9)

Hinton (1946)	Mutuura (1956)	Gerasimov (1935) Hepialidae	Gerasimov (1935) Others	Forbes (1923)	Heinrich (1916)	Fracker (1915) Jugatae	Fracker (1915) Frenatae	Dyar (1895)
Tactile								
D1	T2	I	I	i	I	alpha	alpha	i
D2	T1	II	II	ii	II	beta	beta	ii
SD1	ST1	III	III	iii	III	rho	rho	iii
SD2	ST2	IIIa	IIIa	iiia	IIIa	epsilon	epsilon	iiia
L1	PN1, SC1,SC2	IV	IV	v	IV	theta	kappa	iv
L2	SC1, SC2	V	V	iv	V	kappa	eta	v
L3	C1	VI	VI	vi	VI	eta	mu	vi
SV1	SS1	VIIa	VIIa	viia	VII	pi	pi	vii
SV2	SS2	VIIb	VIIb	viib	VII	nu	nu	vii
SV3	SS3	VIIc	VIIc	viic	VII	tau	tau	vii
V1	S1	VIII	VIII	viii	VIII	sigma	sigma	viii
Proprio-receptor								
MD1	PMT1	X	Xa	-	-	-	-	-
MD2	-	-	Xb	-	-	-	-	-
MD3	MS1	VIId	VIId	ix	-	omega	-	-

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FAMILY KEY TO LEPIDOPTERA LARVAE...........................................................

CHARACTERS, STATES, AND RELIABILITY INDICES.      .16.10.20. 07/26/76

  1. (4) HEAD CAPSULE
           A. LONGER THAN WIDE
           B. AS LONG AS WIDE, OR NEARLY
           C. BETWEEN 1/2 AS LONG AS WIDE TO NEARLY AS LONG AS WIDE
           D. L.T. HALF AS LONG AS WIDE
  2. (5) HEAD CAPSULE EXTENDS BEYOND THE CORONAL NOTCH
           A. L.T. 1/3 ITS WIDTH
           B. FROM 1/3 TO 1/2 ITS WIDTH
           C. FURTHER THAN 1/2 ITS WIDTH
  3. (9) HEAD ORIENTATION
           A. PROGNATHOUS, HEAD DEPRESSED, HORIZONTAL, MOUTH PARTS DIRECTED FORWARD, PARALL
              EL TO LONG AXIS OF BODY
           B. HYPOGNATHOUS OR SEMI-HYPOGNATHOUS, MOUTH PARTS NOT DIRECTED FORWARD
  4. (3) FRONT
           A. CONSPICUOUSLY LONGER THAN WIDE, BUT L.T. TWICE AS LONG AS WIDE
           B. AS WIDE AS LONG, OR NEARLY
           C. WIDER THAN LONG
           D. MORE THAN TWICE AS LONG AS WIDE
  5. (9) FRONT
           A. OPEN BEHIND
           B. CLOSED BEHIND
  6. (1) FRONT
           A. CONSPICUOUSLY EXPANDED AT ANTERIOR END, FRONTAL SUTURES ANGULATE OR NOT
           B. ONLY SLIGHTLY, IF ANY, EXPANDED AT ANTERIOR END, FRONTAL SUTURES ABRUPTLY ANG
              ULATE BETWEEN APEX AND ANTERIOR END OF FRONT
           C. NEITHER EXPANDED AT ANTERIOR END NOR FRONTAL SUTURES ANGULATE. FRONTAL SUTURE
              S EITHER SMOOTHLY CURVING, WAVY, OR STRAIGHT
  7. (5) ADFRONTAL SUTURES
           A. EXTEND BEYOND CORONAL NOTCH
           B. EXTEND TO CORONAL NOTCH, OR NEARLY
           C. EXTEND HALFWAY TO 3/4 THE DISTANCE BETWEEN APEX OF FRONT AND CORONAL NOTCH
           D. EXTENDS L.T. 1/2 THE DISTANCE BETWEEN APEX OF FRONT AND CORONAL NOTCH
  8. (8) FRONT EXTENDS TO THE CORONAL NOTCH
           A. ALL THE WAY, OR NEARLY
           B. FROM 1/2 TO 3/4
           C. L.T. HALFWAY
  9. (9) OCELLI
           A. ALL OBSCURE OR ABSENT
           B. ONE PRESENT
           C. TWO PRESENT
           D. THREE TO FIVE PRESENT
           E. SIX PRESENT
 10. (5) OCELLI 1,2,3, ARRANGED
           A. IN AN ANGLE G.T. 190 D.
           B. IN A STRAIGHT LINE, OR NEARLY (170-190 D.)
           C. IN AN OBTUSE ANGLE, BETWEEN 100 AND 170 D.
           D. IN A RIGHT ANGLE, OR NEARLY (80-100 D.)
           E. IN AN ACUTE ANGLE (L.T. 80 D.)
 11. (5) OCELLI 3,4,5, ARRANGED
           A. IN AN ANGLE G.T. 190 D.
           B. IN A STRAIGHT LINE, OR NEARLY (170-190 D.)
           C. IN AN OBTUSE ANGLE, BETWEEN 100 AND 170 D.
           D. IN A RIGHT ANGLE, OR NEARLY (80-100 D.)
           E. IN AN ACUTE ANGLE (L.T. 80 D.)
 12. (7) OCELLUS 5
           A. NOT CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 L.T
              . 1/2 THE DISTANCE BETWEEN OC1 AND OC4
           B. CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 G.T  1/
              2 BUT L.T. EQUAL TO DISTANCE BETWEEN OC1 AND OC4
           C. AS FAR AWAY OR FURTHER FROM OC4 AS OC4 IS FROM OC1
 13. (5) HEAD SETA A2
           A. CLOSER TO A1 THAN TO A3
           B. EQUIDISTANT OR NEARLY BETWEEN A1 AND A3
           C. CLOSER TO A3 THAN TO A1
 14. (5) HEAD SETAE A1,A2,A3, ARRANGED
           A. IN AN ACUTE ANGLE, L.T. 80 D.
           B. IN A RIGHT ANGLE OR CLOSE TO (80-100 D.)
           C. IN AN OBTUSE ANGLE, 100-170 D.
           D. IN A STRAIGHT LINE, OR NEARLY (170-190 D.)
           E. IN AN ANGLE G.T. 190 D.
 15. (5) HEAD SETA A3
           A. CLOSER TO A2 THAN TO L1
           B. EQUIDISTANT OR NEARLY BETWEEN A2 AND L1
           C. CLOSER TO L1 THAN TO A2


 16. (9) HEAD SETA O1
           A. INSIDE CIRCLE OF EYES
           B. ON A STRAIGHT LINE BETWEEN OC2 AND OC3
           C. OUTSIDE CIRCLE OF EYES
 17. (5) HEAD SETA O1
           A. CLOSER TO OC2 THAN TO OC3
           B. EQUIDISTANT OR NEARLY BETWEEN OC2 AND OC3
           C. CLOSER TO OC3 THAN TO OC2
 18. (5) OCELLUS 1
           A. CLOSER TO A3 THAN TO L1
           B. EQUIDISTANT OR NEARLY BETWEEN A3 AND L1
           C. CLOSER TO L1 THAN TO A3
 19. (5) HEAD SETA L1
           A. FURTHER AWAY FROM OC1 THAN OC1 IS FROM OC4
           B. THE SAME DISTANCE TO OC1 AS OC1 IS TO OC4
           C. CLOSER TO OC1 THAN OC1 IS TO OC4
 20. (3) EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS
           A. PRESENT
           B. ABSENT
 21. (1) SETA D1 ON THORACIC SEGMENT I
           A. DIRECTLY ABOVE XD1 (ANGLE XD1-XD1-D1 0-15 D.)
           B. ABOVE AND CAUDAD OF XD1 (ANGLE XD1-XD1-D1 15-80 D.)
           C. DIRECTLY BEHIND OR BEHIND AND BELOW XD1 (ANGLE XD1-XD1-D1 G.T. OR E.T. 80 D.)
 22. (1) SETAE XD1, D1, D2, ON THORACIC SEG. I ARRANGED
           A. IN A STRAIGHT LINE, OR D2 D2 CLOSER TO DORSAL MESON THAN D1
           B. IN A OBTUSE ANGLE
           C. IN A RIGHT ANGLE
           D. IN AN ACUTE ANGLE
 23. (5) SETA SD2 ON THORACIC SEG. I
           A. BETWEEN SD1 AND SP. IN A STRAIGHT LINE, OR NEARLY
           B. BEHIND SD1, ANGLE SP.-SD1-SD2 1[illegible]-90 D.
           C. ABOVE SD1, ANGLE SP.-SD1-SD2 G.T. 90 D.
 24. (1) SETA XD2 ON THORACIC SEG. I
           A. DISTINCTLY FURTHER CEPHALAD THAN SD1
           B. IN A STRAIGHT LINE, OR NEARLY, WITH XD1 AND SD1
           C. DISTINCTLY FURTHER CAUDAD THAN SD1
 25. (1) SETA L1 ON THORACIC SEG. I
           A. IN A STRAIGHT LINE BETWEEN L2 AND L3
           B. ABOVE L2 AND L3
           C. BELOW L2 AND L3
           D. IN A STRAIGHT LINE CEPHALAD OF L2 AND L3
 26. (1) SETA D1 ON THORACIC SEG. I
           A. CLOSER TO XD1 THAN TO D2
           B. EQUIDISTANT, OR NEARLY, BETWEEN XD1 AND D2
           C. CLOSER TO D2 THAN TO XD1
 27. (1) SETA XD2 ON THORACIC SEG. I
           A. CLOSER TO XD1 THAN TO SD1
           B. EQUIDISTANT OR NEARLY BETWEEN XD1 AND SD2
           C. CLOSER TO SD1 THAN TO XD1
 28. (1) SETA SD1 ON THORACIC SEG I
           A. CLOSER TO XD2 THAN TO SD2
           B. EQUIDISTANT OR NEARLY, BETWEEN SD2 AND XD2
           C. CLOSER TO SD2 THAN TO XD2
 29. (1) SETA SD1 ON THORACIC SEG. I
           A. CLOSER TO SD2 THAN TO SP.
           B. EQUIDISTANT OR NEARLY, BETWEEN SD2 AND SP.
           C. CLOSER TO SP. THAN TO SD2
 30. (1) SETA L1 ON THORACIC SEG. I
           A. CLOSER TO L2 THAN TO SP.
           B. EQUIDISTANT OR NEARLY BETWEEN L2 AND SP.
           C. CLOSER TO SP THAN TO L2
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31. (1) SETAE SV1, SV2 ON THORACIC SEG. I
        A. FURTHER APART THAN L1 IS TO L2
        B. AS FAR APART AS L1 IS TO L2
        C. CLOSER TOGETHER THAN L1 IS TO .2
32. (1) SETA L1 ON THORACIC SEG. I
        A. CLOSER TO L2 THAN TC L3
        B. ECUIDISTANT OR NEARLY, BETWEEN L2 AND L3
        C. CLOSER TO L3 THAN TO L2
33. (1) SETAE D1 AND D2 ON THORACIC SEG. II
        A. AS FAR APART AS D2-SD2 AND SD2-SD1
        B. AND SD1-SD2 CLOSER TOGETHER THAN D2-SD2
        C. CLOSER TOGETHER THAN D2-SD2 AND SD2-SD1
        D. FURTHER APART THAN D2-SD2 AND SD2-SD1
        E. AND SD2-SD1 FURTHER APART THAN D2-SD2
34. (1) SETA L1 ON THORACIC SEG. II
        A. CLOSER TO SD1 THAN TO L2
        B. ECUIDISTANT BETWEEN SD1 AND L2
        C. CLOSER TC L2 THAN TO SD1
35. (1) SETA L1 ON THORACIC SEG. II
        A. CLOSER TO L2 THAN TO L3



        B. EQUIDISTANT BETWEEN L2 AND L3
        C. CLOSER TO L3 THAN TC L2
36. (9) L GP. ON THORACIC SEG. I
        A. DISTINCTLY SEPARATED FROM CERVICAL SHIELD AND FRCM XD, D, AND SD SETAE
        B. WITH XD, D, SD SETAE LOCATED ON ONE DISTINCT CONTINUOUS SCLEROTIZED AREA
37. (5) SETA D2 ON ABD. SEG. 3 ARRANGED
        A. ABOVE AND CAUDAD D1 (ANGLE D1-D1-D2 L.T. 80 D.)
        B. CAUDAD AND ONLY SLIGHTLY ABOVE OR BELOW D1, IF ANY (ANGLE D1-D1-D2 80-100 D.)
        C. DISTINCTLY BELOW AND CAUDAD D1 (ANGLE D1-D1-D2- G.T. 100 D.)
38. (5) SETA L1 ON ABD. SEG. 3
        A. CAUDAD OF SP., ONLY SLIGHTLY ABOVE OR BELOW SP, IF ANY
        B. DISTINCTLY BELOW AND CAUDAD OF SP.
        C. BELOW SP AND ONLY SLIGHTLY CAUDAD OR CEPHALAD OF SP, IF ANY
        D. BELOW SP AND DISTINCTLY CEPHALAD OF SP.
39. (5) SETAE D1 AND D2 ON ABD. SEG. 3
        A. ADJACENT, L.T. OR E.T. .2X THE DISTANCE BETWEEN D1-D1
        B. E.T. 1/5-1/2 THE DISTANCE BETWEEN D1-D1
        C. G.T. 1/2 THE DISTANCE BETWEEN D1-D1
40. (5) SETA L1 ON ABD. SEG. 3
        A. CLOSER TO SP. THAN TO L2
        B. EQUIDISTANT BETWEEN L2 AND SP.
        C. CLOSER TO L2 THAN TO SP.
41. (1) SETA L1 ON ABD. SEG. 3
        A. CLOSER TO L2 THAN TO L3
        B. ECUIDISTANT BETWEEN L2 AND L3
        C. CLOSER TO L3 THAN TO L2
42. (1) ABDOMINAL SEG. 3
        A. LCNGER THAN HIGH
        B. AS LONG AS HIGH
        C. HIGHER THAN LONG
        D. TWICE OR MORE AS HIGH AS LONG
43. (1) ABDOMINAL SEG. 3
        A. DORSO-VENTRALLY FLATTENED, AT LEAST 2X AS WIDE AS HIGH
        B. WIDER THAN HIGH, BUT L.T. 2X AS WIDE AS HIGH
        C. APPROX. AS WIDE AS HIGH
        D. HIGHER THAN WIDE
44. (5) POSITION OF SP. AND L1 ON ABD. SEG. 8
        A. THE SAME OR APPROX. AS ON ABD. SEG. 3
        B. NCTICEABLY DIFFERENT FROM POSITION ON ABD. SEG. 3
45. (5) POSITICN OF SP. ON ABD. SEG. 8
        A. IN LINE WITH SP. ON PRECEEDING ABD. SEGS.
        B. WELL ABOVE SP. ON PRECEEDING ABD. SEGS.
46. (5) SETA D2 ON ABD. SEG. 9
        A. DIRECTLY ABOVE D1 AND ONLY A LITTLE CAUDAD, IF ANY
        B. ABOVE AND CAUDAD OF D1
        C. DISTINCTLY CAUDAC OF D1 AND ONLY SLIGHTLY IF ANY, ABOVE OR BELOW
        D. DISTINCTLY CAUDAD AND BELOW D1
        E. DISTINCTLY BELOW D1 AND ONLY SLIGHTLY CAUDAD OR CEPHALAD, IF ANY
47. (1) SETA D1 ON ABD. SEG. 10
        A. CLOSER TO D1 THAN TO SD1
        B. EQUIDISTANT BETWEEN D1 AND SD1
        C. CLOSER TO SD1 THAN TO D1
48. (1) SETA D1 ON ABD. SEG. 10
        A. CLOSER TO SD1 THAN TO D2
        B. EQUIDISTANT BETWEEN SD1 AND D2
        C. CLOSER TO D2 THAN TO SD1
49. (7) TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD,
        A. MOST OR ALL OBSCURE, ABSENT, OR MINUTE
        B. AT MOST 3 OBSCURE OR ABSENT
        C. ALL SIX PRESENT AND EASILY VISIBLE
50. (5) D SETAE ON ABD. SEG. 9,
        A. BOTH A. O. OR M.
        B. ONE PRESENT, THE OTHER A. O. OR M.
        C. BOTH PRESENT
51. (5) SD SETAE ON ABD. SEG. 9,
        A. 0
        B. 1
        C. 2
52. (9) L SETAE ON THORACIC SEG. I,
        A. 0
        B. 1
        C. 2
        D. 3
53. (9) L SETAE ON ABD. SEG. 3,
        A. 0
        B. 1
        C. 2
        D. 3
        E. MORE THAN 3
54. (5) L SETAE ON ABD. SEG. 9,
        A. 0



        B. 1
        C. 2
        D. 3
55. (9) SV SETAE ON THORACIC SEGMENTS,
        A. A. O. OR P. ON ALL THORACIC SEGS.
        B. 1 ON EACH
        C. 2 ON TI, 1 ON TII AND TIII
        D. 2 ON ALL THREE
56. (5) SV SETAE ON ABD. SEG. 9
        A. 0
        B. 1
        C. 2
        D. 3
57. (9) SEGMENTED SCLEROTIZED THORACIC LEGS
        A. ABSENT
        B. PRESENT
58. (4) PROLEGS ON ABD. SEGS. EXCEPT 10,
        A. ABSENT OR RUDIMENTARY, OR ONLY FLESHY LOBES PRESENT
        B. ONLY ONE OR TWO PAIRS ON ANY SEGMENT 1-9
        C. PRESENT ON ABD. SEGS. 4,5,6
        D. PRESENT ON ABD. SEGS. 3,4,5
        E. PRESENT ON ABD. SEGS.3,4,5,6
        F. PRESENT ON MORE THAN FOUR ABD. SEGS.
59. (4) PROLEGS ON ABD. SEG. 10
        A. PRESENT
        B. ABSENT OR RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER THAN PROLEGS ON A 3-6
60. (7) PROLEGS
        A. ELONGATE, AT LEAST 4X AS LONG AS GREATEST WIDTH
        B. LESS THAN 4X AS LONG AS GREATEST WIDTH
61. (9) CROCHETS
        A. ABSENT ON ALL ABDOMINAL SEGMENTS
        B. ABSENT ONLY CN ABD. SEG. 10 PROLEGS
        C. PRESENT ON A 3-6 AND 10 EVEN IF PROLEGS ARE REDUCED OR ABSENT
62. (1) TOTAL BODY LENGTH, F.G.L.,
        A. L.T. 5MM.
        B. 5-10 MM.
        C. 11-20 MM.
        D. 21-30 MM.
        E. G.T. 30 MM.
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63. (1) CERVICAL SHIELD
A. DISTINCT, HEAVILY SCLEROTIZED, LIGHTLY TO DARKLY PIGMENTED
B. OBSCURE OR REDUCED TO IRREGULAR SCLEROTIZED SPOTS, OR ENTIRELY ABSENT

64. (5) SPIRACLES
A. ALL THE SAME SIZE
B. ON TI AND A8 CONSPICUOUSLY LARGER THAN OTHERS
C. ONLY TI SP. LARGER THAN OTHERS
D. ONLY A8 SP. LARGER THAN OTHERS

65. (7) SPIRACLES SHAPE
A. ROUND
B. ELLIPTICAL OR EGG SHAPED

66. (9) CROCHETS ON A 3 (SERIAL)
A. UNISERIAL
B. BI- OR MULTISERIAL

67. (9) CROCHETS ON A 3 (ORDINAL)
A. UNIORDINAL
B. BI-, TRI-, OR MULTIORDINAL

68. (9) CROCHETS ON A3 ARRANGED (CIRCLE)
A. IN A COMPLETE CIRCLE OR ELLIPSE
B. IN AN INCOMPLETE CIRCLE OR ELLIPSE
C. IN 1 TRANSVERSE BAND
D. IN 2 TRANSVERSE BANDS, OR CROCHETS REDUCED IN NUMBER
E. IN A HOMOIDEOUS MESOSERIES
F. IN A HETEROIDEOUS MESOSERIES

69. (9) HARD SCLEROTIZED, PROMINENT SCOLI
A. ABSENT
B. PRESENT

70. (6) ANAL COMB
A. ABSENT
B. PRESENT

71. (9) SECONDARY SETAE
A. TOTALLY ABSENT
B. NUMEROUS,SHORT OR LONG, SCATTERED OVER CUTICLE, SOMETIMES OBSCURING PRIMARIES IF PRIMARIES PRESENT, THEN SECONDARIES NO LONGER OR STOUTER THAN PRIMARIES. S ECONDARIES GROUPED ON VERRUCAE, VERRICULES, FLESHY LOBES, OR SCOLI ABSENT
C. NUMEROUS, ALL (OR SOME) GROUPED AS DENSE TUFTS OR STOUT BRISTLES ON VERRUCAE, VERRICULES, FLESHY LOBES, OR SCOLI. SCATTERED SHORTER SECS MAY BE PRESENT
D. SCARCE, RESTRICTED TO PROLEGS (4 OR MORE SV SETAE) OR WITH MORE THAN TEN PRIM ARY SETAE (2 D#S, 2 SD#S, 3 L#S, 3 SV#S) ON ABD. SEG. 3
E. ABSENT, LARGE PAIRED OVATE SCALES PRESENT

72. (3) FILAMENTS OR OSMETERIA
A. ABSENT
B. PRESENT

73. (5) MOST OR ALL SETAE
A. ON ELEVATED CHALAZAE OR TUBERCLES
B. NOT ON CHALAZAE, SIMPLE

74. (5) SEGMENTS OF BODY
A. DIVIDED INTO 6 TO 8 ANNULETS
B. NOT DIVIDED INTO MANY ANNULETS

75. (9) POSITION OF SETA SD1 ON ABDOMINAL SEGMENT 8
A. DIRECTLY ABOVE SPIRACLE, OR ONLY SLIGHTLY CAUDAD OR CEPHALAD, IF ANY
B. DIRECTLY IN FRONT OF SPIRACLE, OR ONLY SLIGHTLY ABOVE OR BELOW, IF ANY

76. (5) DISTANCE BETWEEN COXAE ON THORACIC SEGMENT III
A. GREATER THAN 1+1/2 TIMES THE WIDTH OF THE COXA
B. LESS THAN 1+1/2 TIMES THE WIDTH OF THE COXA

77. (5) PROTHORACIC COXAE
A. SEPARATED
B. TOUCH EACH OTHER

78. (9) NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD
A. NINE OR LESS
B. MORE THAN NINE

79. (8) SETAE D2 ON ABD. SEG. 9
A. CLOSER TO EACH OTHER THAN EACH IS TO ITS ASSOCIATED D1, OR ON SAME PINACULUM
B. NOT CONSPICUOUSLY CLOSE, OR NOT ON SAME PINACULUM

80. (9) TIBIA ON THORACIC LEGS
A. VERY LONG, AT LEAST 4X LONGER THAN GREATEST WIDTH
B. NOT UNUSUALLY LONG, LESS THAN 4X AS LONG AS WIDE

81. (9) L SETAE ON ADBOMINAL SEG. 9
A. L1 AND L2 VERY CLOSE, OR ON SAME PINACULUM, DISTANCE BETWEEN L2 AND THE NEXT SETA BELOW AT LEAST 4X THE DISTANCE BETWEEN L1 AND L2
B. L1 AND L2 MORE EVENLY SPACED WITH NEXT SETA BELOW, NOT ASSOCIATED AS ABOVE, N EVER ON SAME PINACULUM

82. (7) CLAW ON THORACIC LEGS
A. ELONGATE, SICLE SHAPED, NOT RECURVED AT TIP
B. CONSPICUOUSLY RECURVED AT TIP, MORE HOOK SHAPED

83. (9) HEAD
A. CONSPICUOUSLY RETRACTED INTO THORAX
B. NOT CONSPICUOUSLY RETRACTED INTO THORAX

84. (9) SETA L3 ON ABDOMINAL SEG. 9
A. VERY CLOSE TO SV SETA, OR ON SAME PINACULUM, DISTANCE BETWEEN L3 AND NEAREST L ABOVE 4X DISTANCE BETWEEN L3 AND SV
B. NOT ASSOCIATED WITH SV SETA, NEVER ON SAME PINACULUM, DISTANCE BETWEEN L3 AND NEAREST L ABOVE LESS THAN 4X DISTANCE BETWEEN L3 AND SV

85. (9) CROCHET ARRANGMENT
A. CIRCULAR
B. ELLIPTICAL

86. (9) SETA D1 ON ABDOMINAL SEG. 9
A. VERY CLOSE TO SD, OR ON SAME PINACULUM, DISTANCE BETWEEN D1 AND D2 4X DISTANC E BETWEEN D1 AND SD1
B. FAR FROM SD, NEVER ON SAME PINACULUM, DISTANCE BETWEEN D1 AND D2 LESS THAN 4X DISTANCE BETWEEN D1 AND SD1

87. (9) SETA SD ON ABDOMINAL SEG. 9
A. VERY CLOSE TO AT LEAST 1 OF THE L SETAE, OR ON SAME PINACULUM, DISTANCE BETWE EN SD AND D1 4X DISTANCE BETWEEN SD AND L
B. FAR FROM ANY L SETA, NEVER ON SAME PINACULUM, DISTANCE BETWEEN SD AND D1 LESS THAN 4X DISTANCE BETWEEN SD AND L

88. (9) OCELLI ONE AND TWO
A. ASSOCIATED TOGETHER, DISTANCE BETWEEN OC2 AND NEXT OCELLUS 4X DISTANCE BETWEE N OCELLI 1 AND 2
B. NOT ASSOCIATED TOGETHER, DISTANCE BETWEEN OC2 AND NEXT OCELLUS MORE EQUAL TO DISTANCE BETWEEN OCELLI 1 AND 2

89. (9) CROCHETS ON CAUDAL PROLEGS
A. DIVIDED INTO TWO GROUPS, BROKEN SERIES
B. NOT DIVIDED INTO TWO GROUPS, CONTINUOUS SERIES

90. (9) L SETAE ON ABDOMINAL SEG. 9
A. ALL THREE CLOSE TOGETHER, OR ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD
B. NOT CLOSE TOGETHER, NEVER ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO L GREAT ER THAN 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD

91. (9) VERRUCA L1 ON ABD. SEG. 7
A. SAME DISTANCE FROM SP. AS ON A1-6
B. FARTHER FROM SP. THAN ON A1-6, OR ABSENT

92. (9) MESO AND META THORAX
A. WITH AT LEAST 4 VERRUCAE BETWEEN LEG AND DORSAL MESON, SD VERRUCA PRESENT
B. WITH ONLY 3 VERRUCAE BETWEEN LEG AND DORSAL MESON, SD VERRUCA ABSENT

93. (9) ABD. SEG. 8
A. WITH AT LEAST 1 MID-DORSAL HORN, SCOLUS, CHALAZA, TUBERCLE, OR SCAR
B. WITHOUT A MID-DORSAL HORN, SCOLUS, CHALAZA, TUBERCLE, OR SCAR

94. (9) ABD. SEG. 9
A. WITH A MID-DORSAL SCOLUS
B. WITHOUT A MID-DORSAL SCOLUS

95. (9) ROW OF CROCHETS ON VENTRAL SIDE OF PROLEGS
A. INTERRUPTED OR REDUCED IN SIZE NEAR CENTER BY A SPATULA-LIKE LOBE
B. NOT INTERRUPTED, NO LOBE PRESENT ON VENTRAL SIDE OF PROLEGS

96. (9) ANAL PLATE ON ABD. SEC. 10
A. BIFURCATE AT TIP, BEARING TWO DISTINCT PROCESSES
B. NOT BIFURCATE, ROUNDED

97. (9) HEAD
A. DISTINCTLY LARGER THAN PROTHORAX IN DIAMETER
B. EQUAL TO OR SMALLER THAN PROTHORAX IN DIAMETER

98. (9) HEAD
A. DISTINCTLY CONICAL OR ANGULATE, OR ARMED DORSALLY WITH SCOLI OR SPINES
B. ROUNDED, WITHOUT SCOLI OR SPINES

99. (9) LABRAL NOTCH
A. SHALLOW, EXTENDING NOT MORE THAN 1/2 THE DISTANCE TO THE BASE OF THE LABRUM
B. DEEP, WITH PARALLEL SIDES, EXTENDING TO BASE OF LABRUM, OR NEARLY
C. ACUTE, V-SHAPED, A GROOVE EXTENDING TO BASE OF LABRUM SOMETIMES PRESENT

100. (9) EVERSIBLE GLAND
A. PRESENT ON DORSOMESON OF ABD. SEG. 7 (SOMETIMES 6)
B. ABSENT ON DORSOMESON OF ABD. SEGS. 6 AND 7

FAMILY KEY TO LEPIDOPTERA LARVAE (A)

TAXA, ABUNDANCE INDICES, AND CHARACTER VALUES. .18.39.28. 07/29/76

	1	11111	11112	22222	22223	33333	33334	44444	44445
	12345 67890	12345	67890	12345	67890	12345	67890	12345	67890
1/ 1. (3) ERIOCRANIIDAE	DCAAB BCAB-	-----	----B	-----	-----	-----	-----	-CB-A	-----
	----- -AAB-	ABBBA	---AA	AA--.	.....	..B..	.....	.....	.....
2/ 2. (3) HEPIALIDAE	AABBB CDBEC	AAACA	ABC-B	ADCA-	CCCCA	-AECB	BCACC	ACCAA	CC-CB
	BDDCC CBEA-	CEA-B	BAAAA	AA--.	.....	.....	.....	.....	.....
3/ 3. (3) NEPTICULIDAE	DBABA --AB-	-----	----B	-----	-----	-----	-----	--C--	---AB
	A---- -AAB-	AAB--	---AA	AA--.	.....	..B..	.....	.....	.....
4/ 3. (3) NEPTICULIDAE	DBABB --AB-	-----	----B	-----	-----	-----	-----	--C--	---AB
	A---- -AAB-	AAB--	---AA	AA--.	.....	..B..	.....	.....	.....
5/ 4. (1) OPCSTEGIDAE	AAADA --AB-	-----	----B	-----	-----	-----	-----	--C--	-----
	----- -AAB-	ABB-A	---AA	AA--.	.....	..B..	.....	.....	.....
6/ 5. (3) INCURVARIINAE	CAAAB CDAEC	AACCC	ACABB	ADBA-	AC-AA	CABCA	ACABC	ADCBA	E--AC
	BDDC- -BAB-	CBABA	AACAA	AA--.	.....	..B..	.....	.....	.....
7/ 5. (3) INCURVARIINAE	CABAB CDAEC	AACCC	ACABB	ADBA-	AC-AA	CABCA	ACABC	ADCBA	E--AC
	BDDC- -BAB-	CBABA	AACAA	AA--.	.....	..B..	.....	.....	.....
8/ 6. (3) PRODOXINAE	C-BAB CDBE-	---CC	----B	-----	-----	-----	-----	-D--A	-----
	----- -VAB-	A-B-A	---AA	AA--.	.....	..A..	.....	.....	.....
9/ 6. (3) PRCDOXINAE	C-BAB CDBD-	---CC	----B	-----	-----	-----	-----	-D--A	-----
	----- -VAB-	A-B-A	---AA	AA--.	.....	..A..	.....	.....	.....
10/ 7. (3) ADELINAE	CAABB CBAEC	AACCC	ABC-B	ABBAA	CAAAA	AABCA	ECABB	ACBBA	AAACC
	-DD-C -EAB-	BBADA	BADAA	AA--.	.....	..B..	.....	.....	.....
11/ 7. (3) ADELINAE	CABBB CBAEC	AACCC	ABC-B	ABBAA	CAAAA	AABCA	ECABB	ACBBA	AAACC
	-DD-C -EAB-	BBADA	BADAA	AA--.	.....	..B..	.....	.....	.....
12/ 8. (3) HELIOZELIDAE	CBAAB -AAC-	-----	----B	----C	----A	-----	A-A--	-CBAA	---A-
	-D--- -AAB-	AAABA	---AA	AA--.	.....	..B..	.....	.....	.....
13/ 8. (3) HELIOZFLIDAE	CBBAB -AAC-	-----	----B	----C	----A	-----	A-A--	-CBAA	---A-
	-D--- -AAB-	AAABA	---AA	AA--.	.....	..B..	.....	.....	.....
14/ 9. (1) TISCHERIIDAE	CBADB CAAEB	BA---	C---B	-----	-----	-----	A-EA-	-CBAA	---A-
	--C-- -AAB-	CBABA	BA-AA	AA--.	.....	..B..	.....	.....	.....
15/ 10. (3) LYCNETIIDAE (LEUC)	CAAAA --ADA	-A---	-----	-----	----A	-----	A-EAC	AC--A	-----
	BD-BC -BABB	C-B-A	AAAAA	AABBA	AA-BB	--B-A	--B--	.....	.....
16/ 11. (3) LYCNETIIDAE	CAAAV --AE-	-A---	-----	-----	----A	-----	A-BAC	AC--A	-----
	BD-BC -BEAB	C-B-A	VAAAA	AABBA	AA-BB	--B--	--A--	.....	.....
17/ 11. (3) LYONETIIDAE	CAAAV --AD-	-A---	-----	-----	----A	-----	A-EAC	AC--A	-----
	BD-BC -BEAB	C-B-A	VAAAA	AABBA	AA-BB	--B--	--A--	.....	.....
18/ 12. (3) LYONETIIDAE (SUCCU)	CABAB --BDB	-A---	-----	-----	----A	-----	A-BCA	AC--A	-----
	BD-BC -BEAA	CBB-A	AADAA	AABBA	BA-BB	-BB--	E-B--	.....	.....
19/ 13. (3) LYONETIIDAE (EED)	CAAAB --AEB	-A---	-----	-----	-----	-----	A-BBC	-C--A	-----
	BC-BC -BEAB	CBB-A	AAAAA	AABBA	BA-BB	-AB-A	--E--	.....	.....
20/ 14. (3) OINOPHILIDAE	CAAAB CBBC-	--ABC	----B	-CBB-	CCAAA	--BCA	ABECA	BADAA	CCACC
	CDDDC BBEAA	C-A-A	AAAAA	AA--.	.....	.....	.....	.....	.....
21/ 15. (5) GRACILARIIDAE (2ND INSTA	CAAAA -AA--	-----	----B	-----	-----	-----	-----	--B-A	---A-
	----- -AAB-	A-B-A	---AA	AA--.	.....	..B..	.....	.....	.....
22/ 15. (5) GRACILARIIDAE (2NC INSTA	DAAAA -AA--	-----	----B	-----	-----	-----	-----	--B-A	---A-
	----- -AAB-	A-B-A	---AA	AA--.	.....	..B..	.....	.....	.....
23/ 16. (5) GPACILARIIDAE (LATE INST	BAKAB -BA--	-----	----B	-----	----A	-----	---B-	-CC-A	-A---
	BC--C -BDA-	CBB-A	AV-AA	AA--.	.....	.....	.....	.....	.....
24/ 16. (5) GRACILARIIDAE (LATE INST	CAAAB -EA--	-----	----B	-----	----A	-----	---B-	-CC-A	-A---
	BC--C -BDA-	CBB-A	AV-AA	AA--.	.....	.....	.....	.....	.....
25/ 16. (5) GRACILARIIDAE (LATE INST	BBAAB -BA--	-----	----B	-----	----A	-----	---B-	-CC-A	-A---
	BC--C -BDA-	CBB-A	AV-AA	AA--.	.....	.....	.....	.....	.....
26/ 16. (5) GRACILARIIDAE (LATE INST	CBAAB -BA--	-----	----B	-----	----A	-----	---B-	-CC-A	-A---
	BC--C -BDA-	CBB-A	AV-AA	AA--.	.....	.....	.....	.....	.....
27/ 16. (5) GRACILARIIDAE (LATE INST	BAEAB -BA--	-----	----B	-----	----A	-----	---B-	-CC-A	-A---
	BC--C -BDA-	CBB-A	AV-AA	AA--.	.....	.....	.....	.....	.....
28/ 16. (5) GRACILARIIDAE (LATE INST	CAEAB -BA--	-----	----B	-----	----A	-----	---B-	-CC-A	-A---
	BC--C -BDA-	CBB-A	AV-AA	AA--.	.....	.....	.....	.....	.....
29/ 16. (5) GRACILARIIDAE (LATE INST	BBBAB -EA--	-----	----B	-----	----A	-----	---B-	-CC-A	-A---
	BC--C -EDA-	CBB-A	AV-AA	AA--.	.....	.....	.....	.....	.....
30/ 16. (5) GRACILARIIDAE (LATE INST	CBBAB -BA--	-----	----B	-----	----A	-----	---B-	-CC-A	-A---
	BC--C -BDA-	CBB-A	AV-AA	AA--.	.....	.....	.....	.....	.....
31/ 17. (3) ACROLOPHINAE	CAB-B AB-ED	-AA-C	BC-CB	CCBB-	BCC-C	CCB--	BCECA	-BBAA	BCACC
	BDDD- CBEAB	CEABB	BAAAA	AA--.	.....	.....	.....	.....	.....
32/ 18. (4) SCARDIINAE	--B-B -BBDC	-AA--	-----	---B-	-ACAA	-----	A-A-C	---AA	-CACC
	BDDCC EBEAB	C-AB-	AAAAA	AABBA	BAABB	-BBBB	BBABB	.....	.....
33/ 19. (4) NEMAPOGONINAE	--B-B -BBEC	-A---	-----	-----	-ACAA	-----	A-A-C	---AA	-CACC
	BDDDC CBEAB	C-AB-	AAAAA	AABBA	BAABB	BBBBB	EBABB	.....	.....
34/ 20. (4) TINEINAE (D)	--B-B -BAEC	-AB--	-----	---B-	-ACAA	-----	A-ABC	---AA	-CACC
	BDDDD BBEAB	C-AB-	AAAAA	AAABA	BAABB	BBEBB	EBEBB	.....	.....
35/ 21. (4) TINEINAE (X)	--E-B -BBDC	-A---	-----	-----	-ACAA	-----	A-A-C	---AA	-CACC
	BDDDC CBEAB	C-AB-	AAAAA	AABBA	BAABB	EBEBB	EBABB	.....	.....
36/ 22. (4) TINEINAE (T)	--B-B -.BB-	--A--	-----	---B-	-ACAA	-----	A-A-B	---AA	-CACC
	BDCDC BBAB-	C-AB-	AAAAA	AABBA	BAABB	EBBBB	BB-BB	.....	.....
37/ 23. (4) PSYCHIDAE	BAEBB -DBE-	AAA-C	A--CB	BBCB-	A-CAA	-ABCC	B-BBC	A---A	EACCC
	BDDDD EPEAB	C-A--	AABAA	AA--.	.....	.....	.....	.....	.....
38/ 23. (4) PSYCHICAE	BAEBB -DBE-	AAA-C	A--CB	BBCB-	A-CAA	-AECC	B-BBC	A---A	EACCC
	BDCDD B-EAB	C-A--	AABAA	AA--.	.....	.....	.....	.....	.....
39/ 23. (4) PSYCHIDAE	BAEBB -DBE-	AAA-C	A--CB	BBCB-	A-CAA	-ABCC	B-BBC	A---A	EACCC
	BDCDD BEEAB	C-A--	AABAA	AA--.	.....	.....	.....	.....	.....
40/ 24. (1) OSCHENHEIMERIIDAE	BPAAB CPAEC	BAACB	A-A-B	CBAB-	ACBAA	-A-CA	A-EBC	A--AA	C--CC
	BDDCD BBEA-	C-B--	AADAA	AA--.	.....	.....	.....	.....	.....
41/ 25. (5) PLUTELLINAE (PR)	--BAB C-BEC	BA---	AC--B	-BBBC	---AB	CAB--	A-EAA	----A	A--CC
	BDC-C BBEAB	C----	BAAAA	AABBA	AAABB	A-BAA	BBBBB	.....	.....
42/ 26. (5) PLUTELLINAF (PL)	-ABAB -CBEC	BACCA	ACC-B	CBBBC	-C-AB	CABBB	ACEBB	B---A	A--CC
	BDDCC BEEAA	C----	AAAAA	AABBA	BAABB	-BB-A	BBBBB	.....	.....

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43/ 27.  (5) PLLTELLINAE (C)              -ABAB -CBEC  BACCA ACA-B  CBBBC -BBAB  CABCB ACBCB  B---A A--CC
                                          BOODC BBEAA  C---- AAAAA  AABBA BAABA  BABAA BBBBB  ..... .....

44/ 28.  (5) PLLTELLINAE (AB)             -ABAB -BBEC  BACBA AC--E  -BBBC -B-AB  CABCB A-BCB  ----A A--CC
                                          BOODC BBEAA  C---- AABAA  AABBA BAABB  -AE-A EBBBB  ..... .....

45/ 29.  (5) PLUTELLINAE (AC)             -ABAB -BAEC  BAACB AC--B  -BBBC C--AB  CABBC A-BCB  ----A A--CC
                                          BOODC BBEAA  C---- AAAAA  AABBA BAABB  -BB-A EAEBB  ..... .....

46/ 30.  (5) ARGYRESTIINAE (A)            --BAB --BEC  -AA-B ACB-B  -BC-C -B-AB  AABCB ABBCC  B---A AAACC
                                          BOOCC -BEAB  CBABA AAAAA  AABBA BAABB  BBBBA EBEBB  ..... .....

47/ 31.  (5) ARGYRESTIINAE (Z)            --BAB --BEC  -ABDA ABAAA  ----C ---AB  ---CB AEECA  B--AA BCACC
                                          BOODC CBEAB  CBABA BAAAA  AABBA BAABB  AABBA BBBBB  ..... .....

48/ 32.  (5) YPCNOMEUTINAE (A)            --PBB -DBEC  AABCB ABA-A  CCBBC -B-AB  CAECA -EEBA  C--AA B--CC
                                          BODCD CBEAB  C---- BAAAA  AABBA BBABB  AABBA BBBBB  ..... .....

49/ 33.  (5) YPCNOMEUTINAE                CABAB --VEC  -A-CA -----  ----C -B-AB  CABC- AB-BY  ---AA B--CC
                                          CBDCC -BEAB  C---- BAAAA  AABBA BBABB  AABBB ABBBB  ..... .....

50/ 34.  (5) YPONOMEUTINAE (L)            --BBB -AAEC  BAACB ABA-B  CDABC -B-AB  CABA- ACABC  ---AA ----C
                                          BODCD BBEAB  C---- AABAA  AABBA BAABB  .BA-- BBBBB  ..... .....

51/ 35.  (3) HELIODINIDAE                 DABBB CBBEC  -AAA- -C--B  B---C -CCAA  ---CA A-B-C  ----A ----C
                                          AODCC CBEAV  C---- AAAAA  AABBA BAABB  ABB-A --VBB  ..... .....

52/ 36.  (3) EPERMENIIDAE                 DAAAB C-BED  BABBA ABB-B  BCCB- ACCAA  B--CB A-B-C  ---AA --CCB
                                          CCDCC BBEA-  C---- AAAAA  AA--V BAABB  ABB-A AEBBB  ..... .....
53/ 36.  (3) EPERMENIIDAE                 DAAAB C-BED  BABBA ABB-B  BCCB- ACCAA  B--CB A-E-C  ---AA --CCB
                                          CCDCC BBEA-  C---- AABAA  AA--V BAABB  ABB-A ABBBB  ..... .....

54/ 37.  (5) SESIIDAE                     D-EAB --AE-  AB--- VC--B  B-C-C -C-AA  --B-C A-C-C  ---VV --ACC
                                          BODCC BBEA-  C---- AADAA  AA--. .....  ..... .....  ..... .....
55/ 37.  (5) SESIIDAE                     D-EAB --BE-  AB--- VC--B  B-C-C -C-AA  --B-C A-C-C  ---VV --ACC
                                          BODCC BBEA-  C---- AADAA  AA--. .....  ..... .....  ..... .....

56/ 38.  (3) GLYPHIPTERYGIDAE             -ABAB -BBEC  BA-C- A-AAB  --BB- ----B  ---CB A-CCC  ----A ---C-
                                          BODDC BBEAA  C---A AAAAA  AABBA BAAAA  AABBA -BBBB  ..... .....
57/ 38.  (3) GLYPHIPTERYGIDAE             -ABAB -BBEC  BA-C- A-AAB  --BB- ----B  ---CB A-CCC  ----A ---C-
                                          BODDC BBEAA  C---A AAAAA  AABBA BAAAA  AABBA EAEBB  ..... .....


58/ 39.  (3) GLYPHIPTERYGIDAE (S)         -ABAB -BBEC  BA-C- A-AAB  --BB- ----B  ---CB A-CCC  ----A ---C-
                                          BODDC BBEAA  C---A AABAA  AABBA BAABA  AABBA -ABBB  ..... .....

59/ 40.  (3) GLYPHIPTERYGIDAE (P)         -ABBB -BBEC  BA-C- A-AAB  --BB- ----B  ---CB B-CCC  ----A ---CC
                                          BODDC BBEAB  C---A BAAAA  AABBA BAABA  AABBA BABBB  ..... .....

60/ 41.  (3) ELACHISTIDAE                 -BAAB CBAE-  ----- ----B  ----- -----  ----- -----  ----A ---A-
                                          ----- -BEA-  C-BAA AABAA  AA--. .....  ..... .....  ..... .....

61/ 42.  (5) COSMOPTERYGIDAE              CABAB -BAEC  -A--- A-A-B  ----- ---AA  ---C- A---C  A--AA AC--C
                                          BOD-C BBEAB  C--BA AAAAA  AA--B BAABB  ABB-A EBEBB  ..... .....

62/ 43.  (5) COSMOPTERYGIDAE (ANON)       CABAB C-AEC  AAACC ACACB  CDBAC --BAB  BABCB ACCCC  B-BAA AABCC
                                          BODCC BBEAB  C-ABA ABAAA  AABBA BABBB  ABB-A EEBBB  ..... .....

63/ 44.  (5) COSMOPTERYGIDAE (TRI)        CABAB ABBEC  AAACC ABABB  CCBBA --BAC  BEBCB ACCCC  B-BBA BBCAC
                                          BODDC BBEAB  C-ABA ABAAA  AABBB BABBB  ABBBA EBBBB  ..... .....

64/ 45.  (5) CCSMOPTERYGIDAE (LIMN)       CABAB ABAEC  BBABC ABAAB  BCBAC B-CAB  BBBCB AACCC  B--AA AACAC
                                          BODDC BBEAB  C--BA ABAAA  AABBA BAABB  ABBBA BBBBB  ..... .....

65/ 46.  (3) MOMPHIDAE (CH)               CAB-B --BE-  -A--- A-A-B  ----- ---AA  ---C- A---C  A--AA ---C-
                                          BCDBC BBEAB  C-ABA AAAAA  AABBA BAABB  -BBBA BBBBB  ..... .....

66/ 47.  (3) MOMPHICAE (MOM)              CABAB CBAEC  BABCA ABABB  CBBAC -C-AB  A-BC- ACEBC  B--AA -CACB
                                          BCDBC BBEAB  C-ABA AAAAA  AABBA BAABB  -BBBA BBBBB  ..... .....

67/ 48.  (3) MCMPHIDAE (MOM)              CABBB C-CEC  BAABC ABAAB  CABB- --BAB  EACCB ABCCC  B--AA BBACC
                                          BODDC BBEAB  C-AC- ABAAA  AABBA BAABB  ABEBA EBEBB  ..... .....

68/ 49.  (3) MOMPHIDAE (BAT)              CABAB A-BEC  CAABB ACA-B  CCBB- B--AB  -EBCB ABCCC  B--AA ACACC
                                          BODDC BBEAB  C-ABB AAAAA  AABBA BAABB  EBBBB EBBBB  ..... .....

69/ 50.  (3) WALSHIIDAE (A)               DBBAB CBAEB  BAADB AAAAB  ----A ----B  AAACB AACAC  B--AA ACB-C
                                          BODCC BBEAB  C--CA AAAAA  AABBA AAABB  -BB-V EBEBB  ..... .....

70/ 51.  (3) WALSHIIDAE                   --BAB C-AE-  -A-CB ABAAB  CBBBC ---AB  -B-CB ACC-A  B--AA ACACC
                                          BODBC BBEAB  C-A-A AAAAA  AABBA BAABB  -BB-A EBBBB  ..... .....
71/ 51.  (3) WALSHIIDAE                   --BAB C-AE-  -A-CB ABAAB  CBBBC ---AB  -B-CB ACC-A  B--AA ACACC
                                          BODCC BBEAB  C-A-A AAAAA  AABBA BAABB  -BB-A EBEBB  ..... .....

72/ 52.  (6) COLEOPHORIDAE                C-VAB -AAE-  BA--- AB--B  CCB-C ---AB  -BBCB A---C  ----A A--CC
                                          BODCC BBAAB  C-ABA AAAAA  AABBA BAABB  -BB-- BBBBB  ..... .....
73/ 52.  (6) COLEOPHORIDAE                C-VAB -AAE-  BA--- AB--B  CCB-C ---AB  -BBCB A---C  ----A A--CC
                                          BODCC BBAAB  C-ABA AABAA  AABBA BAABB  -BB-- EEEBB  ..... .....
74/ 52.  (6) CCLEOPHORICAE                C-VAB -AAE-  BA--- AB--B  CCB-C ---AB  -BBCB A---C  ----A A--CC
                                          BODCC BBAAB  C-ABA AADAA  AABBA BAABB  -BB-- EBEBB  ..... .....

75/ 53.  (6) BLASTOBASIDAE                -AB-B A-BEC  -BA-C A---B  --BBA CCBAA  -BBCA A--BC  A--AA B--CC
                                          BODDC BBEAB  C-AB- AVAAA  AA--A BAABB  ABBBB BBBBB  ..... .....

76/ 54.  (7) OECCPHCRIDAE (A)             CAB-B -BBEC  BAACB ABA-B  CCBBC --BAB  BADCB A-CCC  BC-AA -CACC
                                          BODDC BBEAB  C-ABB ABAAA  AABB- BABBB  ABBB- BABBB  ..... .....

77/ 55.  (7) OECOPHCRIDAE (D)             CABAB -BBEC  BAACC ABAAB  CCBBC --CAB  BA-CB ABCCC  BCCAA BCACC
                                          BODDC BBEAB  C-ABB ABAAA  AABB- BABBB  ABBB- EBBBB  ..... .....

78/ 56.  (7) OECOPHCRIDAE                 CAB-B -BBEC  -AAC- ABA-B  CCBB- CC-AA  ---CA A-C-C  AC-AA -C-CC
                                          VODDC BBEAB  C-AB- ABAAA  AA--- BAABB  ABBB- EEEBB  ..... .....

79/ 57.  (3) ETHMIIDAE                    CABAB -BBEC  BA-C- AC-BB  -B--C ---AA  AABCB ACCCC  BC-AA C--CC
                                          BODDC BBEAA  C--B- ABEAA  AABB- BBBBB  ABBBA EEEBB  ..... .....

80/ 58.  (3) ETHMIIDAE (E. SEM)           CABBB -DCEC  BAACB ACAAB  CCBBA --BAB  AABCB ACCCC  BCCAA BCBCC
                                          BOCDC BBEAB  C-ABB ABAAA  AABB- BABBB  ABBBA EAEBB  ..... .....

81/ 59.  (3) ETHMIIDAE ((PYR)             CAB-B -BBEC  BAACB ACABB  CCBBC CCBAA  BA-CA ABCBC  A--AA CCACC
                                          BODDC BBEAB  C--BA ABAAA  AABB- BABBB  AEEBA EEEBB  ..... .....

82/ 60.  (9) GELECHIIDAE (CH)             --B-B ---EC  BA--- A---B  --B-- -C-AA  --BCA A-C-C  A---A A--CC
                                          BOD-C BBEA-  C--BA ABAAV  A---A BABBB  EEEBA EBEBB  ..... .....
83/ 60.  (9) GELECHIIDAE (CH)             --B-B ---EC  BA--- A---B  --B-- -C-AA  --BCA A-C-C  A---A A--CC
                                          BOD-C BBEA-  C--BA ABEAV  A---A BABBB  EEEBA EEEBB  ..... .....
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 84/ 61. (9) GELECHIIDAE (ER)     --B-B ---EC  BA--- A---B  --B-- -C-AA  --BCA A-C-C  A---A A--CC
                                  BDD-C BBEA-  C--BA AVBAV  A---A BAABB  BBBBA EEEAB  ..... .....
 85/ 61. (9) GELECHIIDAE (ER)     --B-B ---EC  BA--- A---B  --B-- -C-AA  --BCA A-C-C  A---A A--CC
                                  BDD-C BBEA-  C--BA AVAAV  A---A BAABB  BBBBA BBBAB  ..... .....

 86/ 62. (9) GELECHIIDAE (AP)     --B-B ---EC  BA--- A---B  --B-- -C-AA  --BCA A-C-C  A---A A--CC
                                  BDD-C BBEA-  C--BA AADAV  A---A BABBB  ABBB- BBBAB  ..... .....


 87/ 63. (9) GELECHIIDAE (AN)     --B-B ---EC  BA--- A---B  --B-- -C-AA  --BCA A-C-C  A---A A--CC
                                  BDD-C BEEA-  C--BA AVAAV  A---A BABBB  ABB-A BBBAB  ..... .....
 88/ 63. (9) GELECHIIDAE (AN)     --B-B ---EC  BA--- A---B  --B-- -C-AA  --BCA A-C-C  A---A A--CC
                                  BDD-C BBEA-  C--BA AVBAV  A---A BABBB  ABE-A EBEAB  ..... .....

 89/ 64. (3) STENOMIDAE           -AEBB B-CE-  -BA-C A---B  C-BB- CC-AA  ---CA AB-CC  AC--A A--CC
                                  BDCDC -BEA-  C-ABB ABAAA  AABB- BAABB  EBBB- BAVBA  ..... .....
 90/ 64. (3) STENOMIDAE           -AEBB B-CE-  -BA-C A---B  C-BB- CC-AA  ---CA AB-CC  AC--A A--CC
                                  BDDDC -BEA-  C-ABB ABBAA  AABB- BAABB  BBBB- BAVBA  ..... .....
 91/ 64. (3) STENOMIDAE           -AEBB B-BE-  -BA-C A---B  C-BB- CC-AA  ---CA AB-CC  AC--A A--CC
                                  BDCDC -BEA-  C-ABB ABAAA  AABB- BAABB  BBBB- BAVBA  ..... .....
 92/ 64. (3) STENOMIDAE           -AEBB B-BE-  -BA-C A---B  C-BB- CC-AA  ---CA AB-CC  AC--A A--CC
                                  BDDDC -BEA-  C-ABB ABBAA  AABB- BAABB  BBBB- BAVBA  ..... .....

 93/ 65. (7) CARPOSINIDAE         C-B-B --BE-  -AAB- A-B-B  --BB- ---A-  --BCA ABCBC  A---V -C-CC
                                  BCDBC BBEAB  C-ABB AAAAA  AA--A BAABB  -BB-A EBEBB  ..... .....

 94/ 66. (3) ALUCITIDAE           CBBAB C-AEC  BACBB ABBBB  ---B- ACBB-  B-BCA ACCCC  AC-AA CBBCC
                                  BCDBC BBEAB  C-BBA AAAAA  AA--A BAABB  -BB-A EBEBB  ..... .....

 95/ 67. (3) DALCERIDAE           ----- ---E-  ----- -----  ----- -----  ----- -----  -D-AA -----
                                  ----- -AAB-  C-B-A ---AA  AA--. .....  ..A.. .....  ..... .....

 96/ 68. (4) LIMACODIDAE          ----- ---E-  ----- -----  ----- -----  ----- -----  -D--- -----
                                  ----- -BAB-  A-B-- ---AA  AA--. .....  ..A.. .....  ..... .....

 97/ 69. (3) HYELAEIDAE           CABBB -DCEC  BAACB ABAAB  CBBB- BCBA-  B--CA ACCCC  ACCAA BBCCC
                                  BCDBC BBEAB  C-ABB ABA--  AA--B BAABB  -BB-B EBEB-  ..... .....

 98/ 70. (5) THYRIDIDAE           --B-B -DBE-  BBA-- -CA-B  B-CB- ---A-  ----- AC-CC  A---- ---C-
                                  BCDBD BBEAB  C-ABB AAAAA  AA--. .....  ..... .....  ..... .....
 99/ 70. (5) THYRIDIDAE           --B-B -DCE-  BBA-- -CA-B  B-CB- ---A-  ----- AC-CC  A---- ---C-
                                  BCDBD BEEAB  C-ABB AAAAA  AA--. .....  ..... .....  ..... .....
100/ 70. (5) THYRIDIDAE           --B-B -DBE-  BCA-- -CA-B  B-CB- ---A-  ----- AC-CC  A---- ---C-
                                  BCDBD BCEAB  C-ABB AAAAA  AA--. .....  ..... .....  ..... .....
101/ 70. (5) THYRIDIDAE           --B-B -DCE-  ECA-- -CA-B  B-CB- ---A-  ----- AC-CC  A---- ---C-
                                  BCDBD BBEAB  C-ABB AAAAA  AA--. .....  ..... .....  ..... .....

102/ 71. (9) PYRALIDAE            --E-B ---EC  ----- ----B  --BB- -C-AA  --BCA A---C  AC-AA ---CC
                                  BCDVC VBEAB  C---- AVAAA  AA--A BAABB  VBBBV EBBBV  ..... .....
103/ 71. (9) PYRALIDAE            --E-B ---EC  ----- ----B  --BB- -C-AA  --BCA A---C  AC-AA ---CC
                                  BCDVC VBEAB  C---- AVBAA  AA--A BAABB  VBBBV EBEBV  ..... .....
104/ 71. (9) PYRALIDAE            --E-B ---EC  ----- ----B  --BB- -C-AA  --ECA A---C  AC-AA ---CC
                                  BCDVC VBEAB  C---- AVDAA  AA--A BAABB  VBBBV BBBBV  ..... .....

105/ 72. (9) TORTRICIDAE          C-BAB -B-EC  -AB-- A---B  -CB-- CC-AB  A--CA A---C  AC-AV --ACC
                                  BDDVC -BEAB  C-ABA AVAAV  AA--V BAAVB  -BBB- EBBBV  ..... .....

106/ 73. (5) PHALONIIDAE          C-EAB --BE-  ----- ----E  --BB- -CCAA  -BBCA ACC-C  A--AV ---CC
                                  BDDCC -BEAB  C--BA AVAAV  AA--B BAABB  ABB-B ABEB-  ..... .....
107/ 73. (5) PHALONIIDAE          C-EAB --BE-  ----- ----B  --BB- -CCAA  -BBCA ACC-C  A--AV ---CC
                                  BDDCC -BEAB  C--BA AVAAY  AA--B BAAAB  ABB-A AEBB-  ..... .....
108/ 73. (5) PHALONIIDAE          C-EAB --BE-  ----- ----B  --BB- -CCAA  -EBCA ACC-C  A--AV ---CC
                                  BDDCC -BEAB  C--BA AVAAV  AA--B BAABB  EEEBB AEEBA  ..... .....
109/ 73. (5) PHALONIIDAE          C-EAB --AE-  ----- ----E  --BB- -CCAA  -BBCA ACC-C  A--AV ---CC
                                  BDDCC -BEAB  C--BA AVAAV  AA--B BAABB  ABB-B ABEB-  ..... .....
110/ 73. (5) PHALONIIDAE          C-BAB --AE-  ----- ----B  --BB- -CCAA  -BBCA ACC-C  A--AV ---CC
                                  BDDCC -BEAB  C--BA AVAAV  AA--B BAAAB  ABB-A ABBB-  ..... .....
111/ 73. (5) PHALONIIDAE          C-BAB --AE-  ----- ----B  --BB- -CCAA  -EBCA ACC-C  A--AV ---CC
                                  BDDCC -BEAB  C--BA AVAAV  AA--B BAABB  BBBBB ABBBA  ..... .....

112/ 74. (1) CASTNIIDAE           ACECB ABCEC  BBBAB BCBBB  BCCA- CCCAA  B-ECC ACCCC  A--AA A--CC
                                  BCDCC BBEBB  BEBBB B--AA  AABB- AAABB  EB-B- EBE--  ----- -----

113/ 75. (4) COSSIDAE             C-E-B ---EC  -C-B- AC--B  --B-- ----B  --B-- A-C-C  A---- -C-CC
                                  -CDCC -BEA-  C---- AVAAA  AA--A BA-BB  -BB-B EBEBB  ..... .....
114/ 75. (4) COSSIDAE             C-E-B ---EC  -C-B- AC--B  --B-- ----B  --B-- A-C-C  A---- -C-CC
                                  -CDDC -BEA-  C---- AVAAA  AA--A BA-BB  -BE-B EEEBB  ..... .....
115/ 75. (4) COSSIDAE             C-B-B ---EC  -C-B- AC--B  --B-- ----B  --B-- A-C-C  A---- -C-CC
                                  -DDDC -BEA-  C---- AVAAA  AA--A BA-BB  -BB-B BBBBB  ..... .....
116/ 75. (4) COSSIDAE             C-B-B ---EC  -C-B- AC--B  --B-- ----B  --B-- A-C-C  A---- -C-CC
                                  -DDCC -EEA-  C---- AVAAA  AA--A BA-BB  -BB-B BBBBB  ..... .....

117/ 76. (3) DREPANIDAE           CAE-B ---EC  B---- ----B  ----- -----  ----- -----  ----- -----
                                  ----- -BEB-  B--BB AVEAA  AAVB. .....  ..... .....  ..... .....

118/ 77. (4) BREPHINAE            -ABBB -DBEC  EBACC ACBBB  CC-A- CBCAC  ----- ABECB  A---- ---C-
                                  -CD-C -EEA-  CEBBB ABBAA  AABB- BB--B  --B-- --BB-  ----- -----

119/ 78. (3) MIMALLONIDAE         --EAB -DCEC  -BBCB A-A-B  CBBB- B---A  --BCA ACCCC  ACBAA CCACC


                                  BCDBC CBEAB  C-ABB ABAAA  AA--A BAVBB  -EE-B EBEB-  ..... .....
120/ 79. (7) NOTODONTIDAE         --E-B -DCEC  B---- A-AAE  BDB-- ---AA  ----- A---A  --C-A C---C
                                  BCD-- BBEV-  V--BB AAEVA  VAVB. .....  ..... .....  BABBB BEBVB

121/ 80. (5) AGARISTIDAE          -AE-B -D-EC  B---A ACAAV  B---- BBAAA  ---CA ACECA  AC-AA ---CC
                                  BCDBC BBEA-  C-A-B AAEAA  AAB-. .....  ..... .....  ..... .....

122/ 81. (9) NOCTUIDAE            --B-B -D-EC  B---- ACA-V  ---A- --CAV  ---CA A-V-A  A--AA B--VC
                                  BCDBC BBBA-  C---B AVEVA  VAV-. .....  ..... .....  BABBB BBBAB
123/ 81. (9) NOCTUIDAE            --B-B -D-EC  B---- ACA-V  ---A- --CAV  ---CA A-V-A  A--AA B--VC
                                  BCDBC BBCA-  C---B AVEVA  VAV-. .....  ..... .....  BABBB BBBAB
124/ 81. (9) NOCTUIDAE            --E-B -D-EC  B---- ACA-V  ---A- --CAV  ---CA A-V-A  A--AA B--VC
                                  BCDBC BBEA-  C---B AVEVA  VAV-. .....  ..... .....  BABBB EEBAB
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FAMILY KEY TO LEPIDOPTERA LARVAE (#)

TAXA, ABUNDANCE INDICES, AND CHARACTER VALUES. .16.15.23. 07/26/76

	1 12345 67890		11111 11112 12345 67890		22222 22223 12345 67890		33333 33334 12345 67890		44444 44445 12345 67890	
1/ 1. (3) BLASTODACNIDAE	--BAB	ADCEC	BA---	ACB-B	-----	-----	-----	-----	----A	-----
	-----	-BEAA	C-A-A	AABAA	BA--.	.....	.....	.....	.....	.....
2/ 2. (1) EPIPYROPIDAE	-----	---E-	-----	-----	-----	-----	-----	-----	-D---	-----
	-----	-BAA-	C-B-A	AAAAA	BA--.	.....	.....	.....	.....	.....
3/ 3. (4) LIMACODIDAE	-----	---E-	-----	-----	-----	-----	-----	-----	-D---	-----
	-----	-BAB-	A-B--	---AA	BA--.	.....	..A..	.....	.....	.....
4/ 4. (5) PTEROPHORIDAE	--BBB	-BBEC	CAABB	ABBCB	CB-B-	CB-A-	-----	ACCCC	A--AA	C--CC
	CODDD	BBEAA	C-BBA	AABAA	BABBA	BBBBB	AAB--	ABBB-	.....	.....
5/ 5. (7) HESPERIIDAE	-AB-B	-D-E-	B----	----V	-----	-----	-----	-----	-C--B	-----
	-----	-BEA-	C-BBB	ABAAB	BA--.	.....	.....	.....	--BB-	BABAB
6/ 5. (7) HESPERIIDAE	-AB-B	-D-E-	B----	----V	-----	-----	-----	-----	-C--B	-----
	-----	-BEA-	C-BBB	ABBAB	BA--.	.....	.....	.....	--BB-	BABAB
7/ 6. (2) MEGATHYMIDAE	B-B-B	-DCEC	BC---	----B	-----	-----	-----	-----	----B	-----
	-----	-BEAB	C-ABB	ABAAA	BA--.	.....	.....	.....	--BB-	BBBAB
8/ 7. (9) PAPILIONIDAE	BABBB	-DCEC	B----	----B	-----	-----	-----	-----	-CC-A	-----
	-----	-BEAB	C-BCB	ABEVA	BBBB.	.....	.....	.....	--BB-	BBBAB
9/ 8. (9) PIERIDAE	-AB-B	CDCFC	B----	----A	-----	-----	-----	-----	-C--A	-----
	-----	-BEA-	C---B	ABEAV	BAAA.	.....	.....	.....	.....	.....
10/ 9. (8) DANAIINAE	-ABBB	CDCEC	BC---	----A	-----	-----	-----	-----	-C--A	-----
	-----	-BEA-	C---B	ABEAA	BBBV.	.....	.....	.....	--BBB	BBB-B
11/ 10. (8) SATYRINAE	-ABAB	-DCEB	BC---	----B	-----	-----	-----	-----	-CC-A	-----
	-----	-BEA-	C--BA	AVEAA	BAAA.	.....	.....	.....	--BBB	ABB-B
12/ 11. (3) LIBYTHEIDAE	CABAB	CDBEC	B----	----A	-----	-----	-----	-----	-CC-A	-----
	-----	-BEA-	C--BB	ABBAA	BABB.	.....	.....	.....	.....	.....
13/ 12. (6) LYCAENINAE	C-BAB	C--EC	B----	----B	-----	-----	-----	-----	-----	-----
	-----	-BEA-	C----	ABEAA	BAVB.	.....	.....	.....	--BBA	BBB-B
14/ 13. (3) DREPANIDAE	CAB-B	---EC	B----	----B	-----	-----	-----	-----	-----	-----
	-----	-BEB-	---BB	AVEAA	BAVB.	.....	.....	.....	.....	.....
15/ 14. (2) APATELODIDAE	-BBBB	-DBEC	BC---	----B	-----	-----	-----	-----	-----	-----
	-----	-BEA-	CE-BB	ABEAA	BABB-	BBB-B	-BB--	--BB-	--BBB	BBBCB
16/ 15. (9) LASIOCAMPIDAE	--B-B	-DCEC	BC---	----B	-----	-----	-----	-----	----A	-----
	-----	-BEA-	C-BBB	ABEAA	BABB.	.....	.....	.....	ABBBB	BBBAB
17/ 16. (1) BOMBYCIDAE	DBBBB	CCBEC	BB---	----B	-----	-----	-----	-----	-CC-A	-----
	-----	-BEAB	C-ABB	ABEAA	BA-B.	.....	.....	.....	--ABB	ABB-B
18/ 17. (4) SPHINGIDAE	--B-B	CDCEC	B----	----B	-----	-----	-----	-----	-CC-A	-----
	-----	-BEA-	C--AB	ABEAA	BABA.	.....	.....	.....	--VBB	BBB-B
19/ 18. (7) NOTODONTIDAE	--B-B	-DCEC	B----	A-AAB	BDB--	---AA	-----	A---A	--C-A	C---C
	BCD--	BBEV-	---BB	AAEVA	VAVB.	.....	.....	.....	BABBB	BBBVB
20/ 19. (9) NOCTUIDAE	--B-B	-D-EC	B----	ACA-V	---A-	--CAV	---CA	A-V-A	A--AA	B--VC
	BCDBC	BBBA-	C---B	AVEVA	VAV-.	.....	.....	.....	BABBB	BBBAB
21/ 19. (9) NOCTUIDAE	--B-B	-C-EC	B----	ACA-V	---A-	--CAV	---CA	A-V-A	A--AA	B--VC
	BCDBC	BBCA-	C---B	AVEVA	VAV-.	.....	.....	.....	BABBB	BBBAB
22/ 19. (9) NOCTUIDAE	--B-B	-D-EC	B----	ACA-V	---A-	--CAV	---CA	A-V-A	A--AA	B--VC
	BCDBC	BBEA-	C---B	AVEVA	VAV-.	.....	.....	.....	BABBB	BBBAB

FAMILY KEY TO LEPIDOPTERA LARVAE (C)

TAXA, ABUNDANCE INDICES, AND CHARACTER VALUES.   .16.18.20. 07/26/76

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                                                1 11111 11112  22222 22223  33333 33334  44444 44445
                                     12345 67890 12345 67890  12345 67890  12345 67890  12345 67890

 1/  1. (3) ZYGAENIDAE               ----- ---E- ----- -----  ----- -----  ----- -----  -D--A -----
                                     ----- -BEAA C-ABA AAEAA  CA--. .....  ..A.. .....  ..... .....

 2/  2. (4) LIMACODIDAE              ----- ---E- ----- -----  ----- -----  ----- -----  -D--- -----
                                     ----- -BAB- A-B-- ---VA  CA--. .....  ..A.. .....  ..... .....

 3/  3. (4) MEGALOPYGIDAE            ----- ---E- -C--- -----  ----- -----  ----- -----  -D--- -----
                                     ----- -BFAA C---- AAEAA  CA--. .....  ..A.. .....  ..... .....

 4/  4. (5) PTEROPHORIDAE            --BBB -BBEC BA--- AB--B  ----- -----  ----- -----  ---AA -----
                                     ----- -BEAA C-B-A AABAA  CABB- B-B-V  ----- --EB-  ..... .....

 5/  5. (9) PAPILIONIDAE             BABBB -DCEC B---- ----B  ----- -----  ----- -----  -CC-A -----
                                     ----- -BEAB C-BCB ABEVA  CBBB. .....  ..... .....  --BB- BEBAB

 6/  6. (9) NYMPHALINAE              -ABAB -D-E- B---- ----A  ----- -----  ----- -----  ----A -----
                                     ----- -BEA- C---B ABEBA  CAVB. .....  ..... .....  --VBB VBV-B

 7/  7. (3) RIODININAE               BABBB C-CEC BB--- ----B  ----- -----  ----- -----  -CB-- -----
                                     ----- -BEA- C---- ABEBA  CABB. .....  ..... .....  ABBBA BBB-B

 8/  8. (2) APATELODIDAE             -BBBB -DBEC BC--- ----B  ----- -----  ----- -----  ----- -----
                                     ----- -BEA- CE-BB ABEAA  CABB- BBB-B  -BB-- --EB-  --BBB BBBCB

 9/  9. (9) LASIOCAMPIDAE            --B-B -DCEC BC--- ----B  ----- -----  ----- -----  ----A -----
                                     ----- -BEA- C-BBB ABEAA  CABB. .....  ..... .....  ABBBB BEBAB

10/ 10. (8) SATURNIIDAE              -ABBB -DCE- -C--- ----B  ----- -----  ----- -----  -CC-A -----
                                     ----- -BEA- C---B ABEBA  CAB-. .....  ..... .....  --AAB BBB-B

11/ 11. (7) CITHERONIIDAE            -AB-B -DCEC BC--- ----B  ----- -----  ----- -----  ----- -----
                                     ----- -BEA- C---B ABEBA  CAAB. .....  ..... .....  --VVB BBBAB

12/ 12. (7) NOTODONTIDAE             --B-B -DCEC B---- A-AAB  BDB-- ---AA  ----- A---A  --C-A C---C
                                     BCD-- BEEV- ---BB AAEVA  VAVB. .....  ..... .....  BABBB BBBVB

13/ 13. (7) LYMANTRIIDAE             -AB-B -DCEC ----- ----B  ----- -----  ----- -----  ----- -----
                                     ----- -BEA- C-ABB AAEAA  CAB-. .....  ..... .....  AABBB BBBVA

14/ 14. (7) CTENUCHIDAE              --BBB -DCE- -C--- ----B  ----- -----  ----- -----  -CC-- -----
                                     ----- -BEA- C-ABB AAFAA  CAB-. .....  ..... .....  ABBBB BBBAB

15/ 15. (3) PERICOPIDAE              --B-B -DCEC B-AE- AC--B  ----- -----  ----- -----  ----- -----
                                     ----- -BEA- C-ABB AAEAA  CAB-. .....  ..... .....  BBBBB BEBAB
16/ 15. (3) PERICOPIDAE              --B-B -DCEC B-AE- AC--B  ----- -----  ----- -----  ----- -----
                                     ----- -BEA- C-ABB AAFAA  CAB-. .....  ..... .....  BBBBB BBBAB

17/ 16. (9) ARCTIIDAE                --BBB CDCEC B-AE- AC--B  ----- -----  ----- -----  -C--- -----
                                     ----- -BEA- C-ABB AAFAA  CAB-. .....  ..... .....  AABBB BEBAB
18/ 16. (9) ARCTIIDAE                --BBB CDCEC B-AE- AC--B  ----- -----  ----- -----  -C--- -----
                                     ----- -BEA- C-ABB AAEAA  CAB-. .....  ..... .....  AABBB BBBAB

19/ 17. (1) NOLIDAE                  CABBB -D-EC BC-AA ACAAB  ----- -----  ----- -----  --B-A -----
                                     ----- -BCA- C-ABB AAEAA  CAB-. .....  ..... .....  ..... .....

20/ 18. (9) NOCTUIDAE                --B-B -D-EC B---- ACA-V  ---A- --CAV  ---CA A-V-A  A--AA B--VC
                                     BCDBC BEBA- C---B AVEVA  VAV-. .....  ..... .....  BABBB BBBAB
21/ 18. (9) NOCTUIDAE                --B-B -D-EC B---- ACA-V  ---A- --CAV  ---CA A-V-A  A--AA B--VC
                                     BCDBC BBCA- C---B AVEVA  VAV-. .....  ..... .....  BABBB BBBAB
22/ 18. (9) NOCTUIDAE                --B-B -D-EC B---- ACA-V  ---A- --CAV  ---CA A-V-A  A--AA B--VC
                                     BCDBC BBEA- C---B AVEVA  VAV-. .....  ..... .....  BABBB BBBAB
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FAMILY KEY TO LEPIDOPTERA LARVAE (D)

TAXA, ABUNDANCE INDICES, AND CHARACTER VALUES.   .16.18.45. 07/26/76

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                                                 1  11111 11112  22222 22223  33333 33334  44444 44445
                                     123.5 67890  12345 67891  12345 67890  12345 67890  12345 67890

 1/  1. (3) SCYTHRIDAE               CAB-B ADBEC  BACCA AAB-B  CDBBA C--AA  -ABCA ABDCC  ACC-A B--CC
                                     BDDD- DBEAA  C--BA ABAAA  DA--. .....  ..... .....  ..... .....

 2/  2. (4) COSSIDAE                 C-B-B ---EC  -C-B- AC--B  --B-- ----B  --B-- A-C-C  A---- -C-CC
                                     -DDCC -BEA-  C---- AVAAA  DA--A BA-BB  -BB-B BBBBB  ..... .....
 3/  2. (4) COSSIDAE                 C-B-B ---EC  -C-B- AC--B  --B-- ----B  --B-- A-C-C  A---- -C-CC
                                     -DDDC -BEA-  C---- AVAAA  DA--A BA-BB  -BB-B BBBBB  ..... .....
 4/  2. (4) COSSIDAE                 C-B-B ---EC  -C-B- AC--B  --B-- ----B  --B-- A-C-C  A---- -C-CC
                                     -CDDC -BEA-  C---- AVAAA  DA--A BA-BB  -BB-B BBBBB  ..... .....
 5/  2. (4) COSSIDAE                 C-B-B ---EC  -C-B- AC--B  --B-- ----B  --B-- A-C-C  A---- -C-CC
                                     -CDDC -BEA-  C---- AVAAA  DA--A BA-BB  -BB-B BBBBB  ..... .....

 6/  3. (4) THYATIRIDAE              -AB-B -D-EC  BBB-- ACAAB  BD--- ABCA-  -AB-B ACABA  B---A B--CC
                                     BDD-- BBEA-  B-BBB ABEAA  DABB. .....  ..... .....  ..... .....

 7/  4. (9) GEOMETRIDAE              -ABBB CC-EC  B--B- A--AB  C-BA- -B-AA  A--CA A--CA  A---A A--CC
                                     BCDBC BBBA-  --B-B ABEAA  DAVB. .....  ..... .....  ..... .....

 8/  5. (3) EPIPLEMIDAE              CABAB BD-EC  BBACB ACAAB  BD-A- ACCA-  B-BCA ACCCC  ACBBA ABBCC
                                     BCEBD BBEA-  --ABB ABEAA  DAAB. .....  ..... .....  ..... .....

 9/  6. (7) NOTODONTIDAE             --B-B -DCEC  B---- A-AAB  BDB-- ---AA  ----- A---A  --C-A C---C
                                     BCD-- BBEV-  ---BB AAEVA  VAVB. .....  ..... .....  BABBB BBBVB

10/  7. (1) DOA                      --BBB -DCEC  BAACB ACAAB  BCBB- AACAA  ----- ACBBA  B---A C--CC
                                     BCDB- BBEAB  CEBBB ABEAA  DABBA BBBBB  -BBB- B-BB-  --BBB BBBAB

11/  8. (9) LITHOSIINAE (HYPOPREPIA) C-BBB CDCEC  BCBEB ACCCB  BDBA- ACBAA  B--CB ACACA  BCBAB BBBCC
                                     BCEDD BBEA-  C-ABB AAEAA  DB--. .....  ..... .....  ..... .....

12/  9. (9) NOCTUIDAE                --B-B -D-EC  B---- ACA-V  ---A- --CAV  ---CA A-V-A  A--AA B--VC
                                     BCDBC BBBA-  C---B AVEVA  VAV-. .....  ..... .....  BABBB BBBAB
13/  9. (9) NOCTUIDAE                --B-B -D-EC  B---- ACA-V  ---A- --CAV  ---CA A-V-A  A--AA B--VC
                                     BCDBC BBCA-  C---B AVEVA  VAV-. .....  ..... .....  BABBB BBBAB
14/  9. (9) NOCTUIDAE                --B-B -D-EC  B---- ACA-V  ---A- --CAV  ---CA A-V-A  A--AA B--VC
                                     BCDBC BBEA-  C---B AVEVA  VAV-. .....  ..... .....  BABBB BBBAB
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FAMILY KEY TO LEPIDOPTERA LARVAE (A)
PROGRAM KEY. RUN AT 11.18.39 ON 07/29/76. STORAGE REQUIRED = 12379 WORDS.
CHARACTERS = 30, READ, 8, MASKED, 6, USED IN KEY.
ITEMS = 124 READ, 124 MASKED, 142 APPEAR IN KEY, 61 TAXA.
PHASE = 4.00, ALASE = 7.0.., RELSP = 1.01, VARYWT = 1.00.., NCONF = 3
PRESET CHARACTERS - COLUMN,GROUP,CHARACTER
  1, 1, 61
CHARACTER MASK -
[illegible]
KEY INCOMPLETE, MORE INFORMATION NEEDED.
```

OPOSTEGIDAE	61A	57A	5A	2A	1A					
GRACILARIIDAE (2ND INSTAR	61A	57A	5A	2A	1B					
GRACILARIIDAE (2ND INSTA	61A	57A	5A	2A	1D					
NEPTICULIDAE •	61A	57A	5A	2C						
NEPTICULIDAE	61A	57A	59	9C	2B	4B				
ERIOCRANIIDAE	61A	57A	59	9C	3C	4A				
HELIOZELIDAE	61A	57A	59	9D						
PRODOXINAE •	61A	57A	58	9D						
PRODOXINAE •	61A	57A	59	9D						
PRODOXINAE •	61A	57[illegible]	3A	9D						
NOTODONTIDAE •	61A	57[illegible]	63A	9	59A					
LIMACODIDAE	61A	57B	63A	9	59A					
PRODOXINAE •	61A	57B	63A	9	59B					
NOTODONTIDAE	61A	57B	63A	9	59B					
NOTODONTIDAE •	61A	57[illegible]	3I							
NOTODONTIDAE •	61[illegible]	66A	63A	57[illegible]	59A					
NOTODONTIDAE •	61F	66A	63A	67A	59[illegible]					
DREPANIDAE •	61F	66A	69A	67A	59B					
DREPANIDAE •	61F	66A	63A	67[illegible]						
NOTODONTIDAE •	61F	66A	49							
CASTNIIDAE	61F	66B	52C	16[illegible]	35A	8C				
ADELINAE	61F	66[illegible]	[illegible]	16A	35[illegible]	8A				
DALCERIDAE	61C	57A	3A							
TISCHERIIDAE	61C	57A	9[illegible]							
LYONETIIDAE •	61C	579	67A	69A	3A	5A	49A	59A		
LYONETIIDAE (LEUC)	61C	57[illegible]	67A	69A	3A	5A	49B	59C		
LYONETIIDAE •	61C	57[illegible]	67A	69A	3A	58	66A	4A	59A	
LYONETIIDAE (P-D)	61C	57D	67A	69A	3A	59	66A	4A	59A	
OSCHENHEIMERIIDAE	61C	57[illegible]	67A	69A	3A	58	66A	4A	59A	

GRACILARIIDAE (LATE INST•	61C	57A	67A	69A	3A	59	66A	4A	59A												
COLEOPHORIDAE •	61C	57B	67A	69A	3A	59	66A	4A	59A												
ELACHISTIDAE	61C	57A	67A	69A	3A	59	66A	4A	59A												
INCURVARIIDAE	61C	57A	67A	69A	3A	59	66A	4A	59B												
EPERMENIIDAE	61C	57B	67A	69A	3A	59	66A	4B	52C	9C	43C	13B									
OINOPHILIDAE	61C	57B	67A	69A	3A	59	66A	4B	52D	9C	40A	13A									
LYONETIIDAE •	61C	57B	67A	69A	3A	59	6[illegible]														
YPONOMEUTINAE	61C	57B	67A	69A	3B	2B															
NOTODONTIDAE •	61C	57[illegible]	67A	69A	3B	52C	59A														
GRACILARIIDAE (LATE INST•	61C	57[illegible]	67A	69A	3[illegible]	52C	59A														
THYRIDIDAE	61C	57B	67A	69A	3[illegible]	52C	59A														
PYRALIDAE •	61C	57B	67A	69A	3B	52C	59A														
MOMPHIDAE (MOM)	61C	57[illegible]	67A	69A	3[illegible]	52C	59A														
MOMPHIDAE (CM)	61C	57[illegible]	67A	69A	3[illegible]	52C	59A														
COSSIDAE •	61C	57[illegible]	67A	69A	3[illegible]	52C	59A														
NOCTUIDAE •	61C	57[illegible]	67A	69A	3[illegible]	52C	[illegible]A														
ALUCITIDAE	61C	57[illegible]	67A	69A	3[illegible]	52C	59A														
CARPOSINIDAE	61C	57C	67A	69A	3[illegible]	52C	59A														
AGARISTIDAE	61C	57[illegible]	67A	69A	3B	52C	59A														
NOTODONTIDAE •	61C	57B	67A	69A	3[illegible]	52C	59B														
GELECHIIDAE (9[illegible]) •	61C	57[illegible]	67A	69A	3B	2[illegible]	49A	66A	49A	78A	91B										
GELECHIIDAE (AP) •	61C	57[illegible]	67A	69A	3B	52[illegible]	49A	66A	49A	78[illegible]	91A										
TORTRICIDAE •	61C	57[illegible]	67A	69A	3B	52[illegible]	4[illegible]A	66A	49B	75A	93A										
TINEINAE (T)	61C	57B	67A	69A	3[illegible]	52[illegible]	49A	66A	49B	75A	40H	9B									
SCARDIINAE	61C	579	67A	69A	3[illegible]	52[illegible]	4[illegible]A	66A	49[illegible]	75A	[illegible]	90	54C	56B							
TINEINAE ([illegible])	61C	57[illegible]	67A	69A	3[illegible]	2[illegible]	49A	66A	49[illegible]	75A	[illegible]	90	54[illegible]	56C							
GLYPHIPTERYGIDAE	61C	57[illegible]	67A	69A	3[illegible]	52[illegible]	49A	66A	49E	75A	[illegible]	9[illegible]	8[illegible]A	82A	81[illegible]	[illegible]	79A	[illegible]			
PLUTELLINAE (C)	61C	57[illegible]	67A	69A	3	52[illegible]	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]A	82A	41B	84A	79[illegible]	[illegible]			
HELIODINIDAE •	61C	57[illegible]	67A	69A	3[illegible]	52D	49A	66A	49E	75A	[illegible]	9[illegible]	8[illegible]	82[illegible]	55C	88A	[illegible]	55A	3[illegible]	[illegible]	
HEMAROSCINIDAE	61C	57[illegible]	67A	69A	3[illegible]	52D	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	82[illegible]	55C	88A	[illegible]	[illegible]	39A	[illegible]	
TORTRICIDAE •	61C	57[illegible]	67A	69A	3[illegible]	52D	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	82[illegible]	55C	8[illegible]	79A				
PLUTELLINAE (A[illegible])	61C	57[illegible]	67A	69A	3[illegible]	2[illegible]	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	82[illegible]	55C	8[illegible]	79[illegible]	12A	[illegible]	[illegible]	
HELIODINIDAE •	61C	57[illegible]	67A	69A	3[illegible]	52D	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	82[illegible]	55C	88[illegible]	79[illegible]	12A	[illegible]	[illegible]	[illegible]
PLUTELLINAE (PL)	61C	57[illegible]	67A	69A	3[illegible]	2[illegible]	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	8[illegible]	55C	88[illegible]	79[illegible]	12A	[illegible]	[illegible]	[illegible]
TORTRICIDAE •	61C	57[illegible]	67A	69A	3[illegible]	52D	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	82[illegible]	55C	88[illegible]	79[illegible]	12A	[illegible]	7CA	[illegible]
WALSHIIDAE	61C	57D	67A	69A	3[illegible]	2[illegible]	49A	66A	49E	75A	[illegible]	9[illegible]	8[illegible]	82B	55C	88[illegible]	79[illegible]	12A	[illegible]	7CA	[illegible]
TORTRICIDAE •	61C	57[illegible]	67A	69A	3[illegible]	2[illegible]	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	82[illegible]	55C	88[illegible]	79[illegible]	12A	[illegible]	7CA	[illegible]
WALSHIIDAE	61C	[illegible]	67A	69A	[illegible]	2[illegible]	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	[illegible]	55C	88[illegible]	79[illegible]	12A	[illegible]	7CA	[illegible]
WALSHIIDAE (A)	61C	57[illegible]	67A	69A	3[illegible]	2[illegible]	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	82[illegible]	55C	88[illegible]	79[illegible]	12A	[illegible]	7CA	[illegible]
HELIODINIDAE •	61C	[illegible]	67A	69A	[illegible]	2[illegible]	49A	66A	49[illegible]	75A	[illegible]	9[illegible]	8[illegible]	82[illegible]	55C	88[illegible]	79	12A	[illegible]	7CA	[illegible]
COLEOPHORIDAE •	61C	57[illegible]	67A	69A	3	2[illegible]	49A	66A	49[illegible]	7[illegible]A	[illegible]	9[illegible]	8[illegible]	82	55C	88[illegible]	79[illegible]	12A	[illegible]	7CA	[illegible]

TORTRICIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75A	93B	9E	81B 82B	55C	8BB	79C	12A	63C	72A	64C	40C	76B	51B 4A	23B	76
ARGYRESTHIINAE (A)	61C	57B	67A	69A	38	520	69A	66A	49E	75A	93B	9E	81E 82B	55C	8BE	79B	12A	63E	72A	64C	40C	76B	51B 4A	23C	
TORTRICIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75A	93B	9E	81B 82B	55C	8BB	79B	12A	63C	72A	64C	65A 13E 15A 41A				
MOMPHIDAE (FAT)	61C	57B	67A	69A	38	520	69A	66A	49E	75A	93B	9E	81B 82B	55C	8BB	79B	12A	63B	72A	64D	65E 13A 35E 41B				
TORTRICIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75A	93B	9E	81B 82B	55C	8BE	79B	12A	63B	72C						
BLASTOBASIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75A	93B	9E	81B 82B	55C	8BB	79B	12B								
COSSIDAE	61C	57B	67A	69A	38	520	69A	66A	49E	75A	93B	9E	81B 82B	55C	8BE	79C	12C								
TINEINAE (D)	61C	57B	67A	69A	38	20	69A	66A	49E	75A	93B	9E	81B 82B	55C											
PHALONIIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75A	86A														
TORTRICIDAE	61C	57B	67A	69A	38	520	69A	66A	49E	75B	96B	90A													
TORTRICIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75B	86B	90B	79A												
TORTRICIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75B	86B	93B	79B	7CA	45A										
COSMOPTERYGIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75B	86B	90B	79B	7CA	45A										
TORTRICIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75B	86B	90B	79B	7CA	45E										
TORTRICIDAE	61C	57B	67A	69A	38	20	69A	66A	49E	75B	86B	90B	79E	7CE											
PLUTELLIDAE (PH)	61C	57B	67A	69A	38	20	69A	66B	16A 10C	55C	36A 43A 4A	84A 17C 46A 56B													
ARGYRESTHIINAE (2)	61C	57B	67A	69A	38	520	69A	66B	16A 10C	55C	36A 43A 4A	84B 17B 46B 56C													
GLYPHIPTERYGIDAE (F)	61C	57B	67A	69A	38	20	69A	66B	16A 10C	55C	36B 43C 4E	65A 23C 54D 11B													
HEPIALIDAE	61C	57B	67A	69A	38	520	69A	66B	16A 10C	55C	36B 4CC 4B	65B 23C 54C 11A													
YPONOMEUTINAE (A)	61C	57B	67A	69A	38	520	69A	66B	16A 10C	55D															
ACROLOPHINAE	61C	57B	67A	69A	38	520	69A	66B	16B 10C																
GELECHIIDAE (EH)	61C	57B	67A	69A	38	20	69B	55C	78A	89A 35A															
GLYPHIPTERYGIDAE (C)	61C	57B	67A	69A	38	20	68B	55C	78A	89B 35B	87A 83A 54D														
COLEOPHORIDAE	61C	57B	67A	69A	38	20	69H	55C	78A	89B 35B	87B 8[illegible]B 54C	8A 82B 6CB 17B													
PLUTELLIDAE (AH)	61C	57B	67A	69A	38	20	69B	55C	78A	89B 35B	87B 83B 54C	8B 82A 66A 17C													
GELECHIIDAE (AN)	61C	57B	67A	69A	38	520	69B	55C	78B																
YPONOMEUTINAE (L)	61C	57B	67A	69A	38	520	68B	55D	36A 9A 11B 15B																
PSYCHIDAE	61C	57B	67A	69A	38	20	68B	55D	36B 8B 11A 15C																
INCURVARIINAE	61C	57B	67A	69A	38	520	69C																		
LYONETIIDAE (BLCDU)	61C	57B	67A	69A	38	20	69D	9D 43A																	
COLEOPHORIDAE	61C	57B	67A	69A	38	520	69D	9E 40C	16A	12A 11B 23B	78A 89C 35B														
GELECHIIDAE (AF)	61C	57B	67A	69A	38	20	69D	9E 40C	16A	12A 11B 23E	78E 89A 35A														
SESIIDAE	61C	57B	67A	69A	38	520	69D	9E 40C	16A	12B 11A 23C															
SESIIDAE	61C	57B	67A	69A	38	520	69D	9E 40C	16B																
SESIIDAE	61C	57B	67A	69A	38	520	69D	9E 40C	16C																
NOCTUIDAE	61C	57B	67A	69A	93A	40B																			
NOTODONTIDAE	61C	57B	67A	69A	93A	46C																			
NOTODONTIDAE	61C	57B	67A	69A	93B																				
NOTODONTIDAE	61C	57B	67A	69A	9[illegible]C																				
GRACILARIIDAE (LATE INST	61C	57B	67B	52C	3A																				

NOCTUIDAE	61C	57B	67B	52C	33														
BREPHINAE	61C	57B	67B	52C	33														
PIPALLONIDAE	61C	57B	67B	52C	38														
GRACILARIIDAE (LATE INST	61C	57B	67B	52C	38														
PYRALIDAE	61C	57B	67B	52C	38														
COSSIDAE	61C	57B	67B	52C	38														
HYBLAEIDAE	61C	57B	67B	52C	33														
GELECHIIDAE (PF)	61C	57B	67B	52C	93B	78A 81B													
GELECHIIDAE (AH)	61C	57B	67B	52C	93A	78B 81A													
STENOMIDAE	61C	57B	67B	52C	93B	69A	47A	9[illegible]A 78A 91B 12B											
OECOPHORIDAE (A)	61C	57B	67B	52C	93B	69A	47A	90B 78B 91A 12A	8B 17B 7B										
ETHMIIDAE (E, S[illegible]M)	61C	57B	67B	52C	93B	69A	47A	90B 78B 91A 12A	8C 17C 7D										
PHALONIIDAE	61C	57B	67B	52C	93B	69A	47B	9[illegible]A											
TORTRICIDAE	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93A										
TORTRICIDAE	61C	57B	67B	52C	93B	69A	47A	8[illegible]B	93B	79A									
OECOPHORIDAE	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	90B	79B	12A	78A	72A	51A					
OECOPHORIDAE	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	90B	79B	12A	78A	72A	51B	13A	8C 38C 14C 35A			
MOMPHIDAE (HCP)	61C	57B	67B	52C	93B	69A	47B	86B	90C	79B	12A	78A	72A	51B	13A	8C 39D 14B 35B			
TORTRICIDAE	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93E	79B	12A	78A	72A	51E	13E				
OECOPHORIDAE	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93E	79B	12A	78A	72A	51C					
TORTRICIDAE	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93B	79B	12A	78A	72B						
COSMOPTERYGIDAE (A[illegible]S)	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93B	79B	12A	78B	81A	8A 56C 24A					
COSMOPTERYGIDAE (T[illegible]I)	61C	57B	67B	52C	93B	69A	47B	86B	93B	79B	12A	78B	81A	8B 54C 24B	65A 19B 29B	49A 46B 15C 17B			
ETHMIIDAE (CEYH)	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93E	79B	12A	78B	81A	8B 56C 24B	65A 19B 24B	49C 46C 15E 17C			
OECOPHORIDAE (C)	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93E	79B	12A	78B	81A	8C 56C 24B	65E 19A 29C				
GELECHIIDAE (CH)	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93B	79B	12A	78B	81B						
COSMOPTERYGIDAE (LIMN)	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93B	79B	12B	45A 9A 49A 46A							
BLASTOBASIDAE	61C	57B	67B	52C	93B	9A	47B	8[illegible]B	93E	79B	12B	45B 9C 49C 46C							
COSSIDAE	61C	57B	67B	52C	93B	69A	47B	8[illegible]B	93B	79B	12B								
STENOMIDAE	61C	[illegible]	67B	52C	93B	8	47B 78A 12A 12B												
ETHMIIDAE	61C	57B	67B	52C	93B	6[illegible]	47B 79B 96B 12A	41A 46B 77B 35B											
GELECHIIDAE (CH)	61C	[illegible]	67B	52C	93B	69B	47B 79B 93B 12A	41B 46A 77A 35A											

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.FAMILY.KEY.TO.LEPIDOPTERA..LARVAE.(6).........................................

PROGRAM KEY. RUN AT.13.47 ON 07/29/76. STORAGE REQUIRED -  3374 WORDS.

CHARACTERS - 100 READ,  99 MASKED,  25 USED IN KEY.
ITEMS -  22 READ,  22 MASKED,  41 APPEAR IN KEY:  19 TAXA,

RBASE = 4.00, ABASE = 3.00, REUSE = 1.01, VARYWT = 1.0  , NCONF = 7

PRESET CHARACTERS - COLUMN,GROUP,CHARACTER
  1,  1, 58

CHARACTER MASK -
..... .....  ..... .....  ..... .....  ..... .....  ..... .....
..... .....  ..... .....  ..... .....  ..... .....  ..... .....

KEY INCOMPLETE, MORE INFORMATION NEEDED,
.......................................

LIMACODIDAE                 I58AI61A 59BI
EPIPYROPIDAE                I58AI61C 59AI
NOCTUIDAE                  *I58BI
NOCTUIDAE                  *I58CI
HESPERIIDAE                =I58EI68AI97A 70B 53BI
MEGATHYMIDAE                I58EI68AI97B 70A 53AI
PTEROPHORIDAE               I58EI68BI67A 65AI 8B  7B 11C 17BI
BLASTODACNIDAE              I58EI68BI67A 65AI 8C  7D 113 17CI
LIBYTHEIDAE                 I58EI68BI67B 65BI70A 45AI
HESPERIIDAE                =I58EI68BI67B 65BI70B 45BI
SATYRINAE                  *I58EI68EI69AI67AI55A 10BI
NOCTUIDAE                  *I58EI68EI69AI67AI55B 10CI59AI99AI46BI
NOTODONTIDAE               *I58EI68EI69AI67AI55B 10CI59AI99AI46CI
NOTODONTIDAE               *I58EI68EI69AI67AI55B 10CI59AI99BI
NOTODONTIDAE               *I58EI68EI69AI67AI55B 10CI59AI99CI
NOTODONTIDAE               *I58EI68EI69AI67AI55B 10CI59BI
DREPANIDAE                 *I58EI68EI69AI67AI55B 10CI59BI
SATYRINAE                  *I58EI68EI69AI67BI70AI10BI
PIERIDAE                   *I58EI68EI69AI67BI70AI10CI59AI72AI20AI73AI
NOCTUIDAE                  *I58EI68EI69AI67BI70AI10CI59AI72AI20AI73AI
NOCTUIDAE                  *I58EI68EI69AI67BI70AI10CI59AI72AI20AI73BI
BOMBYCIDAE                  I58EI68EI69AI67BI70AI10CI59AI72AI20BI93AI96A  8B 74B 54BI
SPHINGIDAE                 *I58EI68EI69AI67BI70AI10CI59AI72AI20BI93AI96B  8C 74A 54AI
LYCAENINAE                  I58EI68EI69AI67BI70AI10CI59AI72AI20BI93BI95AI
NOCTUIDAE                  *I58EI68EI69AI67BI70AI10CI59AI72AI20BI93BI95BI73AI
APATELODIDAE                I58EI68EI69AI67BI70AI10CI59AI72AI20BI93BI95BI73BI
SPHINGIDAE                 *I58EI68EI69AI67BI70AI10CI59AI72AI20BI93BI95BI73BI
NOCTUIDAE                  *I58EI68EI69AI67BI70AI10CI59AI72AI20BI93BI95BI73BI
LASIOCAMPIDAE               I58EI68EI69AI67BI70AI10CI59AI72AI20BI93BI95BI73BI


IDANAIINAE                 *I58EI68EI69AI67BI70AI10CI59AI72BI74AI
DANAIINAE                  *I58EI68EI69AI67BI70AI10CI59AI72BI74BI20AI
PAPILIONIDAE               *I58EI68EI69AI67BI70AI10CI59AI72BI74BI20BI
DREPANIDAE                 *I58EI68EI69AI67BI70AI10CI59BI
PIERIDAE                   *I58EI68FI69AI67BI70BI
NOCTUIDAE                  *I58EI68EI69BI67AI99AI46BI
NOTODONTIDAE               *I58EI68EI69BI67AI99AI46CI
NOTODONTIDAE               *I58EI68EI69BI67AI99BI
NOTODONTIDAE               *I58EI68FI69BI67AI99CI
NOCTUIDAE                  *I58EI68EI69BI67BI73AI
NOCTUIDAE                  *I58EI68EI69BI67BI73BI72AI
PAPILIONIDAE               *I58EI68EI69BI67BI73BI72BI
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 FAMILY KEY TO LEPIDOPTERA LARVAE (C)
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PROGRAM KEY. RUN AT.[illegible] ON [illegible]/7[illegible]. STORAGE REQUIRED - [illegible] WORDS.

CHARACTERS = [illegible] READ, [illegible] MASKED, [illegible] USED IN KEY.
ITEMS - [illegible] READ, 22 MASKED, [illegible] APPEAR IN KEY: 1[illegible] TAXA.

RBASE = 4.[illegible] , ABASE = 3.  , [illegible] = [illegible], VARYWT = [illegible], NCONF = 3

PRESET CHARACTERS - COLUMN,GROUP,CHARACTER
  1.  1. 55

CHARACTER MASK -
[illegible]

KEY INCOMPLETE, MORE INFORMATION NEEDED.
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LIMACODIDAE		58A							
NOCTUIDAE	*	5[illegible]							
NOCTUIDAE	*	58C	69A	67A	73A				
NOCTUIDAE	*	58C	69A	67A	73B	20A			
NOCTUIDAE	*	58C	69A	67A	73B	20B			
NOLIDAE		58C	69A	67A	73B	20B			
NOCTUIDAE	*	58C	69A	67B					
NOCTUIDAE	*	58C	69B						
PTEROPHORIDAE		58E	67A	68B					
ZYGAENIDAE		58E	67A	68E	59A	65A			
LYMANTRIIDAE		58E	67A	68E	59A	65B	91A	10A	
ARCTIIDAE	=	58E	67A	68E	59A	65B	91A	10B	
NOTODONTIDAE	*	58E	67A	68E	59A	65B	91B	92A	
NOCTUIDAE	*	58E	67A	68E	59A	65B	91B	92A	
PERICOPIDAE	=	58E	67A	68E	59A	65B	91B	92B	
NOCTUIDAE	*	58E	67A	68E	59B	99A	59A	20A	
NOTODONTIDAE	*	58E	67A	68E	59B	99A	59A	20B	
NOCTUIDAE	*	58E	67A	68E	59B	99A	59A	20B	
NOTODONTIDAE	*	58E	67A	68E	59B	99A	59B		
NOTODONTIDAE	*	58E	67A	68E	59B	99B			
NOTODONTIDAE	*	58E	67A	68E	59B	99C			
ARCTIIDAE	=	58E	67A	68F	92A				
CTENUCHIDAE		58E	67A	68F	92B	91A			
PERICOPIDAE	=	58E	67A	68F	92B	91B			
NOCTUIDAE	*	58E	67B	69A	99A	73A			
LASIOCAMPIDAE		58E	67B	69A	99A	73B	72A	91A	92B
NOCTUIDAE	*	58E	67B	69A	99A	73B	72A	91B	92A
PAPILIONIDAE	*	58E	67B	69A	99A	73B	72B		
APATELODIDAE		58E	67B	69A	99C				

NYMPHALINAE	*	58E	67B	69B	98A					
CITHERONIIDAE	*	58E	67B	69B	98B	94A	93A	73A		
SATURNIIDAE		58E	67B	69B	98B	94A	93A	73B		
CITHERONIIDAE	*	58E	67B	69B	98B	94A	93B			
NYMPHALINAE	*	58E	67B	69B	98B	94B	96A			
NYMPHALINAE	*	58E	67B	69B	98B	94B	96B	93A	20A	
CITHERONIIDAE	*	58E	67B	69B	98B	94B	96B	93A	20B	
RIODININAE		58E	67B	69B	98B	94B	96B	93B	72A	95A
NOCTUIDAE	*	58E	67B	69B	98B	94B	96B	93B	72A	95B
NYMPHALINAE	*	58E	67B	69B	98B	94B	96B	93B	72A	95B
CITHERONIIDAE	*	58E	67B	69B	98B	94B	96B	93B	72A	95B
PAPILIONIDAE	*	58E	67B	69B	98B	94B	96B	93B	72B	
MEGALOPYGIDAE		58F								

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.FAMILY.KEY.TO.LEPIDOPTERA.LARVAE.(D)..............................................

PROGRAM KEY. RUN AT.18.49 ON .7/29/76. STORAGE REQUIRED -  2968 WORDS.

CHARACTERS - 10. READ,  99 MASKED,  18 USED IN KEY.
ITEMS -  14 READ,  14 MASKED,  27 APPEAR IN KEY;   9 TAXA,

RBASE = 4.00, ABASE = 3.00, REUSE = 1.01, VARYWT = 1.000, NCONF = 3

PRESET CHARACTERS - COLUMN,GROUP,CHARACTER
  1,  1, 58

CHARACTER MASK -
..... .....  ..... .....  ..... .....  ..... .....  ..... .....
..... .....  ..... .....  ..... .....  ..... .....  ..... .....

INOCTUIDAE                    *I58BI69AI67AI
INOCTUIDAE                    *I58BI69AI67BI49AI
INOCTUIDAE                    *I58BI69AI67BI49BI
IGEOMETRIDAE                   I58BI69AI67BI49CI46AI
INOCTUIDAE                    *I58BI69AI67BI49CI46BI
INOCTUIDAE                    *I58BI69BI
INOCTUIDAE                    *I58CI
ICOSSIDAE                     *I58EI53DI69AI67AI58A 40CI
INOCTUIDAE                    *I58EI53DI69AI67AI58E 40AI99AI46BI
INOTODONTIDAE                 *I58EI53DI69AI67AI58E 40AI99AI46CI
INOTODONTIDAE                 *I58EI53DI69AI67AI58E 40AI99BI
INOTODONTIDAE                 *I58EI53DI69AI67AI58E 40AI99CI
ICOSSIDAE                     *I58EI53DI69AI67BI58A 40CI52CI
ISCYTHRIDAE                    I58EI53DI69AI67BI58A 40CI52DI12A 14C 17A 38DI
ICOSSIDAE                     *I58EI53DI69AI67BI58A 40CI52DI12C 14B 17C 38CI
INOCTUIDAE                    *I58EI53DI69AI67BI58E 40AI52C 61CI49AI
INOCTUIDAE                    *I58EI53DI69AI67BI58E 40AI52C 61CI49BI
INOCTUIDAE                    *I58EI53DI69AI67BI58E 40AI52C 61CI49CI46B 24A 41AI
IDOA                           I58EI53DI69AI67BI58E 40AI52C 61CI49CI46C 24B 41BI
ITHYATIRIDAE                   I58EI53DI69AI67BI58E 40AI52D 61BI
INOCTUIDAE                    *I58EI53DI69BI67AI99AI46BI
INOTODONTIDAE                 *I58EI53DI69BI67AI99AI46CI
INOTODONTIDAE                 *I58EI53DI69BI67AI99BI
INOTODONTIDAE                 *I58EI53DI69BI67AI99CI
INOCTUIDAE                    *I58EI53DI69BI67BI
ILITHOSIINAE (HYPOPREPIA)      I58EI53EI67A 12C 13B 14EI
IEPIPLEMIDAE                   I58EI53EI67B 12B 13A 14CI
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FAMILY KEY TO LEPIDOPTERA LARVAE (A)

PROGRAM KEY. RUN AT.10.39 ON 07/29/76. STORAGE REQUIRED - 12379 WORDS.

CHARACTERS - 100 READ, 00 MASKED, 63 USED IN KEY.
ITEMS - 124 READ, 124 MASKED, 102 APPEAR IN KEY: 81 TAXA,

RBASE = 4.08, RBASE = 3.00, REUSE = 1.81, VARYWT = 1.300, NCONF = 3

PRESET CHARACTERS - COLUMN,GROUP,CHARACTER
  1, 1, 61

CHARACTER MASK -
..... ..... ..... ....8  .0..8 0..00  8808. .....  .888. .88..
..... ..8.. .808. .....  0.... .....  ..... .....  ..... .....

KEY INCOMPLETE, MORE INFORMATION NEEDED.

 1. (    0) CROCHETS ABSENT ON ALL ABDOMINAL SEGMENTS...........................  2
            CROCHETS ABSENT ON ABD. SEG. 10 BUT PRESENT ON AT LEAST 1 OTHER ABDOMINAL
              SEGMENT............................................................  11
            CROCHETS PRESENT ON ABD. SEG. 10 AND AT LEAST 1 OTHER ABDOMINAL SEGMENT..  16
 2. (    1) SEGMENTED SCLEROTIZED THORACIC LEGS ABSENT...........................  3
            SEGMENTED SCLEROTIZED THORACIC LEGS PRESENT..........................  8
 3. (    2) FRONT OPEN BEHIND....................................................  4
            FRONT CLOSED BEHIND..................................................  6
 4. (    3) HEAD CAPSULE EXTENDS BEYOND THE CORONAL NOTCH L.T. 1/3 ITS WIDTH.....  5
            HEAD CAPSULE EXTENDS BEYOND THE CORONAL NOTCH FROM 1/3 TO 1/2 ITS WIDTH..  NEPTICULIDAE
 5. (    4) HEAD CAPSULE LONGER THAN WIDE.........................................  OPOSTEGIDAE
            HEAD CAPSULE BETWEEN 1/2 AS LONG AS WIDE TO NEARLY AS LONG AS WIDE....  GRACILLARIIDAE (2ND INSTA
            HEAD CAPSULE L.T. HALF AS LONG AS WIDE...............................  GRACILLARIIDAE (2ND INSTA
 6. (    3) OCELLI ONE PRESENT....................................................  7
            OCELLI TWO PRESENT....................................................  HELIOZELIDAE
            OCELLI THREE TO FIVE PRESENT..........................................  PRODOXINAE
            OCELLI SIX PRESENT....................................................  PRODOXINAE
 7. (    6) HEAD CAPSULE EXTENDS BEYOND THE CORONAL NOTCH FROM 1/3 TO 1/2 ITS WIDTH; FRONT
              AS WIDE AS LONG, OR NEARLY..........................................  NEPTICULIDAE
            HEAD CAPSULE EXTENDS BEYOND THE CORONAL NOTCH FURTHER THAN 1/2 ITS WIDTH; FRONT
              CONSPICUOUSLY LONGER THAN WIDE, BUT L.T. TWICE AS LONG AS WIDE.....  ERIOCRANIIDAE
 8. (    2) HARD SCLEROTIZED, PROMINENT SCOLI ABSENT..............................  9
            HARD SCLEROTIZED, PROMINENT SCOLI PRESENT.............................  NOTODONTIDAE
 9. (    8) OCELLI THREE TO FIVE PRESENT..........................................  PRODOXINAE
            OCELLI SIX PRESENT....................................................  10
10. (    9) PROLEGS ON ABD. SEG. 10 PRESENT.......................................  NOTODONTIDAE
            PROLEGS ON ABD. SEG. 10 ABSENT OR RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER
              THAN PROLEGS ON A 3-6...............................................  LIMACODIDAE
                                                                                     PRODOXINAE
                                                                                     NOTODONTIDAE
11. (    1) CROCHETS ON A 3 (SERIAL) UNISERIAL....................................  12
            CROCHETS ON A 3 (SERIAL) BI- OR MULTISERIAL...........................  15
12. (   11) HARD SCLEROTIZED, PROMINENT SCOLI ABSENT..............................  13
            HARD SCLEROTIZED, PROMINENT SCOLI PRESENT.............................  NOTODONTIDAE
13. (   12) CROCHETS ON A 3 (ORDINAL) UNIORDINAL..................................  14
            CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL..................  DREPANIDAE
14. (   13) PROLEGS ON ABD. SEG. 10 PRESENT.......................................  NOTODONTIDAE
            PROLEGS ON ABD. SEG. 10 ABSENT OR RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER
              THAN PROLEGS ON A 3-6...............................................  NOTODONTIDAE
                                                                                     DREPANIDAE
15. (   11) L SETAE ON THORACIC SEG. I, 2; HEAD SETA O1 ON A STRAIGHT LINE BETWEEN OC2 AND
              OC3; L GP. ON THORACIC SEG. I DISTINCTLY SEPARATED FROM CERVICAL SHIELD AND
              FROM XD, D, AND SD SETAE; FRONT EXTENDS TO THE CORONAL NOTCH L.T. HALFWAY.....  CASTNIIDAE
            L SETAE ON THORACIC SEG. I, 3; HEAD SETA O1 INSIDE CIRCLE OF EYES; L GP. ON


              THORACIC SEG. I WITH XD, D, SD SETAE LOCATED ON ONE DISTINCT CONTINUOUS
              SCLEROTIZED AREA; FRONT EXTENDS TO THE CORONAL NOTCH ALL THE WAY, OR NEARLY...  ADELINAE
16. (    1) SEGMENTED SCLEROTIZED THORACIC LEGS ABSENT...........................  17
            SEGMENTED SCLEROTIZED THORACIC LEGS PRESENT..........................  18
17. (   16) HEAD CONSPICUOUSLY RETRACTED INTO THORAX..............................  PALAEPHATIDAE
            HEAD NOT CONSPICUOUSLY RETRACTED INTO THORAX..........................  TISCHERIIDAE
18. (   16) CROCHETS ON A 3 (ORDINAL) UNIORDINAL..................................  19
            CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL..................  70
19. (   18) HARD SCLEROTIZED, PROMINENT SCOLI ABSENT..............................  20
            HARD SCLEROTIZED, PROMINENT SCOLI PRESENT.............................  76
20. (   19) HEAD ORIENTATION PROGNATHOUS, HEAD DEPRESSED, HORIZONTAL, MOUTH PARTS DIRECTED
              FORWARD, PARALLEL TO LONG AXIS OF BODY..............................  21
            HEAD ORIENTATION HYPOGNATHOUS OR SEMI-HYPOGNATHOUS, MOUTH PARTS NOT DIRECTED
              FORWARD.............................................................  27
21. (   20) FRONT OPEN BEHIND....................................................  22
            FRONT CLOSED BEHIND..................................................  23
22. (   21) OCELLI ONE AND TWO ASSOCIATED TOGETHER, DISTANCE BETWEEN OC2 AND NEXT OCELLUS
              4X DISTANCE BETWEEN OCELLI 1 AND 2; PROLEGS ON ABD. SEG. 10 PRESENT.....  LYONETIIDAE
            OCELLI ONE AND TWO NOT ASSOCIATED TOGETHER, DISTANCE BETWEEN OC2 AND NEXT
              OCELLUS MORE EQUAL TO DISTANCE BETWEEN OCELLI 1 AND 2; PROLEGS ON ABD. SEG.
              10 ABSENT OR RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER THAN PROLEGS ON A
              3-6.................................................................  LYONETIIDAE (LEUC)
23. (   21) CROCHETS ON A 3 (SERIAL) UNISERIAL....................................  24
            CROCHETS ON A 3 (SERIAL) BI- OR MULTISERIAL...........................  LYONETIIDAE
24. (   23) FRONT EXTENDS TO THE CORONAL NOTCH ALL THE WAY, OR NEARLY............  25
            FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4...................  26
25. (   24) PROLEGS ON ABD. SEG. 10 PRESENT.......................................  LYONETIIDAE
                                                                                     LYONETIIDAE (PHYL)
                                                                                     OSCOPHORIDAE
                                                                                     GRACILLARIIDAE (LATE INST
                                                                                     COLEOPHORIDAE
                                                                                     ELACHISTIDAE
            PROLEGS ON ABD. SEG. 10 ABSENT OR RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER
              THAN PROLEGS ON A 3-6...............................................  INCURVARIINAE
26. (   24) L SETAE ON THORACIC SEG. I, 2; OCELLI SIX PRESENT; SETA L1 ON ABD. SEG. 3
              CLOSER TO L2 THAN TO SP.; HEAD SETA A2 EQUIDISTANT OR NEARLY BETWEEN A1 AND
              A3..................................................................  EPERMENIIDAE
            L SETAE ON THORACIC SEG. I, 3; OCELLI TWO PRESENT; SETA L1 ON ABD. SEG. 3
              CLOSER TO SP. THAN TO L2; HEAD SETA A2 CLOSER TO A1 THAN TO A3.......  OINOPHILIDAE
27. (   20) L SETAE ON THORACIC SEG. I, 1.........................................  YPONOMEUTINAE
            L SETAE ON THORACIC SEG. I, 2.........................................  28
            L SETAE ON THORACIC SEG. I, 3.........................................  29
28. (   27) PROLEGS ON ABD. SEG. 10 PRESENT.......................................  NOTODONTIDAE
                                                                                     GRACILLARIIDAE (LATE INST
                                                                                     INTRIIDAE
                                                                                     PYRALIDAE
                                                                                     NOMPHIDAE (NOM)
                                                                                     NOMPHIDAE (CH)
                                                                                     COSSIDAE
                                                                                     NOCTUIDAE
                                                                                     ALUCITIDAE
                                                                                     CARPOSINIDAE
                                                                                     AGARISTIDAE
            PROLEGS ON ABD. SEG. 10 ABSENT OR RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER
              THAN PROLEGS ON A 3-6...............................................  NOTODONTIDAE
29. (   27) CROCHETS ON A3 ARRANGED (CIRCLE) IN A COMPLETE CIRCLE OR ELLIPSE......  30
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            CROCHETS ON A3 ARRANGED (CIRCLE) IN 1 TRANSVERSE BAND.................  INCURVARIINAE
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              NUMBER..............................................................  72
30. (   29) CROCHETS ON A 3 (SERIAL) UNISERIAL....................................  31
            CROCHETS ON A 3 (SERIAL) BI- OR MULTISERIAL...........................  61
31. (   30) CROCHETS ON CAUDAL PROLEGS DIVIDED INTO TWO GROUPS, BROKEN SERIES.....  32
            CROCHETS ON CAUDAL PROLEGS NOT DIVIDED INTO TWO GROUPS, CONTINUOUS SERIES..  33
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32. (31) NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD NINE OR LESS; L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 MORE EVENLY SPACED WITH NEXT SETA BELOW, NOT ASSOCIATED AS ABOVE, NEVER ON SAME PINACULUM.......... GELECHIIDAE (BR)
NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD MORE THAN NINE; L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 VERY CLOSE, OR ON SAME PINACULUM, DISTANCE BETWEEN L2 AND THE NEXT SETA BELOW AT LEAST 4X THE DISTANCE BETWEEN L1 AND L2.......... GELECHIIDAE (AN)

33. (31) POSITION OF SETA SD1 ON ABDOMINAL SEGMENT 8 DIRECTLY ABOVE SPIRACLE, OR ONLY SLIGHTLY CAUDAD OR CEPHALAD, IF ANY.......... 34
POSITION OF SETA SD1 ON ABDOMINAL SEGMENT 8 DIRECTLY IN FRONT OF SPIRACLE, OR ONLY SLIGHTLY ABOVE OR BELOW, IF ANY.......... 56

34. (33) L SETAE ON ABDOMINAL SEG. 9 ALL THREE CLOSE TOGETHER, OR ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD.... TORTRICIDAE
L SETAE ON ABDOMINAL SEG. 9 NOT CLOSE TOGETHER, NEVER ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO L GREATER THAN 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD.......... 35

35. (34) OCELLI ONE PRESENT.......... TINEINAE (T)
OCELLI THREE TO FIVE PRESENT.......... 36
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36. (35) L SETAE ON ABD. SEG. 9, 2; SV SETAE ON ABD. SEG. 9 1.......... SCARDIINAE
L SETAE ON ABD. SEG. 9, 3; SV SETAE ON ABD. SEG. 9 2.......... TINEINAE (X)

37. (35) TIBIA ON THORACIC LEGS VERY LONG, AT LEAST 4X LONGER THAN GREATEST WIDTH; CLAW ON THORACIC LEGS ELONGATE, SICKLE SHAPED, NOT RECURVED AT TIP.......... 38
TIBIA ON THORACIC LEGS NOT UNUSUALLY LONG, LESS THAN 4X AS LONG AS WIDE; CLAW ON THORACIC LEGS CONSPICUOUSLY RECURVED AT TIP, MORE HOOK SHAPED.......... 39

38. (37) L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 VERY CLOSE, OR ON SAME PINACULUM, DISTANCE BETWEEN L2 AND THE NEXT SETA BELOW AT LEAST 4X THE DISTANCE BETWEEN L1 AND L2; SETA L3 ON ABDOMINAL SEG. 9 NOT ASSOCIATED WITH SV SETA, NEVER ON SAME PINACULUM, DISTANCE BETWEEN L3 AND NEAREST L ABOVE LESS THAN 4X DISTANCE BETWEEN L3 AND SV; SETAE D2 ON ABD. SEG. 9 CLOSER TO EACH OTHER THAN EACH IS TO ITS ASSOCIATED D1, OR ON SAME PINACULUM; SETA L1 ON ABD. SEG. 3 CLOSER TO L2 THAN TO SP.......... GLYPHIPTERYGIDAE
L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 MORE EVENLY SPACED WITH NEXT SETA BELOW, NOT ASSOCIATED AS ABOVE, NEVER ON SAME PINACULUM; SETA L3 ON ABDOMINAL SEG. 9 VERY CLOSE TO SV SETA, OR ON SAME PINACULUM, DISTANCE BETWEEN L3 AND NEAREST L ABOVE 4X DISTANCE BETWEEN L3 AND SV; SETAE D2 ON ABD. SEG. 9 NOT CONSPICUOUSLY CLOSE, OR NOT ON SAME PINACULUM; SETA L1 ON ABD. SEG. 3 EQUIDISTANT BETWEEN L2 AND SP.......... PLUTELLINAE (C)

39. (37) SV SETAE ON THORACIC SEGMENTS, 2 ON TI, 1 ON TII AND TIII.......... 40
SV SETAE ON THORACIC SEGMENTS, 2 ON ALL THREE.......... TINEINAE (D)

40. (39) OCELLI ONE AND TWO ASSOCIATED TOGETHER, DISTANCE BETWEEN OC2 AND NEXT OCELLUS 4X DISTANCE BETWEEN OCELLI 1 AND 2.......... 41
OCELLI ONE AND TWO NOT ASSOCIATED TOGETHER, DISTANCE BETWEEN OC2 AND NEXT OCELLUS MORE EQUAL TO DISTANCE BETWEEN OCELLI 1 AND 2.......... 42

41. (40) L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 VERY CLOSE, OR ON SAME PINACULUM, DISTANCE BETWEEN L2 AND THE NEXT SETA BELOW AT LEAST 4X THE DISTANCE BETWEEN L1 AND L2; CROCHET ARRANGEMENT CIRCULAR; SETA L1 ON ABD. SEG. 3 DISTINCTLY BELOW AND CAUDAD OF SP.; SD SETAE ON ABD. SEG. 9, 2.......... HELIODINIDAE
L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 MORE EVENLY SPACED WITH NEXT SETA BELOW, NOT ASSOCIATED AS ABOVE, NEVER ON SAME PINACULUM; CROCHET ARRANGEMENT ELLIPTICAL; SETA L1 ON ABD. SEG. 3 CAUDAD OF SP., ONLY SLIGHTLY ABOVE OR BELOW SP, IF ANY; SD SETAE ON ABD. SEG. 9, 1.......... NEMAPOGONINAE

42. (40) SETAE D2 ON ABD. SEG. 9 CLOSER TO EACH OTHER THAN EACH IS TO ITS ASSOCIATED D1, OR ON SAME PINACULUM.......... TORTRICIDAE
SETAE D2 ON ABD. SEG. 9 NOT CONSPICUOUSLY CLOSE, OR NOT ON SAME PINACULUM.......... 43

43. (42) OCELLUS 5 NOT CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 L.T. 1/2 THE DISTANCE BETWEEN OC1 AND OC4.......... 44
OCELLUS 5 CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 G.T. 1/2 BUT L.T. EQUAL TO DISTANCE BETWEEN OC1 AND OC4.......... BLASTOBASIDAE
OCELLUS 5 AS FAR AWAY OR FURTHER FROM OC4 AS OC4 IS FROM OC1.......... COSSIDAE

44. (43) PROLEGS ELONGATE, AT LEAST 4X AS LONG AS GREATEST WIDTH.......... 45
PROLEGS LESS THAN 4X AS LONG AS GREATEST WIDTH.......... 47

45. (44) FRONT EXTENDS TO THE CORONAL NOTCH ALL THE WAY, OR NEARLY.......... PLUTELLINAE (AC)
FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4.......... 46

46. (45) HEAD SETAE A1,A2,A3, ARRANGED IN AN ACUTE ANGLE, L.T. 80 D.; SETA L1 ON ABD. SEG. 3 CLOSER TO L2 THAN TO SP.; SD SETAE ON ABD. SEG. 9, 1; SV SETAE ON ABD. SEG. 9 2.......... HELIODINIDAE

HEAD SETAE A1,A2,A3, ARRANGED IN AN OBTUSE ANGLE, 120-170 D.; SETA L1 ON ABD. SEG. 3 EQUIDISTANT BETWEEN L2 AND SP.; SD SETAE ON ABD. SEG. 9, 1; SV SETAE ON ABD. SEG. 9 1.......... PLUTELLINAE (PL)

47. (44) ANAL COMB ABSENT.......... 48
ANAL COMB PRESENT.......... TORTRICIDAE

48. (47) L SETAE ON ABD. SEG. 9, 3.......... TORTRICIDAE
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L SETAE ON ABD. SEG. 9, 2.......... 53
L SETAE ON ABD. SEG. 9, 3.......... 55

49. (48) SETA L1 ON ABD. SEG. 3 CLOSER TO SP. THAN TO L2; SETA L1 ON THORACIC SEG. II EQUIDISTANT BETWEEN L2 AND L3; SETA L1 ON ABD. SEG. 3 EQUIDISTANT BETWEEN L2 AND L3.......... WALSHIIDAE
SETA L1 ON ABD. SEG. 3 CLOSER TO L2 THAN TO SP.; SETA L1 ON THORACIC SEG. II CLOSER TO L2 THAN TO L3; SETA L1 ON ABD. SEG. 3 CLOSER TO L2 THAN TO L3.......... TORTRICIDAE

50. (48) SETA L1 ON ABD. SEG. 3 CLOSER TO SP. THAN TO L2.......... WALSHIIDAE
SETA L1 ON ABD. SEG. 3 CLOSER TO L2 THAN TO SP.......... 51

51. (50) DISTANCE BETWEEN COXAE ON THORACIC SEGMENT III GREATER THAN 1+1/2 TIMES THE WIDTH OF THE COXA.......... WALSHIIDAE (A)
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52. (51) SD SETAE ON ABD. SEG. 9, 2; FRONT AS WIDE AS LONG, OR NEARLY.......... HELIODINIDAE
SD SETAE ON ABD. SEG. 9, 1; FRONT CONSPICUOUSLY LONGER THAN WIDE, BUT L.T. TWICE AS LONG AS WIDE.......... 53

53. (52) SETA SD2 ON THORACIC SEG. I BEHIND SD1, ANGLE SP.-SD1-SD2 10-90 D.......... 54
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54. (53) ADFRONTAL SUTURES EXTEND BEYOND CORONAL NOTCH; SETA L1 ON THORACIC SEG. II EQUIDISTANT BETWEEN L2 AND L3.......... COLEOPHORIDAE
ADFRONTAL SUTURES EXTEND TO CORONAL NOTCH, OR NEARLY; SETA L1 ON THORACIC SEG. II CLOSER TO L2 THAN TO L3.......... TORTRICIDAE

55. (48) SPIRACLES SHAPE ROUND; HEAD SETA A2 EQUIDISTANT OR NEARLY BETWEEN A1 AND A3; SETA L1 ON THORACIC SEG. II CLOSER TO L2 THAN TO L3; SETA L1 ON ABD. SEG. 3 CLOSER TO L2 THAN TO L3.......... TORTRICIDAE
SPIRACLES SHAPE ELLIPTICAL OR EGG SHAPED; HEAD SETA A2 CLOSER TO A1 THAN TO A3; SETA L1 ON THORACIC SEG. II EQUIDISTANT BETWEEN L2 AND L3; SETA L1 ON ABD. SEG. 3 EQUIDISTANT BETWEEN L2 AND L3.......... MOMPHIDAE (BAT)

56. (33) SETA D1 ON ABDOMINAL SEG. 9 VERY CLOSE TO SD, OR ON SAME PINACULUM, DISTANCE BETWEEN D1 AND D2 4X DISTANCE BETWEEN D1 AND SD1.......... PHALONIIDAE
SETA D1 ON ABDOMINAL SEG. 9 FAR FROM SD, NEVER ON SAME PINACULUM, DISTANCE BETWEEN D1 AND D2 LESS THAN 4X DISTANCE BETWEEN D1 AND SD1.......... 57

57. (56) L SETAE ON ABDOMINAL SEG. 9 ALL THREE CLOSE TOGETHER, OR ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD.... TORTRICIDAE
L SETAE ON ABDOMINAL SEG. 9 NOT CLOSE TOGETHER, NEVER ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO L GREATER THAN 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD.......... 58

58. (57) SETAE D2 ON ABD. SEG. 9 CLOSER TO EACH OTHER THAN EACH IS TO ITS ASSOCIATED D1, OR ON SAME PINACULUM.......... TORTRICIDAE
SETAE D2 ON ABD. SEG. 9 NOT CONSPICUOUSLY CLOSE, OR NOT ON SAME PINACULUM.......... 59

59. (58) ANAL COMB ABSENT.......... 60
ANAL COMB PRESENT.......... TORTRICIDAE

60. (59) POSITION OF SP. ON ABD. SEG. 8 IN LINE WITH SP. ON PRECEEDING ABD. SEGS.......... TORTRICIDAE
COSMOPTERYGIDAE
POSITION OF SP. ON ABD. SEG. 8 WELL ABOVE SP. ON PRECEEDING ABD. SEGS.......... TORTRICIDAE

61. (60) HEAD SETA O1 INSIDE CIRCLE OF EYES; OCELLI 1,2,3, ARRANGED IN AN OBTUSE ANGLE, BETWEEN 100 AND 170 D.......... 62
HEAD SETA O1 ON A STRAIGHT LINE BETWEEN OC2 AND OC3; OCELLI 1,2,3, ARRANGED IN A RIGHT ANGLE, OR NEARLY (80-100 D.).......... ACROLOPHINAE

62. (61) SV SETAE ON THORACIC SEGMENTS, 2 ON TI, 1 ON TII AND TIII.......... 63
SV SETAE ON THORACIC SEGMENTS, 2 ON ALL THREE.......... PRONCHOTINAE (A)

63. (62) L GP. ON THORACIC SEG. I DISTINCTLY SEPARATED FROM CERVICAL SHIELD AND FROM XD, ON SEPARATE PINACULA; SETA L1 ON ABD. SEG. 3 CLOSER TO SP. THAN TO L2; FRONT CONSPICUOUSLY LONGER THAN WIDE, BUT L.T. TWICE AS LONG AS WIDE.......... 64
L GP. ON THORACIC SEG. I WITH XD, SD, SV SETAE LOCATED ON ONE DISTINCT CONTINUOUS SCLEROTIZED AREA; SETA L1 ON ABD. SEG. 3 CLOSER TO L2 THAN TO SP.; FRONT AS WIDE AS LONG, OR NEARLY.......... 65

64. (63) SETA L3 ON ABDOMINAL SEG. 9 VERY CLOSE TO SV SETA, OR ON SAME PINACULUM, DISTANCE BETWEEN L3 AND NEAREST L ABOVE 4X DISTANCE BETWEEN L3 AND SV; HEAD SETA O1 CLOSER TO OC3 THAN TO OC2; SETA D2 ON ABD. SEG. 9 DIRECTLY ABOVE D1 AND ONLY A LITTLE CAUDAD, IF ANY; SV SETAE ON ABD. SEG. 9 1.......... PLUTELLINAE (PR)

SETA L3 ON ABDOMINAL SEG. 9 NOT ASSOCIATED WITH SV SETA, NEVER ON SAME PINACULUM, DISTANCE BETWEEN L3 AND NEAREST L ABOVE LESS THAN 4X DISTANCE BETWEEN L3 AND SV; HEAD SETA O1 EQUIDISTANT OR NEARLY BETWEEN OC2 AND OC3; SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1; SV SETAE ON ABD. SEG. 9 2...... ARGYRESTIINAE (Z)

65. (63) SPIRACLES SHAPE ROUND; SETA SD2 ON THORACIC SEG. I BEHIND SD1, ANGLE SP.-SD1-SD2 10-90 D.; L SETAE ON ABD. SEG. 9, 3; OCELLI 3,4,5, ARRANGED IN A STRAIGHT LINE, OR NEARLY (170-190 D.)...... GLYPHIPTERYGIDAE (P)

SPIRACLES SHAPE ELLIPTICAL OR EGG SHAPED; SETA SD2 ON THORACIC SEG. I ABOVE SD1, ANGLE SP.-SD1-SD2 G.T. 90; L SETAE ON ABD. SEG. 9, 2; OCELLI 3,4,5, ARRANGED IN AN ANGLE G.T. 190 D...... HEPIALIDAE

66. (29) SV SETAE ON THORACIC SEGMENTS, 2 ON TI, 1 ON TII AND TIII...... 67

SV SETAE ON THORACIC SEGMENTS, 2 ON ALL THREE...... 71

67. (66) NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD NINE OR LESS...... 68

NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD MORE THAN NINE...... GELECHIIDAE (AN)

68. (67) CROCHETS ON CAUDAL PROLEGS DIVIDED INTO TWO GROUPS, BROKEN SERIES; SETA L1 ON THORACIC SEG. II CLOSER TO L2 THAN TO L3...... GELECHIIDAE (BR)

CROCHETS ON CAUDAL PROLEGS NOT DIVIDED INTO TWO GROUPS, CONTINUOUS SERIES; SETA L1 ON THORACIC SEG. II EQUIDISTANT BETWEEN L2 AND L3...... 69

69. (68) SETA SD ON ABDOMINAL SEG. 9 VERY CLOSE TO AT LEAST 1 OF THE L SETAE, OR ON SAME PINACULUM, DISTANCE BETWEEN SD AND D1 4X DISTANCE BETWEEN SD AND L1; TIBIA ON THORACIC LEGS VERY LONG, AT LEAST 4X LONGER THAN GREATEST WIDTH; L SETAE ON ABD. SEG. 9, 3...... GLYPHIPTERYGIDAE (S)

SETA SD ON ABDOMINAL SEG. 9 FAR FROM ANY L SETA, NEVER ON SAME PINACULUM, DISTANCE BETWEEN SD AND D1 LESS THAN 4X DISTANCE BETWEEN SD AND L1; TIBIA ON THORACIC LEGS NOT UNUSUALLY LONG, LESS THAN 4X AS LONG AS WIDE; L SETAE ON ABD. SEG. 9, 2...... 70

70. (69) FRONT EXTENDS TO THE CORONAL NOTCH ALL THE WAY, OR NEARLY; CLAW ON THORACIC LEGS CONSPICUOUSLY RECURVED AT TIP, MORE HOOK SHAPED; PROLEGS LESS THAN 4X AS LONG AS GREATEST WIDTH; HEAD SETA O1 EQUIDISTANT OR NEARLY BETWEEN OC2 AND OC3...... COLEOPHORIDAE

FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4; CLAW ON THORACIC LEGS ELONGATE, SICLE SHAPED, NOT RECURVED AT TIP; PROLEGS ELONGATE, AT LEAST 4X AS LONG AS GREATEST WIDTH; HEAD SETA O1 CLOSER TO OC3 THAN TO OC2...... PLUTELLINAE (AB)

71. (66) L GP. ON THORACIC SEG. I DISTINCTLY SEPARATED FROM CERVICAL SHIELD AND FROM XD, D, AND SD SETAE; FRONT EXTENDS TO THE CORONAL NOTCH ALL THE WAY, OR NEARLY; OCELLI 3,4,5, ARRANGED IN A STRAIGHT LINE, OR NEARLY (170-190 D.); HEAD SETA A3 EQUIDISTANT OR NEARLY BETWEEN A2 AND L1...... YPONOMEUTINAE (L)

L GP. ON THORACIC SEG. I WITH XD, D, SD SETAE LOCATED ON ONE DISTINCT CONTINUOUS SCLEROTIZED AREA; FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4; OCELLI 3,4,5, ARRANGED IN AN ANGLE G.T. 190 D.; HEAD SETA A3 CLOSER TO L1 THAN TO A2...... PSYCHIDAE

72. (29) OCELLI THREE TO FIVE PRESENT; SETA L1 ON ABD. SEG. 3 CLOSER TO SP. THAN TO L2...... LYONETIIDAE (BUCCU)

OCELLI SIX PRESENT; SETA L1 ON ABD. SEG. 3 CLOSER TO L2 THAN TO SP...... 73

73. (72) HEAD SETA C1 INSIDE CIRCLE OF EYES...... 74

HEAD SETA C1 ON A STRAIGHT LINE BETWEEN OC2 AND OC3...... SESIIDAE

HEAD SETA C1 OUTSIDE CIRCLE OF EYES...... SESIIDAE

74. (73) OCELLUS 5 NOT CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 L.T. . 1/2 THE DISTANCE BETWEEN OC1 AND OC4; OCELLI 3,4,5, ARRANGED IN A STRAIGHT LINE, OR NEARLY (170-190 D.); SETA SD2 ON THORACIC SEG. I BEHIND SD1, ANGLE SP.-SD1-SD2 10-90 D...... 75

OCELLUS 5 CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 G.T 1/ 2 BUT L.T. EQUAL TO DISTANCE BETWEEN OC1 AND OC4; OCELLI 3,4,5, ARRANGED IN AN ANGLE G.T. 190 D.; SETA SD2 ON THORACIC SEG. I ABOVE SD1, ANGLE SP.-SD1-SD2 G.T. 90...... SESIIDAE

75. (74) NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD NINE OR LESS; CROCHETS ON CAUDAL PROLEGS NOT DIVIDED INTO TWO GROUPS, CONTINUOUS SERIES; SETA L1 ON THORACIC SEG. II EQUIDISTANT BETWEEN L2 AND L3...... COLEOPHORIDAE

NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD MORE THAN NINE; CROCHETS ON CAUDAL PROLEGS DIVIDED INTO TWO GROUPS, BROKEN SERIES; SETA L1 ON THORACIC SEG. II CLOSER TO L2 THAN TO L3...... GELECHIIDAE (AP)

76. (19) LATERAL NOTCH SHALLOW, EXTENDING NOT MORE THAN 1/2 THE DISTANCE TO THE BASE OF THE LABRUM...... 77

LATERAL NOTCH DEEP, WITH PARALLEL SIDES, EXTENDING TO BASE OF LABRUM, OR NEARLY...... NOTODONTIDAE

LATERAL NOTCH ACUTE, V-SHAPED, A GROOVE EXTENDING TO BASE OF LABRUM SOMETIMES PRESENT...... NOTODONTIDAE

77. (76) SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1...... NOCTUIDAE

SETA D2 ON ABD. SEG. 9 DISTINCTLY CAUDAD OF D1 AND ONLY SLIGHTLY IF ANY, ABOVE OR BELOW...... NOTODONTIDAE

78. (18) L SETAE ON THORACIC SEG. I: 2...... 79

L SETAE ON THORACIC SEG. I: 3...... 80

79. (78) HEAD ORIENTATION PROGNATHOUS, HEAD DEPRESSED, HORIZONTAL, MOUTH PARTS DIRECTED FORWARD, PARALLEL TO LONG AXIS OF BODY...... GRACILARIIDAE (LATE INST

HEAD ORIENTATION HYPOGNATHOUS OR SEMI-HYPOGNATHOUS, MOUTH PARTS NOT DIRECTED FORWARD...... NOCTUIDAE
DREPANINAE
HIMALLONIDAE
GRACILARIIDAE (LATE INST
PYRALIDAE
COSSIDAE
HYBLAEIDAE

80. (78) CROCHETS ON CAUDAL PROLEGS DIVIDED INTO TWO GROUPS, BROKEN SERIES...... 81

CROCHETS ON CAUDAL PROLEGS NOT DIVIDED INTO TWO GROUPS, CONTINUOUS SERIES...... 82

81. (80) NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD NINE OR LESS; L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 MORE EVENLY SPACED WITH NEXT SETA BELOW, NOT ASSOCIATED AS ABOVE, NEVER ON SAME PINACULUM...... GELECHIIDAE (BR)

NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD MORE THAN NINE; L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 VERY CLOSE, OR ON SAME PINACULUM, DISTANCE BETWEEN L2 AND THE NEXT SETA BELOW AT LEAST 4X THE DISTANCE BETWEEN L1 AND L2...... GELECHIIDAE (AN)

82. (80) CROCHETS ON A3 ARRANGED (CIRCLE) IN A COMPLETE CIRCLE OR ELLIPSE...... 83

CROCHETS ON A3 ARRANGED (CIRCLE) IN AN INCOMPLETE CIRCLE OR ELLIPSE...... 100

83. (82) SETA SD ON ABDOMINAL SEG. 9 VERY CLOSE TO AT LEAST 1 OF THE L SETAE, OR ON SAME PINACULUM, DISTANCE BETWEEN SD AND D1 4X DISTANCE BETWEEN SD AND L...... 84

SETA SD ON ABDOMINAL SEG. 9 FAR FROM ANY L SETA, NEVER ON SAME PINACULUM, DISTANCE BETWEEN SD AND D1 LESS THAN 4X DISTANCE BETWEEN SD AND L...... 86

84. (83) L SETAE ON ABDOMINAL SEG. 9 ALL THREE CLOSE TOGETHER, OR ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD; NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD NINE OR LESS; L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 MORE EVENLY SPACED WITH NEXT SETA BELOW, NOT ASSOCIATED AS ABOVE, NEVER ON SAME PINACULUM; OCELLUS 5 CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 G.T 1/ 2 BUT L.T. EQUAL TO DISTANCE BETWEEN OC1 AND OC4...... STENOMIDAE

L SETAE ON ABDOMINAL SEG. 9 NOT CLOSE TOGETHER, NEVER ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO L GREATER THAN 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD; NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD MORE THAN NINE; L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 VERY CLOSE, OR ON SAME PINACULUM, DISTANCE BETWEEN L2 AND THE NEXT SETA BELOW AT LEAST 4X THE DISTANCE BETWEEN L1 AND L2; OCELLUS 5 NOT CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 L.T . 1/2 THE DISTANCE BETWEEN OC1 AND OC4...... 85

85. (84) FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4; HEAD SETA O1 EQUIDISTANT OR NEARLY BETWEEN OC2 AND OC3; ADFRONTAL SUTURES EXTEND TO CORONAL NOTCH, OR NEARLY...... OECOPHORIDAE (A)

FRONT EXTENDS TO THE CORONAL NOTCH L.T. HALFWAY; HEAD SETA O1 CLOSER TO OC3 THAN TO OC2; ADFRONTAL SUTURES EXTENDS L.T. 1/2 THE DISTANCE BETWEEN APEX OF FRONT AND CORONAL NOTCH...... ETHMIIDAE (E. SEM)

86. (83) SETA D1 ON ABDOMINAL SEG. 9 VERY CLOSE TO SD, OR ON SAME PINACULUM, DISTANCE BETWEEN D1 AND D2 4X DISTANCE BETWEEN D1 AND SD1...... PHALONIIDAE

SETA D1 ON ABDOMINAL SEG. 9 FAR FROM SD, NEVER ON SAME PINACULUM, DISTANCE BETWEEN D1 AND D2 LESS THAN 4X DISTANCE BETWEEN D1 AND SD1...... 87

87. (86) L SETAE ON ABDOMINAL SEG. 9 ALL THREE CLOSE TOGETHER, OR ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD...... TORTRICIDAE

L SETAE ON ABDOMINAL SEG. 9 NOT CLOSE TOGETHER, NEVER ON SAME PINACULUM, DISTANCE BETWEEN ANY TWO L GREATER THAN 1/4 DISTANCE BETWEEN ANY L AND SV OR ANY L AND SD...... 88

88. (87) SETAE D2 ON ABD. SEG. 9 CLOSER TO EACH OTHER THAN EACH IS TO ITS ASSOCIATED D1, OR ON SAME PINACULUM...... TORTRICIDAE

SETAE D2 ON ABD. SEG. 9 NOT CONSPICUOUSLY CLOSE, OR NOT ON SAME PINACULUM...... 89

89. (88) OCELLUS 5 NOT CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 L.T . 1/2 THE DISTANCE BETWEEN OC1 AND OC4...... 90

OCELLUS 5 CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 G.T 1/ 2 BUT L.T. EQUAL TO DISTANCE BETWEEN OC1 AND OC4...... 99

OCELLUS 5 AS FAR AWAY OR FURTHER FROM OC4 AS OC4 IS FROM OC1...... COSSIDAE

90. (89) NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD NINE OR LESS.......... 91
NUMBER OF SETAE ON OR NEAR A10 PROLEG BELOW CAUDAL SHIELD MORE THAN NINE.......... 95

91. (90) ANAL COMB ABSENT.... 92
ANAL COMB PRESENT.... TORTRICIDAE

92. (91) SD SETAE ON ABD. SEG. 9, 3.... OECOPHORIDAE
SD SETAE ON ABD. SEG. 9, 1.... 93
SD SETAE ON ABD. SEG. 9, 2.... OECOPHORIDAE

93. (92) HEAD SETA A2 CLOSER TO A1 THAN TO A3.... 94
HEAD SETA A2 EQUIDISTANT OR NEARLY BETWEEN A1 AND A3.... TORTRICIDAE

94. (93) FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4; SETA L1 ON ABD. SEG. 3 BELOW SP AND ONLY SLIGHTLY CAUDAD OR CEPHALAD OF SP, IF ANY; HEAD SETAE A1,A2,A3, ARRANGED IN AN OBTUSE ANGLE, 130-170; SETA L1 ON THORACIC SEG. II CLOSER TO L2 THAN TO L3.... OECOPHORIDAE
FRONT EXTENDS TO THE CORONAL NOTCH L.T. HALFWAY; SETA L1 ON ABD. SEG. 3 BELOW SP AND DISTINCTLY CEPHALAD OF SP.; HEAD SETAE A1,A2,A3, ARRANGED IN A RIGHT ANGLE OR CLOSE TO (90-100 D.); SETA L1 ON THORACIC SEG. II EQUIDISTANT BETWEEN L2 AND L3.... MOMPHIDAE (MOM)

95. (94) L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 VERY CLOSE, OR ON SAME PINACULUM, DISTANCE BETWEEN L2 AND THE NEXT SETA BELOW AT LEAST 4X THE DISTANCE BETWEEN L1 AND L2.... 96
L SETAE ON ABDOMINAL SEG. 9 L1 AND L2 MORE EVENLY SPACED WITH NEXT SETA BELOW, NOT ASSOCIATED AS ABOVE, N EVER ON SAME PINACULUM.... GELECHIIDAE (CH)

96. (95) FRONT EXTENDS TO THE CORONAL NOTCH ALL THE WAY, OR NEARLY; L SETAE ON ABD. SEG. 9, 2; SETA XD2 ON THORACIC SEG. I DISTINCTLY FURTHER CEPHALAD THAN SD1.... COSMOPTERYGIDAE (ANON)
FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4; L SETAE ON ABD. SEG. 9, 3; SETA XD2 ON THORACIC SEG. I IN A STRAIGHT LINE, OR NEARLY, WITH XD1 AND SD1... 97

97. (96) SPIRACLES SHAPE ROUND; HEAD SETA L1 THE SAME DISTANCE TO OC1 AS OC1 IS TO OC4; SETA SD1 ON THORACIC SEG 1 EQUIDISTANT OR NEARLY, BETWEEN SD2 AND XD2.... 98
SPIRACLES SHAPE ELLIPTICAL OR EGG SHAPED; HEAD SETA L1 FURTHER AWAY FROM OC1 THAN OC1 IS FROM OC4; SETA SD1 ON THORACIC SEG 1 CLOSER TO SD2 THAN TO XD2.... OECOPHORIDAE (O)

98. (97) TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, MOST OR ALL OBSCURE, ABSENT, OR MINUTE; SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1; HEAD SETA A3 CLOSER TO L1 THAN TO A2; HEAD SETA O1 EQUIDISTANT OR NEARLY BETWEEN OC2 AND OC3.... COSMOPTERYGIDAE (TRI)
TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, ALL SIX PRESENT AND EASILY VISIBLE; SETA D2 ON ABD. SEG. 9 DISTINCTLY CAUDAD OF D1 AND ONLY SLIGHTLY IF ANY, ABOVE OR BELOW; HEAD SETA A3 EQUIDISTANT OR NEARLY BETWEEN A2 AND L1; HEAD SETA O1 CLOSER TO OC3 THAN TO OC2.... ETHMIIDAE (EPYR)

99. (89) CROCHET ARRANGEMENT CIRCULAR; FRONT EXTENDS TO THE CORONAL NOTCH ALL THE WAY, OR NEARLY; TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, MOST OR ALL OBSCURE, ABSENT, OR MINUTE; SETA D2 ON ABD. SEG. 9 DIRECTLY ABOVE D1 AND ONLY A LITTLE CAUDAD, IF ANY.... COSMOPTERYGIDAE (LIMN)
CROCHET ARRANGEMENT ELLIPTICAL; FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4; TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, ALL SIX PRESENT AND EASILY VISIBLE; SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1.... PLASTOBASIDAE

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 FAMILY KEY TO LEPIDOPTERA LARVAE (8)
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PROGRAM KEY. RUN AT.19.47 ON 07/29/76. STORAGE REQUIRED - 3376 WORDS.

CHARACTERS - 10, READ, 99 MASKED, 26 USED IN KEY.
ITEMS - 22 READ, 22 MASKED, -1 APPEAR IN KEY, 19 TAXA.

RBASE = 6.00, ABASE = 3.00, REUSE = 1.01, VARYWT = 1.00, NCONF = 3

PRESET CHARACTERS - COLUMN,GROUP,CHARACTER
  1, 1, 58

CHARACTER MASK -
..... .....  ..... .....  ..... .....  ..... .....  ..... .....
..... .....  ..... .....  ..... .....  ..... .....  ..... .....

KEY INCOMPLETE, MORE INFORMATION NEEDED.
.........................................

   1. (    6) PROLEGS ON ABD. SEGS. EXCEPT 1., ABSENT OR RUDIMENTARY, OR ONLY FLESHY LOBES
                 PRESENT.................................................  2
              PROLEGS ON ABD. SEGS. EXCEPT 1., ONLY ONE OR TWO PAIRS ON ANY SEGMENT 1-9...  NOCTUIDAE
              PROLEGS ON ABD. SEGS. EXCEPT 1., PRESENT ON ABD. SEGS. 4,5,6.............  NOCTUIDAE
              PROLEGS ON ABD. SEGS. EXCEPT 1., PRESENT ON ABD. SEGS.3,4,5,6.............  3

   2. (    1) CROCHETS ABSENT ON ALL ABDOMINAL SEGMENTS; PROLEGS ON ABD. SEG. 10 ABSENT OR
                 RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER THAN PROLEGS ON A 3-6.......  LIMACODIDAE
              CROCHETS PRESENT ON ABD. SEG. 10 AND AT LEAST 1 OTHER ABDOMINAL SEGMENT;
                 PROLEGS ON ABD. SEG. 10 PRESENT.........................................  EPIPYROPIDAE

   3. (    1) CROCHETS ON A3 ARRANGED (CIRCLE) IN A COMPLETE CIRCLE OR ELLIPSE...........  4
              CROCHETS ON A3 ARRANGED (CIRCLE) IN AN INCOMPLETE CIRCLE OR ELLIPSE.........  5
              CROCHETS ON A3 ARRANGED (CIRCLE) IN A HOMOIDEOUS MESOSERIES.................  8

   4. (    3) HEAD DISTINCTLY LARGER THAN PROTHORAX IN DIAMETER; ANAL COMB PRESENT; CERVICAL
                 SHIELD OBSCURE OR REDUCED TO IRREGULAR SCLEROTIZED SPOTS, OR ENTIRELY ABSENT..  HESPERIIDAE
              HEAD EQUAL TO OR SMALLER THAN PROTHORAX IN DIAMETER; ANAL COMB ABSENT; CERVICAL
                 SHIELD DISTINCT, HEAVILY SCLEROTIZED, LIGHTLY TO DARKLY PIGMENTED..........  MEGATHYMIDAE

   5. (    3) CROCHETS ON A 3 (ORDINAL) UNIORDINAL; SPIRACLES SHAPE ROUND...................  6
              CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL; SPIRACLES SHAPE
                 ELLIPTICAL OR EGG SHAPED................................................  7

   6. (    5) FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4; ADFRONTAL SUTURES EXTEND TO
                 CORONAL NOTCH, OR NEARLY; OCELLI 3,4,5, ARRANGED IN AN OBTUSE ANGLE, BETWEEN
                 100 AND 170; HEAD SETA O1 EQUIDISTANT OR NEARLY BETWEEN OC2 AND OC3.........  PTEROPHORIDAE
              FRONT EXTENDS TO THE CORONAL NOTCH L.T. HALFWAY; ADFRONTAL SUTURES EXTENDS L.T.
                 1/2 THE DISTANCE BETWEEN APEX OF FRONT AND CORONAL NOTCH; OCELLI 3,4,5,
                 ARRANGED IN A STRAIGHT LINE, OR NEARLY (170-190 D.); HEAD SETA O1 CLOSER TO
                 OC3 THAN TO OC2.........................................................  BLASTOBASIDAE

   7. (    5) ANAL COMB ABSENT; POSITION OF SP. ON ABD. SEG. 8 IN LINE WITH SP. ON PRECEEDING
                 ABD. SEGS...............................................................  LIBYTHEIDAE
              ANAL COMB PRESENT; POSITION OF SP. ON ABD. SEG. 8 WELL ABOVE SP. ON PRECEEDING
                 ABD. SEGS...............................................................  HESPERIIDAE

   8. (    3) HARD SCLEROTIZED, PROMINENT SCOLI ABSENT......................................  9
              HARD SCLEROTIZED, PROMINENT SCOLI PRESENT.....................................  26

   9. (    8) CROCHETS ON A 3 (ORDINAL) UNIORDINAL..........................................  10
              CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL..........................  14

  10. (    9) SPIRACLES SHAPE ROUND; OCELLI 1,2,3, ARRANGED IN A STRAIGHT LINE, OR NEARLY
                 (170-190 D.)............................................................  SATYRINAE
              SPIRACLES SHAPE ELLIPTICAL OR EGG SHAPED; OCELLI 1,2,3, ARRANGED IN AN OBTUSE
                 ANGLE, BETWEEN 100 AND 170..............................................  11

  11. (   10) PROLEGS ON ABD. SEG. 10 PRESENT...............................................  12
              PROLEGS ON ABD. SEG. 10 ABSENT OR RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER
                 THAN PROLEGS ON A 3-6...................................................  NOTODONTIDAE
                                                                                             DREPANIDAE

  12. (   11) LABRAL NOTCH SHALLOW, EXTENDING NOT MORE THAN 1/2 THE DISTANCE TO THE BASE OF
                 THE LABRUM..............................................................  13
              LABRAL NOTCH DEEP, WITH PARALLEL SIDES, EXTENDING TO BASE OF LABRUM, OR NEARLY..  NOTODONTIDAE
              LABRAL NOTCH ACUTE, V-SHAPED, A GROOVE EXTENDING TO BASE OF LABRUM SOMETIMES
                 PRESENT.................................................................  NOTODONTIDAE


  13. (   12) SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1..............................  NOCTUIDAE
              SETA D2 ON ABD. SEG. 9 DISTINCTLY CAUDAD OF D1 AND ONLY SLIGHTLY IF ANY, ABOVE
                 OR BELOW................................................................  NOTODONTIDAE

  14. (    9) ANAL COMB ABSENT..............................................................  15
              ANAL COMB PRESENT.............................................................  PIERIDAE

  15. (   14) OCELLI 1,2,3, ARRANGED IN A STRAIGHT LINE, OR NEARLY (170-190 D.)..............  SATYRINAE
              OCELLI 1,2,3, ARRANGED IN AN OBTUSE ANGLE, BETWEEN 100 AND 170..................  16

  16. (   15) PROLEGS ON ABD. SEG. 10 PRESENT...............................................  17
              PROLEGS ON ABD. SEG. 10 ABSENT OR RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER
                 THAN PROLEGS ON A 3-6...................................................  DREPANIDAE

  17. (   16) FILAMENTS OR OSMETERIA ABSENT..................................................  18
              FILAMENTS OR OSMETERIA PRESENT.................................................  24

  18. (   17) EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS PRESENT.....................  19
              EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS ABSENT......................  20

  19. (   18) MOST OR ALL SETAE ON ELEVATED CHALAZAE OR TUBERCLES...........................  PIERIDAE
                                                                                             NOCTUIDAE
              MOST OR ALL SETAE NOT ON CHALAZAE, SIMPLE......................................  NOCTUIDAE

  20. (   18) ABD. SEG. 8 WITH AT LEAST 1 MID-DORSAL HORN, SCOLUS, CHALAZA, TUBERCLE, OR SCAR.  21
              ABD. SEG. 8 WITHOUT A MID-DORSAL HORN, SCOLUS, CHALAZA, TUBERCLE, OR SCAR......  22

  21. (   20) ANAL PLATE ON ABD. SEG. 10 BIFURCATE AT TIP, BEARING TWO DISTINCT PROCESSES;
                 FRONT EXTENDS TO THE CORONAL NOTCH FROM 1/2 TO 3/4; SEGMENTS OF BODY NOT
                 DIVIDED INTO MANY ANNULETS; SPIRACLES ON T1 AND A8 CONSPICUOUSLY LARGER THAN
                 OTHERS..................................................................  BOMBYCIDAE
              ANAL PLATE ON ABD. SEG. 10 NOT BIFURCATE, ROUNDED; FRONT EXTENDS TO THE CORONAL
                 NOTCH L.T. HALFWAY; SEGMENTS OF BODY DIVIDED INTO 6 TO 8 ANNULETS; SPIRACLES
                 ALL THE SAME SIZE.......................................................  SPHINGIDAE

  22. (   20) ROW OF CROCHETS ON VENTRAL SIDE OF PROLEGS INTERRUPTED OR REDUCED IN SIZE NEAR
                 CENTER BY A SPATULA-LIKE LOBE...........................................  LYCAENINAE
              ROW OF CROCHETS ON VENTRAL SIDE OF PROLEGS NOT INTERRUPTED, NO LOBE PRESENT ON
                 VENTRAL SIDE OF PROLEGS.................................................  23

  23. (   22) MOST OR ALL SETAE ON ELEVATED CHALAZAE OR TUBERCLES...........................  NOCTUIDAE
              MOST OR ALL SETAE NOT ON CHALAZAE, SIMPLE......................................  APATELODIDAE
                                                                                             SPHINGIDAE
                                                                                             NOCTUIDAE
                                                                                             LASIOCAMPIDAE

  24. (   17) SEGMENTS OF BODY DIVIDED INTO 5 TO 8 ANNULETS..................................  DANAIINAE
              SEGMENTS OF BODY NOT DIVIDED INTO MANY ANNULETS................................  25

  25. (   24) EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS PRESENT.....................  DANAIINAE
              EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS ABSENT......................  PAPILIONIDAE

  26. (    8) CROCHETS ON A 3 (ORDINAL) UNIORDINAL..........................................  27
              CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL..........................  29

  27. (   26) LABRAL NOTCH SHALLOW, EXTENDING NOT MORE THAN 1/2 THE DISTANCE TO THE BASE OF
                 THE LABRUM..............................................................  28
              LABRAL NOTCH DEEP, WITH PARALLEL SIDES, EXTENDING TO BASE OF LABRUM, OR NEARLY..  NOTODONTIDAE
              LABRAL NOTCH ACUTE, V-SHAPED, A GROOVE EXTENDING TO BASE OF LABRUM SOMETIMES
                 PRESENT.................................................................  NOTODONTIDAE

  28. (   27) SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1..............................  NOCTUIDAE
              SETA D2 ON ABD. SEG. 9 DISTINCTLY CAUDAD OF D1 AND ONLY SLIGHTLY IF ANY, ABOVE
                 OR BELOW................................................................  NOTODONTIDAE

  29. (   26) MOST OR ALL SETAE ON ELEVATED CHALAZAE OR TUBERCLES...........................  NOCTUIDAE
              MOST OR ALL SETAE NOT ON CHALAZAE, SIMPLE......................................  30

  30. (   29) FILAMENTS OR OSMETERIA ABSENT..................................................  NOCTUIDAE
              FILAMENTS OR OSMETERIA PRESENT.................................................  PAPILIONIDAE
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FAMILY KEY TO LEPIDOPTERA LARVAE (C)
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PROGRAM KEY. RUN AT.19.48 ON 07/29/79. STORAGE REQUIRED -  2910 WORDS.

CHARACTERS - 1?, READ, 56 MASK D, 18 USED IN KEY.
ITEMS - 22 READ, 22 MASKED, 22 APPEAR IN KEY. 1? TAXA.

RBASE = 4.0.., ABASE = 3...., RUSE = 1.0.., VARYWT = 1.0... NCONF = 3

PRESET CHARACTERS - COLUMN,GROUP,CHARACTER
  1, 1, 58

CHARACTER MASK -
..... .....  ..... .....  0.... 0...0  .0.0. 0C0.0  .00.. 00000
0...0 0....  ..... .....  ..... .....  0.... 0....  ..... .....

KEY INCOMPLETE, MORE INFORMATION NEEDED.
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 1. (   0) PROLEGS ON ABD. SEGS. EXCEPT 1., ABSENT OR RUDIMENTARY, OR ONLY FLESHY LOBES
              PRESENT..........................................................  LIMACODIDAE
           PROLEGS ON ABD. SEGS. EXCEPT 1., ONLY ONE OR TWO PAIRS ON ANY SEGMENT 1-9........  NOCTUIDAE
           PROLEGS ON ABD. SEGS. EXCEPT 1., PRESENT ON ABD. SEGS. 4,5,6........................  2
           PROLEGS ON ABD. SEGS. EXCEPT 1., PRESENT ON ABD. SEGS.3,4,5,6......................  2
           PROLEGS ON ABD. SEGS. EXCEPT 1., PRESENT ON MORE THAN FOUR ABD. SEGS.............  MEGALOPYGIDAE

 2. (   1) HARD SCLEROTIZED, PROMINENT SCOLI ABSENT.......................................  3
           HARD SCLEROTIZED, PROMINENT SCOLI PRESENT......................................  NOCTUIDAE

 3. (   2) CROCHETS ON A 3 (ORDINAL) UNIORDINAL.........................................  4
           CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL..........................  NOCTUIDAE

 4. (   3) MOST OR ALL SETAE ON ELEVATED CHALAZAE OR TUBERCLES............................  NOCTUIDAE
           MOST OR ALL SETAE NOT ON CHALAZAE, SIMPLE.......................................  5

 5. (   4) EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS PRESENT......................  NOCTUIDAE
           EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS ABSENT.......................  NOCTUIDAE
                                                                                              NOLIDAE

 6. (   1) CROCHETS ON A 3 (ORDINAL) UNIORDINAL.........................................  7
           CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL..........................  18

 7. (   6) CROCHETS ON A3 ARRANGED (CIRCLE) IN AN INCOMPLETE CIRCLE OR ELLIPSE..............  PTEROPHORIDAE
           CROCHETS ON A3 ARRANGED (CIRCLE) IN A HOMOIDEOUS MESOSERIES.......................  8
           CROCHETS ON A3 ARRANGED (CIRCLE) IN A HETEROIDEOUS MESOSERIES.....................  16

 8. (   7) HARD SCLEROTIZED, PROMINENT SCOLI ABSENT.......................................  9
           HARD SCLEROTIZED, PROMINENT SCOLI PRESENT......................................  13

 9. (   8) SPIRACLES SHAPE ROUND..........................................................  ZYGAENIDAE
           SPIRACLES SHAPE ELLIPTICAL OR EGG SHAPED........................................  10

10. (   9) VERRUCA L1 ON ABD. SEG. 7 SAME DISTANCE FROM SP. AS ON A1-6....................  11
           VERRUCA L1 ON ABD. SEG. 7 FARTHER FROM SP. THAN ON A1-6, OR ABSENT..............  12

11. (  10) EVERSIBLE GLAND PRESENT ON DORSOMESON OF ABD. SEG. 7 (SOMETIMES 6)...............  LYMANTRIIDAE
           EVERSIBLE GLAND ABSENT ON DORSOMESON OF ABD. SEGS. 6 AND 7........................  ARCTIIDAE

12. (  10) MESO AND META THORAX WITH AT LEAST 4 VERRUCAE BETWEEN LEG AND DORSAL MESON, SO
              VERRUCA PRESENT..................................................................  NOTODONTIDAE
                                                                                              NOCTUIDAE
           MESO AND META THORAX WITH ONLY 3 VERRUCAE BETWEEN LEG AND DORSAL MESON, SO
              VERRUCA ABSENT...................................................................  PERICOPIDAE

13. (   8) LABRAL NOTCH SHALLOW, EXTENDING NOT MORE THAN 1/2 THE DISTANCE TO THE BASE OF
              THE LABRUM.......................................................................  14
           LABRAL NOTCH DEEP, WITH PARALLEL SIDES, EXTENDING TO BASE OF LABRUM, OR NEARLY..  NOTODONTIDAE
           LABRAL NOTCH ACUTE, V-SHAPED, A GROOVE EXTENDING TO BASE OF LABRUM SOMETIMES
              PRESENT..........................................................................  NOTODONTIDAE

14. (  13) PROLEGS ON ABD. SEG. 1. PRESENT..................................................  15
           PROLEGS ON ABD. SEG. 1. ABSENT OR RUDIMENTARY OR AT LEAST CONSIDERABLY SMALLER
              THAN PROLEGS ON A 3-6.............................................................  NOTODONTIDAE

15. (  14) EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS PRESENT......................  NOCTUIDAE
           EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS ABSENT.......................  NOTODONTIDAE
                                                                                              NOCTUIDAE


16. (   7) MESO AND META THORAX WITH AT LEAST 4 VERRUCAE BETWEEN LEG AND DORSAL MESON, SO
              VERRUCA PRESENT..................................................................  ARCTIIDAE
           MESO AND META THORAX WITH ONLY 3 VERRUCAE BETWEEN LEG AND DORSAL MESON, SO
              VERRUCA ABSENT...................................................................  17

17. (  16) VERRUCA L1 ON ABD. SEG. 7 SAME DISTANCE FROM SP. AS ON A1-6....................  CTENUCHIDAE
           VERRUCA L1 ON ABD. SEG. 7 FARTHER FROM SP. THAN ON A1-6, OR ABSENT..............  PERICOPIDAE

18. (   6) HARD SCLEROTIZED, PROMINENT SCOLI ABSENT.......................................  19
           HARD SCLEROTIZED, PROMINENT SCOLI PRESENT......................................  23

19. (  18) LABRAL NOTCH SHALLOW, EXTENDING NOT MORE THAN 1/2 THE DISTANCE TO THE BASE OF
              THE LABRUM.......................................................................  20
           LABRAL NOTCH ACUTE, V-SHAPED, A GROOVE EXTENDING TO BASE OF LABRUM SOMETIMES
              PRESENT..........................................................................  APATELODIDAE

20. (  19) MOST OR ALL SETAE ON ELEVATED CHALAZAE OR TUBERCLES............................  NOCTUIDAE
           MOST OR ALL SETAE NOT ON CHALAZAE, SIMPLE.......................................  21

21. (  20) FILAMENTS OF OSMETERIA ABSENT...................................................  22
           FILAMENTS OF OSMETERIA PRESENT..................................................  PAPILIONIDAE

22. (  21) VERRUCA L1 ON ABD. SEG. 7 SAME DISTANCE FROM SP. AS ON A1-6; MESO AND META
              THORAX WITH ONLY 3 VERRUCAE BETWEEN LEG AND DORSAL MESON, SO VERRUCA ABSENT...  LASIOCAMPIDAE
           VERRUCA L1 ON ABD. SEG. 7 FARTHER FROM SP. THAN ON A1-6, OR ABSENT; MESO AND
              META THORAX WITH AT LEAST 4 VERRUCAE BETWEEN LEG AND DORSAL MESON, SO VERRUCA
              PRESENT..........................................................................  NOCTUIDAE

23. (  18) HEAD DISTINCTLY CONICAL OR ANGULATE, OR ARMED DORSALLY WITH SCOLI OR SPINES.....  NYMPHALINAE
           HEAD ROUNDED, WITHOUT SCOLI OR SPINES..........................................  24

24. (  23) ABD. SEG. 9 WITH A MID-DORSAL SCOLUS..........................................  25
           ABD. SEG. 9 WITHOUT A MID-DORSAL SCOLUS.......................................  27

25. (  24) ABD. SEG. 8 WITH AT LEAST 1 MID-DORSAL HORN, SCOLUS, CHALAZA, TUBERCLE, OR SCAR.  26
           ABD. SEG. 8 WITHOUT A MID-DORSAL HORN, SCOLUS, CHALAZA, TUBERCLE, OR SCAR.......  CITHERONIIDAE

26. (  25) MOST OF ALL SETAE ON ELEVATED CHALAZAE OR TUBERCLES............................  CITHERONIIDAE
           MOST OR ALL SETAE NOT ON CHALAZAE, SIMPLE.......................................  SATURNIIDAE

27. (  24) ANAL PLATE ON ABD. SEG. 10 BIFURCATE AT TIP, BEARING TWO DISTINCT PROCESSES.....  NYMPHALINAE
           ANAL PLATE ON ABD. SEG. 10 NOT BIFURCATE, ROUNDED..............................  28

28. (  27) ABD. SEG. 8 WITH AT LEAST 1 MID-DORSAL HORN, SCOLUS, CHALAZA, TUBERCLE, OR SCAR.  29
           ABD. SEG. 8 WITHOUT A MID-DORSAL HORN, SCOLUS, CHALAZA, TUBERCLE, OR SCAR.......  30

29. (  28) EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS PRESENT......................  NYMPHALINAE
           EVERSIBLE GLAND ON VENTRAL SIDE OF T1 BETWEEN LEGS ABSENT.......................  CITHERONIIDAE

30. (  28) FILAMENTS OF OSMETERIA ABSENT...................................................  31
           FILAMENTS OF OSMETERIA PRESENT..................................................  PAPILIONIDAE

31. (  30) ROW OF CROCHETS ON VENTRAL SIDE OF PROLEGS INTERRUPTED OR REDUCED IN SIZE NEAR
              CENTER BY A SPATULA-LIKE LOBE....................................................  RIODININAE
           ROW OF CROCHETS ON VENTRAL SIDE OF PROLEGS NOT INTERRUPTED, NO LOBE PRESENT ON
              VENTRAL SIDE OF PROLEGS..........................................................  NOCTUIDAE
                                                                                              NYMPHALINAE
                                                                                              CITHERONIIDAE
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FAMILY KEY TO LEPIDOPTERA LARVAE (D)
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PROGRAM KEY. RUN AT.14.49 ON 07/29/75. STORAGE REQUIRED -  1969 WORDS.

CHARACTERS - 1J  READ,  99 MASKED,  13 USED IN KEY.
ITEMS -  16 READ,  14 MASKED,  27 APPEAR IN KEY;  9 TAXA.

RBASE = 4.00, ABASE = 3.00, REUSE = 1.01, VARYWT = 1.00, NCONF = 3

PRESET CHARACTERS - COLUMN,GROUP,CHARACTER
  1,  1, 58

CHARACTER MASK -
..... .....  ..... .....  ..... .....  ..... .....  ..... .....
..... .....  ..... .....  ..... .....  ..... .....  ..... .....

  1. (    0) PROLEGS ON ABD. SEGS. EXCEPT 10, ONLY ONE OF TWO PAIRS ON ANY SEGMENT 1-9.......  2
             PROLEGS ON ABD. SEGS. EXCEPT 1., PRESENT ON ABD. SEGS. 4.5.6.....................  NOCTUIDAE
             PROLEGS ON ABD. SEGS. EXCEPT 1., PRESENT ON ABD. SEGS.3,4,5,6....................  6
  2. (    1) HARD SCLEROTIZED, PROMINENT SCOLI ABSENT.........................................  3
             HARD SCLEROTIZED, PROMINENT SCOLI PRESENT........................................  NOCTUIDAE
  3. (    2) CROCHETS ON A 3 (ORDINAL) UNIORDINAL.............................................  NOCTUIDAE
             CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL.............................  4
  4. (    3) TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, MOST OR ALL OBSCURE, ABSENT, OR
               MINUTE.........................................................................  NOCTUIDAE
             TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, AT MOST 3 OBSCURE OR ABSENT.......  NOCTUIDAE
             TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, ALL SIX PRESENT AND EASILY
               VISIBLE........................................................................  5
  5. (    4) SETA D2 ON ABD. SEG. 9 DIRECTLY ABOVE D1 AND ONLY A LITTLE CAUDAD, IF ANY........  GEOMETRIDAE
             SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1....................................  NOCTUIDAE
  6. (    1) L SETAE ON ABD. SEG. 3, 3........................................................  7
             L SETAE ON ABD. SEG. 3, MORE THAN 3..............................................  21
  7. (    6) HARD SCLEROTIZED, PROMINENT SCOLI ABSENT.........................................  8
             HARD SCLEROTIZED, PROMINENT SCOLI PRESENT........................................  18
  8. (    7) CROCHETS ON A 3 (ORDINAL) UNIORDINAL.............................................  9
             CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL.............................  12
  9. (    8) CROCHETS ON A3 ARRANGED (CIRCLE) IN A COMPLETE CIRCLE OR ELLIPSE; SETA L1 ON
               ABD. SEG. 3 CLOSER TO L2 THAN TO SP............................................  COSSIDAE
             CROCHETS ON A3 ARRANGED (CIRCLE) IN A HOMOIDEOUS MESOSERIES; SETA L1 ON ABD.
               SEG. 3 CLOSER TO SP. THAN TO L2................................................  10
 10. (    9) LABRAL NOTCH SHALLOW, EXTENDING NOT MORE THAN 1/2 THE DISTANCE TO THE BASE OF
               THE LABRUM.....................................................................  11
             LABRAL NOTCH DEEP, WITH PARALLEL SIDES, EXTENDING TO BASE OF LABRUM, OR NEARLY...  NOTODONTIDAE
             LABRAL NOTCH ACUTE, V-SHAPED, A GROOVE EXTENDING TO BASE OF LABRUM SOMETIMES
               PRESENT........................................................................  NOTODONTIDAE
 11. (   10) SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1....................................  NOCTUIDAE
             SETA D2 ON ABD. SEG. 9 DISTINCTLY CAUDAD OF D1 AND ONLY SLIGHTLY IF ANY, ABOVE
               OR BELOW.......................................................................  NOTODONTIDAE
 12. (    8) CROCHETS ON A3 ARRANGED (CIRCLE) IN A COMPLETE CIRCLE OR ELLIPSE; SETA L1 ON
               ABD. SEG. 3 CLOSER TO L2 THAN TO SP............................................  13
             CROCHETS ON A3 ARRANGED (CIRCLE) IN A HOMOIDEOUS MESOSERIES; SETA L1 ON ABD.
               SEG. 3 CLOSER TO SP. THAN TO L2................................................  15
 13. (   12) L SETAE ON THORACIC SEG. I, 2....................................................  COSSIDAE
             L SETAE ON THORACIC SEG. I, 3....................................................  14
 14. (   13) OCELLUS 5 NOT CONSPICUOUSLY SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND
               OC5 L.T. 1/2 THE DISTANCE BETWEEN OC1 AND OC4; HEAD SETAE A1,A2,A3, ARRANGED
               IN AN OBTUSE ANGLE, 1..-17.; HEAD SETA O1 CLOSER TO OC2 THAN TO OC3; SETA L1
               ON ABD. SEG. 3 BELOW SP AND DISTINCTLY CEPHALAD OF SP...........................  SCYTHRIDAE
             OCELLUS 5 AS FAR AWAY OR FURTHER FROM OC4 AS OC4 IS FROM OC1; HEAD SETAE
               A1,A2,A3, ARRANGED IN A RIGHT ANGLE OR CLOSE TO (90-10. D.); HEAD SETA O1
               CLOSER TO OC1 THAN TO OC2; SETA L1 ON ABD. SEG. 3 BELOW SP AND ONLY SLIGHTLY
               CAUDAD OR CEPHALAD OF SP, IF ANY...............................................  COSSIDAE
 15. (   12) L SETAE ON THORACIC SEG. I, 2; CROCHETS PRESENT ON ABD. SEG. 10 AND AT LEAST 1


               OTHER ABDOMINAL SEGMENT........................................................  16
             L SETAE ON THORACIC SEG. I, 3; CROCHETS ABSENT ON ABD. SEG. 10 BUT PRESENT ON
               AT LEAST 1 OTHER ABDOMINAL SEGMENT.............................................  THYATIRIDAE
 16. (   15) TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, MOST OR ALL OBSCURE, ABSENT, OR
               MINUTE.........................................................................  NOCTUIDAE
             TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, AT MOST 3 OBSCURE OR ABSENT.......  NOCTUIDAE
             TACTILE SETAE XD, D, SD ON T1 CERVICAL SHIELD, ALL SIX PRESENT AND EASILY
               VISIBLE........................................................................  17
 17. (   16) SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1; SETA XD2 ON THORACIC SEG. I
               DISTINCTLY FURTHER CEPHALAD THAN SD1; SETA L1 ON ABD. SEG. 3 CLOSER TO L2
               THAN TO L3.....................................................................  NOCTUIDAE
             SETA D2 ON ABD. SEG. 9 DISTINCTLY CAUDAD OF D1 AND ONLY SLIGHTLY IF ANY, ABOVE
               OR BELOW; SETA XD2 ON THORACIC SEG. I IN A STRAIGHT LINE, OR NEARLY, WITH XD1
               AND SD1; SETA L1 ON ABD. SEG. 3 EQUIDISTANT BETWEEN L2 AND L3..................  ?DA
 18. (    7) CROCHETS ON A 3 (ORDINAL) UNIORDINAL.............................................  19
             CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL.............................  NOCTUIDAE
 19. (   18) LABRAL NOTCH SHALLOW, EXTENDING NOT MORE THAN 1/2 THE DISTANCE TO THE BASE OF
               THE LABRUM.....................................................................  20
             LABRAL NOTCH DEEP, WITH PARALLEL SIDES, EXTENDING TO BASE OF LABRUM, OR NEARLY...  NOTODONTIDAE
             LABRAL NOTCH ACUTE, V-SHAPED, A GROOVE EXTENDING TO BASE OF LABRUM SOMETIMES
               PRESENT........................................................................  NOTODONTIDAE
 20. (   19) SETA D2 ON ABD. SEG. 9 ABOVE AND CAUDAD OF D1....................................  NOCTUIDAE
             SETA D2 ON ABD. SEG. 9 DISTINCTLY CAUDAD OF D1 AND ONLY SLIGHTLY IF ANY, ABOVE
               OR BELOW.......................................................................  NOTODONTIDAE
 21. (    6) CROCHETS ON A 3 (ORDINAL) UNIORDINAL; OCELLUS 5 AS FAR AWAY OR FURTHER FROM OC4
               AS OC4 IS FROM OC1; HEAD SETA A2 EQUIDISTANT OR NEARLY BETWEEN A1 AND A3;
               HEAD SETAE A1,A2,A3, ARRANGED IN AN ANGLE G.T. 13. D...........................  LITHOSIINAE (HYPOPREPIA)
             CROCHETS ON A 3 (ORDINAL) BI-, TRI-, OR MULTIORDINAL; OCELLUS 5 CONSPICUOUSLY
               SEPARATED FROM OCELLI 1-4, DISTANCE BETWEEN OC4 AND OC5 G.T. 1/2 BUT L.T.
               EQUAL TO DISTANCE BETWEEN OC1 AND OC4; HEAD SETA A2 CLOSER TO A1 THAN TO A3;
               HEAD SETAE A1,A2,A3, ARRANGED IN AN OBTUSE ANGLE, 1..-17.......................  EPIPLEMIDAE
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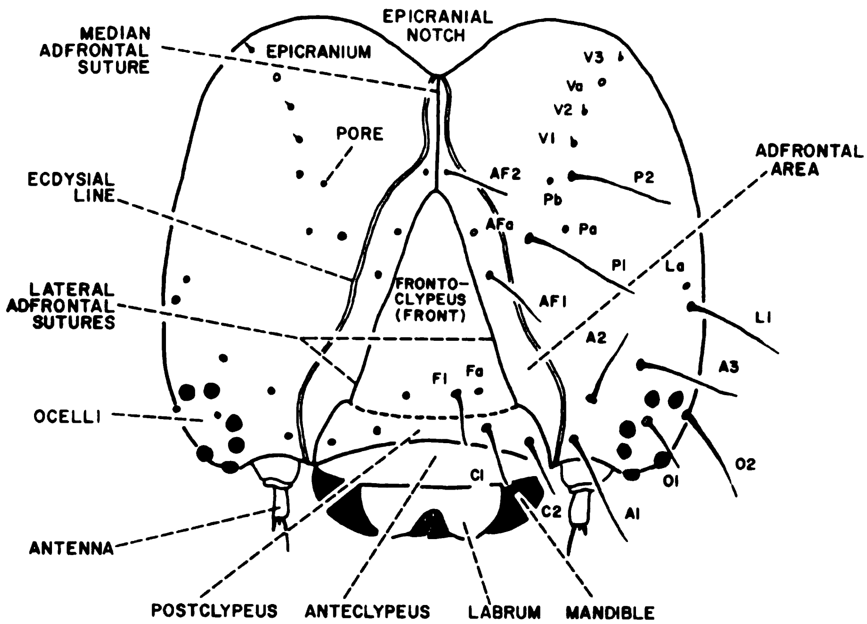
FIGURES

Fig. 1. Generalized head capsule of Lepidoptera larva, frontal aspect.

Fig. 2. Generalized head capsule of Lepidoptera larva, lateral aspect and ocelli numbering system.

1


EPICRANIAL NOTCH
MEDIAN ADFRONTAL SUTURE
EPICRANIUM
PORE
ECDYSIAL LINE
LATERAL ADFRONTAL SUTURES
OCELLI
ANTENNA
FRONTO-CLYPEUS (FRONT)
ADFRONTAL AREA
V3
Va
V2
V1
AF2
P2
Pb
AFa
Pa
P1
La
AF1
L1
A2
A3
F1
Fa
C1
C2
O1
O2
A1
POSTCLYPEUS
ANTECLYPEUS
LABRUM
MANDIBLE

2

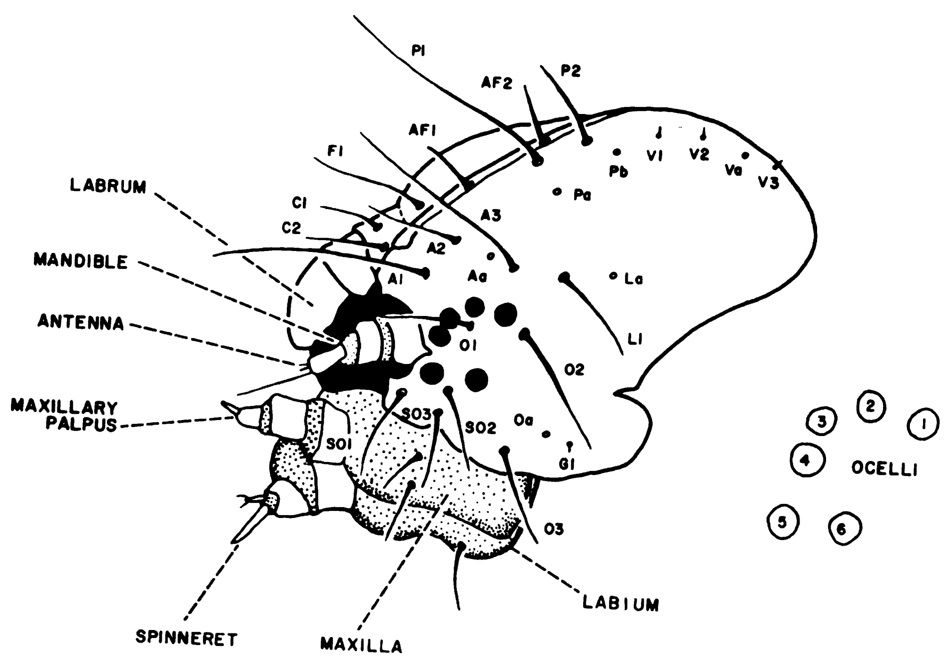
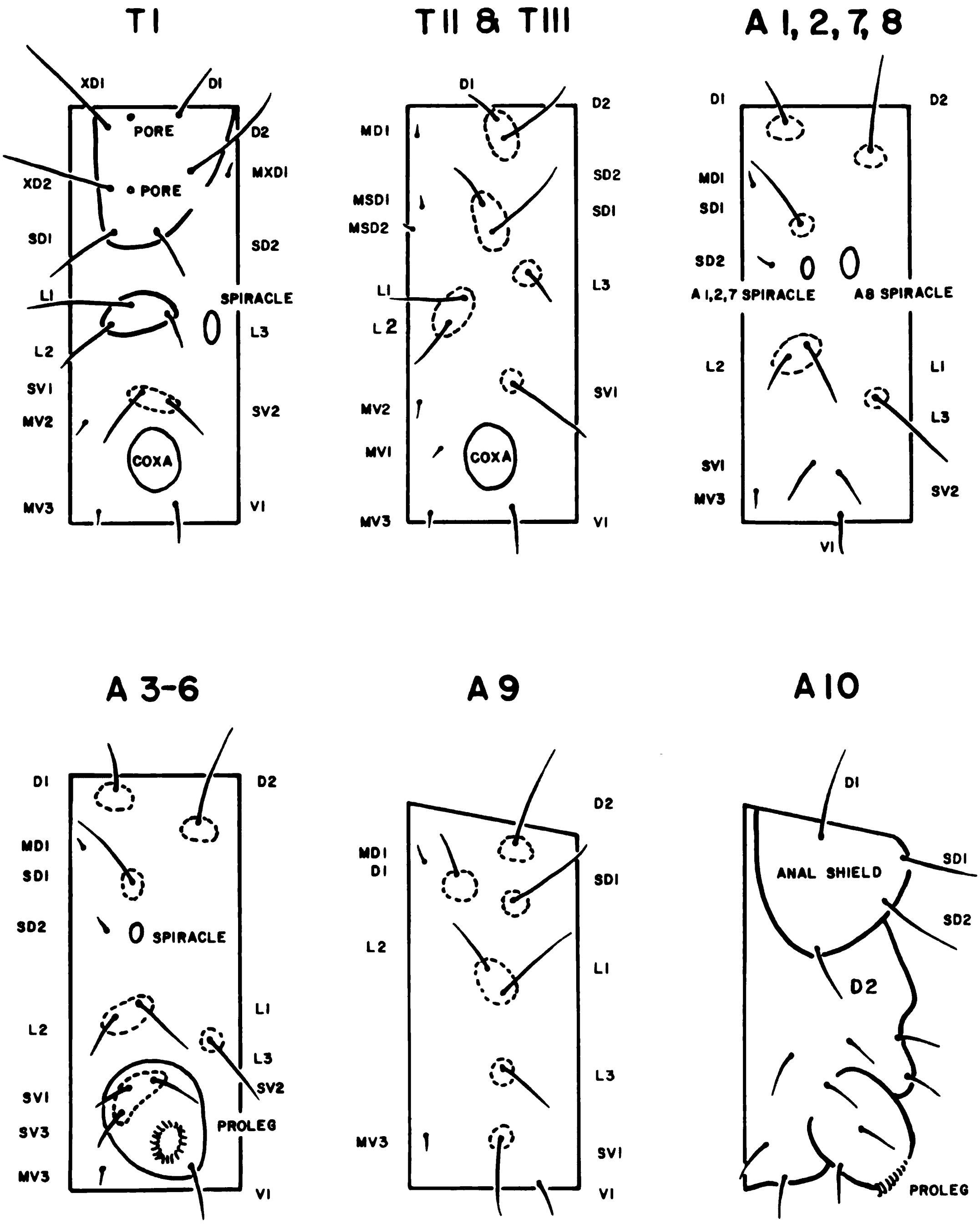

P1
AF2
P2
AF1
F1
C1
C2
A3
A2
A1
Aa
V1
V2
Va
V3
Pb
Pa
La
L1
O1
O2
SO3
SO2
SO1
Oa
G1
O3
LABRUM
MANDIBLE
ANTENNA
MAXILLARY PALPUS
SPINNERET
MAXILLA
LABIUM
OCELLI
1
2
3
4
5
6

Fig. 3 Generalized setal map of Lepidoptera larva and chaetotaxy of Hinton (1946).

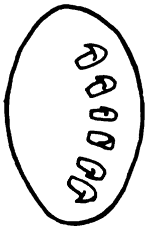
3


TI
XDI
DI
PORE
D2
MXDI
XD2
PORE
SDI
SD2
LI
SPIRACLE
L3
L2
SVI
MV2
SV2
COXA
MV3
VI
TII & TIII
DI
D2
MDI
SD2
MSDI
SDI
MSD2
LI
L3
L2
SVI
MV2
MVI
COXA
MV3
VI
A I, 2, 7, 8
DI
D2
MDI
SDI
SD2
A I,2,7 SPIRACLE
A8 SPIRACLE
L2
LI
L3
SVI
MV3
SV2
VI
A 3-6
DI
D2
MDI
SDI
SD2
SPIRACLE
LI
L2
L3
SV2
SVI
SV3
PROLEG
MV3
VI
A 9
D2
MDI
DI
SDI
L2
LI
L3
MV3
SVI
VI
A IO
DI
SDI
ANAL SHIELD
SD2
D2
PROLEG

Figures 4 - 11. Prolegs and crochet arrangments found in Lepidoptera larvae.

Fig. 4. Single transverse band.
Fig. 5. Two transverse bands.
Fig. 6. Uniordinal complete circle.
Fig. 7. Biordinal complete circle.
Fig. 8. Triordinal complete circle.
Fig. 9. Elongate ventral proleg as in many Plutellinae, Pterophoridae.
Fig. 10. Lycaenidae, Brephidium exilis Boisd. (USNM). Ventral proleg.
Fig. 11. Noctuidae, Polia sp. Ventral proleg, mesoseries arrangment.

4



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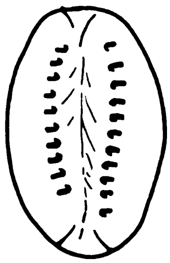

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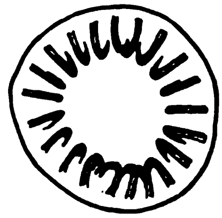
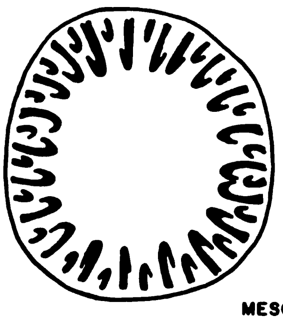


MESON

← CEPHALAD

7



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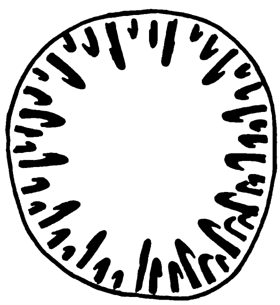

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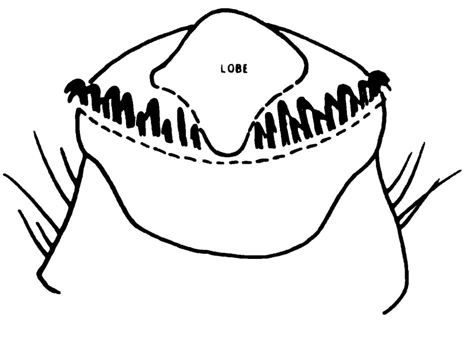
MESON

← CEPHALAD

10



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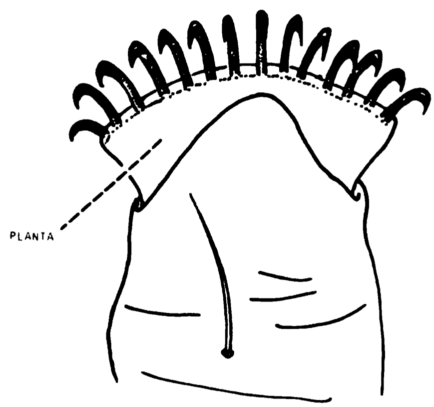


MESON

← CEPHALAD

Figures 12-14. Crochet arrangments.

Fig. 12. Biordinal mesopenellipse on a ventral proleg.

Fig. 13. Stenomidae, *Setiostoma xanthobasis* (coll. Habeck). Caudal proleg.

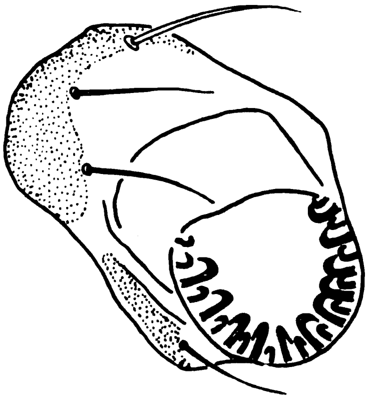
Fig. 14. Drepanidae, *Drepana sp*. (USNM). Ventral proleg, biordinal mesoseries plus uniordinal lateroseries.

Fig. 15. Theoretical information content of taxa at the family level.

A. A homogeneous family.

B. A heterogeneous family.

12



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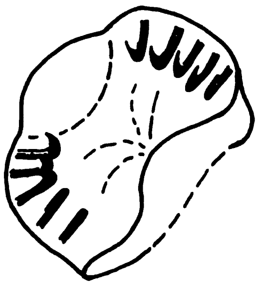


MESON

← CEPHALAD

14

MESON

← CEPHALAD

15

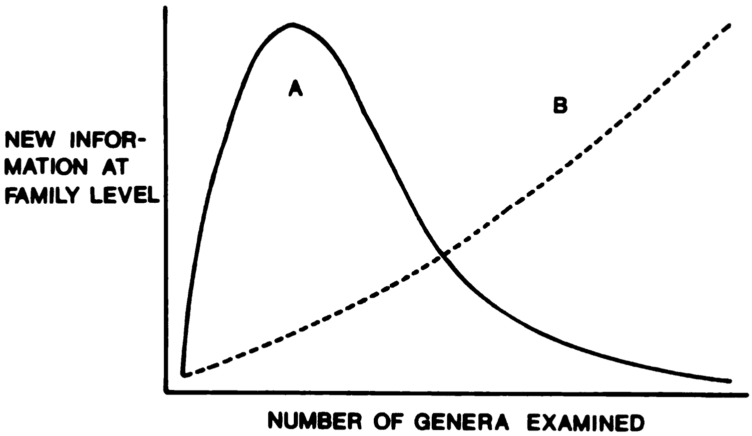
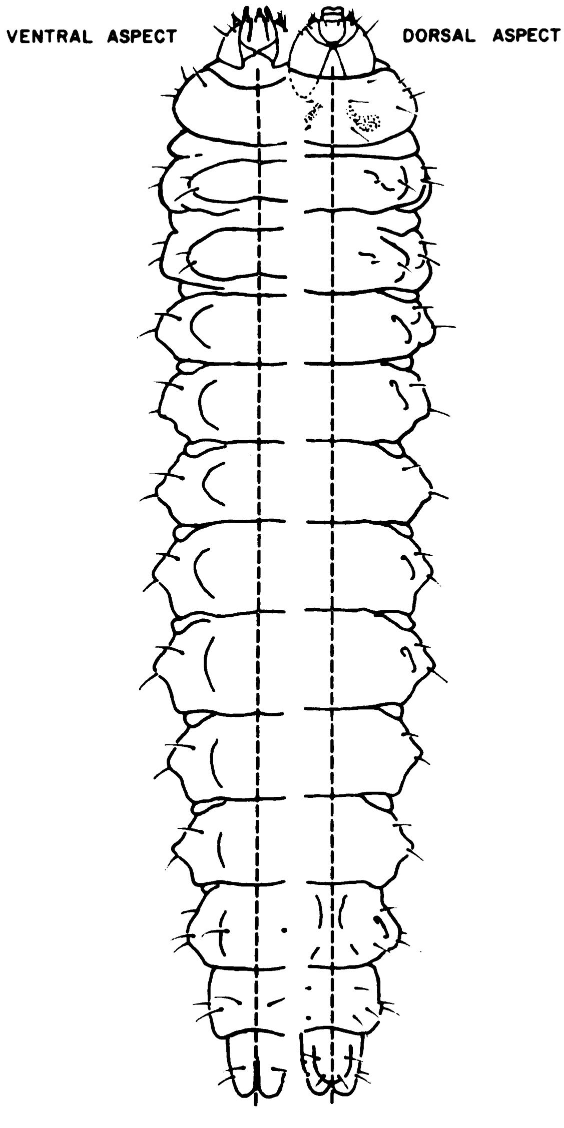


Fig. 16. Eriocraniidae, Mnemonica sp. (USNM). Dorsal and ventral aspects.

Fig. 17. Hepialidae, Dalaca sp. (USNM). Left lateral aspect.

16



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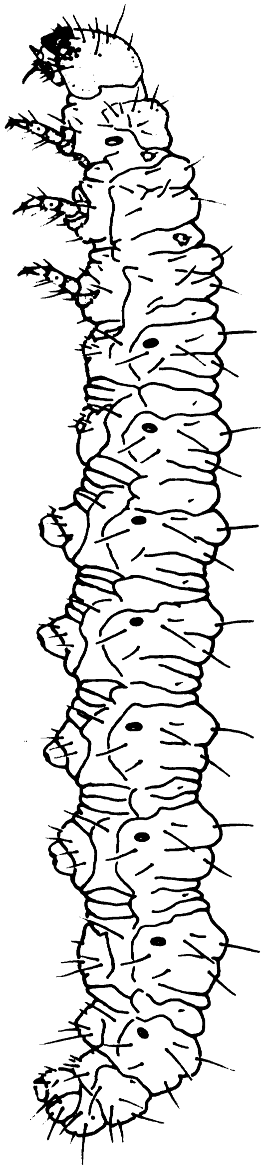
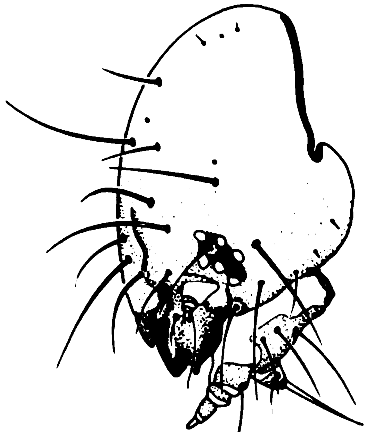


Figures 18-23. Hepialidae and Micropterygidae.

Fig. 18. Hepialidae, Dalaca sp.(USNM). Head lateral aspect.
Fig. 19. Dalaca sp. Prothoracic shield, lower half of left lateral aspect.
Fig. 20. Dalaca sp. Right ventral proleg showing multiserial crochet arrangement.
Fig. 21. Micropterygidae, Micropteryx sp. (England, USNM). A body seta, detail.
Fig. 22. Micropteryx sp. Left lateral aspect.
Fig. 23. Micropteryx sp. Head, left lateral aspect.

18



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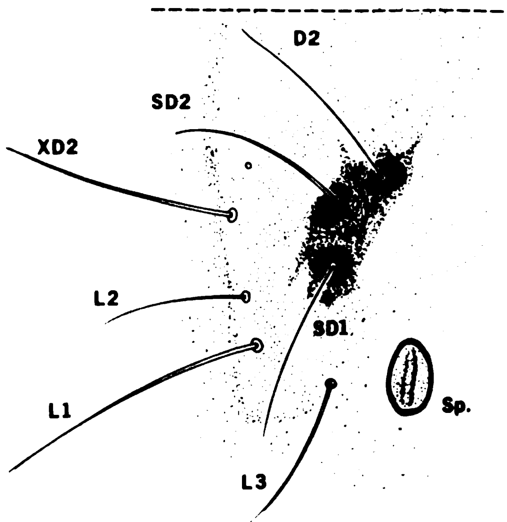

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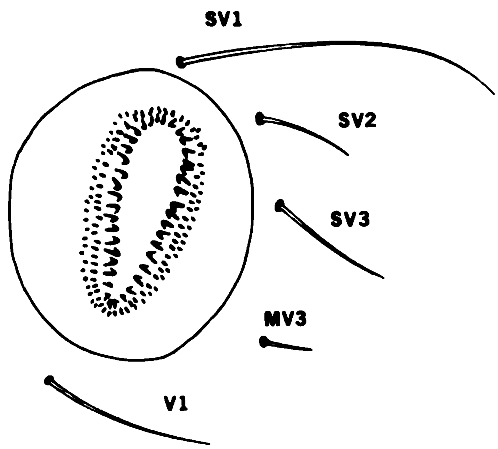

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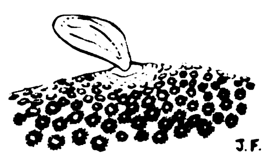

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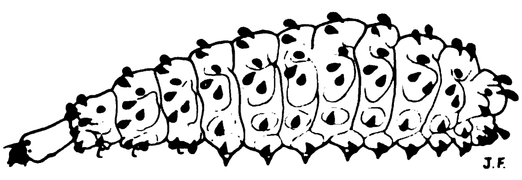

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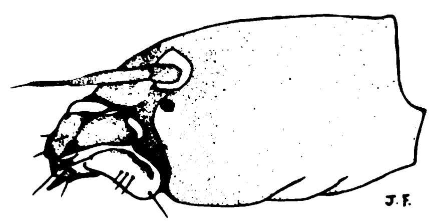

Figures 24-27. Psychidae and Nepticulidae.

Fig. 24. Psychidae, Solenobia walshella (Clemens) (USNM). Lateral aspect.

Fig. 25. S. walshella. Head, frontal aspect.

Fig. 26. S. walshella. Prothoracic shield, left lateral aspect.

Fig. 27. Nepticulidae, Ectoedemia populella Busck (USNM). Lateral aspect (see Fig. 69 for head).

Figures 28-31. Cosmopterygidae and Yponomeutidae.

Fig. 28. Cosmopterygidae, *Limnaecia phragmitella* Stainton (USNM). Head, left lateral aspect, detail; ocelli and cranial setae in immediate vicinity.

Fig. 29. *L. phragmitella*. Lateral aspect.

Fig. 30. Yponomeutidae, *Zelleria pyri* Clarke (USNM). Left ventral proleg, multiserial crochet arrangment.

Fig. 31. *Z. pyri*. Lateral aspect.

Figures 32-37. Blastobasidae, Blastodacnidae.

Fig. 32. Blastobasidae, *Valentinia glanduella* Riley (USNM). Head, TI, & TII, lateral aspect.
Fig. 33. *V. glanduella*. A3, left lateral aspect.
Fig. 34. *V. glanduella*. A8, A9, & A10, left lateral aspect.
Fig. 35. *V. glanduella*. Head, left lateral aspect, detail; ocelli and cranial setae in immediate vicinity.
Fig. 36. Blastodacnidae, *Aetia bipunctella* (Chambers) (USNM). Head, TI & TII, lateral aspect.
Fig. 37. *A. bipunctella*. A3 left lateral aspect.

Figures 38-41. Thyrididae, Dioptidae, Libytheidae.

Fig. 38. Thyrididae, Dysodia granulata (Neumoegen) (USNM). Lateral aspect.
Fig. 39. Dioptidae, Phryganidia californica (Packard) (USNM).
Fig. 40. Libytheidae, Libythea bachmani (Kirtland) (USNM).
Fig. 41. L. bachmani. Detail od spiracle and setae, A3 left lateral aspect.

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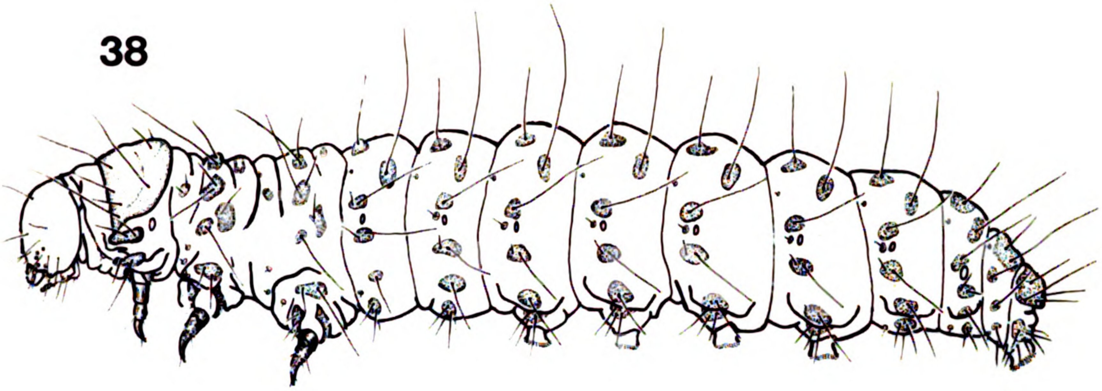

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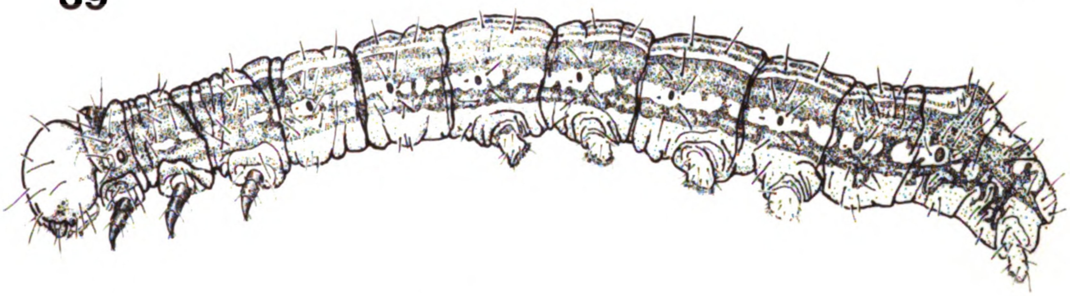

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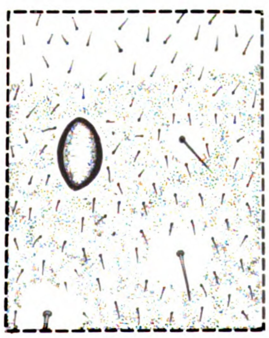


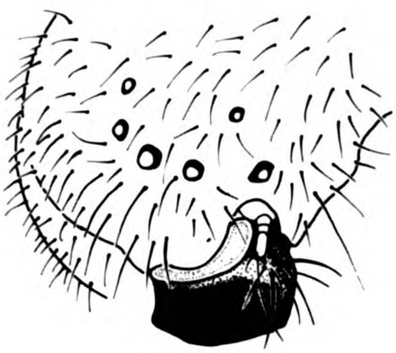
Figures 42-44. Epipyropidae, Mimallonidae.

Fig. 42. Epipyropidae, Epipyrops sp. (USNM). Ventral aspect.
Fig. 43. Mimallomidae, Cicinnus melsheimeri (Harris) (USNM).
Fig. 44. C. melsheimeri. Right ventral proleg.

Figures 45-49. Hesperiidae, Adopaea lineola Ochsenheimer (MSU).

Fig. 45. Head, left lateral aspect.
Fig. 46. TI detail around spiracle, left lateral aspect.
Fig. 47. A3 dorsal aspect.
Fig. 48. Anal comb.
Fig. 49. Lateral aspect.

45



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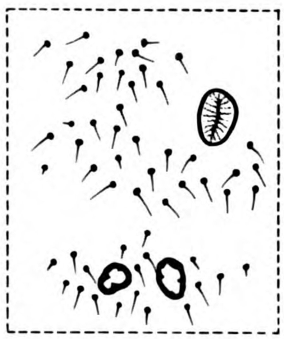

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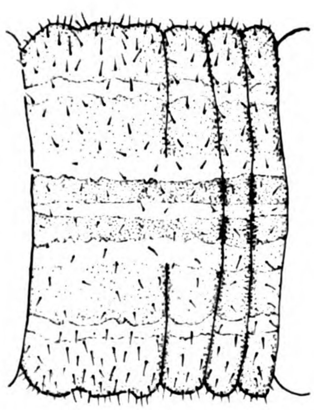

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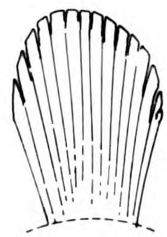

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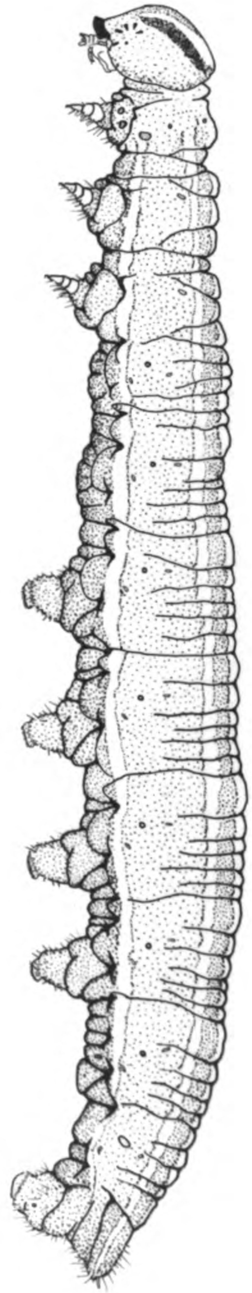
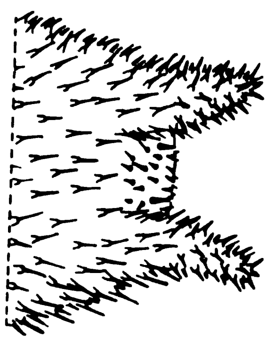


Figures 50-54. Satyrinae, Cercyonis pegala (=alope) (Fab.) (USNM).

Fig. 50. A10 dorsal aspect, bifurcate anal plate.
Fig. 51. Detail of head, left lateral aspect, ocelli.
Fig. 52. Larva, lateral aspect.
Fig. 53. Detail of cuticle showing secondary setae on chalazae.
Fig. 54. A3, left lateral aspect.

50



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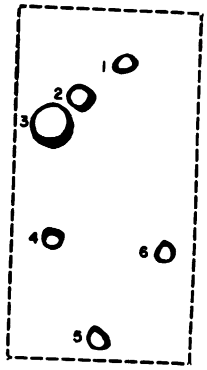

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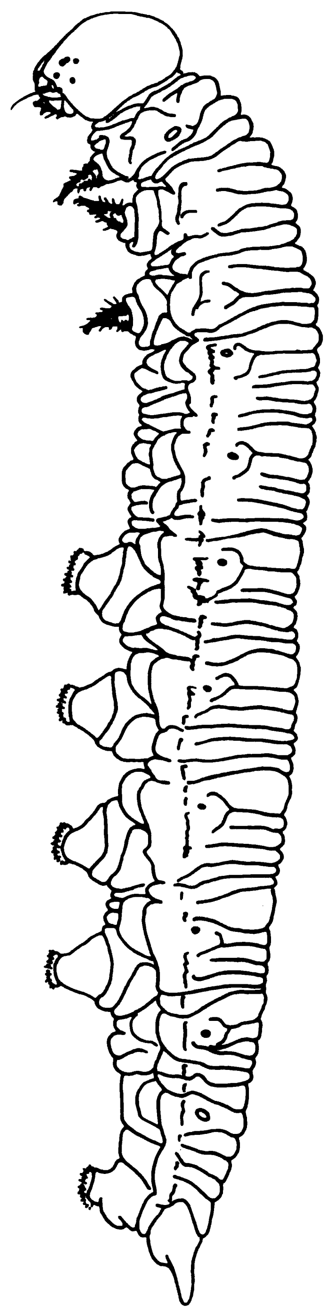

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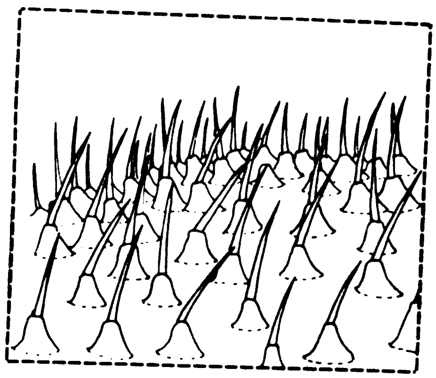

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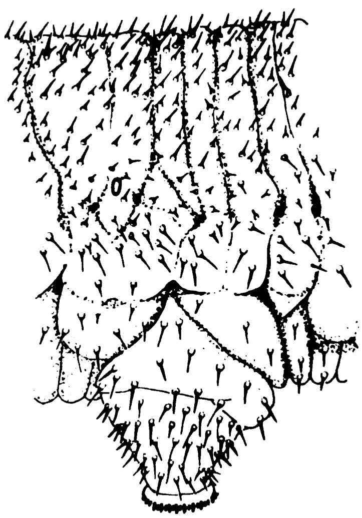

Figures 55-58. Pericopidae, Nolidae.

Fig. 55. Composia fidelissima Herrich-Schaeffer.
Fig. 56. C. fidelissima Ventral proleg, lateral aspect; crochets arranged in a heteroideous mesoseries.
Fig. 57. C. fidelissima. Enlarged verruca.
Fig. 58. Nolidae, Celama sorghiella Riley (USNM).

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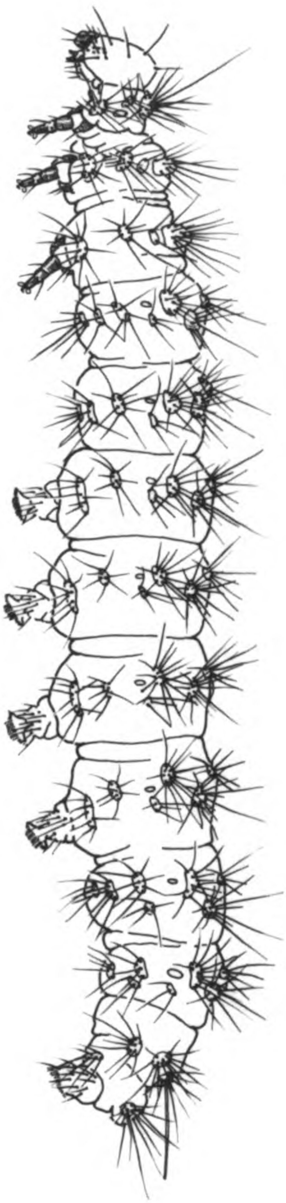

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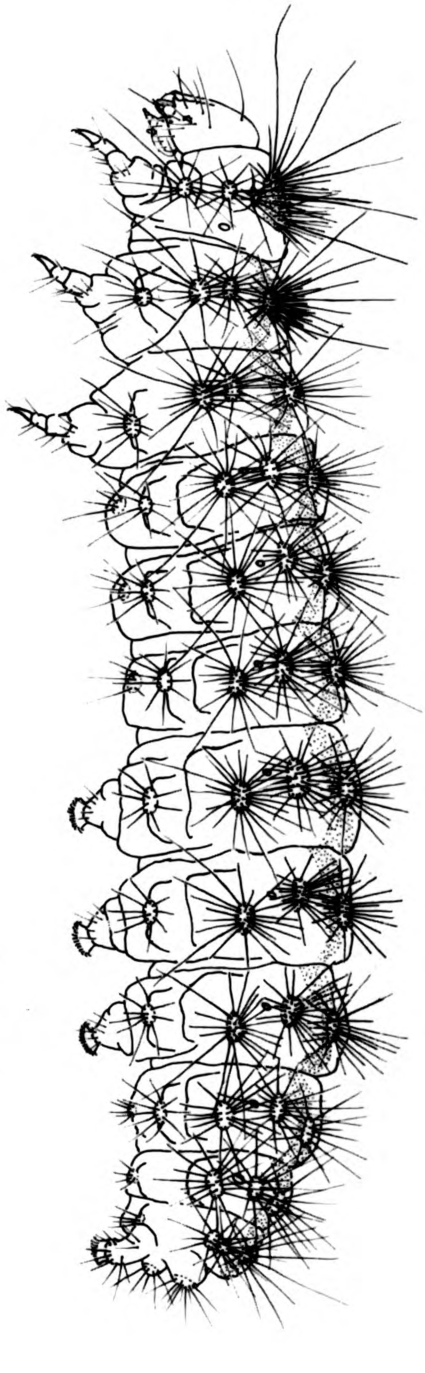

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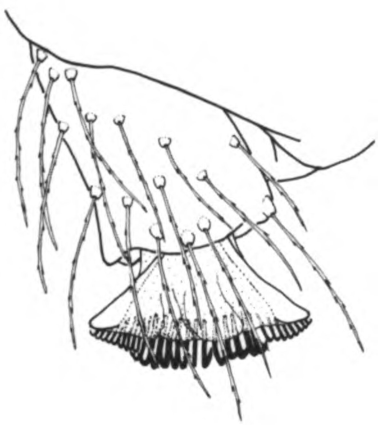

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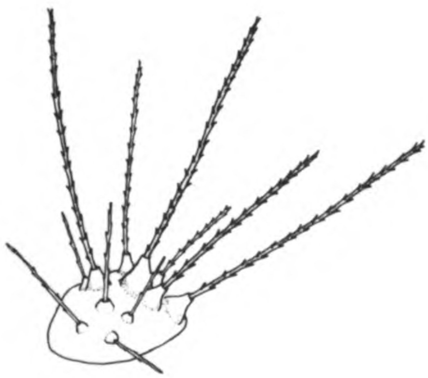

Figures 59-66. Tischeriidae, Heliozelidae, Lyonetiidae

Fig. 59. Tischeriidae, *Tischeria malifoliella* (Clemens) (USNM). Head, dorsal aspect.

Fig. 60. *T. malifoliella*. Ocelli, ocellar setae, and outline of anterior part of head.

Fig. 61. Heliozelidae, *Coptodisca splendoriferella* Clemens (USNM). Head, dorsal aspect.

Fig. 62. *C. splendoriferella*. Ocelli, ocellar setae, and outline of anterior part of head.

Fig. 63. Lyonetiidae, *Proleucoptera smilaciella* Busck (USNM). Head, dorsal aspect.

Fig. 64. *P. smilaciella*. Ocelli, ocellar setae, and outline of anterior part of head.

Fig. 65. Lyonetiidae, *Paraleucoptera albella* (Chambers) (USNM). Head, dorsal aspect.

Fig. 66. *P. albella*. Ocelli, ocellar setae, and outline of anterior part of head.

Figures 67-72. Nepticulidae, Eriocraniidae, Gracillariidae, Opostegidae.

Fig. 67. Nepticulidae, Nepticula myricafoliella Busck (USNM). Head, dorsal aspect.

Fig. 68. Eriocraniidae, Mnemonica sp. (USNM). Head, dorsal aspect.

Fig. 69. Nepticulidae, Ectoedemia populella Busck (USNM). Head, dorsal aspect (see also Fig. 27).

Fig. 70. E. populella. Ocelli, ocellar setae, and outline of anterior part of head.

Fig. 71. Gracillariidae, Marmara salictella Clemens (USNM). Head, dorsal aspect.

Fig. 72. Opostegidae, Opostega sp. (USNM). Head and TI, dorsal aspect.

Figures 73-83. Gracillariidae, Lyonetiidae, and some characters used in the key.

Fig. 73. Gracillariidae *Phyllocnistes populella* Chambers (USNM). Head, dorsal aspect, early instar.

Fig. 74. *P. populella*. Head, dorsal aspect, 4th instar.

Fig. 75. Lyonetiidae, *Lyonetia speculella* Clemens (USNM). Head, left lateral aspect, ocelli (cranial setae left out).

Fig. 76. Plutellinae, typical crochet arrangment on a ventral proleg.

Fig. 77. Frontal aspect of typical head, fronto-clypeus extending less than halfway to the epicranial notch.

Fig. 78. Fronto-clypeus extending more than halfway to epicranial notch.

Fig. 79. Fronto-clypeus reaching the epicranial notch.

Fig. 80. Typical labrum with shallow labral notch.

Fig. 81. Noctuidae, *Acronycta americana* (MSU). Labrum with a deep notch.

Fig. 82. Notodontidae, *Heterocampa manteo* Doubleday (MSU). Labrum with a v-shaped notch and a groove.

Fig. 83. Saturniidae, *Telea polyphemus* Cramer. Labrum with a very deep u-shaped notch.

Figures 84-94. Characters used in the key.

Figs. 84-91. Various arrangments of ocelli and cranial setae A1, A2, A3, L1, and O1.

Fig. 92. Gelechiidae, *Autosticha pelodas* (Meyrick) (USNM). Seta SD1 on A3 and modified pinaculum.

Fig. 93. Blastobasidae, *Eubolepia gargantuella* Hein. (USNM). Seta SD1 on A3 and a semicircular pinaculum.

Fig. 94. Glyphipterygidae, *Rhobanda gaurisiana* (Walker) (USNM). Thoracic leg with an elongate tarsus.

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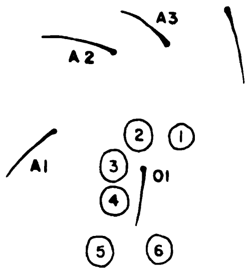

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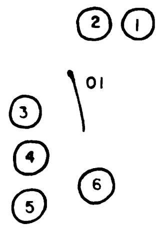

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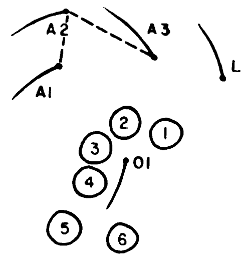

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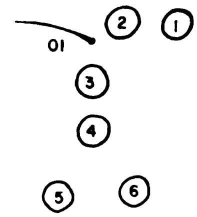

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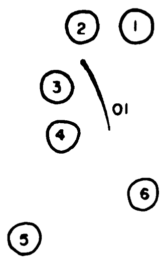

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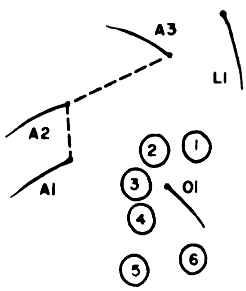

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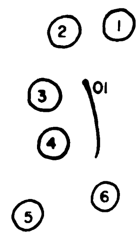

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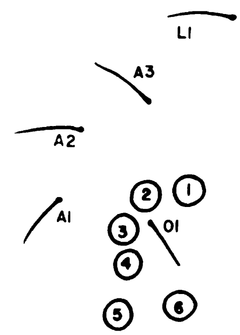

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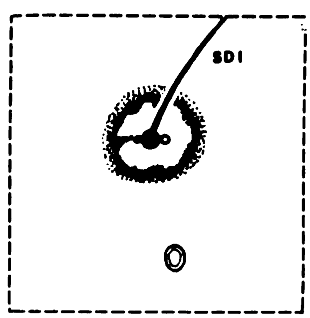

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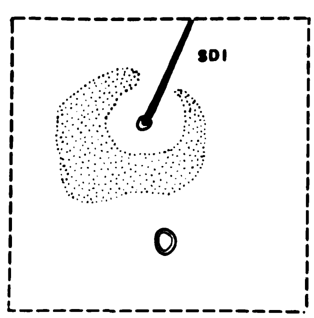

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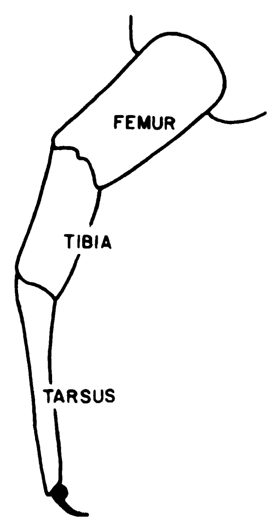

Figures 95-102. Characters used in the key.

Fig. 95. Setal arrangment on TI with SD2 caudad of SD1.
Fig. 96. Setal arrangment on TI with SD2 dorsad of SD1.
Fig. 97. Notodontidae, Heterocampa manteo Doubleday (MSU). TI lateral aspect. SD1 & SD2 excluded from the prothoracic shield.
Fig. 98. Arctiidae, Hypoprepia fucosa (Hubner) (USNM). TII lateral aspect.
Fig. 99. Arctiidae. Verruca arrangment on TII, lateral aspect.
Fig. 100. Pericopidae. Verruca arrangment on TII, lateral aspect.
Fig. 101. Ctenuchidae. Verruca arrangment on A6 & A7, lateral aspect.
Fig. 102. Pericopidae. Verruca arrangment on A6 & A7, lateral aspect.

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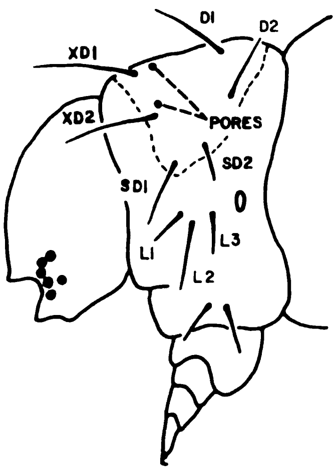

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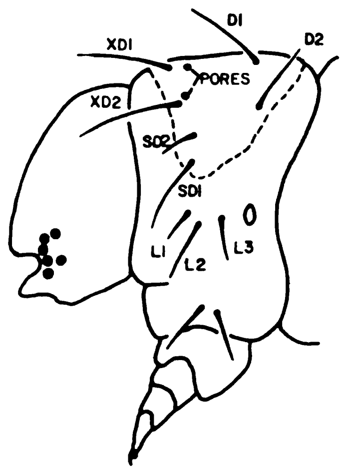

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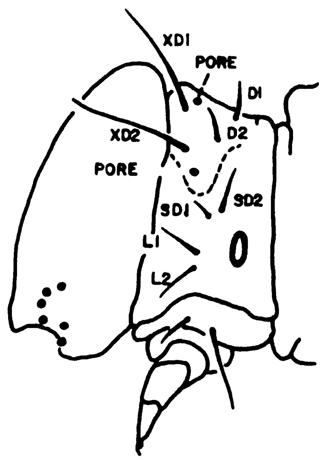

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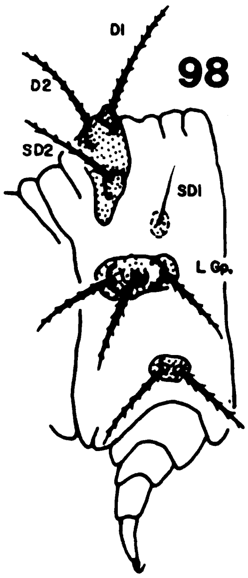

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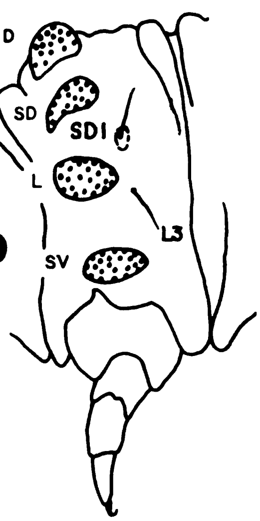

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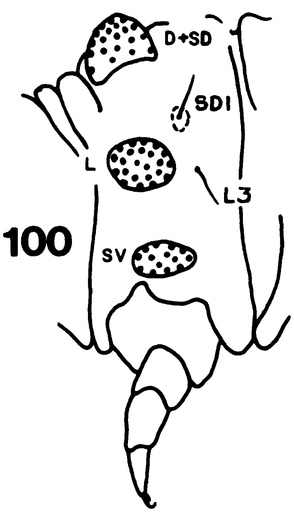

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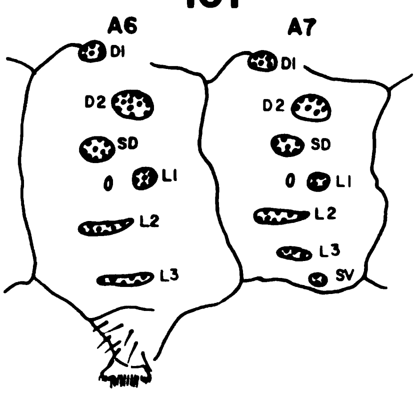

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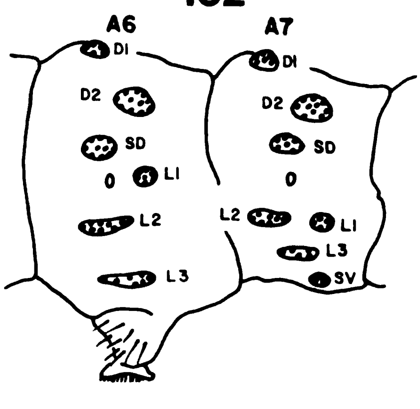

Figures 103-109. Characters used in the key.

Figs. 103-105. A3, left lateral aspect, various setal arrangments.
Fig. 106. Noctuidae. A6 & A7, left lateral aspect.
Fig. 107. Cossidae, Dyspessa ulula (Bkh.) (USNM, Italy). A3, left lateral aspect.
Fig. 108. Sesiidae, Paranthrene robiniae (Hy. Edwards) (USNM). A7 & A8 dorsal aspects showing location of caudo-projecting spiracles on A8.
Fig. 109. Incurvariidae, Lampronia sp. (J.A. Powell, coll.) A3 dorsal aspect.

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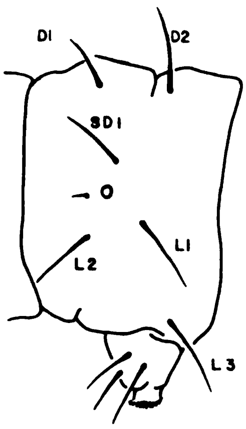

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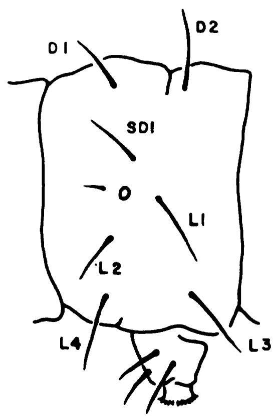

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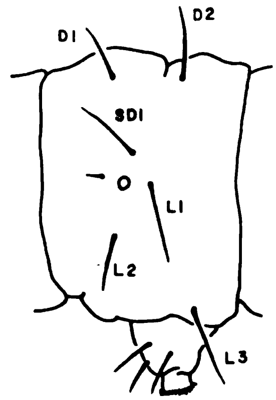

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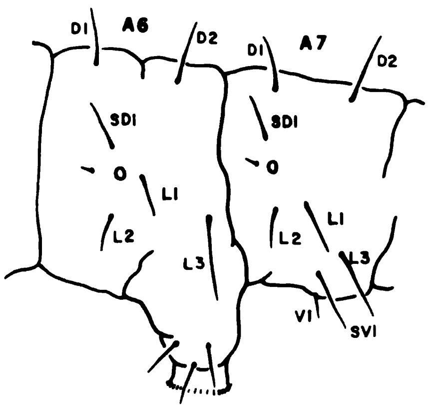

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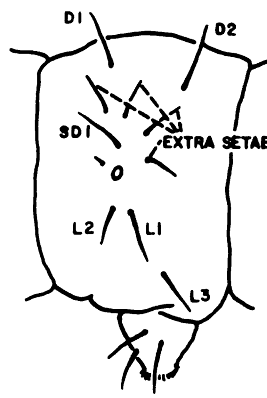

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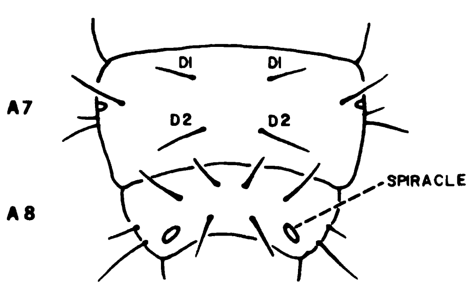

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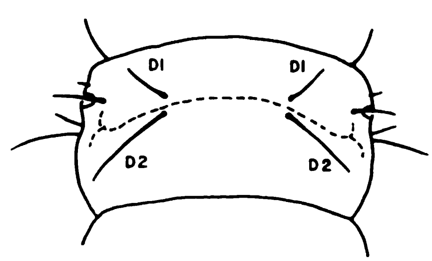

Figures 110-117. Characters used in the key.

Fig. 110. A8 left lateral aspect, SD1 dorsad of the spiracle.
Fig. 111. A8 left lateral aspect, SD1 cephalad of the spiracle.
Fig. 112. Tortricidae. A9 & A10, dorsal aspect. Setae D2 on a common mid-dorsal pinaculum on A9.
Figs. 113, 114, 115, 117. Various setal arrangments on A9, left lateral aspect.
Fig. 116. Notodontidae, *Heterocampa manteo* Doubleday (MSU). A9 & A10 left lateral aspect, with extra seta on A10.

Figures 118-123. Left lateral aspects of A6 below spiracle, showing different kinds of prolegs.

Fig. 118. Pyralidae, Ostrinia nubilalis (Hubner) (MSU).
Fig. 119. Cossidae, Chilecomodia sp. (USNM).
Fig. 120. Pterophoridae, Platyptilia antirrhina Lange (Lange, coll.)
Fig. 121. Geometridae, Cingilia caternaria Drury (USNM).
Fig. 122. Noctuidae, Agrotinae. Choephora fungorum (Grote) (USNM).
Fig. 123. Noctuidae, Acronyctinae. Acronycta oblinita Smith & Abbott (USNM).