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The Bionomics of Acarina

Associated With Selected Turfgrasses

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Saad ELSayed Salem

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THE BIONOMICS OF ACARINA ASSOCIATED WITH SELECTED TURFGRASSES

By

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ABSTRACT

THE BIONOMICS OF ACARINA ASSOCIATED WITH SELECTED TURFGRASSES

By

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The present study assessed population density, seasonal fluctuation, and vertical distribution of selected genera and species of Acarina inhabiting the soil under six species of turfgrass.

During both study years (1985 and 1986) Acarina were the dominant soil artheopods. Within Acarina, Prostigmata were most numerous, followed by Mesostigmata; Cryptostigmata ranked third and Astigmata fourth.

Data obtained on several of the most abundant genera and species were subjected to detailed analyses. Results indicated distinct differences between the studied taxa. While some showed no preference for either of the sampled strata (0-15 and 16-30 cm depth), *Eupodes* spp. for instance were clearly upper horizon dwellers. Seasonal patterns of

abundance were synchronous in 1985 and 1986 for Eupodes spp. and Tydeus bedfordiensis but not for others. For several taxa, significant relationships between abundance and soil moisture and temperature were established.

Most importantly, turfgrass species exerted a significant influence on abundance and distribution of several taxa. Smooth bromegrass and Kentucky blues grass were generally favorable to Bakerdania spp. and Rhodacarellus silesiacus; highest abundance of the predaceous Hypoaspis aculeifer was recorded under tall fescue, while Tydeus bedfordiensis seemed to be numerous under redtop.

Further studies of functional relationships between root system characteristics, associated microflora and arthropod population dynamics are recommended.

بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

In the name of Allah the most merciful and the most beneficient

DEDICATION

To my mother, for her love and support
(May Allah forgive her and let her
soul rest in peace)

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I. INTRODUCTION

The edaphic ecosystem is profoundly marked by a great number of dependent interrelations. we are constantly confronted with many functional relationships that mites share with other organisms. Therefore, the study of soil mites must fundamentally be an ecological one. Soil mites have wide spatial and temporal distributions, great species diversity, and narrow ecological sensitivity making them a prime candidate for ecological studies.

Turfgrass is a complex system consisting of roots, stems, and leaves of grass plants together with a tightly intermingled layer of dead and living roots, stems and organic debris commonly called thatch. This habitat supports a diverse assemblage of invertebrates (Streu, 1973; Cockfield and Potter 1983). Taxa that are present in turfgrass include Annelida, Nematoda, Diplopoda, Protura, Acarina and Collembola; they are considered important to plant-litter decomposition and nutrient recycling in soil communities. These animals aid the decomposition process by fragmenting and conditioning plant debris in their guts before further breakdown by microflora (Lofty, 1974; Wallwork, 1983). They are also responsible for disseminating bacteria and fungi, enriching the soil and mixing organic materials into the soil while migrating vertically.

Distribution and abundance of soil animals are determined by a large number of factors, among the abiotic factors, soil moisture, temperature, pH and organic matter are highly important (Hagvar and Abrahamsen, 1980).

From a survey of literature, it was found that little has been done in studying population dynamics of soil organisms inhabiting turfgrass systems. Therefore this study was undertaken to answer the following questions:

1. What is the effect of different grass covers on the abundance of the most dominant prostigmatid and mesostigmatid mite species and genera?

2. What are the seasonal dynamics of selected mite species and genera in relation to major ecological factors?

3. What is the vertical distribution of selected mite species and genera in relation to major ecological factors?

II. REVIEW OF LITERATURE

1. Horizontal patterns and effect of plant covers on population dynamics of soil arthropods:

The importance of habitat has been emphasized by Southwood (1977). It remains as a basic step in the concrete study of any ecosystem. However, ecosystem descriptions, as with any system, depends on the selected space-time resolution level.

Dillon and Gibson (1962) reported that the Isotomidae (Collembola) and Eupodidae (Acarina) were overwhelmingly dominant families in an old meadow. They found that an unusual feature was the virtual absence of Oribatei, which was possibly related to soil dryness. They also stated that populations of both Collembola and Acarina fluctuated with time and showed no regular seasonal rhythm and the vertical movements of almost all species occurred from time to time with no seasonal regularity; there was no evidence that the changes as a whole bore any simple relationship to fluctuation of soil temperature, moisture, pH or organic content. They also reported that among mesostigmatid mites, Rhodacaridae were exceptional in being most numerous.

Christiansen, in the case of Collembola, (1964) summed up the connection with macroflora by saying that there is generally a moderate amount of correspondence between plant cover and collembolan association, but little evidence of restriction of individual Collembola species to one species of plant.

Christen (1974) stated that it is general knowledge that numbers of soil microarthropods vary under different types of plant cover. Pasture crops with dense root systems generally can be expected to support larger populations than cultivated row crops, thus reflecting root influence.

Alejnikova and Utrobina (1975) said that the variety of soil invertebrate species increase in the same way as their density reaching a maximum under perennial grass and in field plantations. They also pointed out that plant cover effects were most striking in the case of microarthropods, in particular when they compared population density and group composition in four crop rotations. Depending on plant cover, dominance of individual species also changed. The authors suggested that, since plant cover greatly affected soil animal population structure, man could control soil animals and ultimately soil fertility by changing farm crop composition.

Krivolutsky (1975) reported that oribatid mite population density was highest in forest soils and lowest in desert soils. His studies suggested that oribatid mites could be used as a soil type bioindicator.

Singh and Pillai (1975) studied microarthropod population density in a wide variety of habitats and found that Acari were the most dominant group in all habitats, ranging from 45.5 to 71.7% of the total fauna, while Collembola ranged from 11.9 to 41.7%. They also noticed that Collembola and Oribatei were dominant in higher organic matter soils, while Prostigmata predominated in soils, poor in organic matter.

Loring et al. (1981) stated that no-till plots had stable populations of Collembola and Acarina which fluctuated regularly. Plowed plots exhibited a sharp decrease in populations, followed by a sharp increase in populations, followed by a sharp increase in populations toward the end of the growing season.

Petersen (1982) stated that great diffrences have been found between population fluctuations of individual acarine orders. Thus, data compiled for Prostigmata and Astigmata provided a number of examples of density changes, one month with several thousands/m2 and virtual absence of members of these taxa in another month. Contrary to this, Cryptostigmata and Mesostigmata generally showed moderate changes in population size. For collembola and Acari, woodland sites showed weaker annual amplitudes in population density than non-wooded sites. By comparing tropical and temperate regions, he was able to say that in most cases grassland sites in tropical regions showed higher fluctuatios than temperate grassland sites. Observed differences between communities were explained mainly as diffrences in environmental stability under, the infuence of local climate, soil properties and degree of exposure.

Whelan (1985) sampled the herbs and soil of three grassland sites each month for one year. The soil also was sampled to a depth of 7.6 cm, then divided into two subsamples of 3.8 cm each. Peak populations of Acari were recorded in the summer months which corresponded with high herb populations. Permanent pasture had high populations in the soil especially in the 3.8 - 7.6 cm stratum.

Whelan (1986) then reported that populations in herbaceous stratum, were dominated by microphytophagous and panphytophagous species while microphytophagous and predacious species dominated the soil populations.

Hendrix et al. (1986) suggested that the decomposition processes of no-tillage agroecosystems were functionally similar to those occurring in natural systems, where gradual decay of organic matter and slow nutrient release from plant residues is under the control of soil fauna as well as microflora.

Curry and Momen (1988) studied the arthropod fauna of managed grassland 2.5 and 6 years old; unmanaged 6 years old grassland; and an old field margin on reclaimed cutaway peat. They recorded 209 species or higher taxa including 5 new species. Mean collembolan population densities reached a maximum in the 2.5 year site, while a minimum was recorded in the old field margin. Meesostigmata dominated all habitats except the 2.5 years-old site where Astigmata were most abundant.

2. Seasonal fluctuation and vertical distribution of soil arthropod populations:

Sheals (1957) suggested that seasonal fluctuations of soil Cryptostigmata in uncultivated grassland where caused by movement to other habitats for reproduction. Hayes (1963), Wood (1967) and Luxton (1972) suggested that depth distribution of mite species may be controlled by a complex of physiological and behavioral characteristics. Importance of food selection and influence of relative humidity and temperature also appeared to be considerable.

Hayes (1965) stated that all species of phthiracarid mites occurred predominantly in litter and humus with no real seasonal differences. Madge (1965) reported the highest number of oribatid mites during winter (November-February) and the lowest during late summer and fall (July-October) at Rothamsted Experimental Station.

Fujikawa (1970) recorded the average population density (individual no. /20cm2) of the upper 15 cm of soil over 15 sampling occasions was 13.8 ± 6.9 in a natural Picea forest. The most complex faunal composition was observed in the natural mixed forest. In most cases the population density in the upper 5.0 cm layer of soil was significantly greater than that in the 5-10 cm and 10-15 cm strata.

Anderson (1971) suggested that vertical distribution of Oribatei was governed more by selection of certain food materials and characteristics of soil horizons than by physical characteristics of their environment.

Usher (1971) mentioned that of 22 mesostigmatid species studied, seasonal distribution Was detected in 15 species. Only 5 of these showed single annual maximum population densities. The mesostigmatids Pergamasus lapponicus and Veigaia transisalae were autumn species, since their maximum population size was recorded during September, October and November. Eugamasus sp. was a winter species with maximum population during January and February. Arctoseius magnanalis and Rhodacarus roseus were summer species. He also observed that, among mesostigmatid populations, there was no intense vertical stratification during periods of suitable climatic conditions. However, when climatic factors became less suitable; the animals migrated, downwards, establishing a more defined vertical stratification.

Wallwork (1972), in his study of distribution patterns and population dynamics of microarthropods in juniper litter and underlying mineral soil, pointed out that peak densities occurred in April and December. The December peak was produced mainly by population increases in mineral soil, whereas the April peak reflected population increases in litter.

Price (1973) reported prostigmatid adaptations to xeric conditions, and cautioned against shallow sampling which can result in substantial underestimates of total soil microarthropod populations. Fujikawa (1974) compared oribatid faunas from different microhabitats in a forest floor. He found that each stratum contained a particular fauna, and the number of individuals as well as species of oribatid mites in litter stratum was comparable to that observed in soil strata.

Pande and Berthet (1975) found no statistically significant correlation between species size and their depth penetration, although it remains generally true that larger species dominate the surface layers of soil (Stepanich 1975).

Aitchison (1979) investigated snow cover effects in southern Manitoba, and found that the families Eupodidae, Rhagidiidae and Parasitidae were some of the most abundant winter-active groups. She also found no correlation between number of trapped mites and below-snow temperature.

Zacharda (1979a.) stated that some rhagidiids were polyvoltine and.that the occurrence of their developmental stages was season-independent. On the other hand some species were monovoltine with strictly season-dependent life cycles; adults of species inhabiting dry habitats, e.g., xerotherm grassy steppes and rocky dry steppes, occured predominantly in winter and disappeared during spring and summer.

Holt (1981) suggested that vertical distribution of adult Cryptostigmata was highly correlated with percent organic matter, and distribution of larger individuals appeared not to be influenced by pore size or total soil porosity. Distribution of numerous smaller Cryptostigmata appeared to be influenced by availability of smaller soil pores.

Salem (1981) recorded monthly fluctuations in population densities of tarsonemid mite species in relation to soil temperature and moisture in Egypt. He reported that the highest population densities of Acarina groups occurred in spring and fall.

Darlong and Alfred. (1982) found a general trend for mean total populations of soil arthropods to increase in both forest and Jhum sites with the advent of the warm and rainy season. This decreased with the advent of the dry and cold season. He also saw seasonal variations among different soil arthropod groups which may have been due to vertical movements.

Leetham and Milchunas (1985) suggested that composition and distribution of soil microarthropods on the semiarid shortgrass steppe was a function of tradeoffs between resource availability and environmental benignity mediated through body size constraints on the ability to withstand cycles of anhydrobiosis.

3. <u>Effects of ecoloeical factors on soil arthropod population dynamics</u>:

According to Andrewartha and Birch (1954) population size is determined by four components of the environment: weather, food, other animals and pathogens, and locus. Individual importance of these components may vary between different populations in different habitats. For terrestrial animals, variation of specific physical conditions (climate) greatly influences all parameters of population growth. The combination of soil moisture and temperature is the most important factor for soil animals.

Many studies have demonstrated that soil arthropods are non- randomly distributed. The following is a review of the factors causing this non-randomness.

Loots and Ryke (1967) obtained a highly significant correlation value of 0.90 between the ratio of Oribatei: Trombidiformes and the percentage of organic matter in different soils. Oribatei dominated in soils with high organic matter, whereas Trombidiformes were more abundant in soils with low percentage of organic materials. They suggested that small species of trombidiforms might feed on protozoa and bacteria which are present in small pore spaces.

Bursell (1970) found that moisture deficiency could be an important mortality factor. Mukharji and Singh (1970) stated that there was a direct correlation between soil moisture content, temperature and arthropod population dynamics. They concluded that as soil moisture increased, arthropod populations simultaneously increased and vice-versa.

Butcher et al. (1971) summarized that the majority of Collembola and Cryptostigmata studies reviewed, reported an aggregated distribution of individuals within the three dimensional environment of the soil. They concluded that aggregation tendencies could be attributed to "water, temperature, time of day, microclimate, season, food source, microflora, vegetation, etc....." and that the reliability of estimating each of these influences depended in part upon the extent to which individual investigator, sought to document their speculations, inferences or conclusions.

Chernova et al. (1971) in Russia found that both numbers and biomass of micro-arthropods increased with a rise in organic matter content. Edwards and Lofty (1971) in England reported that some soil-inhabiting invertebrates survived extreme heat or cold in an active phase. But this was unusual, more often they became inactive and aestivated, coincident with adverse periods, or survived as eggs or pupae. Some species avoided extreme temperatures at the soil surface by moving down into soil strata where temperatures were less extreme and much more stable until the surface again became acceptable.

The same authors also commented that changes in temperature can influence numbers of soil-inhabiting invertebrates not only directly, but also indirectly by changing the moisture content of soil. Most dry soils have a specific heat of only about 0.2 cal./g so that they warm up rapidly when exposed to the sun. Increasing their moisture content increased thermal capacity, and warming up took place less rapidly. Wet soils also had a greater thermal conductivity than dry soils so that temperature gradients in them were less than those in dry soils. All these factors may influence the effects of extreme temperature on invertebrates in soils.

Metz (1971) reported that substrate moisture content determines, to a large degree, number of micro-arthropods. On several occasions, his litter samples from Loblolly pine forest floors after several weeks of drought yielded very few mites; 2 days after wetting a square meter of the floor with 20 liters of water, from 5 to 10 times more mites were recovered.

The same author described a laboratory experiment to determine survival and movement of mites under different moisture regimes. Groups of mites, including seven species of Oribatei, were shown to move between mineral soil and organic layers as moisture conditions changed. Mesostigmata had a better survival rate than either Oribatei or Trombidiformes.

Usher (1975) demonstrated a relationship between numbers of arthropods and soil moisture or soil temperature, while Plowman (1979) was unable to find any such relationships. The former author (1976) indicated that patchy distribution of either food or soil water was the most likely cause of soil arthropod aggregations.

Wallwork (1976) suggested that correlation between environmental factors and species assemblages were of limited value because a complexity of environmental factors acted upon the species and because of different physiological tolerances of different species.

Mitchell (1979) pointed out that a forest soil was a mosaic of biotic and abiotic components, arranged differentially with respect to horizontal and vertical distribution and temporal patterns. Of the abiotic parameters, temperature and moisture seemed especially critical in affecting physiological activity and distribution of oribatids. Depth was a complex variable linked with a number of components, all of which may affect both inter-and intra- specific oribatid distribution. Food was probably the most important factor affecting the biology of oribatids. The distribution and population dynamics of microphytophages may be directly related to availability of microbial food resources.

Regniere (1980) said that soil insects were highly dependent on soil moisture which had direct effects on egg development and hatching.

Joosse (1981) stated that population changes of some collembolan species were infuenced by an interacting complex of biotic and physical factors, which varied according to environmental favourability.

Luxton (1981) concluded that environmental variables such as precipitation and litter fall may exert important short-term infuences on some populations, and that the same species in different environments may not always be confidently compared to a single phenological pattern.

Whitford et al. (1981) have shown that in desert ecosystems, mites, Collembola and nematodes all reacted, very quickly to simulated rainfall, increasing significantly in litter within an hour after it was moistened.

Petersen (1982) reported a high proportion of prostigmata and a relatively low ratio of Collembola to total Acarina in shortgrass steppe. He attributed this to a negative correlation between acarine density and soil moisture, and a positive correlation between collembolan density, soil moisture and organic matter.

Boyne and Hain (1983) studied the development and fecundity of Neoseiulus fallacis under various relative humidity levels and found them similar for all relative humidity ranges tested, except at the lowest range (60-65%). There none of the individuals survived to maturity.

Mitra et al. (1983) stated that in grassy plots, higher temperature and R.H. resulted in an increase in number of Collembola, while lower temperature and R.H. were preferred by Acarina.

Hagvar (1984) studied "6 common mite species in Norwegian coniferous forest soils." He found that the abundance of these species in different soils was related to a number of soil chemical factors. Their occurrance was also related to soil and humus types, plant communities and soil fertility.

III. MATERIALS AND METHODS

1. Site description:

This study was conducted at the Hancock Turfgrass Research Center, located on the campus of Michigan State University. To study the effects of turfgrass types on the bionomics of soil acarina, 6 grasses were seeded into plots during 1982, and are listed in Table 1.

Table 1: List of turfgrass species in the study area

Common Name	Scientific Name
Smooth bromegrass	*Bromus inermis*
Kentucky bluegrass	*Poa protensis*
Orchardgrass	*Dactylis glomerata*
Timothy	*Phleum pratense*
Tall fescue	*Festuca arundinaceae*
Redtop	*Agrostis alba*

The turf blocks measured 8.2 m by 9.1 m with the long axis running north to south (Figure 1). All blocks were mowed at a height of 10.2 cm on 8 May, 1983 and 10 May 1984

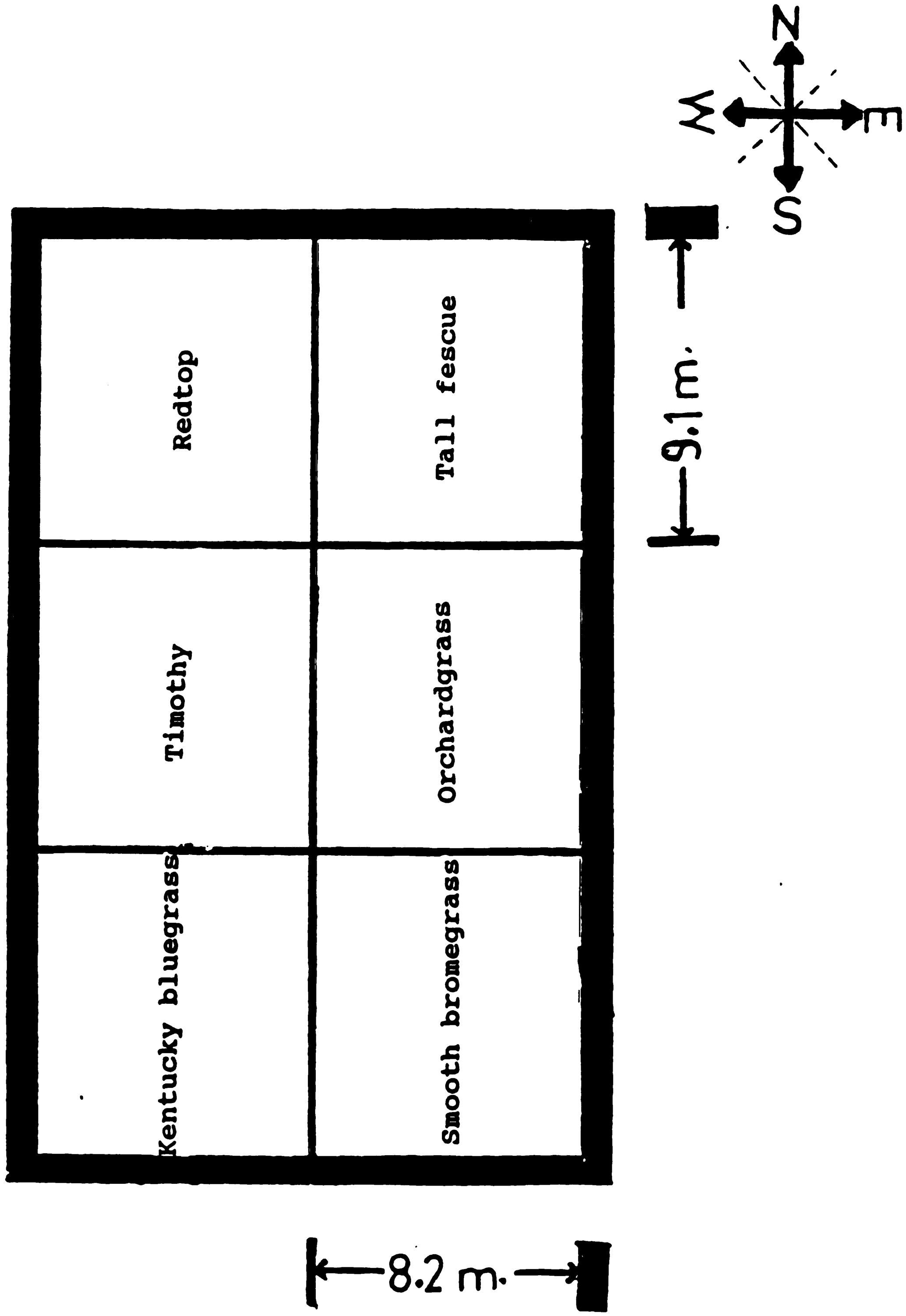


Figure 1. Diagram of the 6 sample blocks and their different grass covers.

and were then kept without any treatment until sampling began in 1985.

2. Description of grassplant covers

A. Smooth bromegrass (*Bromus inermis*)

Forms an upright, coarse textured turf which spreads vegetatively by vigorous, fleshy rhizomes that form a firm sod. Root system extensive.

B Kentucky bluegrass (*Poa protensis*)

Forms a medium textured, green to dark turf of good shoot density. The extensive root system in concentrated primarily in the upper 15-25 cm of the soil profile, some roots may penetrate to depths of 40 to 60 cm under mowed conditions. Root system persists as a perennial.

C. Orchardgrass (*Dactylis glomerata*)

The texture of this grass is quite coarse with leaves folded in the bud shoot and sheaths distinctly compressed. It forms an open sod of low shoot density. Orchardgrass is basically a bunch-type grass since it has neither rhizomes nor stolons. Orchardgrass has rapid early spring growth, its drought tolerance is greater than that of timothy but not as good as that of smooth bromegrass.

D. Timothy (_Phleum pratense_)

This grass tend to behave as a bunch type with poor sod forming qualities. Leaves frequently have a grayish-green appearance. The root system is shallow, fibrous and replaced annually.

E. Tall fescue (_Festuca arundinaceae_)

Forms a turf of very low shoot density and has dark green leaves. The root system is extensive, coarse and deeper than most cool season turf grass.

F. Redtop (_Agrostis alba_)

Forms a stemmy, coarse textured, open turf of low shoot density. The root system is regenerated annually.

3. _Soil Analysis_:

After Tullgren extraction of arthropods, the first 36 soil samples obtained from the study site were composited, passed through a 2-mm sieve and subsampled. Soil pH, K, Ca, Mg, and P were determined according to routine methods of the Soil Testing Laboratory of Michigan State University. Soil pH was determined in 1:1 water suspension, using a Beckman zeromatic glass electrode pH meter. Phosphorus was extracted with Bray p-1 reagent using a 1:8 soil to solution ratio; available K, Ca, and Mg with 1-0 N NH4 OAC (pH 7.0) using 1:8 soil to solution ratio.

The study area's soil type is fine loamy, mixed, Mesic Aeric Ochraquairs (formerly Capac Sandy Clay Loam). The soil texture is classified as sandy clay loam, with pH of 7.3. Soil chemical test results for available nutrients were as follows:

available P = 173 lb/A

exchangeable K = 280 lb/A

available Ca = 4480 lb/A

available Mg = 547 lb/A

Soil organic matter contents also were determined according to routine methods of the Soil Testing Laboratory of Michigan State University as follows:

Reagents:

1. 0.5 M $Na_2Cr_2O_7$; Dissolve 149 g of $Na_2Cr_2O_7$ 2 H_2O in water and dilute to 1 liter.
2. H_2SO_4, concentrated, 96%.

Procedure:

1. Using an NCR-13 1-g scoop, scoop 1 g of soil into a 50-mL Erlenmeyer flask, using standard scooping techniques.
2. Add 10 mL of $Na_2Cr_2O_7$ solution by means of dispenser.
3. Add 10 mL of concentrated sulfuric acid, using a suitable dispenser. A supply of 2% $NaHCO_3$ should be readily

available to nutralize spilled acid on skin, clothing, or lab bench.

4. Allow to react for 30 minutes.
5. Dilute with 15 mL of water and mix.
6. Allow to stand three hours or overnight.
7. Transfer 10 mL (or other suitable volume) of clear supernatant into a colorimeter tube. This can be accomplished conviniently by use of a pipette bank set to dip a suitable distance into the supernatant solution. Care must be taken not to disturb the sediment on the bottom of the flask.
8. The blue color intensity of the supernatant is read on a colorimeter at 645 nm, with the reagent blank set to give 100% transmittance (or 0 absorbance). The instrument is calibrated to read percent organic matter (or tons per acre) from a standard curve prepared from soils of known organic matter content.

Soil organic matter averaged between 3.2% and 3.7% (Table 2), indicating good uniformity among turf blocks.

Table 2: Average percent of soil organic matter under different grasses.

Grasses	% of Organic matter 0-15 cm stratum	% of organic matter 15-30 cm stratum
Smooth bromegrass	3.4	3.2
Kentucky bluegrass	3.2	3.3
Orchardgrass	3.6	3.7
Timothy	3.6	3.7
Tall fescue	3.3	3.5
Redtop	3.6	3.6

4. <u>Soil Temperature</u>:

A Yellow Springs telethermometer with a 12 cm probe was used to record soil temperature after allowing it to equilibrate in the soil for at least 1/2 hour. Temperature was measured at two depths: 7.5 cm and 23.5 cm on each sampling date under each grass.

5. <u>Soil Moisture</u>:

On each biweekly sampling date, 1 sample from each depth layer under each grass was placed in tightly covered containers, 6.5 cm high by 9 cm diameter; samples were weighed wet, oven-dried at 60^{0}C oven for one week or until no further weight loss occurred, and re-weighed. Percent soil moisture was obtained by using the following equation: % soil moisture = 100[(wet weight-dry weight)/ dry weight].

6. Precipitation:

Precipitation data were obtained from the U. S. National Weather Service, South Farm Station, which is very close to the study area.

7. Sampling and extraction methods:

Three replicate samples per date, cut in half to provide subsamples of the upper and lower profile (0 - 15 and 16 - 30 cm) were taken from each turf block using a metal coring device with a diameter of 6 cm and a height of 15 cm with a tapered interior edge to relieve compression of the core (Figure 2). Thirty-six samples were thus taken on a biweekly schedule from April 15 to December 1, 1985 and from April 1 until December 1, 1986. Samples were sealed in plastic bags and were transported in an ice chest to prevent temperature-induced mortality before extraction.

Extraction was initiated less than one hour after collection by using Tullgren funnels. To provide heat, each funnel had a 25-watt light bulb connected to a rheostat. A labelled vial with a solution of 1% glycerin in 95% ethanol was placed beneath each funnel. Soil cores were extracted

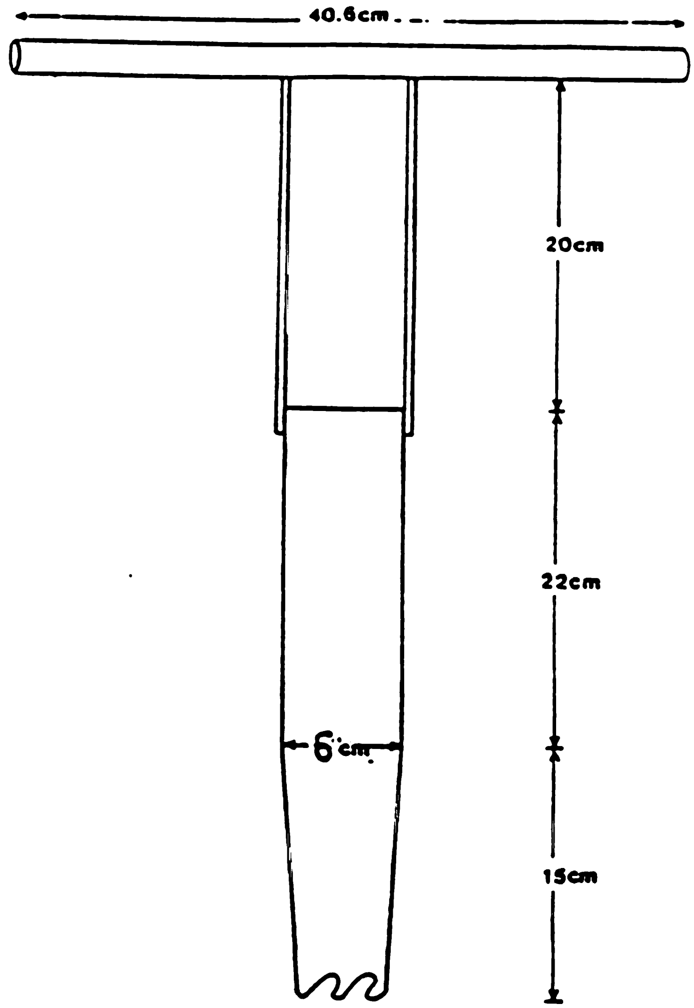


Figure 2. Diagram of soil core device.

for 72 hours, heat intensity being gradually increased to maximum during this time.

Collected animals were initially separated into collembolan families, mite orders, spiders, centipedes, millipedes and other arthropods. Two orders of mites, Mesostigmata and Prostigmata, were separated and mounted on slides for further identification to genus and species levels.

8. Slide mounting technique:

All specimens of the orders Mesostigmata and Prostigmata were mounted for further identification as follows:

1. Clearing in a solution of 10% KOH for 10 minutes.
2. Washing in distilled water for 5 minutes.
3. Mounting in a drop of Hoyer's media on a glass slide, straightening the specimens' appendages, then covering them with coverslips of size 00.
4. Heating in a 50^{0}C oven overnight, then ringing the covers with nail polish for a permanent seal. The collections were deposited at the Laboratory of Invertebrate Zoology, Michigan State University.

9. Statistical analysis:

Split-plot analysis of variance was used to test the effects of the three main factors included in this study: grass type, biweekly sampling dates (season) and profile depth, along with their interactions.

Tukey's Test was used for comparison among means whenever significant differences occurred. Correlation analysis and multiple regression were used to study relationships among population density, % soil moisture and soil temperature. ANOVA tables of split-plot and multiple regression analysis, and results of simple correlations, are given in appendices.

IV. RESULTS AND DISCUSSION

1. Ecological Parameters

1.1. Soil Temperature

Since temperature did not differ significantly with grass type, the data presented in Tables 3 and 4 are averages for each depth and date of 1985 and 1986. However, soil temperatures were significantly different among sampling dates (two-way analysis of variance). In 1985, the highest temperatures were recorded on July 1, July 15 and Aug 1, at approximately 27^{0}C for the 0 - 15 cm stratum (Figure 3), and at slightly over 25^{0}C for the 16 - 30 cm stratum. Soil temperature started to decrease beginning October 1, 1985, with only 1^{0}C being recorded on December 1 (Figure 4).

In 1986, the highest recorded soil temperature occurred on July 15, with an average of approximately 28^{0}C in the upper soil stratum, while it was slightly over 25^{0}C in the 16 - 30 cm stratum. Temperature began decreasing in early October until it dropped to less than 1^{0}C in November and December (Figures 5 and 6).

Table 3: Average recorded soil temperature (°C) and moisture during 1985.

	0 - 15 cm				16 - 30 cm			
	Moisture		Temp °C		Moisture		Temp °C	
Dates	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Aprl 1	---	---	---	---	---	---	---	---
Aprl 15	15.9	±1.7	12.0	±0.5	17.7	±1.0	8.5	±0.4
May 1	16.0	±1.7	12.9	±0.4	13.3	±1.1	11.8	±0.4
May 15	13.8	±1.6	16.3	±0.8	11.3	±1.0	13.6	±0.5
June 1	10.6	±1.2	16.7	±0.6	9.6	±1.3	14.0	±0.5
June 15	13.8	±1.8	17.3	±0.4	10.8	±1.0	15.7	±0.5
July 1	6.4	±1.1	26.3	±0.5	8.0	±1.1	22.9	±0.3
July 15	11.2	±1.4	26.5	±0.3	7.0	±1.4	25.3	±0.3
Aug 1	6.5	±1.1	26.3	±0.4	5.4	±1.0	23.6	±0.3
Aug 15	11.2	±1.1	21.6	±0.4	9.8	±1.2	18.3	±0.2
Sept 1	14.2	±1.4	25.4	±0.3	13.7	±1.4	21.7	±0.6
Sept 15	10.2	±0.9	19.5	±0.5	10.7	±1.4	17.9	±0.3
Oct 1	15.1	±0.7	11.2	±0.3	12.9	±0.8	10.1	±0.1
Oct 15	12.8	±1.0	12.2	±0.2	12.2	±0.9	11.1	±0.1
Nov 1	16.6	±0.4	11.3	±0.3	15.6	±1.1	10.1	±0.2
Nov 15	16.2	±1.3	12.1	±0.3	14.4	±1.1	10.2	±0.2
Dec 1	16.9	±3.1	0.9	±0.1	14.8	±2.4	2.2	±0.1

Each mean derived from 6 measurements/date.

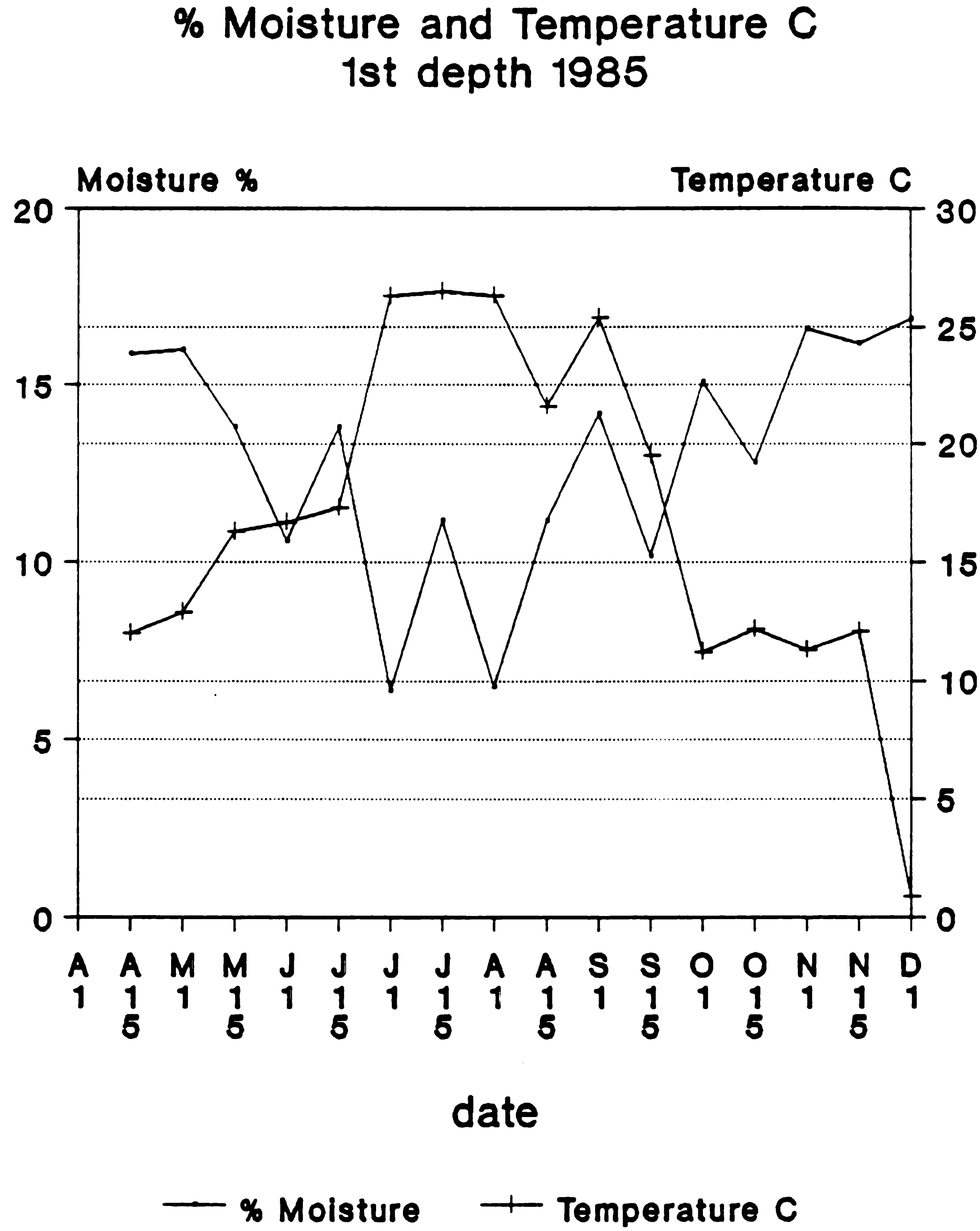


Figure 3. Average recorded soil temperature and moisture of the 0 - 15 cm stratum during 1985.

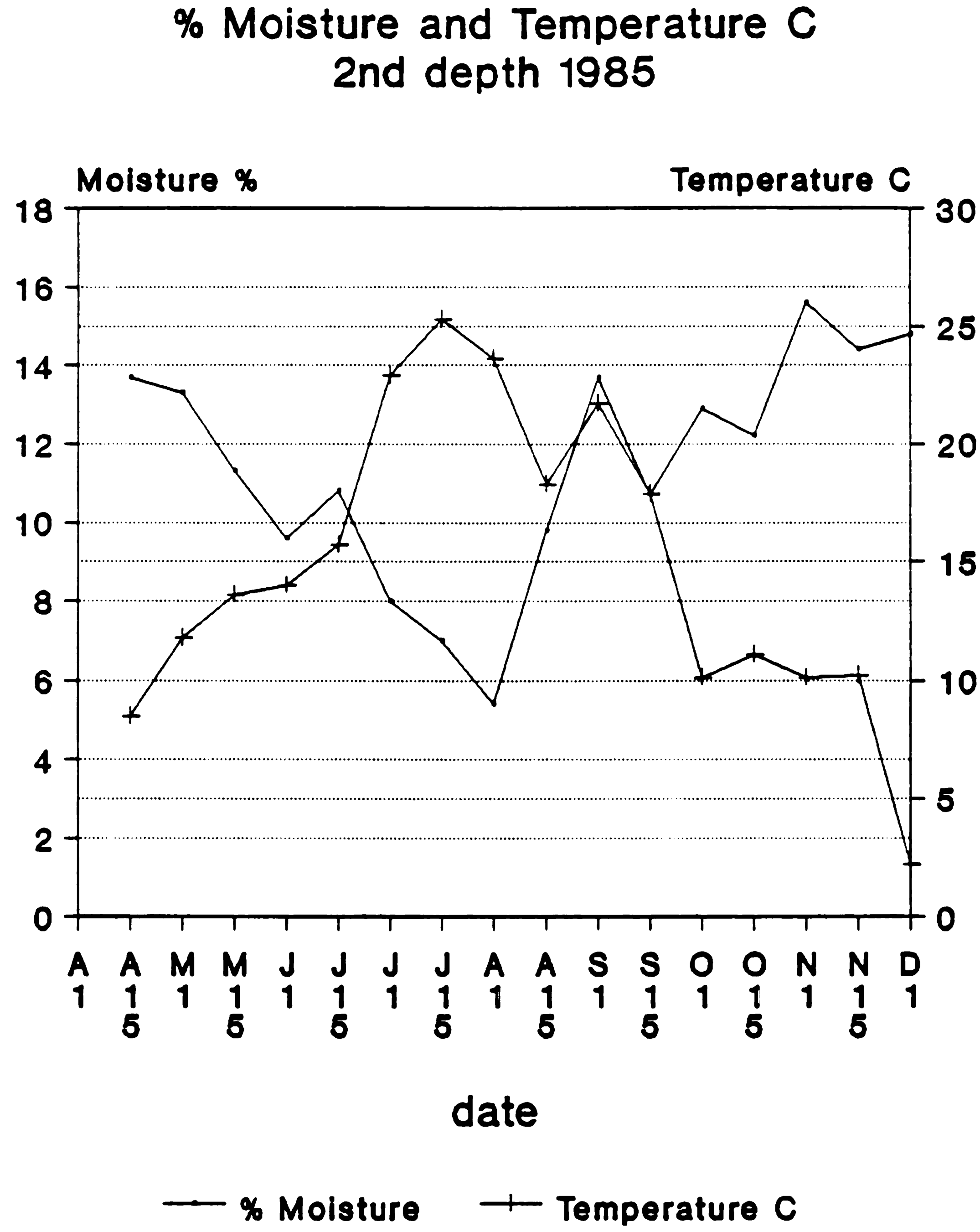


Figure 4. Average recorded soil temperature and moisture of the 16 - 30 cm stratum during 1985.

Table 4: Average recorded soil temperature (°C) and moisture during 1986.

	0 - 15 cm				16 - 30 cm			
	Moisture		Temp °C		Moisture		Temp °C	
Dates	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Aprl 1	15.9	±1.4	11.7	±0.2	14.8	±0.9	8.2	±0.2
Aprl 15	15.7	±1.4	13.4	±0.2	13.7	±1.4	12.4	±0.5
May 1	12.7	±1.6	11.5	±0.5	11.3	±1.4	9.6	±0.5
May 15	16.7	±1.9	19.8	±0.3	14.5	±1.6	17.3	±0.3
June 1	9.2	±1.6	20.4	±0.2	11.5	±1.5	18.4	±0.3
June 15	14.2	±1.3	20.6	±0.3	14.1	±0.8	19.4	±0.1
July 1	12.7	±1.0	19.6	±0.2	14.3	±0.7	18.6	±0.1
July 15	13.4	±1.0	27.6	±0.3	14.5	±0.3	25.3	±0.3
Aug 1	13.4	±2.0	22.7	±0.3	11.7	±1.7	21.2	±0.2
Aug 15	12.6	±1.8	23.3	±0.4	11.0	±1.5	22.0	±0.3
Sept 1	15.9	±2.2	18.6	±0.1	13.7	±1.7	17.5	±0.1
Sept 15	16.9	±1.8	17.1	±0.4	15.3	±1.0	15.5	±0.1
Oct 1	21.0	±2.5	13.5	±0.8	17.8	±1.2	14.0	±0.6
Oct 15	16.5	±0.8	10.1	±0.4	15.2	±1.0	9.1	±0.2
Nov 1	19.4	±1.1	9.0	±0.8	15.4	±0.5	9.0	±0.3
Nov 15	15.4	±1.1	1.0	±0.2	14.1	±0.7	1.6	±0.3
Dec 1	17.5	±2.1	1.4	±0.2	16.1	±1.7	2.3	±0.2

Each mean derived from 6 measurements/date.

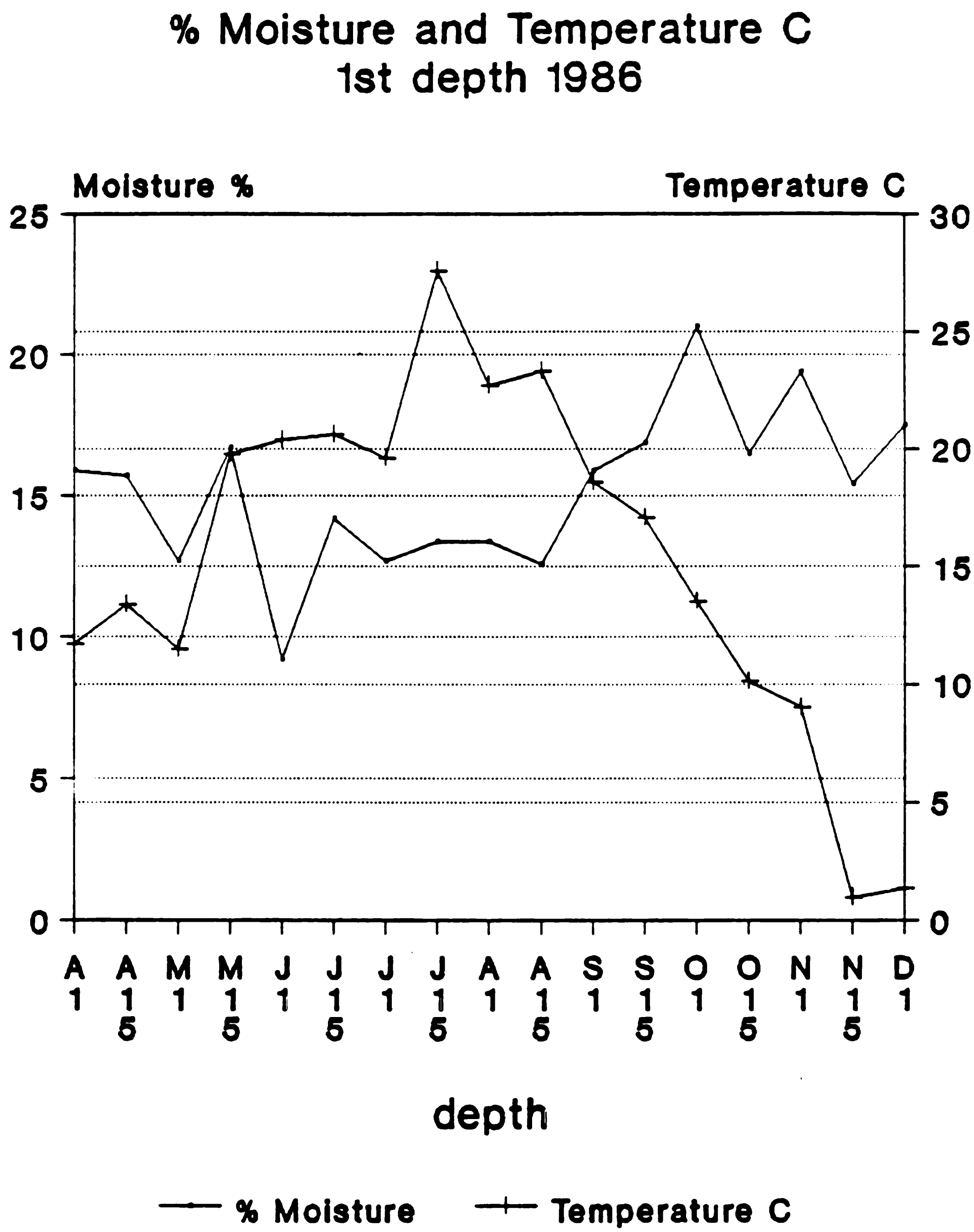


Figure 5. Average recorded soil temperature and moisture of the 0 - 15 cm stratum during 1986.

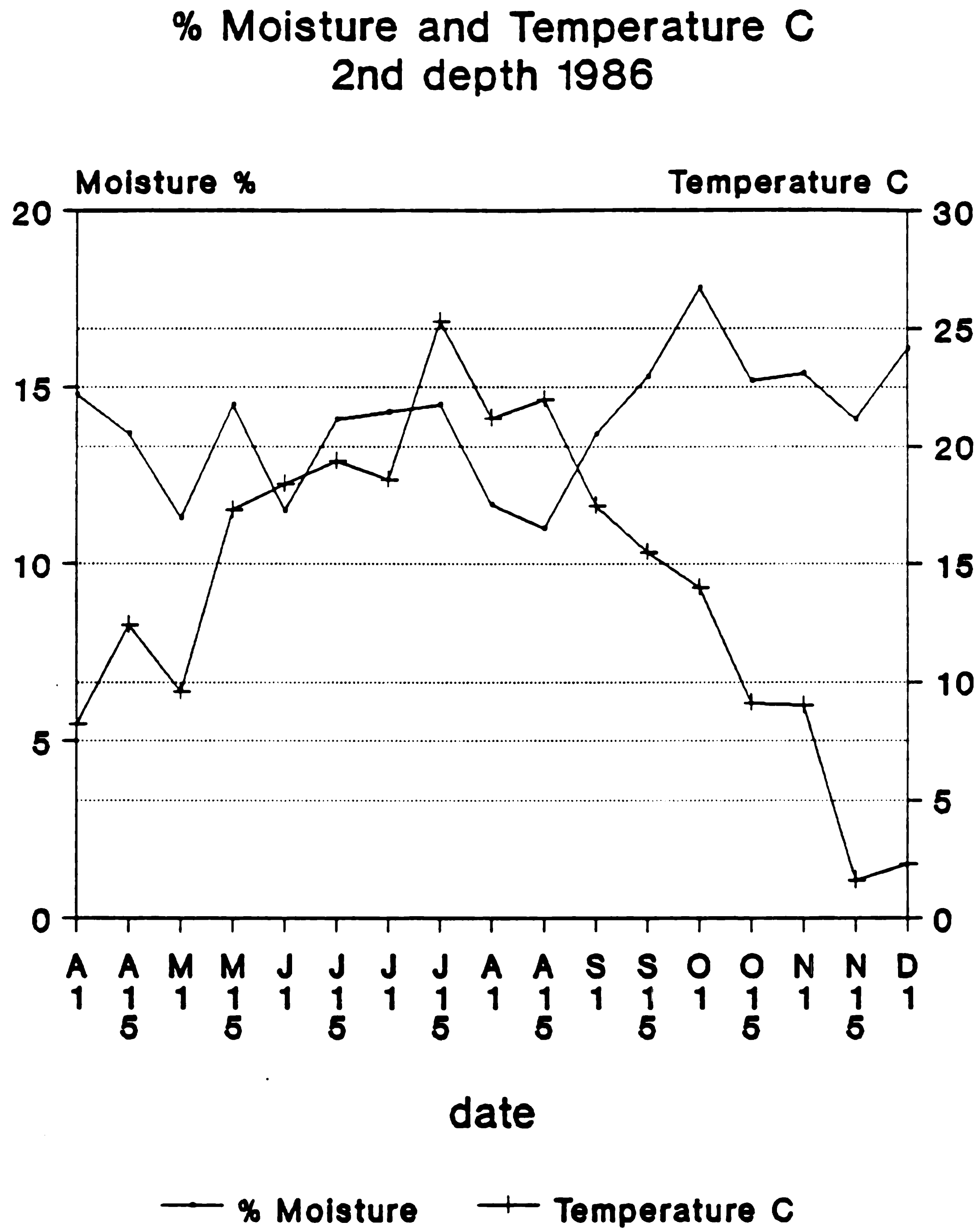


Figure 6. Average recorded soil temperature and moisture of the 16 - 30 cm stratum during 1986.

1.2. Soil Moisture

Percent soil moisture under different grass covers for the two depth strata is given in Table 3 and 4. Since statistical analysis (two-way analysis of variance) revealed no differences among grass blocks, but soil moistures differed with sampling dates, data presented in Figures 3, 4, 5, and 6 are averages derived from all grasses in 1985 and 1986.

In 1985, the driest period occurred between July 1 and August 15 at both depths. Percent soil moisture ranged from 4.1% to 22.2% in 1985, while in 1986 it ranged from 9.1% to 24.4%. Overall, 1985 was drier than 1986.

1.3. Precipitation

Rainfall is presented as totals for the two weeks preceding sampling dates (Figure 7). In 1985 the periods of April 16 to May 1 and June 16 to July 1 were drier than in 1986, with precipitation totalling 0.48 cm and 0.58 cm respectively. In general, lower rainfall resulted in lower soil moisture at all depths in 1985 (Figures 3 - 6). The driest period in 1986 occurred between October 16 and November 1, with 0.8 cm rainfall.

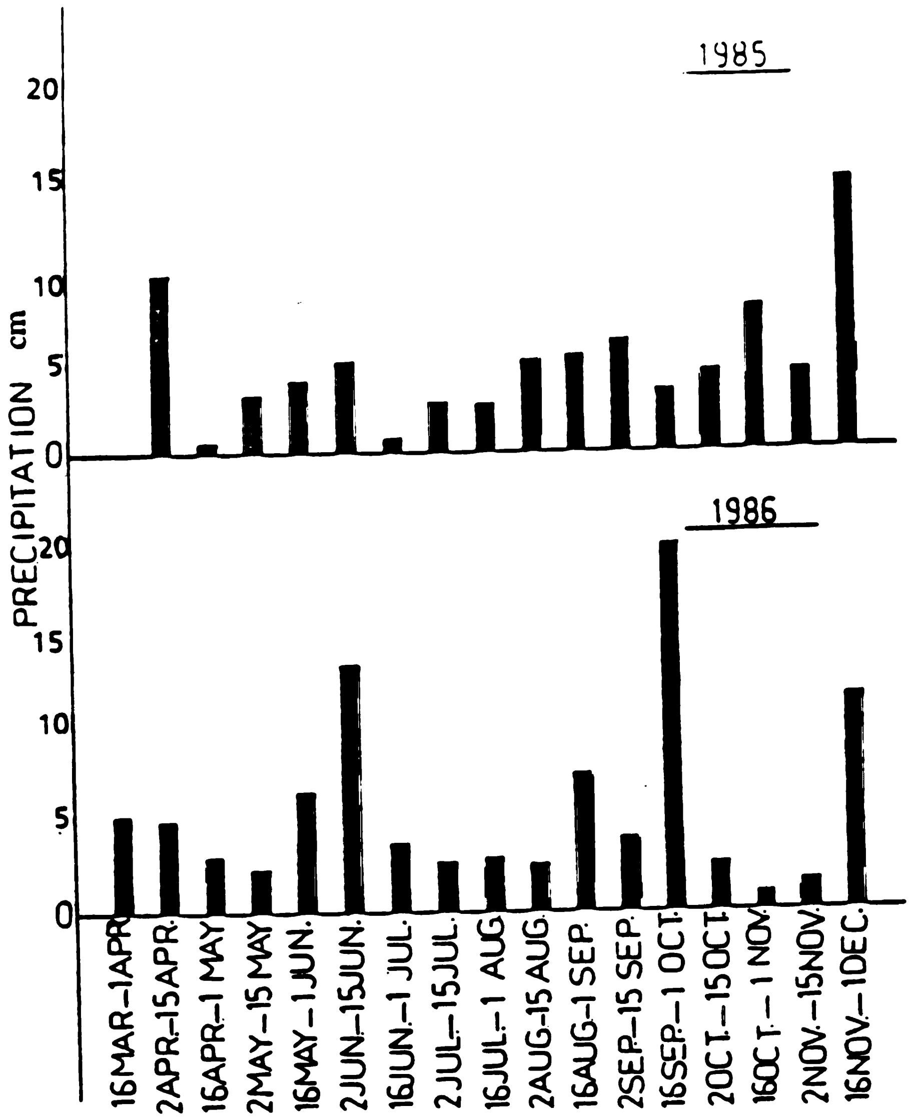


Figure 7. Amount of precipitation received in the study area during 1985 and 1986.

2. Distribution and dynamics of Acarina:

A. Relative dominance of acarine orders:

The four orders of Acarina, Prostigmata, Mesostigmata, Cryptostigmata and Astigmata, occurred under all six species of grasses at Hancock Turfgrass Research Center. The relative numerical distribution among these mite orders (Table 5 and Figure 8) in 1985 and 1986 revealed that Prostigmata were the most dominant, followed by Mesostigmata; Cryptostigmata ranked third and Astigmata were the least dominant in both years. It is also clear (Table 5) that the density of Acarina in 1986 was doubled over 1985; this may be related to the fact that 1985 was hotter and drier than 1986.

B. Order Prostigmata

Prostigmatid mites were the most prevalent group present under turfgrass in the study area. Within this order in which basic body morphology is subject to diverse modifications, four suborders (cohorts) were recorded. The suborder Heterostigmata was most dominant, followed by Eupodina; Endeostigmata and Raphignathae were found in very low numbers.

Table 5. Relative dominance of Acarina orders in 1985 and 1986.

Mite orders	1985 N	1985 %	1986 N	1986 %
Prostigmata	4006	63.8	11456	83.0
Mesostigmata	1690	26.9	1201	8.9
Cryptostigmata	498	7.9	798	5.9
Astigmata	88	1.4	83	2.2
Total	6282		13478	

N = the total number of specimens obtained per year.

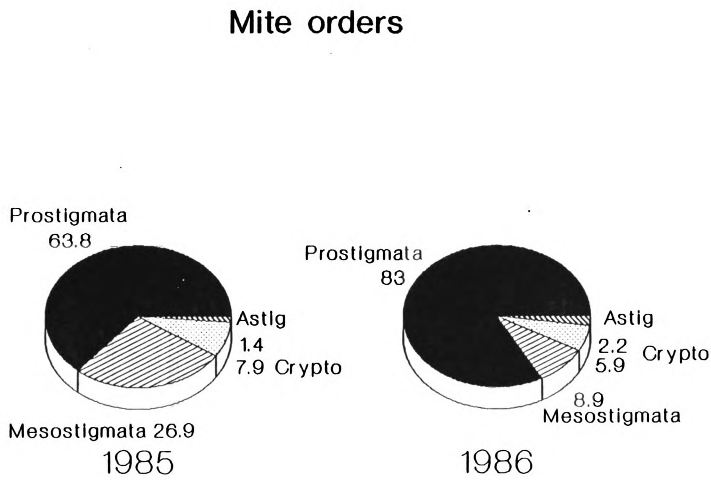


Figure 8. Relative dominance (%) of acarine orders (all grasses lumped).

B.1. Effect of grass covers on densities of Prostigmata:

Split-plot analysis of variance of prostigmatid counts revealed no significant differences ($p > 0.25$) between grasses in 1985 (Table 6 and Figure 9). For 1986, analysis showed very marginal differences ($p < 0.25$) between grasses in accommodating prostigmatid populations. For both strata combined, smooth bromegrass harbored the highest numbers of Prostigmata (28100/m^2), followed by Kentucky bluegrass (24650/m^2); the extensive root system and vigorous fleshy rhizomes of these two grasses may provide rich habitats for prostigmatid populations. Tall fescue harbored the lowest population (10450/m^2); this grass also has an extensive root system, but it can penetrate to depths below 40 cm; the rhizosphere of tall fescue may therefore not have been completely sampled in this study.

B.2. Biweekly fluctuations of prostigmatid populations:

Date effects were significant at $p < 0.001$ in both years (App. B). Although overall numbers of prostigmatids were more than doubled in the second year of the study, seasonal abundance patterns of 1985 (Figure 10) were repeated in 1986 (Figure 11). Density maxima occurred in July and October, followed by population declines in late fall. Increased rainfall in 1986 seems to have been a contributing factor toward larger populations in July of that year; its effect

Table 6: Population densities ±SE/m² of Prostigmata in each soil stratum under different grasses.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Grasses	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Sm. bg	4900	±700	3700	±1050	8800	±1550	19300	±8950
Ky. bg	4350	±700	2750	± 450	16750	±8650	7900	±1150
Ordgrs	5050	±800	1750	± 350	5650	± 800	7450	±1800
Timthy	3550	±500	1950	± 300	8450	±1200	8200	±1600
Tl Fse	4400	±950	2350	± 450	4950	± 900	5500	±1300
Redtop	4250	±700	2800	± 550	9750	±2550	9600	±2700

N = 48 for 1985, 51 for 1986

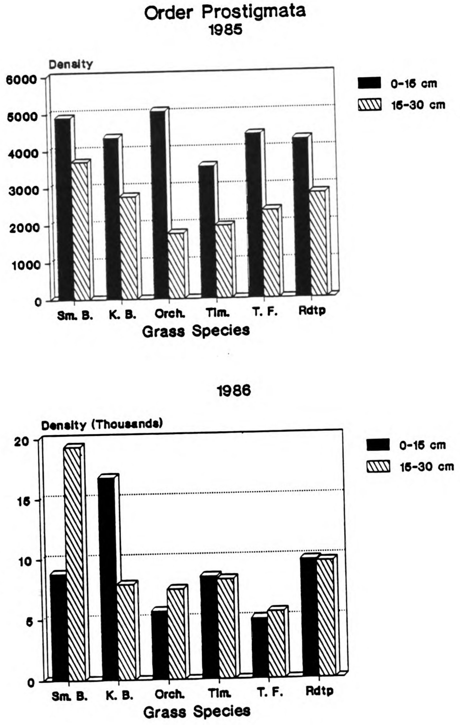


Figure 9. Prostigmata densities /m^2 in both soil strata under different grass covers.

was then amplified in a second wave of reproduction which led to an all-time population peak of 87700/m^2 on October 1 (Figure 11).

B.3. Vertical distribution of prostigmatid populations:

Using lumped data from all grasses, split-plot analysis of variance (App. B) showed highly significant depth effects for prostigmatid populations in 1985 ($p < 0.001$). On all sampling dates, Prostigmata were more numerous in the 0 - 15 cm stratum than in the 16 - 30 cm layer (Table 7, Figure 12). As previously mentioned, precipitation was low throughout 1985 and did not penetrate deeply, as evidenced by low soil moisture (Table 3). Higher moisture in the upper stratum, and its potential effect on the mites' food sources (fungi and bacteria), were probably the main driving variable for prostigmatid distribution.

For 1986, statistical analysis (App. B) showed no significant difference between depths. Prostigmatids occurred in almost equal densities in both strata. Occasionally, populations were higher in the 16 - 30 cm stratum, on dates when soil temperatures were high (Table 7 and Figure 12). Higher precipitation in 1986, penetrating deeply through both sampled strata, apparently resulted in relatively even mite distribution.

Table 7: Mean seasonal density /m² ±SE of Prostigmata in upper and lower soil strata; data from all grasses lumped.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Dates	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Aprl 1	---	---	---	---	10100	± 3650	8000	± 2400
Aprl 15	4550	±1350	2650	± 750	2600	± 700	2700	± 1000
May 1	3250	± 750	1950	± 550	2600	± 500	1650	± 350
May 15	4600	± 900	1600	± 500	2650	± 900	1250	± 450
June 1	5250	±1050	2450	± 750	4400	± 1100	3900	± 1100
June 15	5050	±1150	2550	± 750	9950	± 1700	17050	± 3200
July 1	8850	±1700	4350	± 950	8200	± 2000	9900	± 2550
July 15	5850	±1400	3300	±1000	21550	± 5450	25000	± 3000
Aug 1	3600	± 750	1400	± 250	13700	± 2050	14000	± 3450
Aug 15	3450	±1300	1600	± 500	10450	± 1850	10150	± 2450
Sept 1	2050	±1000	1650	± 450	4350	± 1250	5050	± 900
Sept 15	2700	± 700	900	± 200	10350	± 1350	6650	± 1400
Oct 1	6050	± 950	4000	± 950	37350	±24400	50350	±24950
Oct 15	5700	±2100	5200	±2500	5800	± 1500	4550	± 1100
Nov 1	3200	± 950	2600	± 800	5050	± 1400	2050	± 250
Nov 15	3400	± 650	3150	± 900	2800	± 600	1350	± 350
Dec 1	3400	± 900	1200	± 500	2100	± 800	750	± 150

N = 18 per date and depth

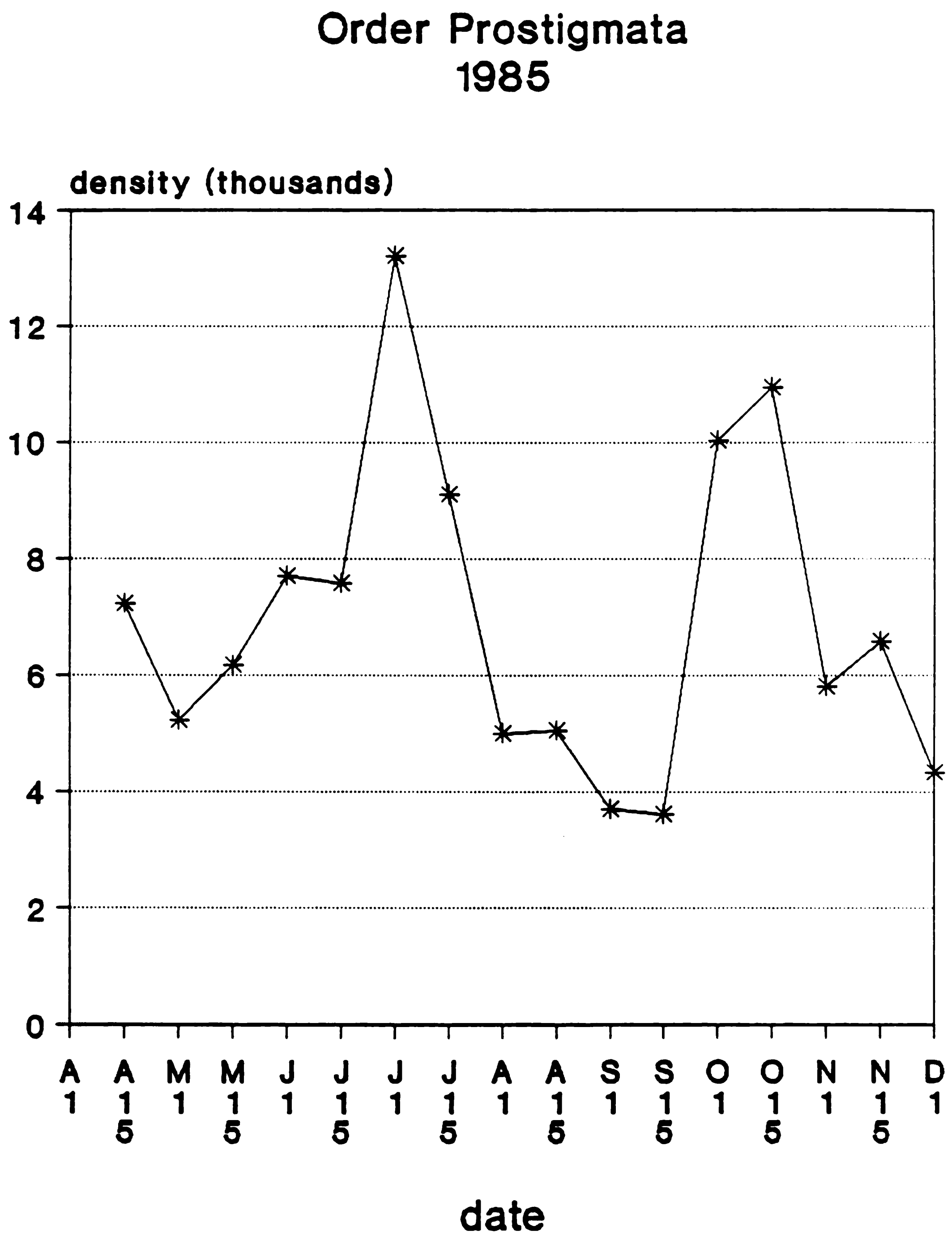


Figure 10. Biweekly fluctuation of Prostigmata during 1985, all grasses combined.

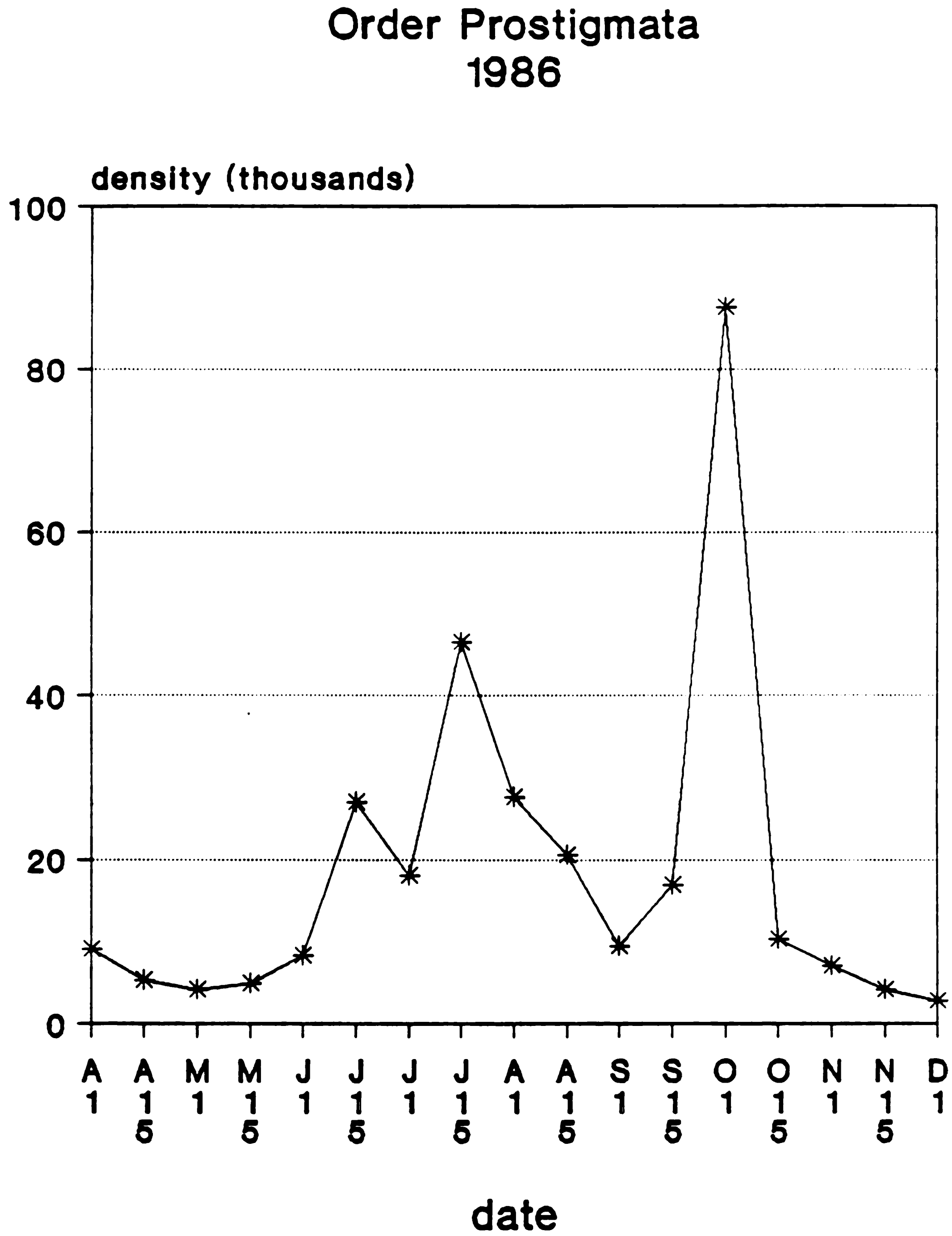


Figure 11. Biweekly fluctuation of Prostigmata during 1986, all grasses combined.

No correlation between abundance and temperature could be obtained for either depth and either year; i.e., large populations during hot as well as cool seasons (Figures 10 and 11) were most likely the result of inherent reproductive patterns, irrespective of temperature.

For the 0-15 cm stratum, but not for the lower layer, positive correlations to soil moisture existed in both years. Together with the between-year differences discussed above (upper stratum preferred by Prostigmata in 1985, when rain did not penetrate deeply), this indicates that moisture was a significant determinant of vertical distribution.

With respect to potential effects of grass types, split-plot analysis of variance showed significant interaction among grass types, sampling dates and depths in both years. Grass-specific population means for each date and depth were then compared (App. A) using Tukey's 95% MSD. For 1985, mean abundance of Prostigmata under orchardgrass in the upper soil stratum on July 1 was significantly different only from that under smooth bromegrass. On October 15, mite density under tall fescue was higher than under all other grasses (Figure 13). In the lower soil stratum during 1985, there were no differences between population densities under the six grasses, with one exception: on October 15, mean density under smooth

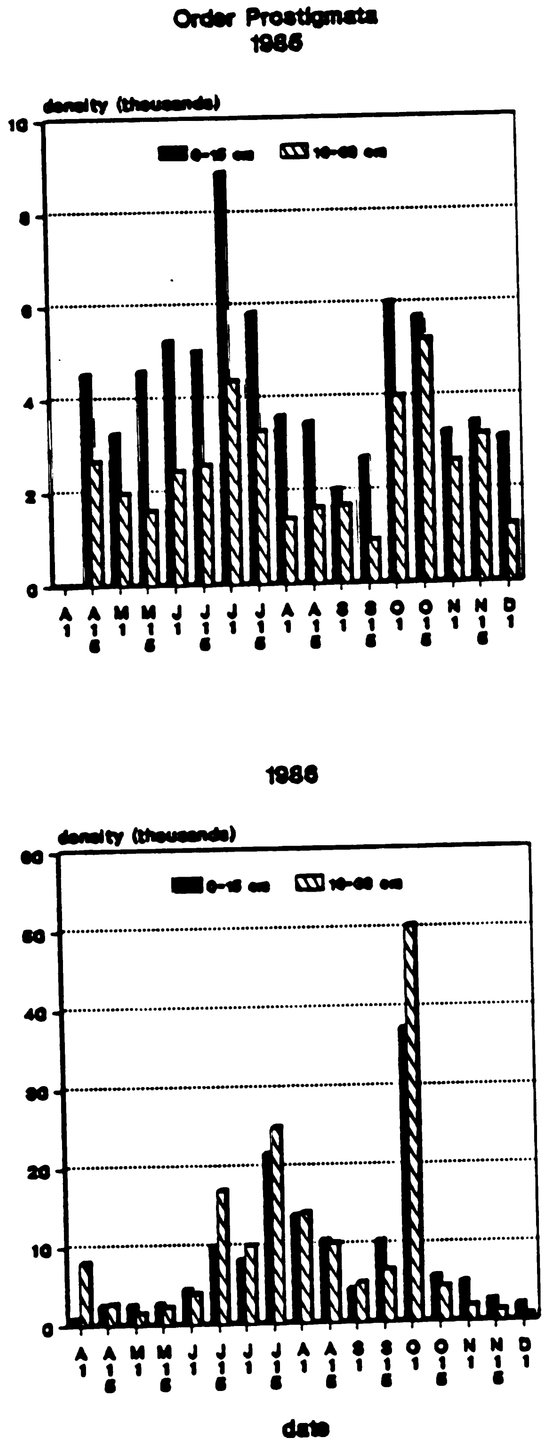
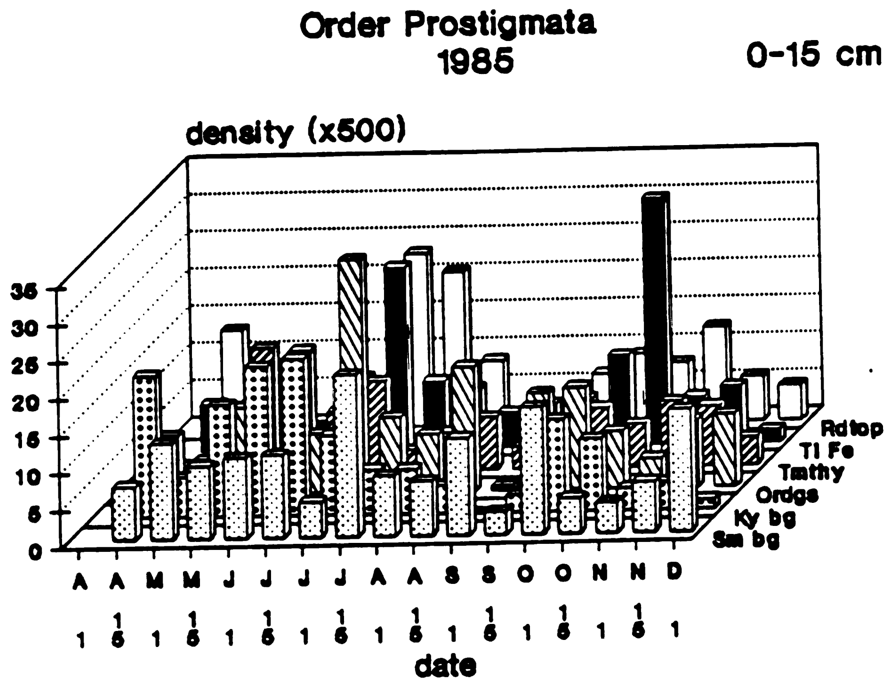


Figure 12. Vertical distribution of Prostigmata during 1985 and 1986., all grasses combined.

bromegrass was significantly higher than all other recorded densities (App. A and Figure 13).

In 1986, the only differences among densities occurred on October 1, when Prostigmata were significantly more numerous under Kentucky bluegrass (0 - 15 cm layer, Figure 14). In the lower stratum on the same date, mean population density was much higher under smooth bromegrass than under all other grasses (App. A and Figure 14).



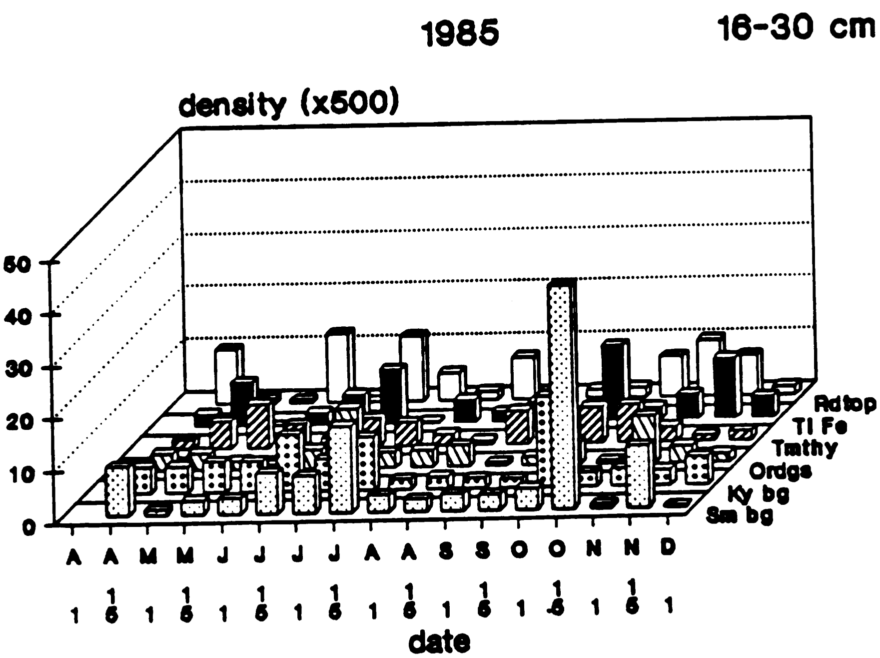


Figure 13. Mean seasonal densities of order Prostigmata under different grasses at each depth during 1985.

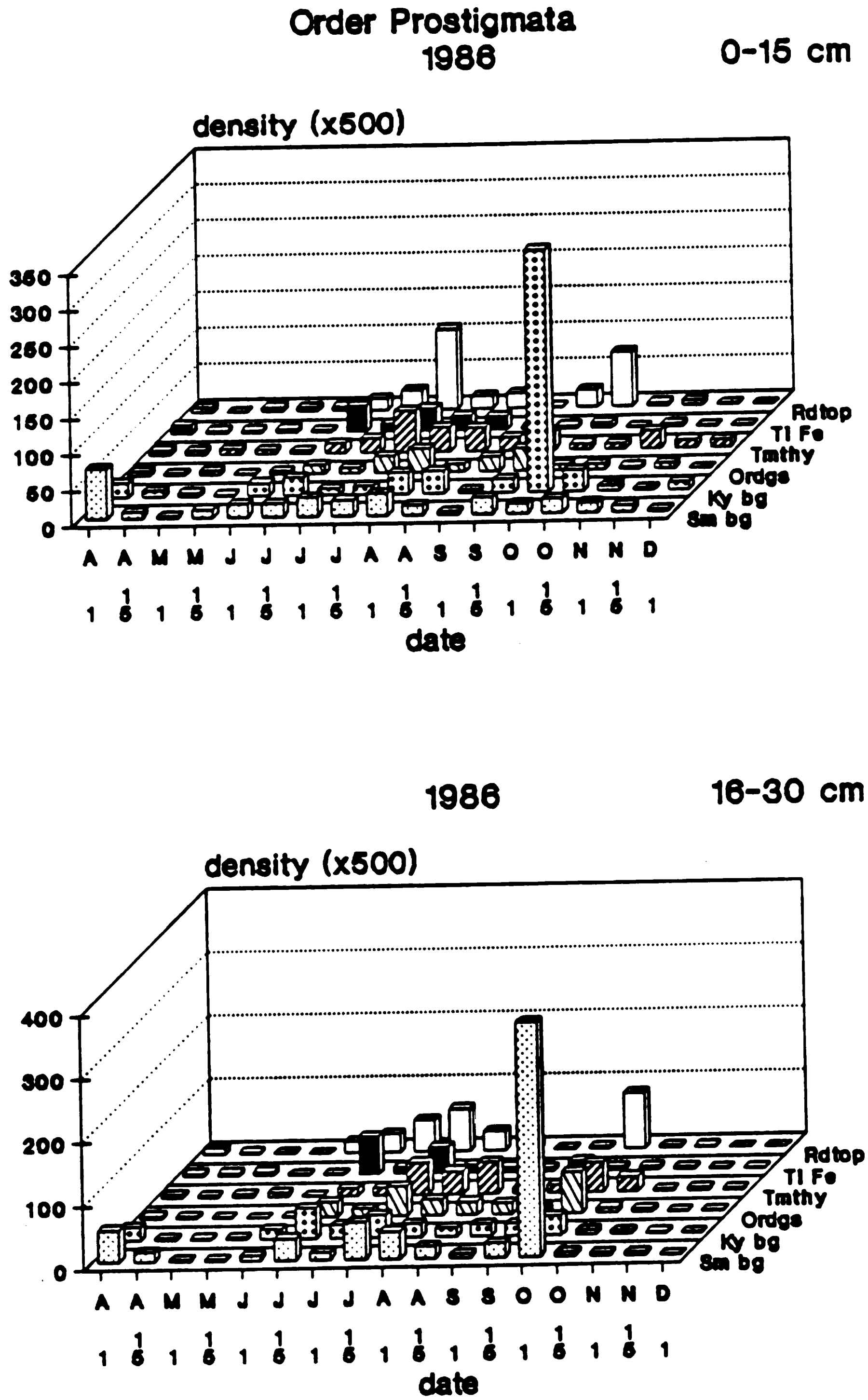


Figure 14. Mean seasonal densities of order Prostigmata under different grasses at each depth during 1986.

C. Suborder Heterostigmata

Heterostigmata were dominant among prostigmatid mites. The suborder was represented by nine genera, two of which were most prevalent in both 1985 and 1986: *Tarsonemus* spp. and *Bakerdania* spp. Table 8 and Figure 15 show dominance percentages of these two genera among total Heterostigmata in 1985 and 1986.

C.1. *Tarsonemus*:

Tarsonemus spp. constituted the highest proportion of Heterostigmata (37.4% in 1985 and 71.2% in 1986), with an approximately seven-fold increase in total numbers (Table 8). A possible cause for this increase in 1986 may have been higher precipitation and higher soil moisture, which allowed growth of fungal and bacterial colonies, the main food sources of the species in this genus. Further studies studies would be required to validate this suggestion.

C.2. Effect of grass covers on densities of *Tarsonemus* spp.:

Split-plot analysis of variance revealed very little difference ($p < 0.25$) among grasses in accommodating *Tarsonemus* spp. populations in 1985. In 1986, there was no evidence at all of differences ($p > 0.25$) among grasses. However, smooth bromegrass seemed to support the highest populations in both years, with $2250/m^2$ and $17150/m^2$

Table 8. Relative dominance of Heterostigmata genera in 1985 and 1986.

	1985		1986	
Genera	N	%	N	%
Tarsonemus	891	37.4	6727	71.2
Bakerdania	395	16.6	446	4.7
Scutacarus	355	14.9	321	3.4
Other genera	743	31.1	1953	20.7
Total	2384		9447	

N = the total number of specimens obtained per year.

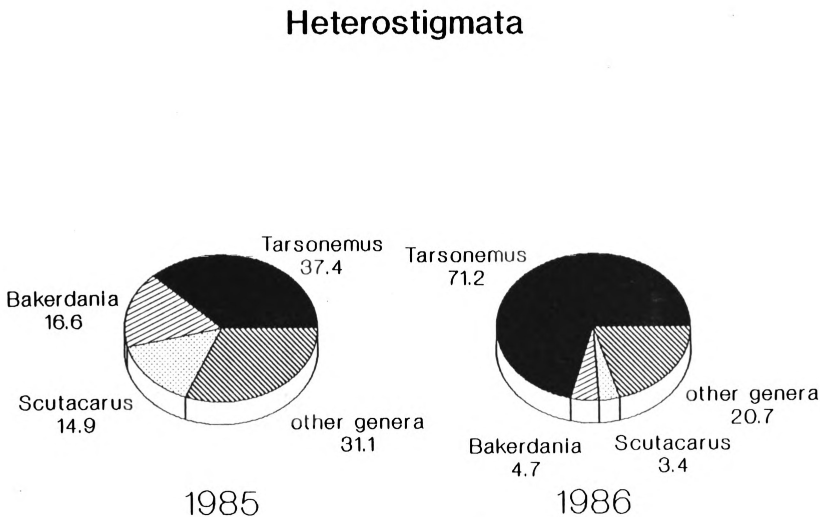


Figure 15. Relative dominance (%) of heterostigmatid genera in 1985 and 1986.

respectively (Table 9 and Figure 16). This may be related to the extensive, fleshy rhizome system of this grass which could promote fungal and bacterial colonies.

C.3. Biweekly fluctuation of Tarsonemus spp. populations:

Split-plot analysis of variance, using combined data from all grasses (App. B), showed highly significant differences ($p < 0.001$) among population densities on different dates. In 1985, Tarsonemus spp. showed two prolonged peaks, one from early June until late July. The second peak occurred throughout October (Table 10 and Figure 17).

In 1986, Tarsonemus spp. again exhibited two peaks, on July 15 and October 1 (Table 10 and Figure 18). The pattern observed in 1985 was thus essentially repeated in 1986.

C.4. Vertical distribution of Tarsonemus spp. populations:

Highly significant density differences ($p < 0.005$) with depth occurred in 1985, but not in 1986 ($p > 0.50$) (App. B). In 1985, Tarsonemus spp. were found in higher numbers in the upper soil stratum throughout most dates (Table 10 and Figure 19) possibly related to low precipitation and insufficient penetration of water into soil. In 1986, although depth was not a significant factor, higher abundances were recorded for the lower soil stratum on 7 out

Table 9: Population densities ±SE/m² of <u>Tarsonemus</u> spp. in each soil stratum under different grasses.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Grasses	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Sm. bg	1400	±450	850	±250	3000	±600	14150	±8000
Ky. bg	1050	±250	550	±150	10850	±7350	3650	±650
Ordgrs	800	±150	450	±150	3050	±600	4250	±1450
Timthy	650	±150	450	±100	3850	±800	5250	±1300
Tl Fse	750	±150	500	±100	2400	±600	3000	±1050
Redtop	1000	±200	800	±250	5600	±2000	6850	±2300

N = 48 in 1985, 51 in 1986

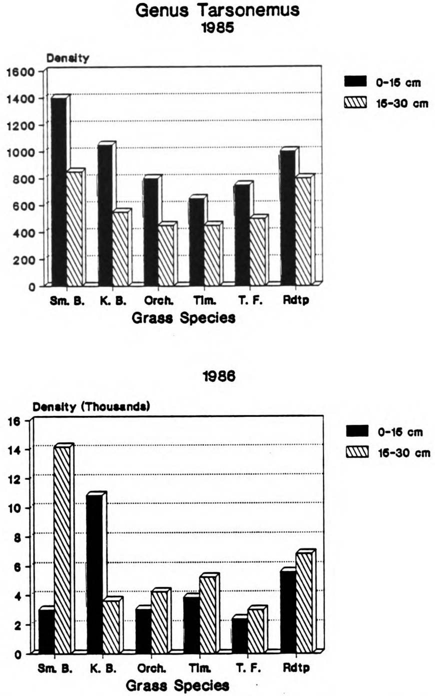


Figure 16. Tarsonemus spp. densities $/m^2$ in both soil strata under different grass covers.

Table 10: Mean seasonal density /m² ±SE of Tarsonemus spp. in upper and lower soil strata; data from all grasses lumped.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Dates	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Aprl 1	---	---	---	---	800	±250	800	±250
Aprl 15	1000	±450	950	±400	350	±100	850	±650
May 1	900	±300	400	±150	400	±200	200	±100
May 15	1000	±250	300	±100	700	±250	550	±300
June 1	1350	±300	1150	±450	1850	±750	1400	±400
June 15	1950	±650	800	±300	4700	±1100	9950	±2350
July 1	1350	±300	1500	±300	4800	±1300	6650	±2100
July 15	1450	±700	1150	±500	15350	±4150	17900	±2400
Aug 1	300	±250	200	±100	6100	±1400	10200	±3250
Aug 15	100	± 50	100	± 50	3800	±850	6150	±2150
Sept 1	1100	±850	450	±200	1200	±500	850	±350
Sept 15	450	±300	150	± 50	5350	±950	4000	±950
Oct 1	1200	±300	650	±200	30500	±20700	42950	±22250
Oct 15	1150	±250	650	±300	2050	±600	1450	±300
Nov 1	650	±200	600	±150	2600	±1150	850	±150
Nov 15	800	±200	450	±300	1000	±350	300	±150
Dec 1	200	±100	100	± 50	200	±100	150	±50

N = 18 per data and depth

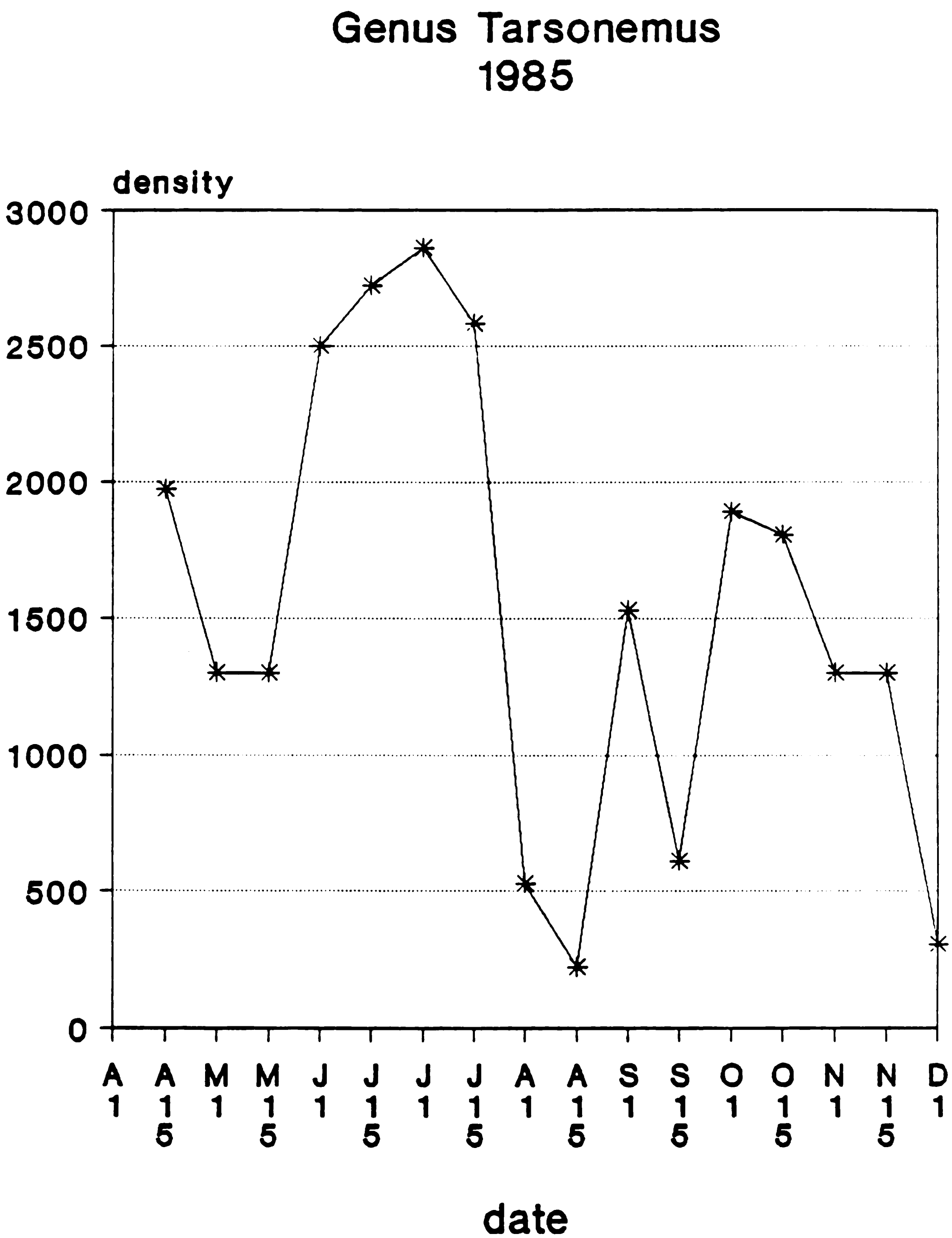


Figure 17. Biweekly fluctuation of <u>Tarsonemus</u> spp. during 1985, all grasses combined.

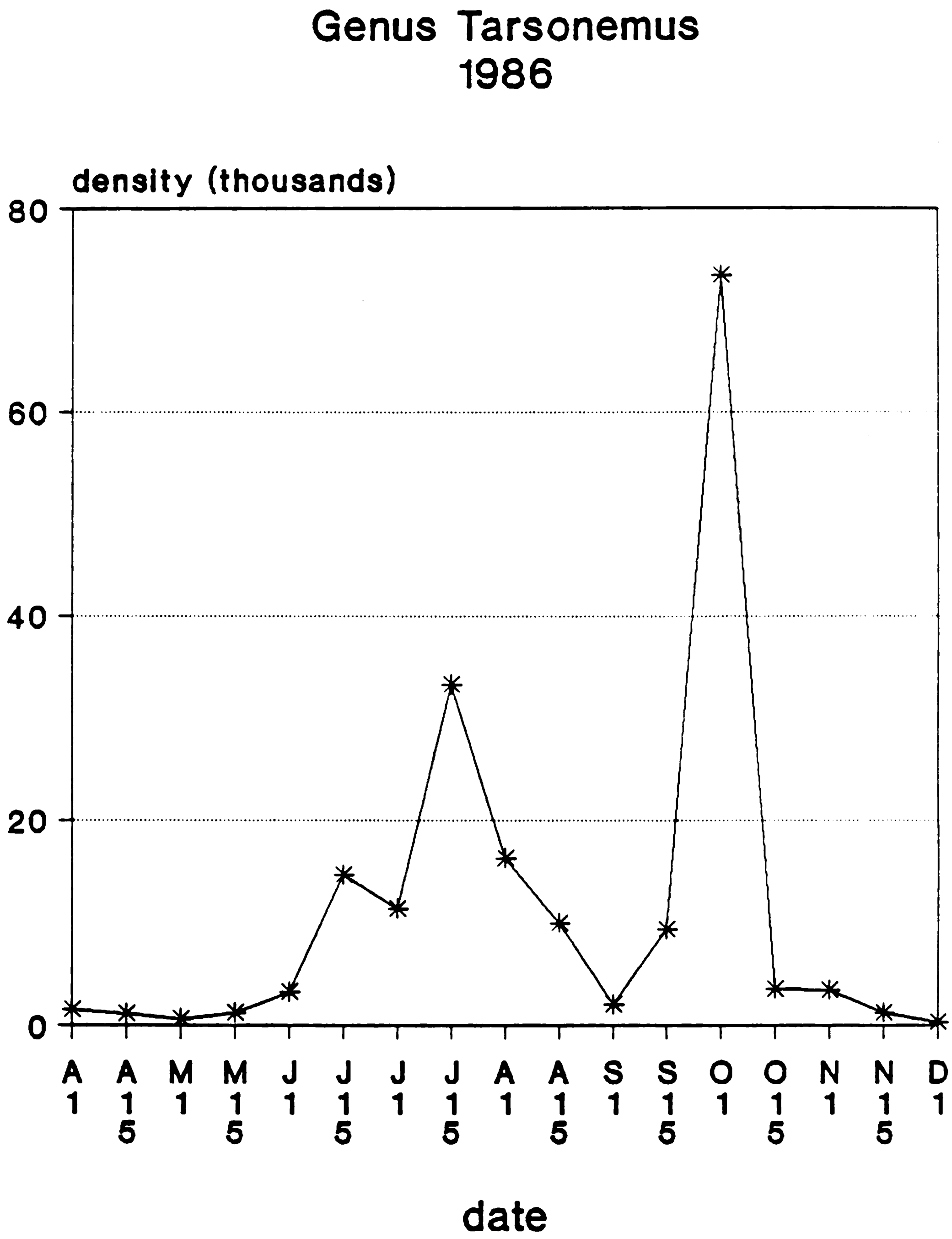


Figure 18. Biweekly fluctuation of Tarsonemus spp. during 1986, all grasses combined.

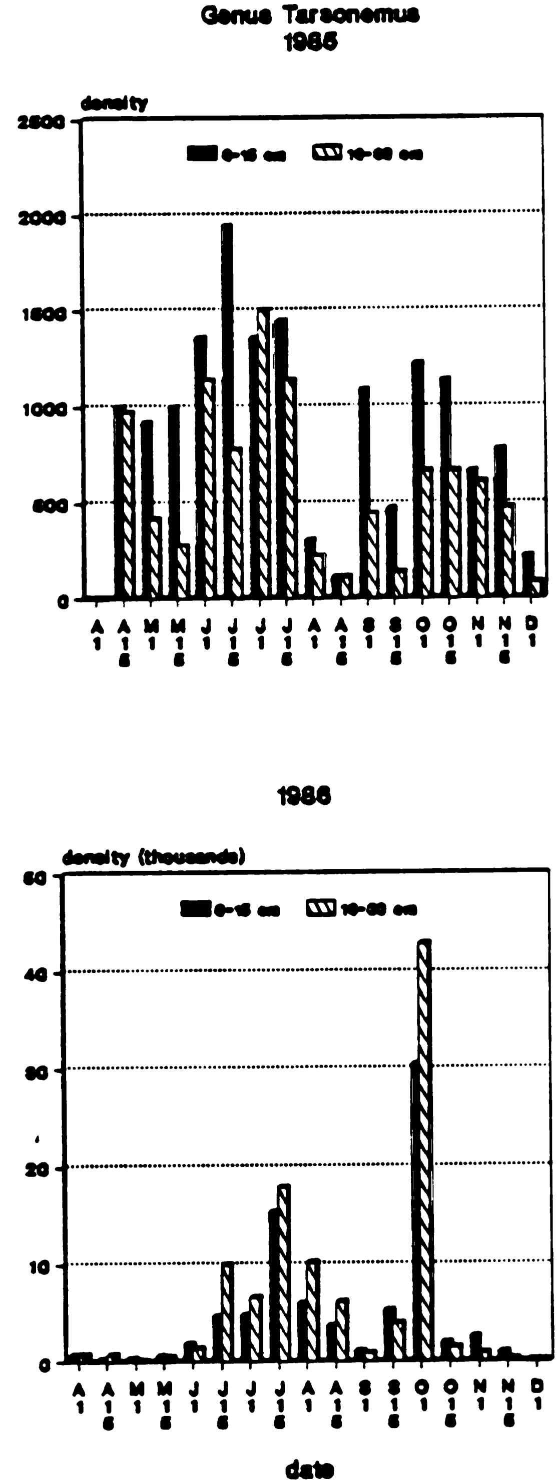


Figure 19. Vertical distribution of Tarsonemus spp. during 1985. and 1986, all grasses combined.

of 17 sampling dates. However, it seems that *Tarsonemus* spp. freely inhabited both strata in 1986 because of more evenly distributed moisture (Figure 19).

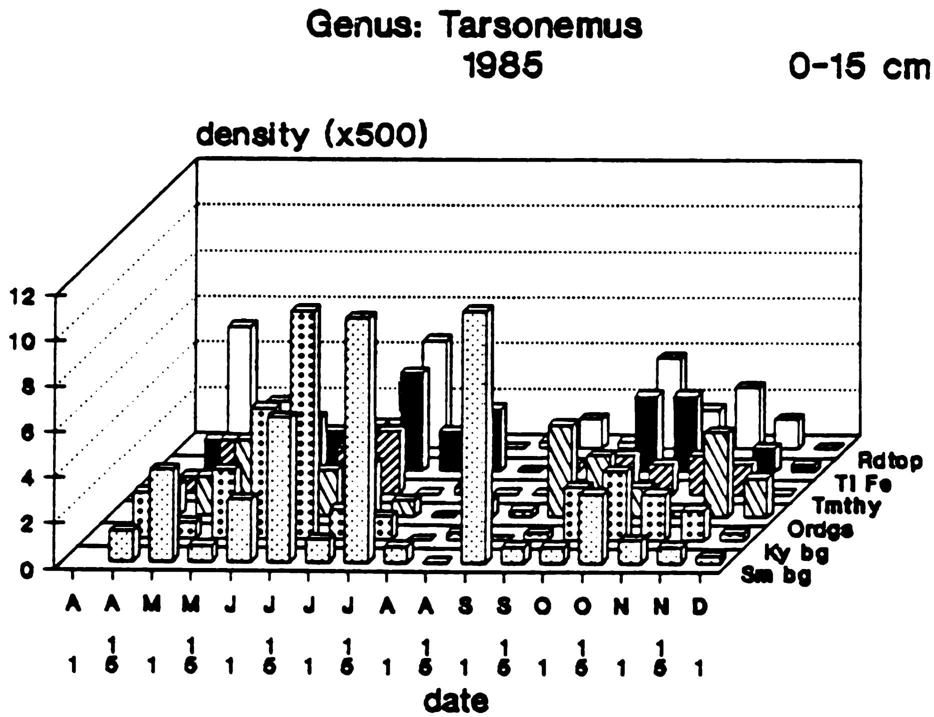
Soil temperature and moisture were not correlated to abundances at either depth, indicating that density changes were probably due to seasonal events of reproduction and mortality inherent in the members of this genus.

Anova (App. B) of densities under each turfgrass revealed very little interaction ($p<0.25$) between grasses and dates in 1985 and none at all in 1986, although abundance estimates for either stratum differed between grasses on several dates. In general, significantly higher densities occurred mainly under smooth bromegrass and Kentucky bluegrass (Figures 20 and 21), again indicating that these grasses provide advantageous below-ground habitats for *Tarsonemus* spp. Although overall abundance appeared modulated by grass species, lack of grass/date interaction points out the basically similar seasonal fluctuation patterns of *Tarsonemus* spp. under all grasses.

C.5. Genus Bakerdania

C.6. Effect of grass covers on densities of Bakerdania spp.

Split-plot analysis of variance showed highly significant differences ($p < 0.001$) between grasses in



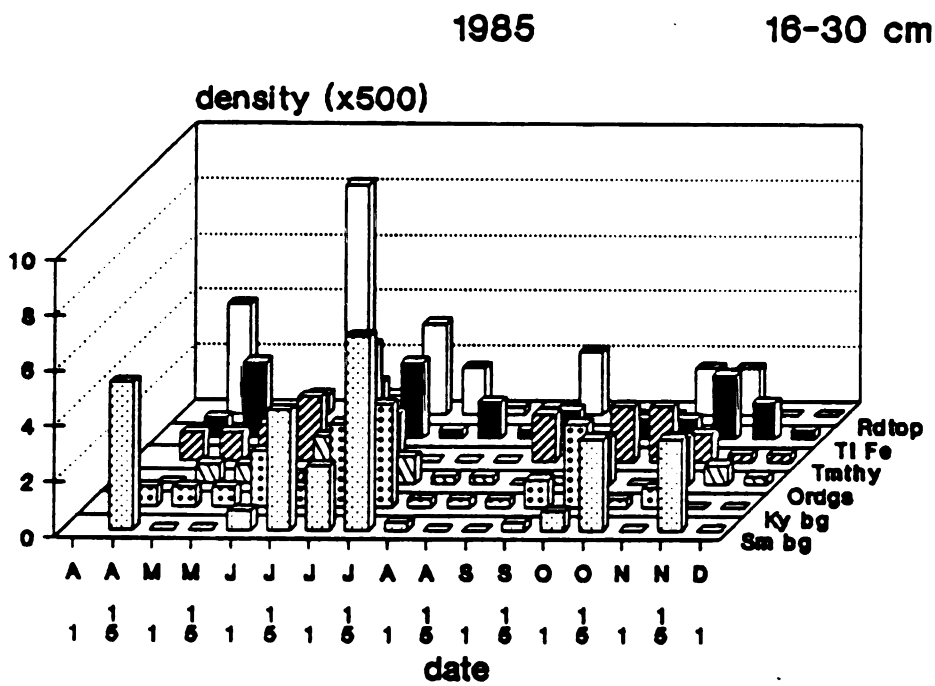
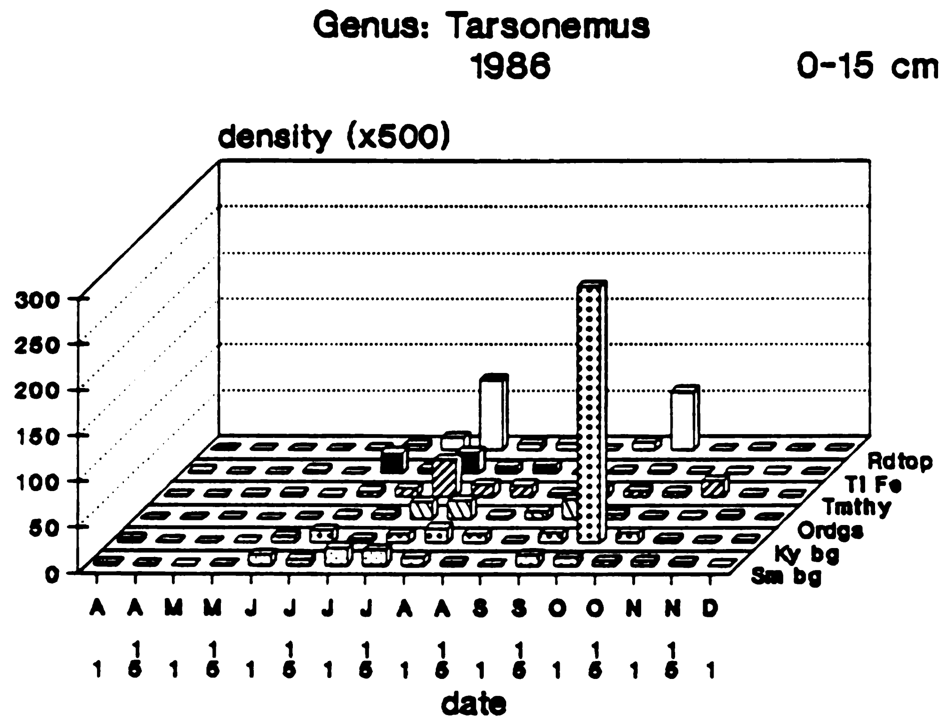


Figure 20. Mean seasonal densities of <u>Tarsonemus</u> spp. under different grasses at each depth during 1985.



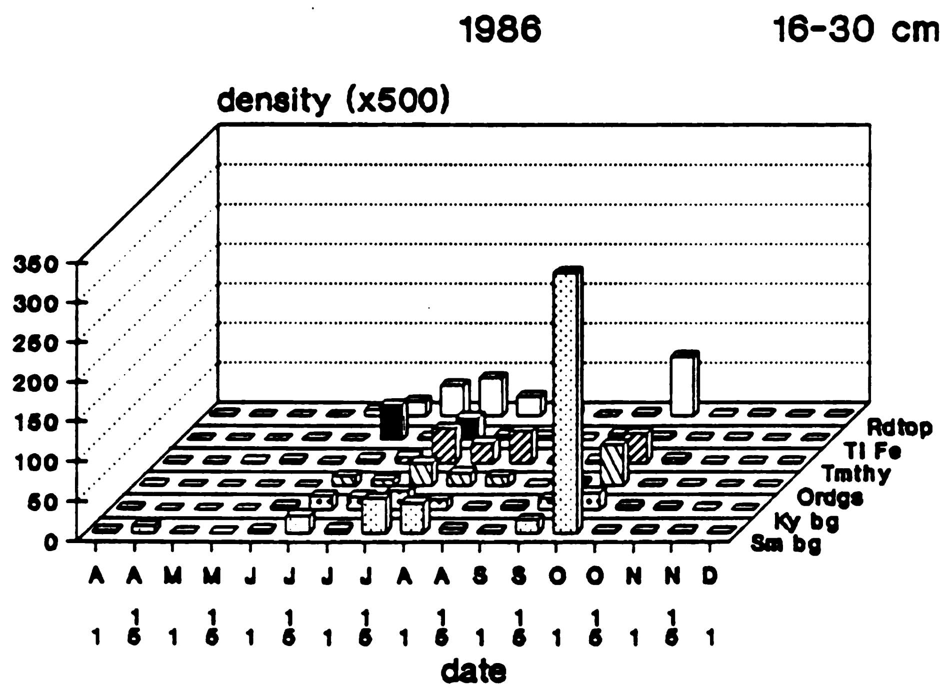


Figure 21. Mean seasonal densities of Tarsonemus spp. under different grasses at each depth during 1986.

supporting *Bakerdania* spp. populations in both 1985 and 1986. The highest abundance of *Bakerdania* spp. was recorded for Kentucky bluegrass with $1300/m^2$ and $1750/m^2$ in 1985 and 1986 respectively, possibly related to the extensive root system of these species. The lowest population density was recorded for redtop, the species with the deepest-ranging root system of all grasses investigated (Table 11 and Figure 22).

C.7. Biweekly fluctuations of Bakerdania spp. populations:

Densities of *Bakerdania* spp. differed between dates in 1985 and 1986 ($P < 0.001$). Highest abundances were recorded at the beginning of each season ($2000/m^2$ in 1985 and $2550/m^2$ in 1986), followed by moderate fluctuations throughout the rest of each year. On December 1, increased densities of $1450/m^2$ in 1985 and $1100/m^2$ in 1986 were again recorded (Figures 23 and 24), indicating a pattern consistent between years.

C.8. Vertical distribution of Bakerdania spp. populations:

Vertical distribution of the genus differed greatly ($p < 0.005$) with depths in both 1985 and 1986. *Bakerdania* spp. preferred the upper soil stratum throughout all dates except on June 1, June 15 and September 1 in both 1985 and 1986 (Table 12 and Figure 25).

Table 11: Population densities ±SE/m² of *Bakerdania* spp. in each soil stratum under different grasses.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Grasses	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Sm. bg	800	±200	300	±50	500	±150	350	±100
Ky. bg	550	±200	750	±200	1200	±350	550	±150
Ordgrs	500	±100	100	±50	200	±100	50	±50
Timthy	300	±100	100	±50	750	±250	250	±100
Tl Fse	300	±100	200	±50	250	±150	50	--
Redtop	150	±100	50	±50	100	±50	50	±50

N = 48 for 1985, 51 for 1986

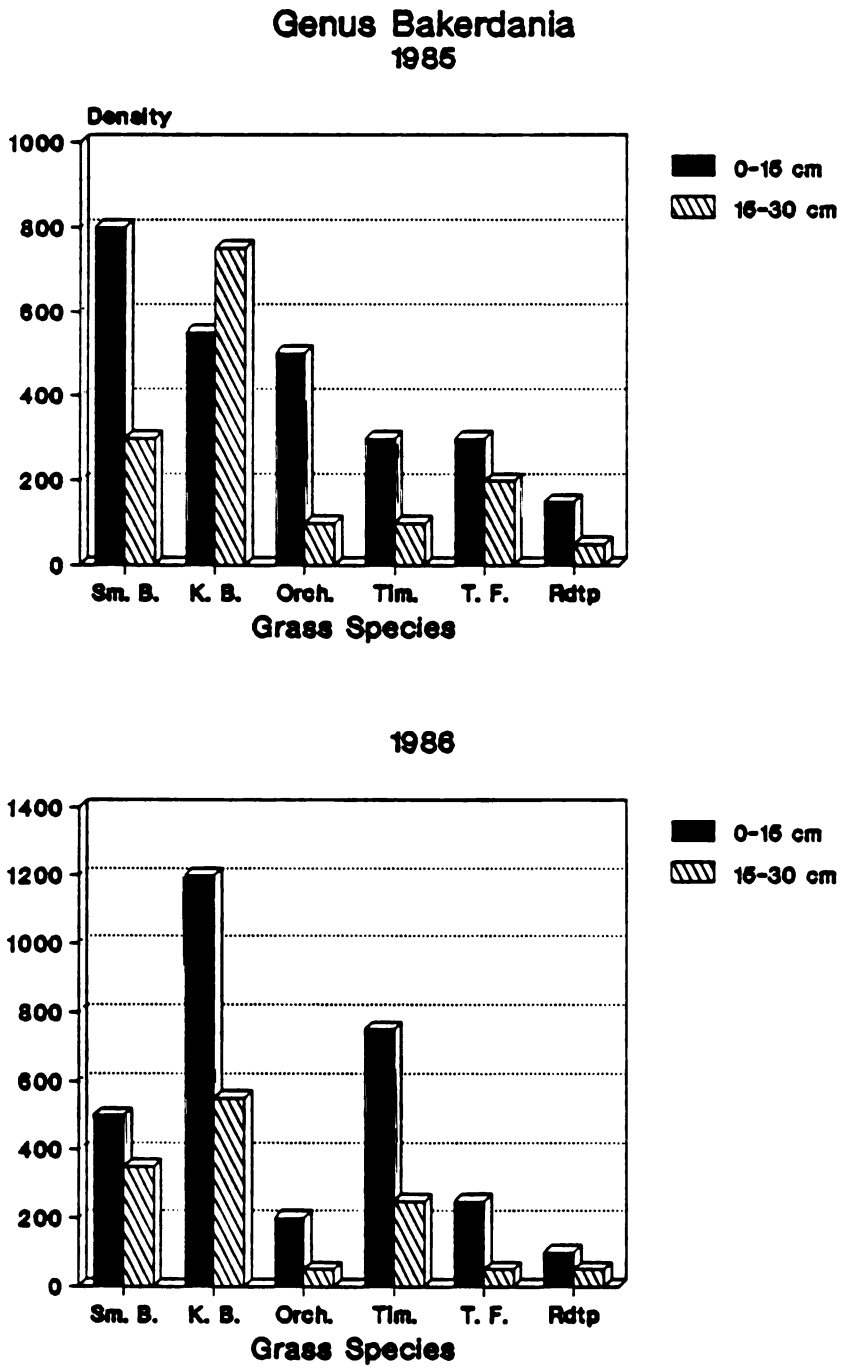


Figure 22. Bakerdania spp. densities /m^2 in both soil strata under different grass covers.

Table 12: Mean seasonal density /m² ±SE of *Bakerdania* spp. in upper and lower soil strata; data from all grasses lumped.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Dates	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Aprl 1	---	---	---	---	1800	±600	750	±400
Aprl 15	1450	±550	550	±200	1050	±550	400	±200
May 1	150	±100	500	±250	550	±250	200	±100
May 15	650	±200	100	±100	150	±100	150	±100
June 1	150	±100	200	±100	400	±150	650	±250
June 15	200	±100	800	±400	100	±50	150	±100
July 1	200	±100	150	±100	300	±150	250	±100
July 15	100	±50	150	±50	200	±150	50	±50
Aug 1	100	±50	0	--	250	±150	50	±50
Aug 15	250	±150	50	±50	750	±600	150	±100
Sept 1	150	±100	200	±150	150	±150	200	±150
Sept 15	150	±100	0	--	700	±400	150	±100
Oct 1	550	±200	350	±150	150	±100	50	±50
Oct 15	750	±200	100	±50	150	±100	50	±50
Nov 1	300	±100	200	±150	200	±100	50	±50
Nov 15	650	±200	250	±100	650	±300	400	±200
Dec 1	1100	±450	350	±300	1100	±500	0	--

N = 18 per date and depth

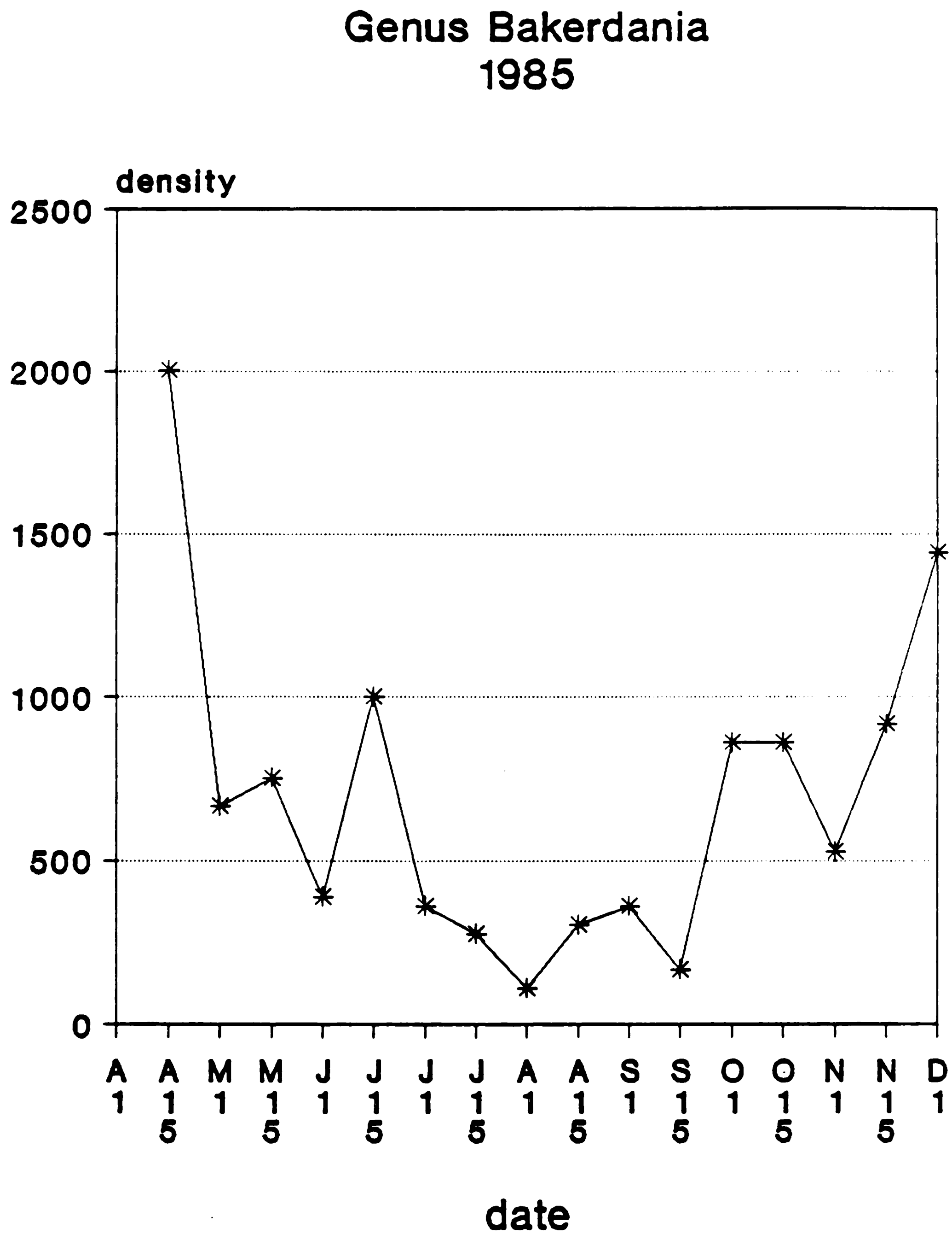


Figure 23. Biweekly fluctuation of Bakerdania spp. during 1985, all grasses combined.

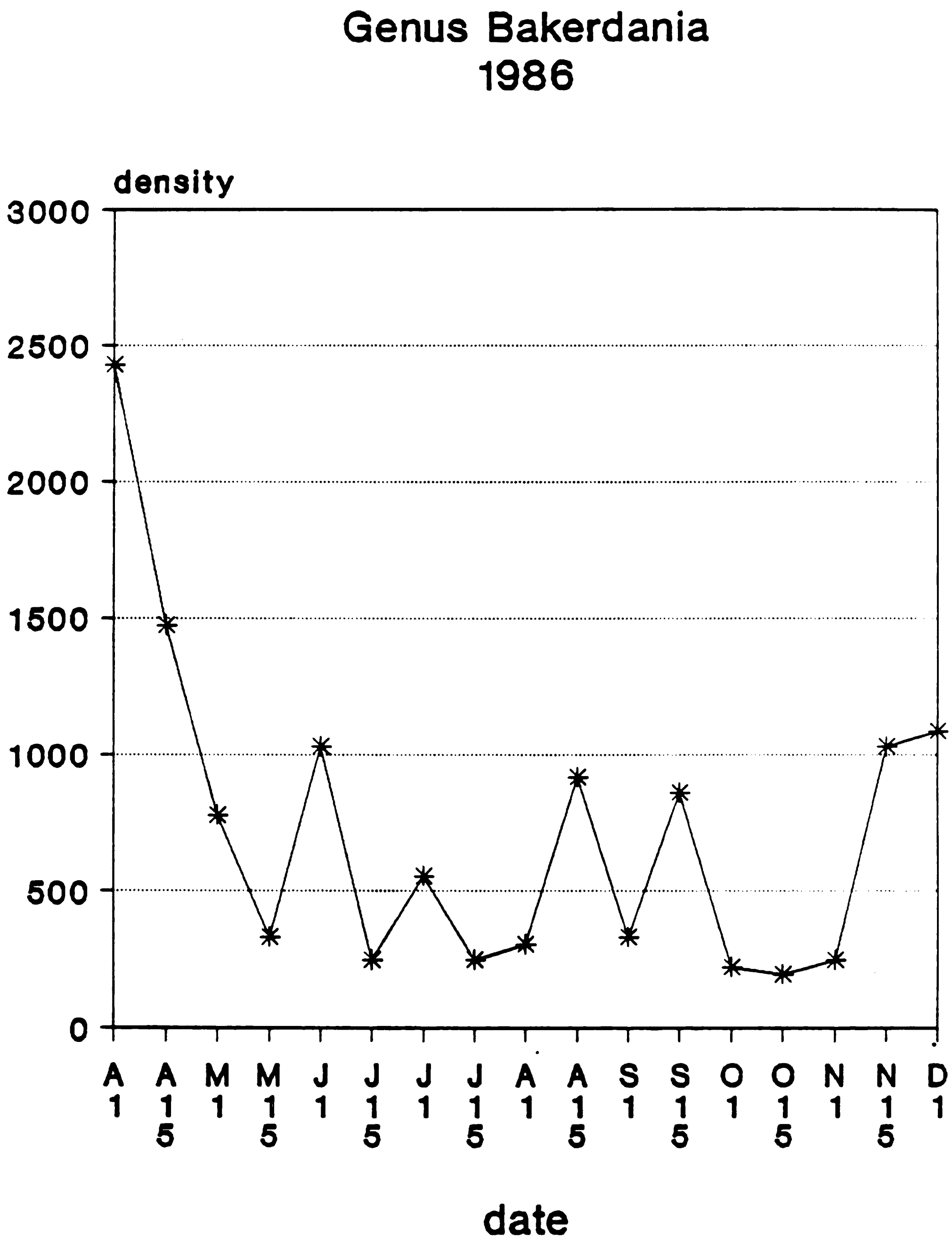


Figure 24. Biweekly fluctuation of <u>Bakerdania</u> spp. during 1986, all grasses combined.

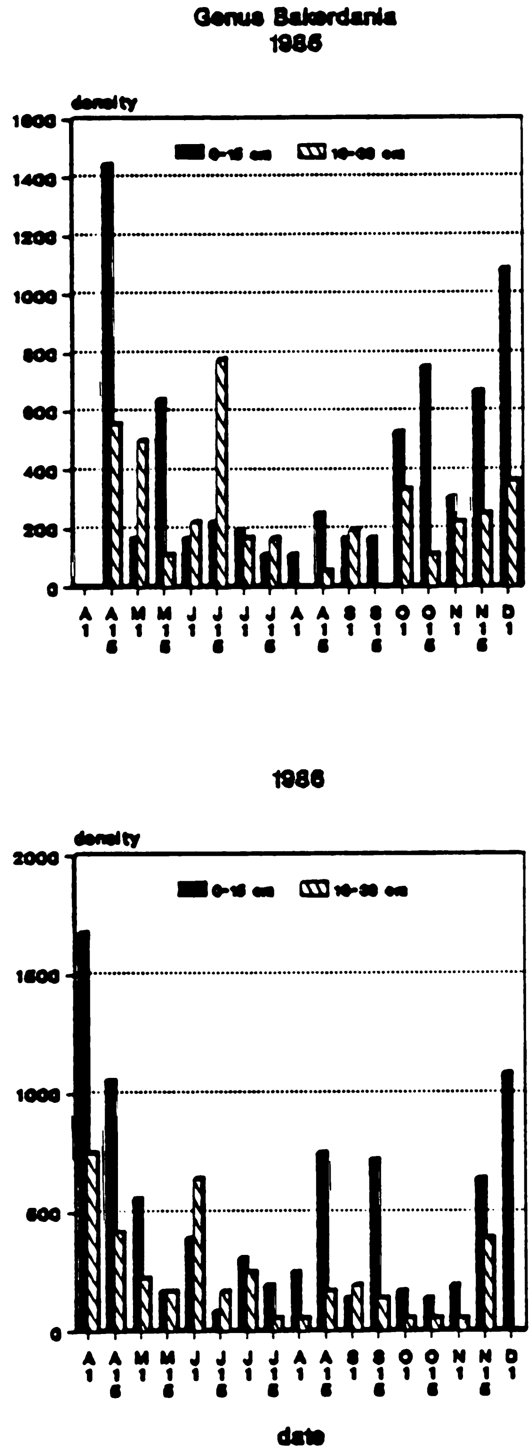
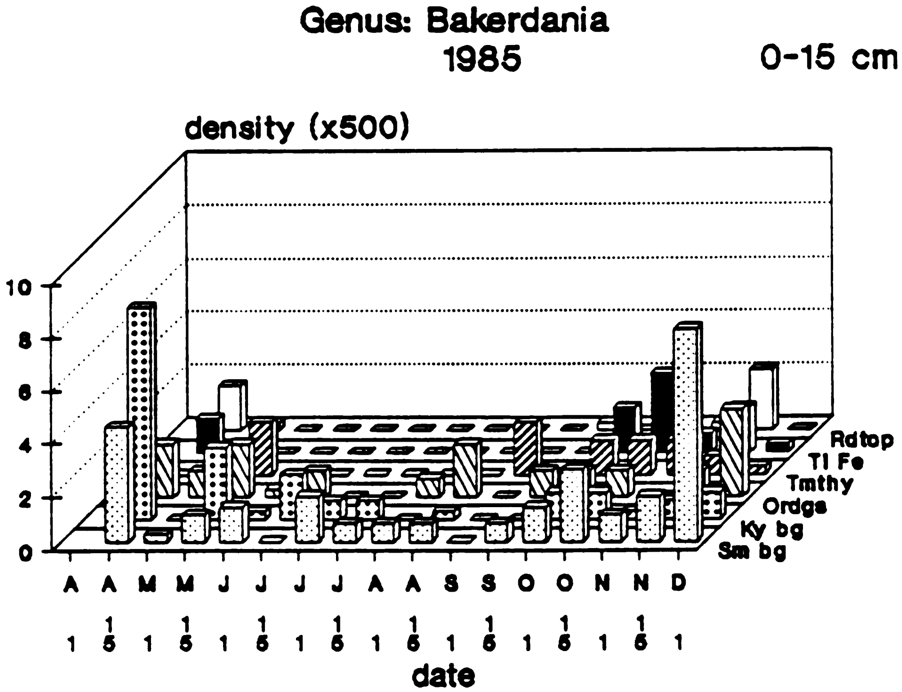


Figure 25. Vertical distribution of Bakerdania spp. during 1985. and 1986, all grasses combined.

Since populations tended to peak in early and late season of both years (Figures 23 and 24), it is not surprising that correlations between abundance and temperature were negative. In 1985, a significant relationship between densities and moisture of the upper stratum existed, partially explaining mid-summer population declines during this low precipitation year.

Interaction between grasses, dates and depths was also significant. With a single exception (smooth bromegrass), date-specific comparisons strongly indicated that Kentucky bluegrass supported the largest numbers of *Bakerdania* spp. (Figure 26). On several dates in 1986, Kentucky bluegrass again proved superior in terms of abundances of *Bakerdania* spp. (Figure 27).



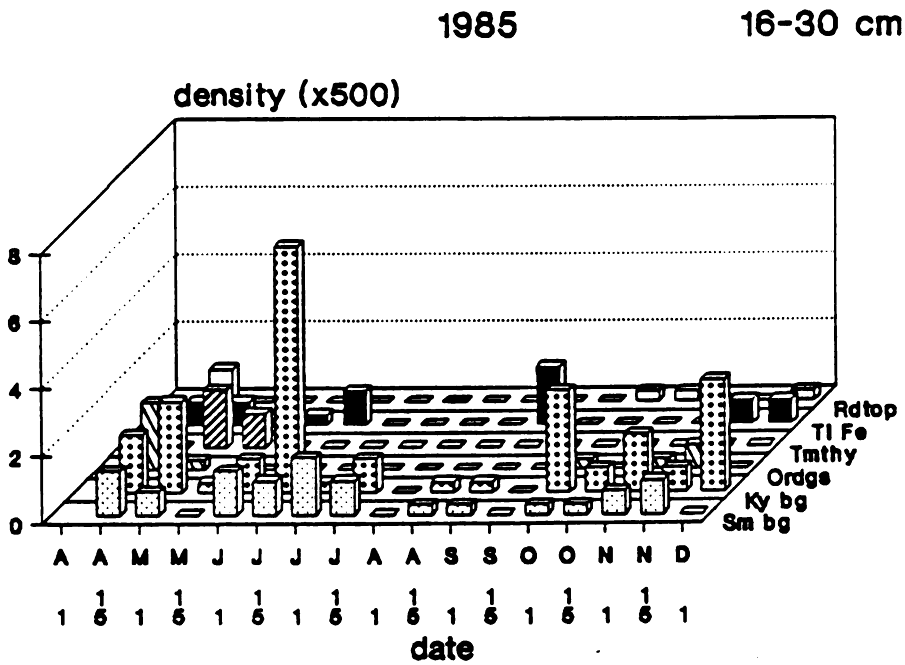


Figure 26. Mean seasonal densities of Bakerdania spp. under different grasses at each depth during 1985.

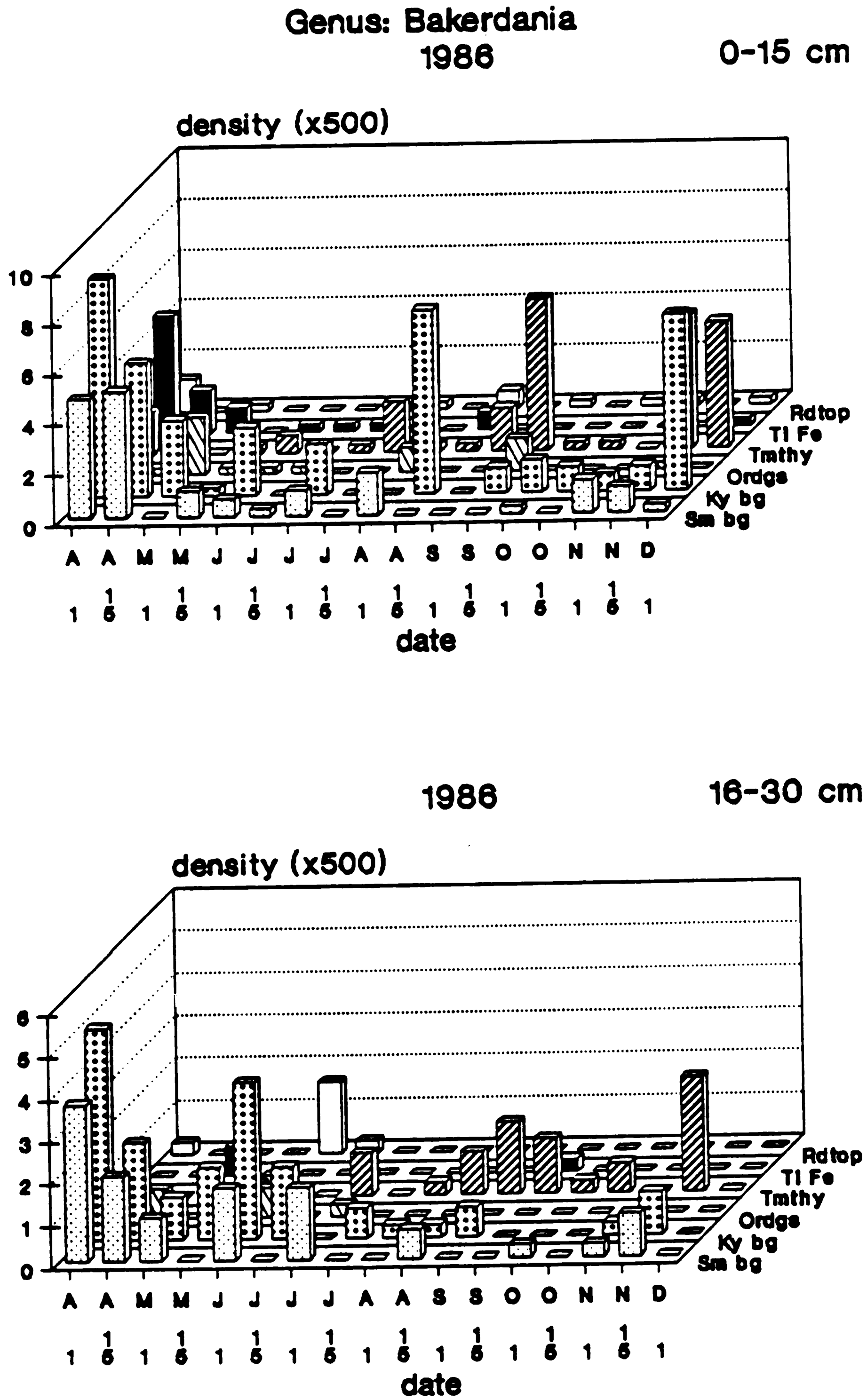


Figure 27. Mean seasonal densities of <u>Bakerdania</u> spp. under different grasses at each depth during 1986.

D. Suborder: Eupodina

The suborder Eupodina (excluding the family Tydeidae which is treated separately in this study) was represented by 5 genera: Eupodes spp., Cocceupodes spp., Rhagidia spp., Coccorhagidia spp. and Ereynetus spp. The relative dominance of these genera recorded in Table 13 and illustrated graphically in Figure 28. The genus Eupodes was dominant with 55.7% and 45.5% in 1985 and 1986 respectively.

D.1. Effect of grass covers on densities of Eupodes spp.:

Grass cover had a significant effect ($p < 0.001$) on Eupodes spp. populations in 1985. The highest densities were obtained for orchardgrass with $850/m^2$ followed by tall fescue with $700/m^2$, while the lowest abundance occurred under redtop with $200/m^2$, (Table 14 and Figure 29).

In 1986, no significant differences among grasses existed. However, the highest density now occurred under redtop with $400/m^2$ while the genus was essentially absent under Kentucky bluegrass (Table 14).

D.2 Biweekly fluctuation of Eupodes spp. populations:

As shown in Figure 30 and 31, Eupodes spp.abundances varied greatly over each season (date effects significant at $p < 0.001$). Population peaks were observed in July of 1985 and August of 1986, with occassional complete disappearance

Table 13. Relative dominance of Eupodina genera in 1985 and 1986.

Genera	1985 N	1985 %	1986 N	1986 %
Eupodes	301	55.7	137	45.5
Cocceupodes	97	18.0	50	16.6
Rhagidia	94	17.4	44	14.6
Coccorhagidia	16	3.0	2	0.7
Ereynetus	32	5.9	68	22.6
total	540		301	

N = the total number of specimens obtained per year.

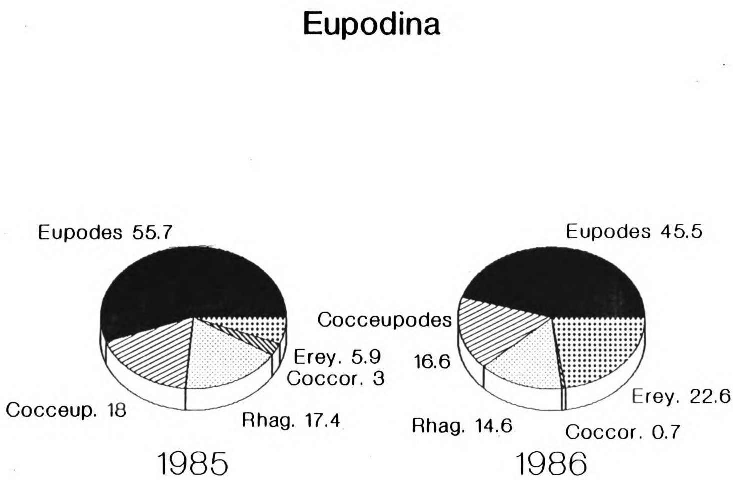


Figure 28. Relative dominance (%) of Eupodina genera in 1985 and 1986.

Table 14: Population densities ±SE/m² of *Eupodes* spp. in each soil stratum under different grasses.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Grasses	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Sm. bg	300	±50	50	±50	150	±100	0	--
Ky. bg	450	±100	50	--	50	--	50	±50
Ordgrs	850	±200	0	--	150	±50	0	--
Timthy	400	±150	50	--	250	±100	50	--
Tl Fse	700	±200	50	±50	250	±50	50	--
Redtop	200	±50	50	±50	400	±150	0	--

N = 48 for 1985, 51 for 1986

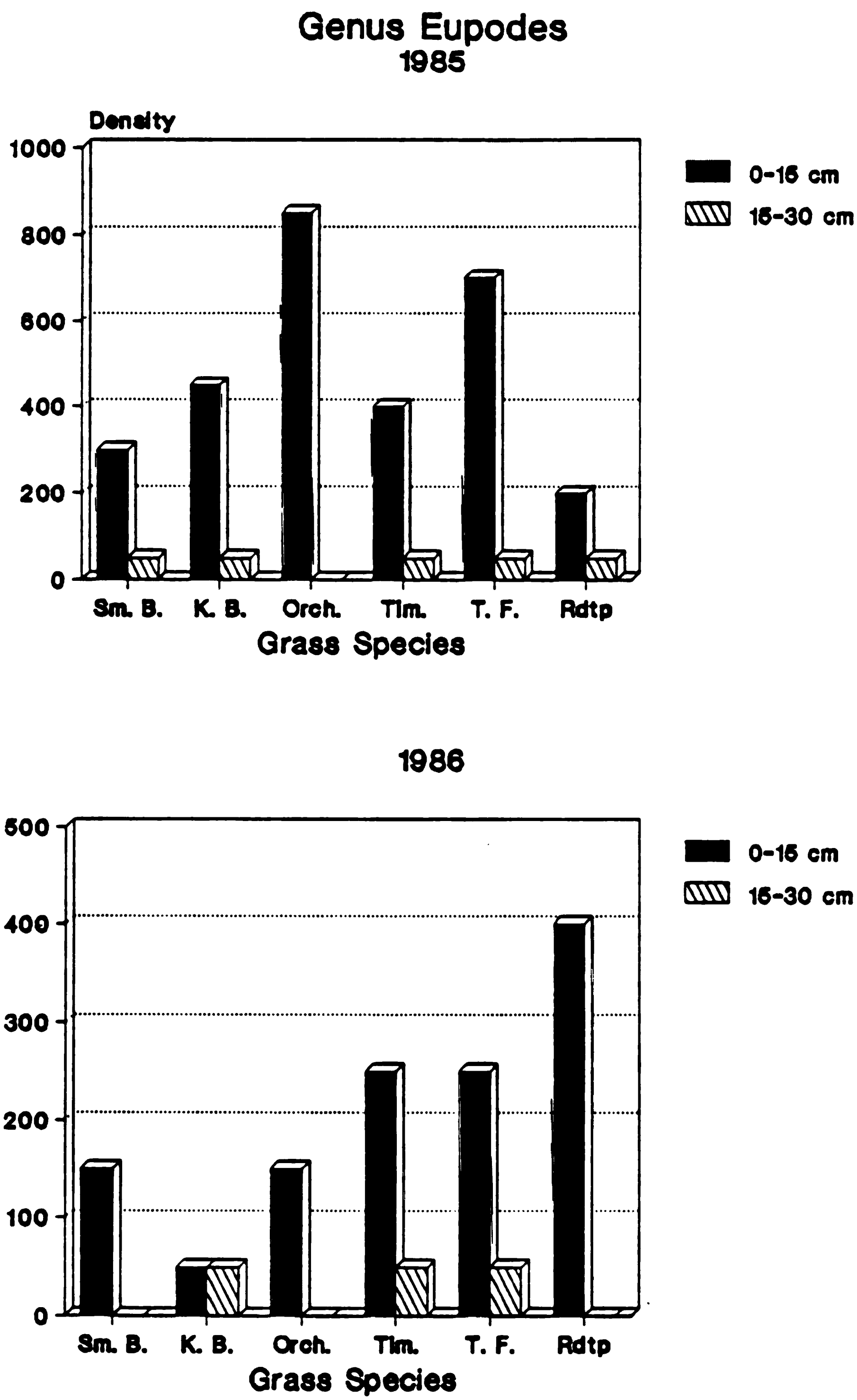


Figure 29. *Eupodes* spp. densities /m^2 in both soil strata under different grass covers.

Table 15: Mean seasonal density /m² ±SE of <u>Eupodes</u> spp. in upper and lower soil strata; data from all grasses lumped.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Dates	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Aprl 1	---	---	---	---	200	±100	50	±50
Aprl 15	150	±100	0	--	0	--	0	--
May 1	150	±100	50	±50	100	±50	100	±50
May 15	350	±150	100	±100	100	±100	0	--
June 1	1100	±350	0	--	50	±50	0	--
June 15	400	±150	100	±50	0	--	0	--
July 1	1850	±550	50	±50	150	±100	0	--
July 15	950	±250	0	--	200	±100	50	±50
Aug 1	300	±150	50	±50	650	±200	50	±50
Aug 15	700	±200	50	±50	1050	±450	200	±100
Sept 1	200	±100	0	--	350	±150	0	--
Sept 15	350	±150	0	--	200	±100	0	--
Oct 1	250	±100	0	--	50	±50	0	--
Oct 15	300	±100	50	±50	50	±50	0	--
Nov 1	200	±150	0	--	50	±50	0	--
Nov 15	200	±100	50	±50	200	±100	0	--
Dec 1	400	±200	100	±100	150	±150	0	--

N = 18 per date and depth

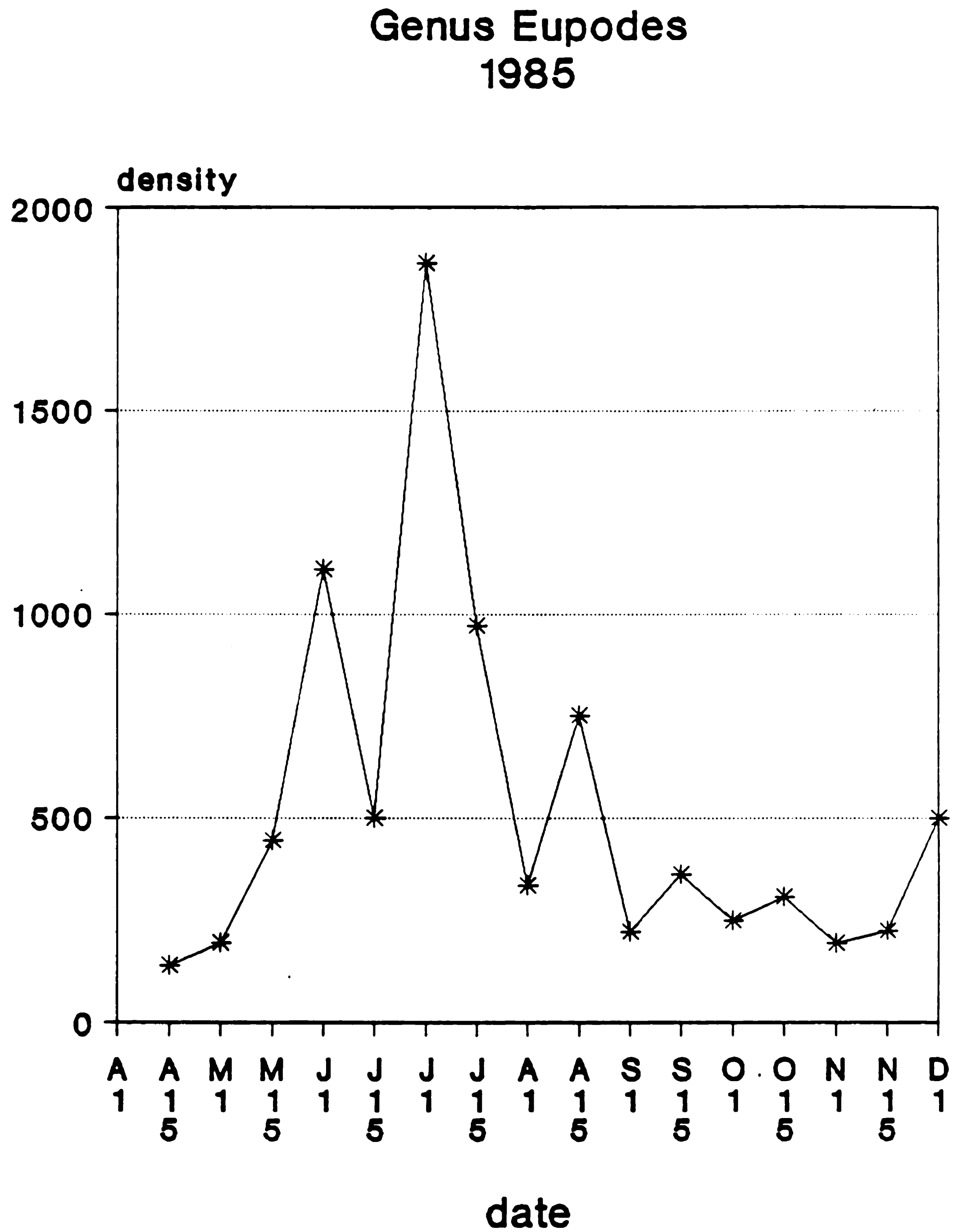


Figure 30. Biweekly fluctuation of *Eupodes* spp. during 1985, all grasses combined.

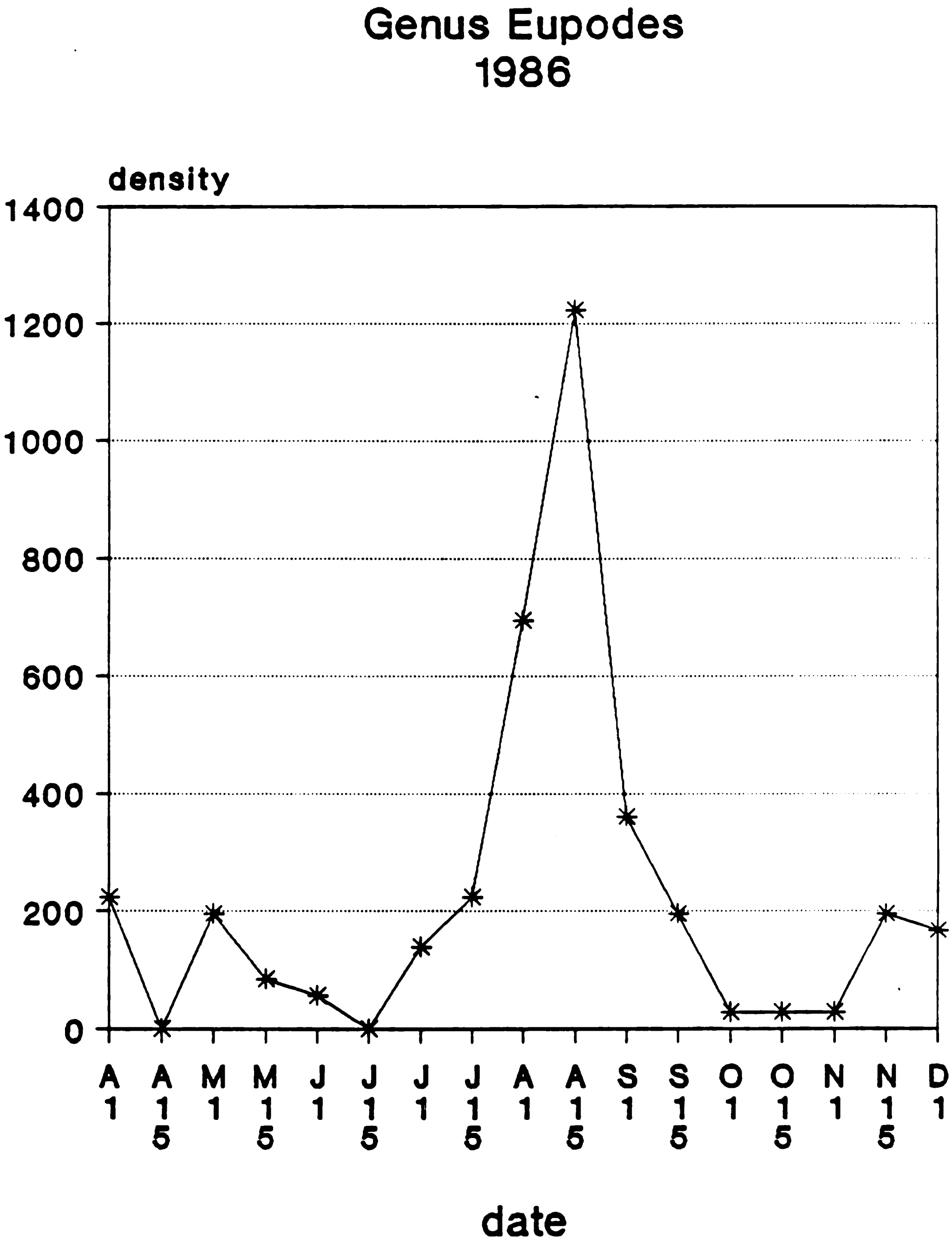


Figure 31. Biweekly fluctuation of <u>Eupodes</u> spp. during 1986, all grasses combined.

(Figure 31). In both years, maximal abundances coincided approximately with the highest temperatures of the season (Figure 3-6).

D.3 Vertical distribution of *Eupodes* spp. populations:

Statistical results indicated a pronounced vertical stratification for the genus ($p < 0.001$). Throughout all dates, *Eupodes* spp. were found in much higher densities in the upper soil stratum (Table 15 and Figure 32). Zero counts were frequently recorded for the lower stratum (on 43% of all sampling occassions in 1985, and 59% in 1986). Clearly, *Eupodes* spp. were upper soil dwellers.

Consistantly, in both years and at both depths, population abundance was positively correlated to temperature and negatively to moisture (App. C). These temperature relations simply indicated that the genus was not adversely affected by high temperatures, allowing population maxima to occur in mid-season.

Grass-specific seasonal abundances (Figures 33 and 34), tested by Tukey's MSD (App. A), showed no differences between orchardgrass and tall fescue for the upper soil stratum. On several dates, however, these two grasses supported significantly higher populations than any other turf species. Orchardgrass and tall fescue thus seemed to provide the best habitats for *Eupodes* spp. In the lower soil

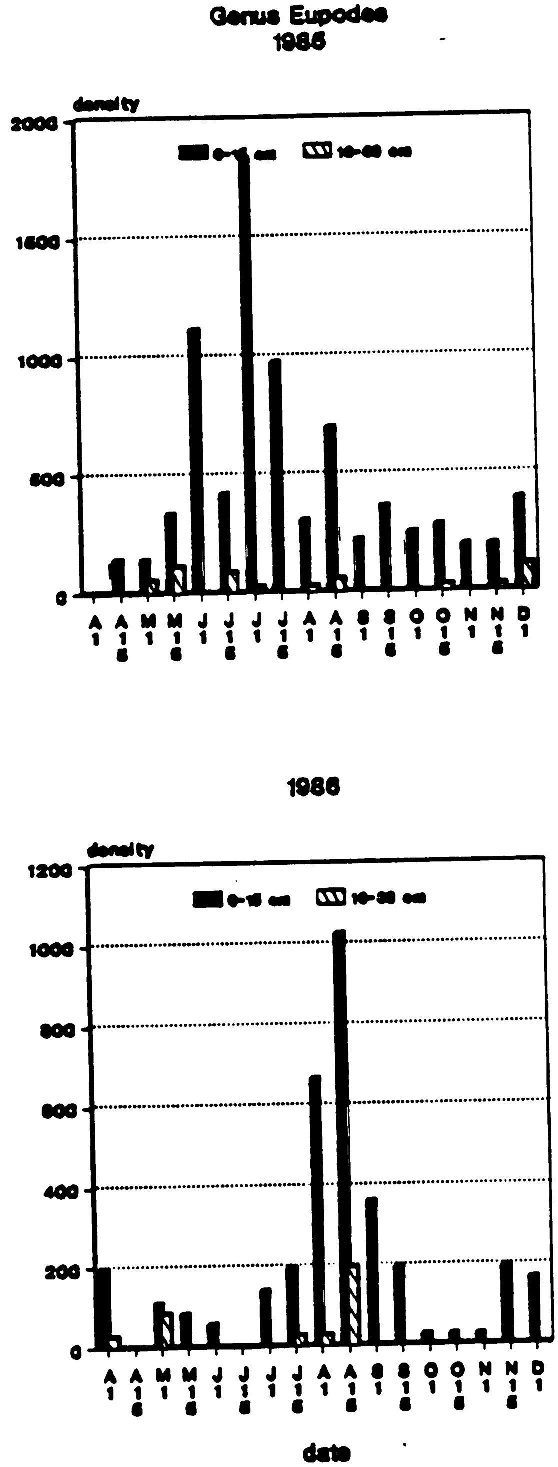


Figure 32. Vertical distribution of <u>Eupodes</u> spp. during 1985. and 1986, all grasses combined.

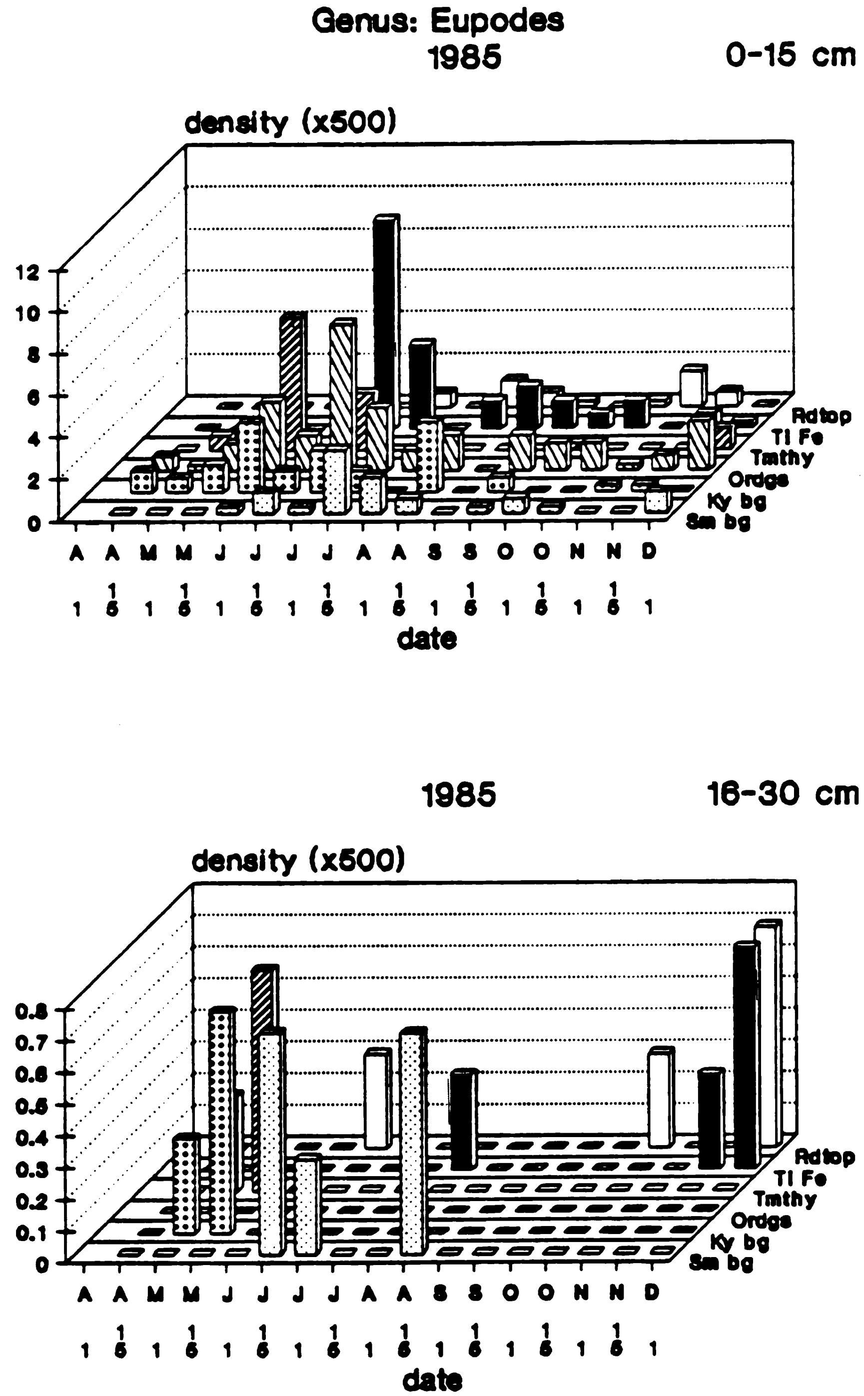
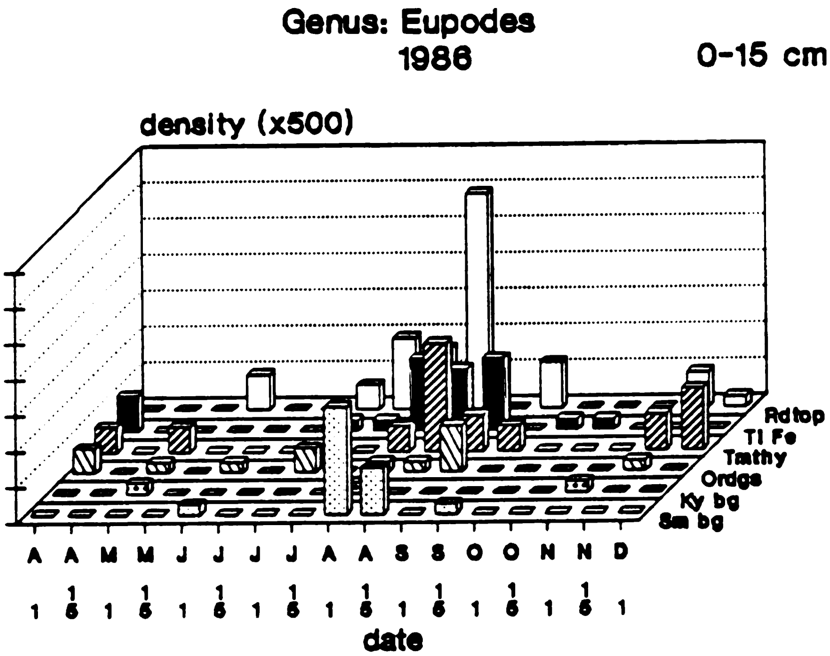


Figure 33. Mean seasonal densities of <u>Eupodes</u> spp. under different grasses at each depth during 1985.



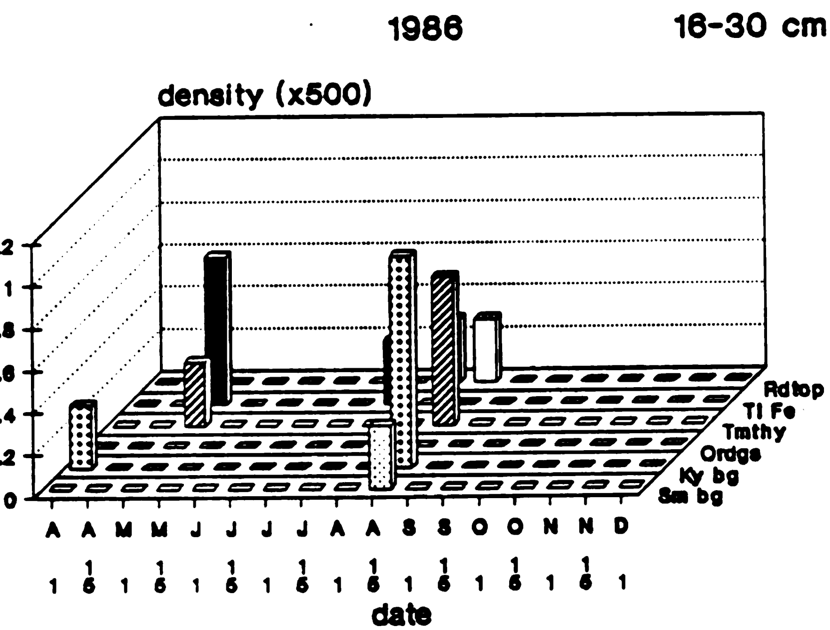


Figure 34. Mean seasonal densities of *Eupodes* spp. under different grasses at each depth during 1986.

layer, poorly populated by these mites, no grass specific differences existed.

E. Family: Tydeidae

The classification of this family is in a state of flux. Most authors recognize 25 genera and more than 200 named species. It is unclear whether species complexes with discrete patterns and habitats exist or whether they are ubiquitous and nearly omnivorous. Tydeidae can be predacious, fungivorous or facultatively phytophagous and have a cosmopolitan distribution (Kethley 1982). In this study the family Tydeidae alone comprised 15.4% (1985) and 10.0% (1986) of all prostigmatids, and was the dominant family in the suborder Eupodina. Two species of this family occurred regularly throughout most sampling dates, in both years: Tydeus (Lorrya) bedfordiensis Evans and Metapronematus leucohippeus Treat. Dominance of these two species within the family was 33.5% and 25.4% for T. bedfordiensis and 29.5% and 29.3% for M. leucohippeus in 1985 and 1986 respectively (Table 16 and Figure 35).

E.1. Effect of grass covers on population dynamics of Tydeus bedfordiensis:

In both years, grass type significantly affected population densities of T. bedfordiensis. Redtop supported the highest numbers (approximately $700/m^2$) (Table 17 and Figure 36). Redtop has a root system which is regenerated

Table 16. Relative dominance of species in the family Tydeidae in 1985 and 1986.

Genera	1985 N	%	1986 N	%
T. bedfordiensis	185	33.5	281	25.4
M. leucohippeus	163	29.5	324	29.3
other species	205	37.0	500	45.3
Total	553		1105	

N = the total number of specimens obtained per year.

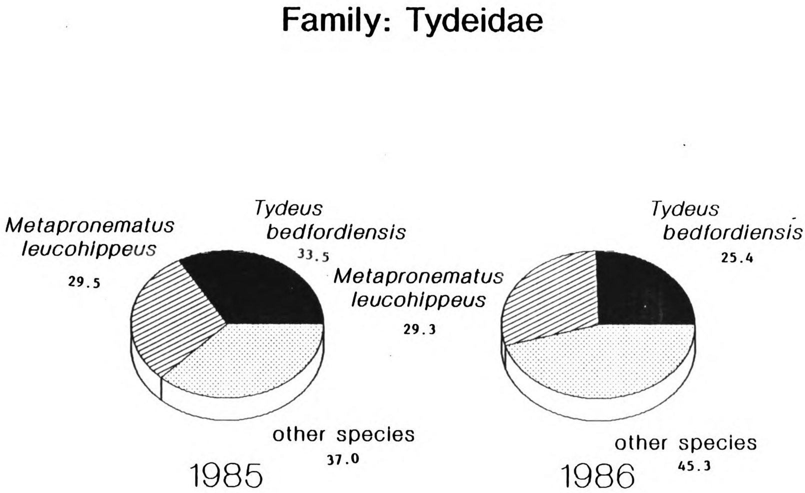


Figure 35. Relative dominance (%) of selected species of Tydeidae in 1985 and 1986.

Table 17: Population densities ±SE/m² of *Tydeus bedfordiensis* in each soil stratum under different grasses.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Grasses	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Sm. bg	250	±50	100	±50	150	±50	200	±50
Ky. bg	150	±50	100	±50	150	±50	150	±50
Ordgrs	100	±50	100	±50	250	±100	100	±50
Timthy	150	±50	150	±100	200	±50	250	±100
Tl Fse	100	±50	150	±100	300	±100	350	±100
Redtop	450	±200	200	±100	400	±100	300	±100

N = 48 for 1985, 51 for 1986

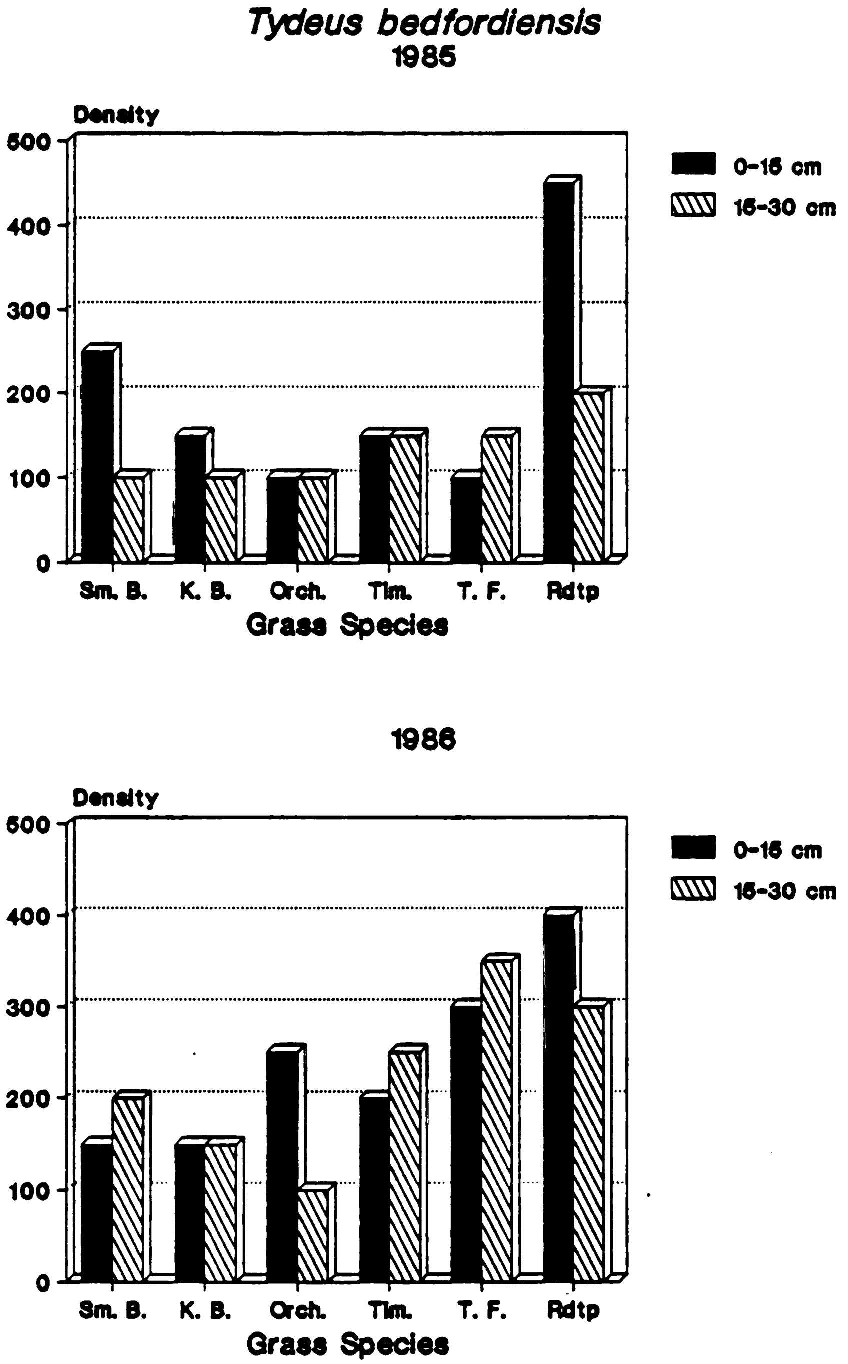


Figure 36. Tydeus bedfordiensis densities /m² in both soil strata under different grass covers.

annually and thus leaves plenty of plant residues which may support fungal colonies, which may be the potential food sources for *T. bedfordiensis*.

E.2. *Biweekly fluctuation of Tydeus bedfordiensis population*:

Population densities of *T. bedfordiensis* differed greatly ($p < 0.001$) over time in both years. In 1985, highest abundance occurred on July 1, with pronounced lows or complete absence in the fall (Figure 37). The pattern was repeated in 1986, although the summer peak was more prolonged and slightly bimodal (Figure 38). The species was thus most numerous during hot and dry periods, dramatic mid-season increases most likely being due to a single maximum in reproductive activity.

E.3. *Vertical distribution of Tydeus bedfordiensis*:

Tydeus bedfordiensis populations essentially did not differ between depths (Table 18 and Figure 39), showing no persistent preference for either soil stratum.

As expected in view of the species' mid-summer population peaks (Figures 37 and 38), relations between abundances and edaphic factors were analogous to those encountered in Eupodes spp.: consistently, populations at both depths were positively correlated to temperature, and negatively to moisture (App. C).

Table 18: Mean seasonal density /m² ±SE of Tydeus bedfordiensis in upper and lower soil strata; data from all grasses lumped.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Dates	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Aprl 1	0	--	0	--	100	±50	100	±50
Aprl 15	300	±100	100	±50	50	±50	100	±50
May 1	300	±150	150	±100	100	±50	100	±50
May 15	250	±150	100	±100	100	±50	0	--
June 1	100	±100	0	--	150	±50	200	±50
June 15	0	--	50	±50	650	±250	850	±300
July 1	1000	±500	850	±350	500	±250	350	±100
July 15	200	±100	150	±50	650	±200	600	±250
Aug 1	350	±100	200	±50	1000	±300	400	±250
Aug 15	200	±100	150	±100	300	±100	300	±100
Sept 1	0	--	0	--	50	±50	400	±150
Sept 15	50	±50	150	±100	50	±50	100	±100
Oct 1	150	±50	100	±50	150	±50	200	±100
Oct 15	100	±50	50	±50	100	±100	50	±50
Nov 1	50	±50	0	--	0	--0	100	±50
Nov 15	50	±50	0	--	100	±50	0	--
Dec 1	100	±50	0	--	50	±50	50	±50

N = 18 per date and depth

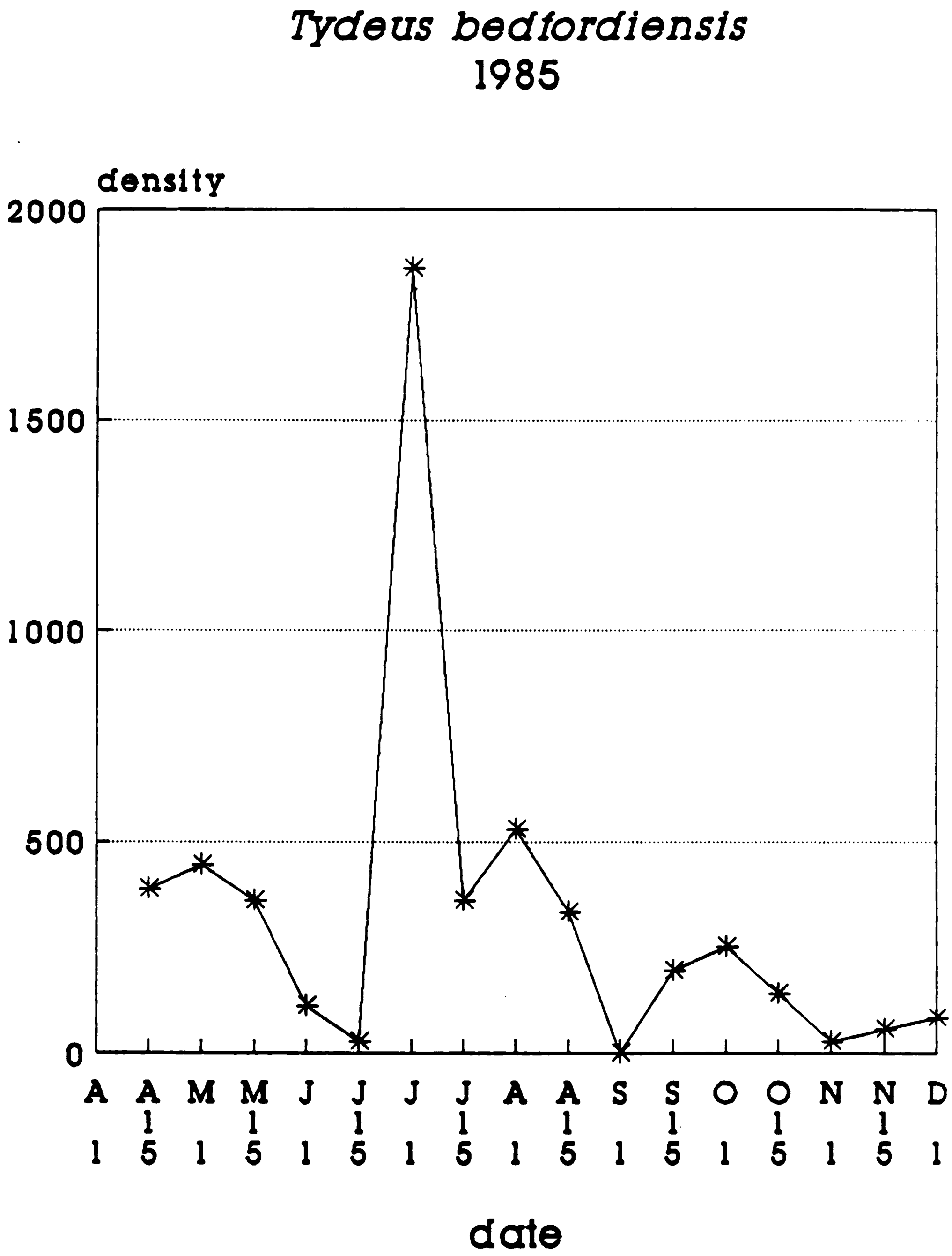


Figure 37. Biweekly fluctuation of Tydeus bedfordiensis during 1985, all grasses combined.

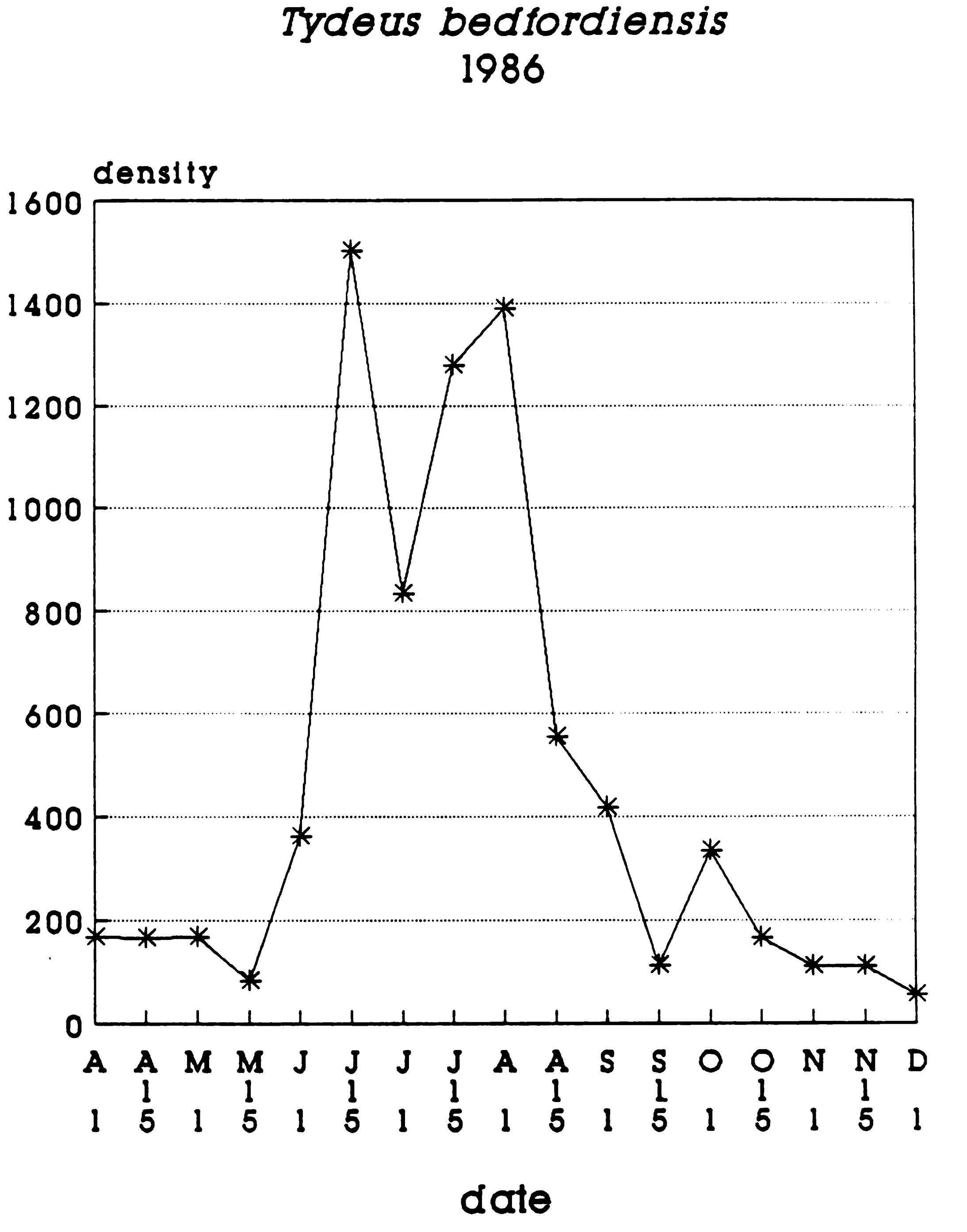


Figure 38. Biweekly fluctuation of <u>Tydeus bedfordiensis</u> during 1986, all grasses combined.

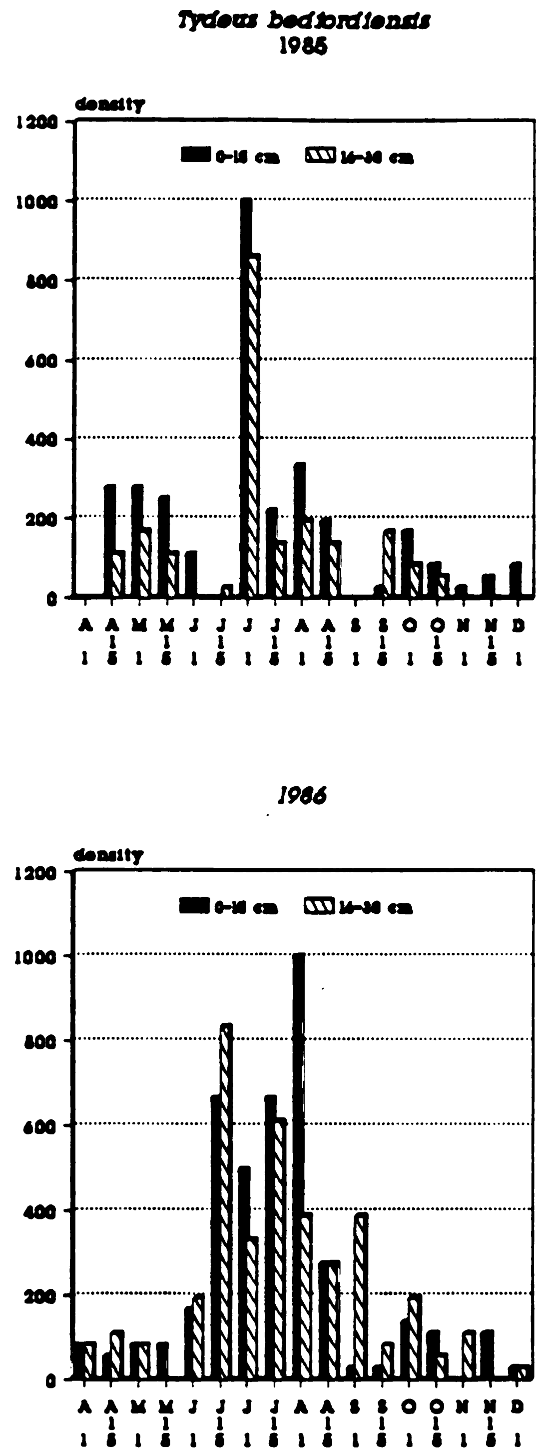
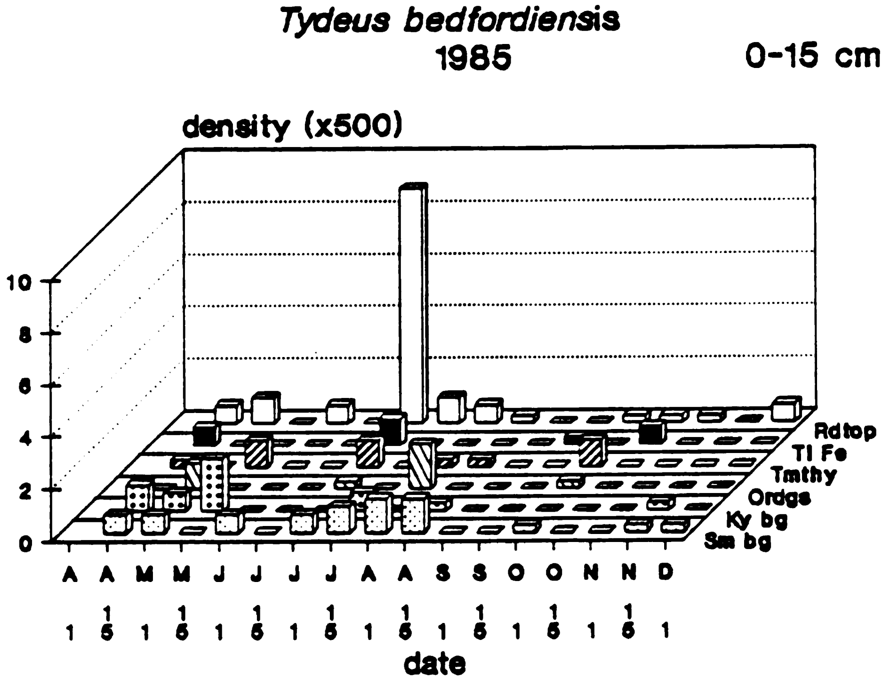


Figure 39. Vertical distribution of <u>Tydeus bedfordiensis</u> during 1985 and 1986, all grasses combined.



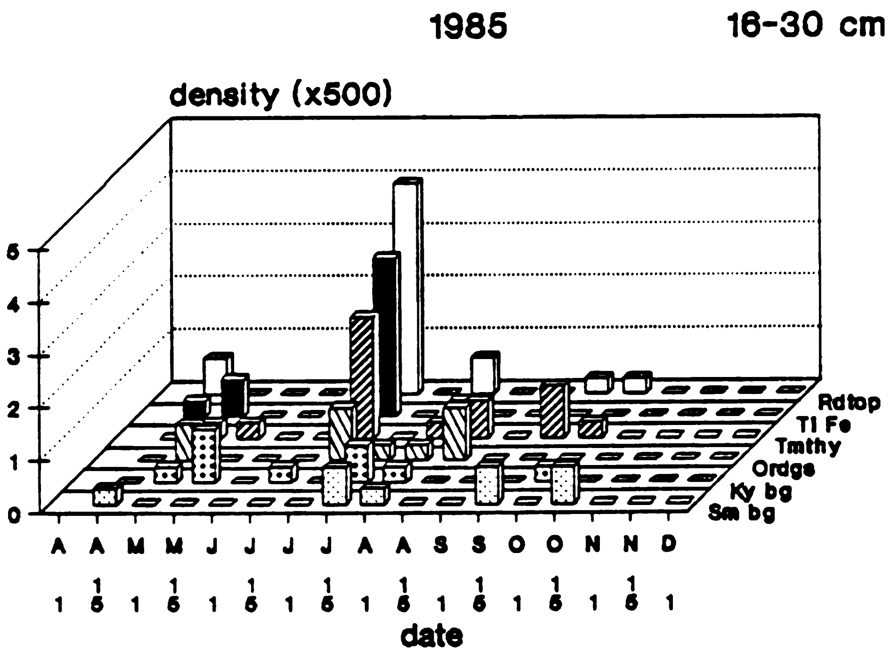


Figure 40. Mean seasonal densities of Tydeus bedfordiensis under different grasses at each depth during 1985.

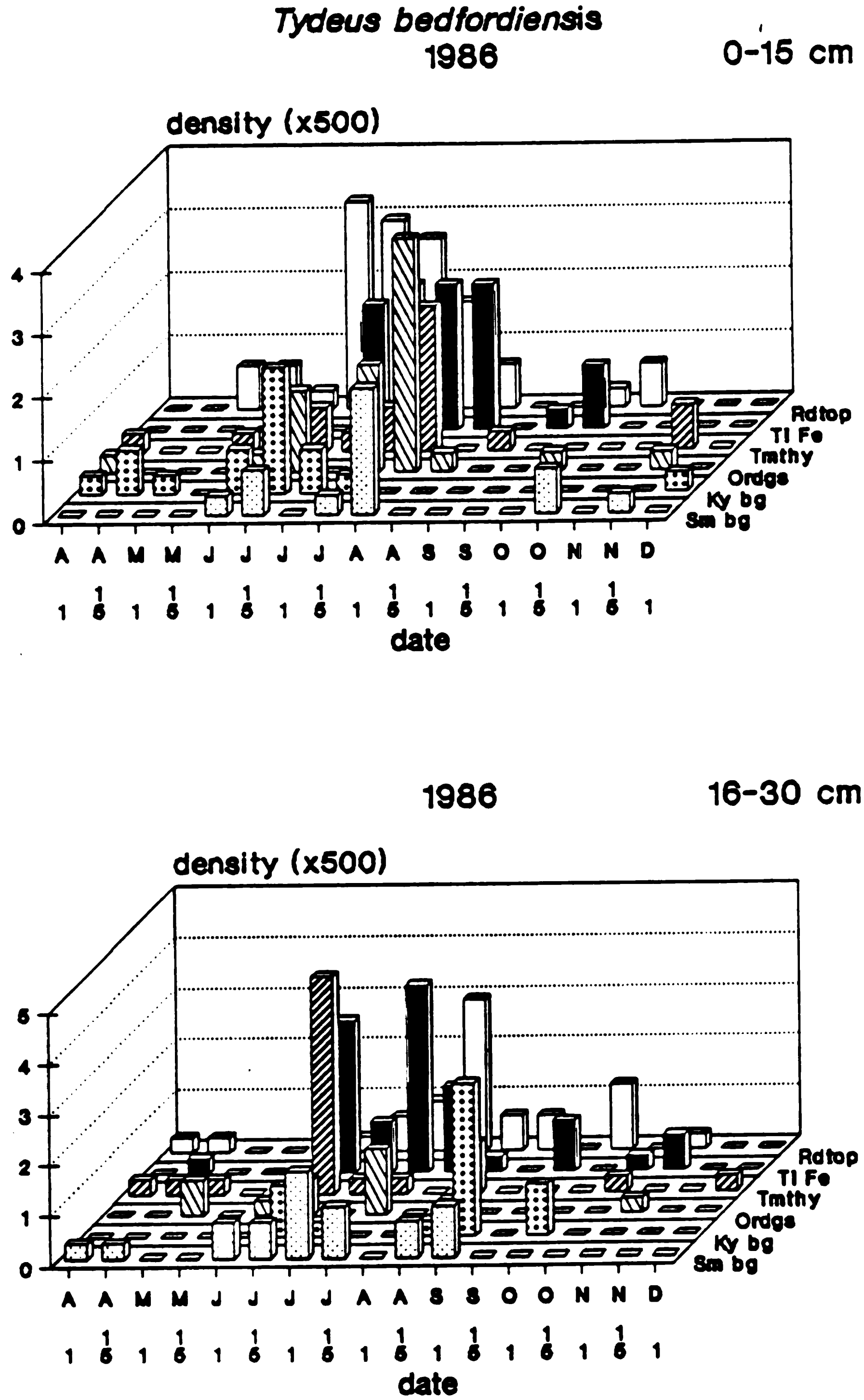


Figure 41. Mean seasonal densities of Tydeus bedfordiensis under different grasses at each depth during 1986.

Redtop was the only grass species singled out from all others in terms of supporting the highest densities of *T. bedfordiensis*. On several dates, and more often in the upper than in the lower stratum, abundances were significantly higher under redtop (App. A, Figures 40 and 41).

E.4. Effect of grass covers on numbers of *Metapronematus leucohippeus*:

In 1985, densities of *M. leucohippeus* were almost equal under the six grasses. In 1986, weak differences ($p < 0.1$) among grasses existed: Kentucky bluegrass supported highest numbers with a yearly mean of 800/m^2, while lowest mean density was recorded under tall fescue (Table 19 and Figure 42).

E.5. Biweekly fluctuation of *Metapronematus leucohippeus*:

Much as in other mite taxa, seasonal abundance estimates fluctuated greatly during each year ($p < 0.001$). Unlike other taxa, however, seasonal density patterns were highly discrepant between years (Figures 43 and 44). Early and late-season population lows provided the only points of similarity. Density maxima of 1985 occurred in July, while the single pronounced increase of 1986 was recorded in October.

No explanations are readily apparent. One may speculate, however, that the species is physiologically (reproductively) flexible; and /or that changing below

Table 19: Population densities ±SE/m^2 of _Metapronematus leucohippeus_ in each soil stratum under different grasses.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Grasses	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Sm. bg	200	±50	100	±50	500	±200	100	±50
Ky. bg	150	±50	50	±50	500	±300	300	±100
Ordgrs	100	±50	100	±50	300	±150	350	±150
Timthy	100	±50	250	±100	100	±50	450	±300
Tl Fse	50	±50	150	±50	50	±50	150	±50
Redtop	100	±50	300	±150	200	±50	200	±100

N = 48 for 1985, 51 for 1986

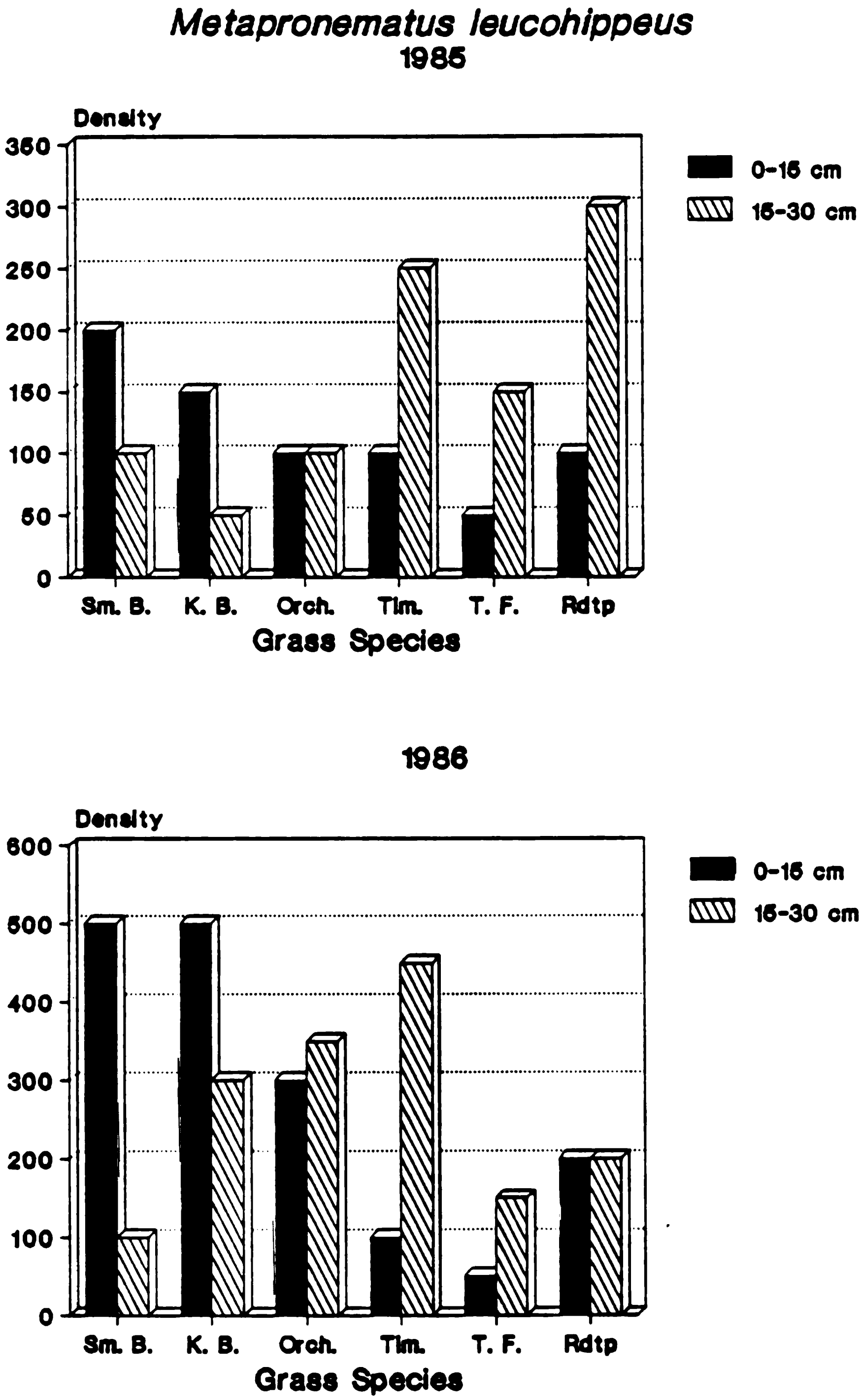


Figure 42. Metapronematus leucohippeus densities /m^2 in both soil strata under different grass covers.

ground conditions under the six grasses, which had not been mowed or otherwise treated since May 1984, had some effect on this particular species. The latter interpretation is supported by a general shift in yearly mean densities, populations increasing under smooth bromegrass, Kentucky bluegrass and orchardgrass (Table 19).

E.6 Vertical distribution of *Metapronematus leucohippeus*:

The species was distributed almost equally over depths in both years, although in July and August of 1985 the lower stratum seemed to be preferred (Table 20 and Figure 45).

Given the mid summer peak of *M. leucohippeus* in 1985, it is not surprising that densities were positively correlated to temperature, and negatively to moisture during that year (App. C). With no significant relationships emerging for 1986, it seems that the explanatory power of edaphic variables for either densities or vertical distribution was generally weak.

With respect to grass-specific vertical distribution, no clear trends emerged. At either depth, and on several dates, populations were highest under any one of the six grasses (Figures 46 and 47). No clear preference for any grass species or grass related depth could be shown.

Table 20: Mean seasonal density /m² ±SE of Metapronematus leucohippeus in upper and lower soil strata; data from all grasses lumped.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Dates	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Aprl 1	---	---	---	---	50	±50	50	±50
Aprl 15	150	±50	50	±50	50	±50	50	±50
May 1	100	±100	50	±50	150	±50	100	±50
May 15	200	±100	50	±50	0	--	50	±50
June 1	300	±150	350	±150	0	--	50	±50
June 15	50	±50	150	±100	100	±50	0	--
July 1	400	±150	450	±200	50	±50	50	±50
July 15	100	±50	550	±200	100	±50	150	±50
Aug 1	200	±100	200	±50	300	±200	50	±50
Aug 15	100	±50	450	±300	100	±100	150	±50
Sept 1	0	--	100	±100	850	±350	400	±150
Sept 15	50	±50	100	±50	400	±150	200	±100
Oct 1	150	±50	100	±50	200	±100	650	±250
Oct 15	0	--	0	--	2050	±850	2150	±800
Nov 1	150	±50	0	--	300	±150	200	±100
Nov 15	50	±50	0	--	50	±50	0	--
Dec 1	0	--	0	--	0	--	0	--

N = 18 per date and depth

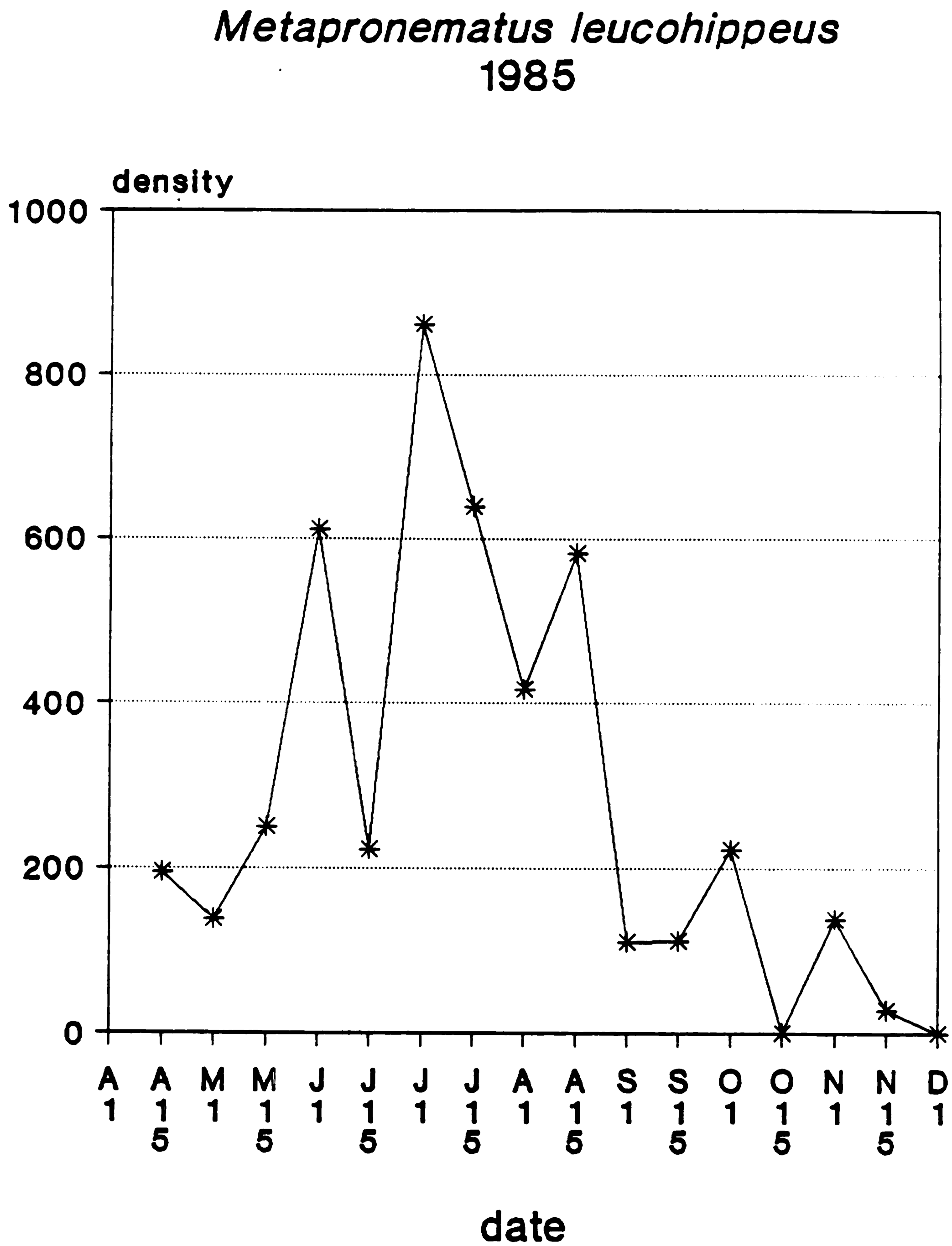


Figure 43. Biweekly fluctuation of Metapronematus leucohippeus during 1985, all grasses combined.

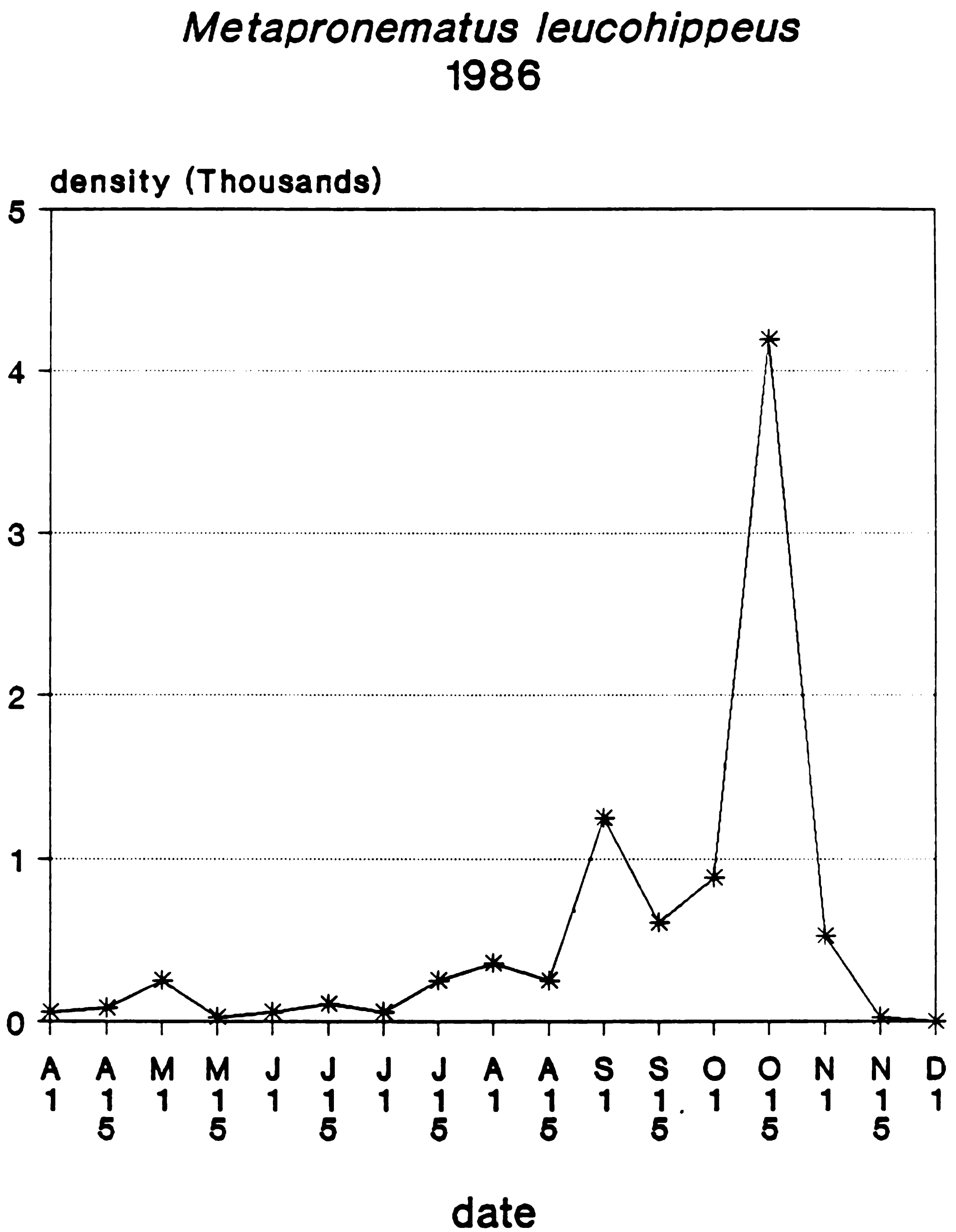


Figure 44. Biweekly fluctuation of <u>Metapronematus leucohippeus</u> during 1986, all grasses combined.

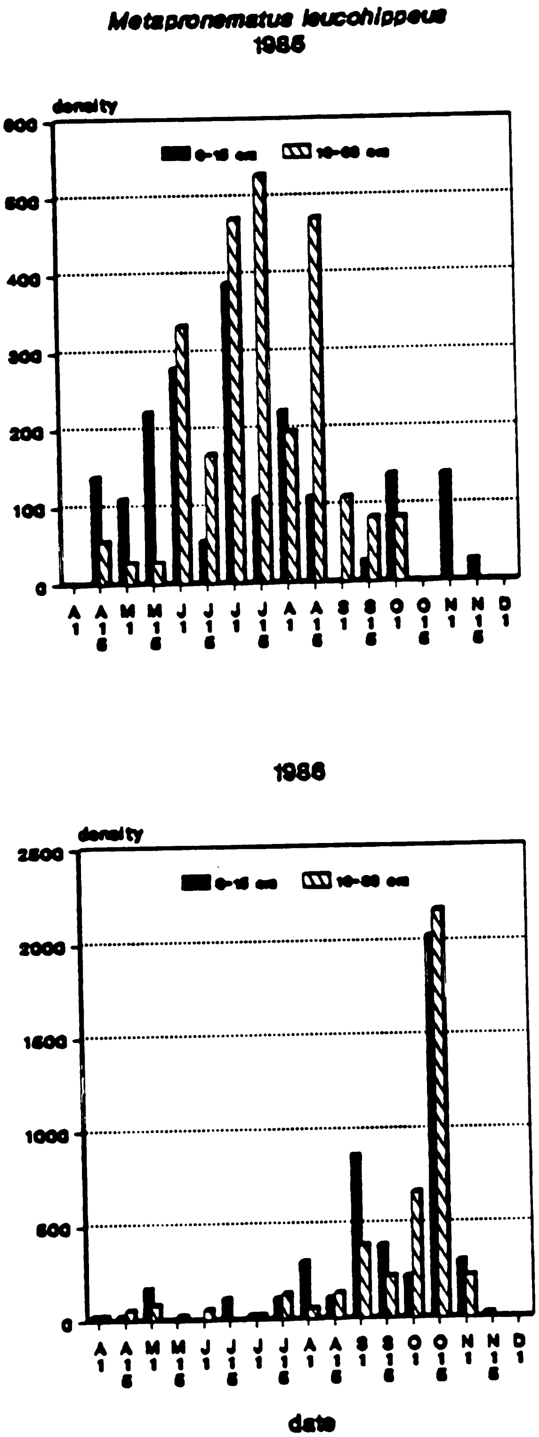
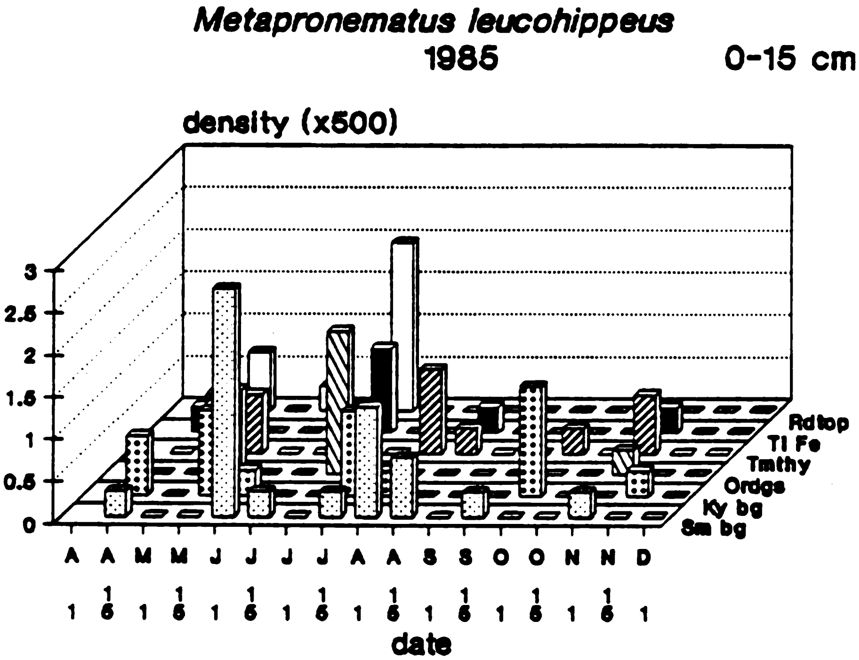


Figure 45. Vertical distribution of <u>Metapronematus leucohippeus</u> during 1985 and 1986, all grasses combined.



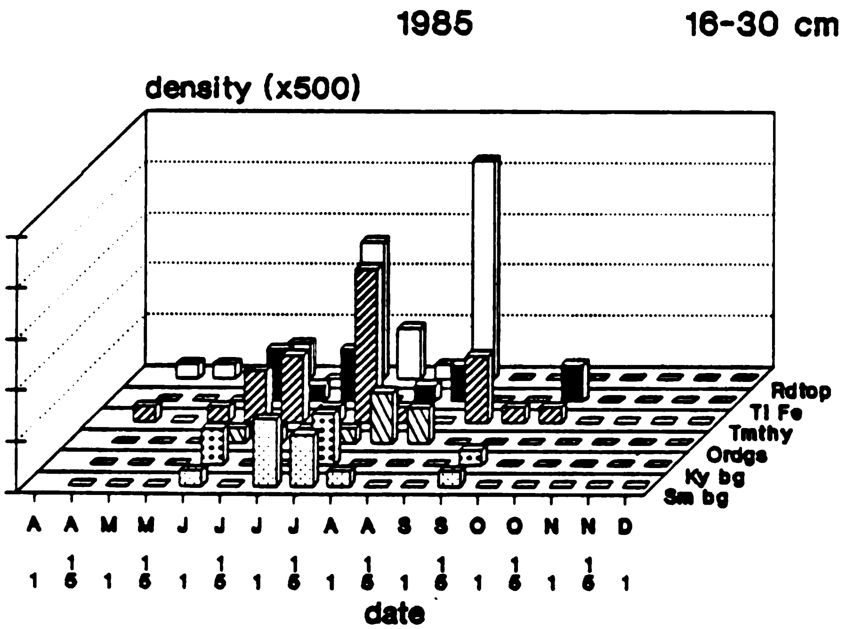
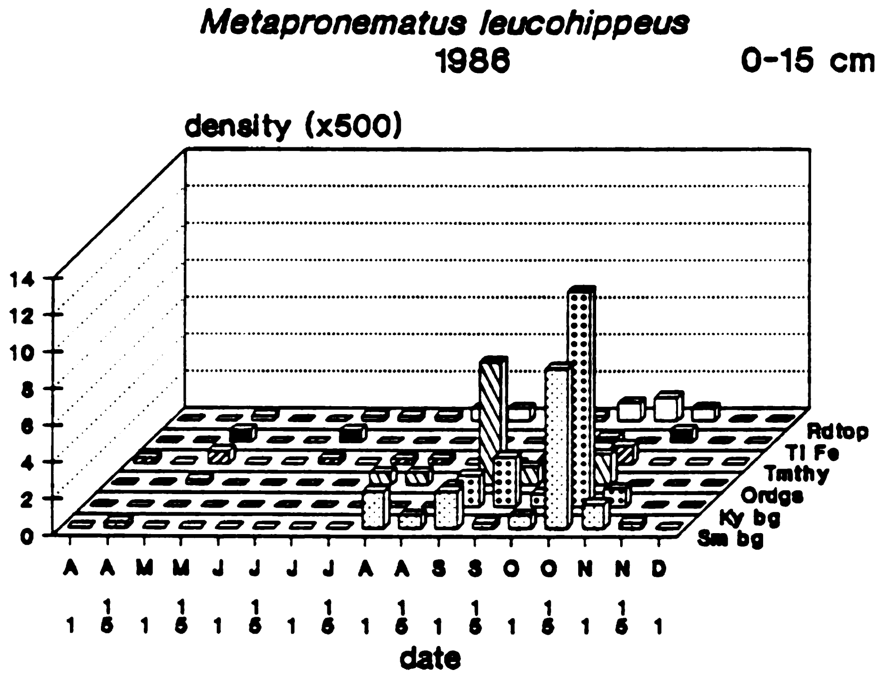


Figure 46. Mean seasonal densities of <u>Metapronematus leucohippeus</u> under different grasses at each depth during 1985.



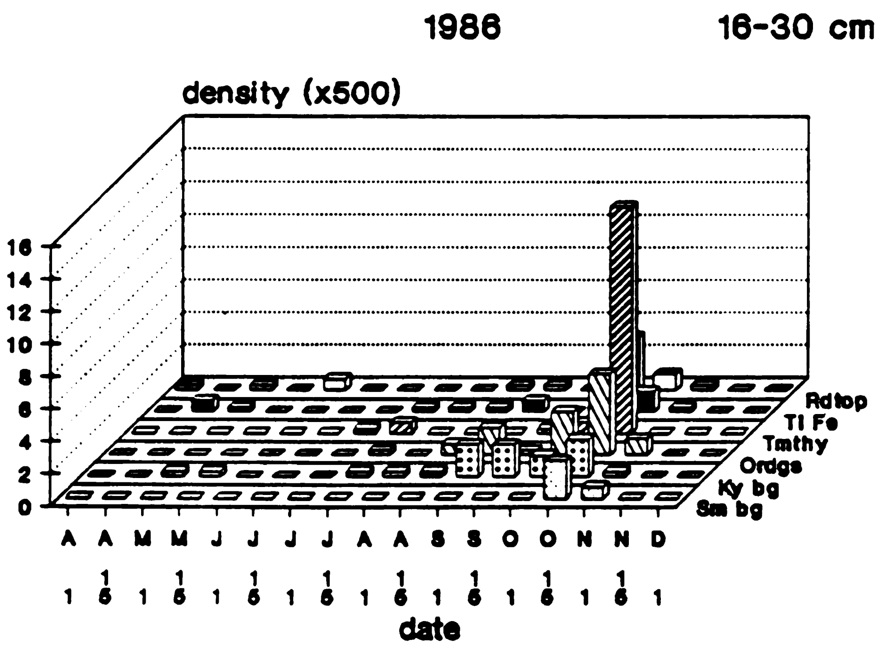


Figure 47. Mean seasonal densities of Metapronematus leucohippeus under different grasses at each depth during 1986.

F. Order: Mesostigmata

Mesostigmata ranked second among Acarina, after Prostigmata; their relative dominance was 26.9% and 8.9% of total mites in 1985 and 1986 respectively. Two species of the mesostigmatids occurred regularly throughout this study: Rhodacarellus silesiacus Willmann with 79.1% and 76.6% in 1985 and 1986, and Hypoaspis aculeifer Canestrini with 7.0% and 6.8% dominance. All other species together constituted 13.9% of total Mesostigmata in 1985 and 16.6% in 1986 (Table 21 and Figure 48). All species recorded in this study are free-living and soil-inhabiting mites except for Dermanyssus gallinae Degeer which is known to be ectoparasitic on birds and mammals. However, it has been stated by Gilyarov (1977) that its accidental appearance in soil is possible, The species made up only 2% of total mesostigmatids in 1985 and 3.3% in 1986. The mites probably dropped off birds and mammals visiting the study area.

F.1. Effect of grass covers on numbers of Rhodacarellus silesiacus:

Highly significant differences existed among grasses ($p < 0.001$) in accommodating Rhodacarellus silesiacus populations in both years. Lumped over both depths, highest density in 1985 was found under smooth bromegrass with $5150/m^2$ followed by orchardgrass with $4600/m^2$. Least numbers

Table 21. Relative dominance of species of order Mesostigmata in 1985 and 1986.

species	1985 N	1985 %	1986 N	1986 %
R. silesiacus	1326	79.1	911	76.6
H. aculifer	118	7.0	81	6.8
D. gallinae	34	2.0	39	3.3
other species	198	11.9	158	13.3
total	1676		1189	

N = the total number of specimens obtained per year.

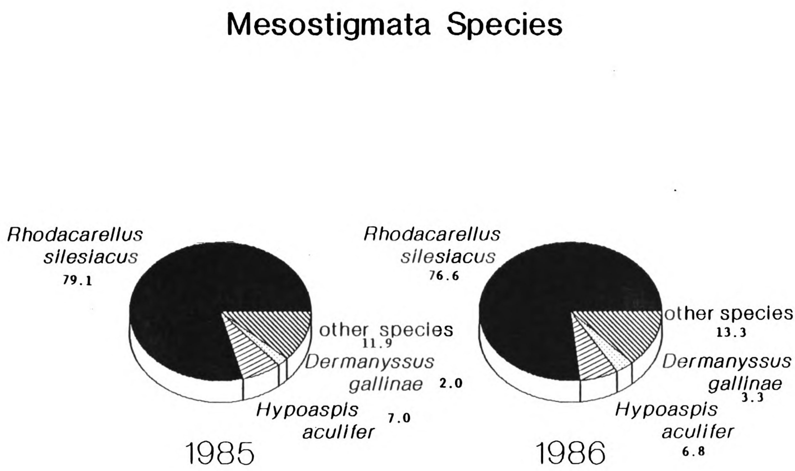


Figure 48. Relative dominance (%) of selected species of Mesostigmata in 1985 and 1986.

Table 22: Population densities ±SE/m² of *Rhodacarellus silesiacus* in each soil stratum under different grasses.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Grasses	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Sm. bg	2100	±500	3050	±1000	1050	±350	1000	±450
Ky. bg	900	±350	1500	±450	1200	±300	1000	±250
Ordgrs	1750	±400	2850	±800	1650	±500	1150	±300
Timthy	600	±200	350	±100	750	±150	550	±150
Tl Fse	400	±150	50	±50	200	±100	200	±50
Redtop	100	±50	100	±50	100	±50	100	±50

N = 48 for 1985, 51 for 1986

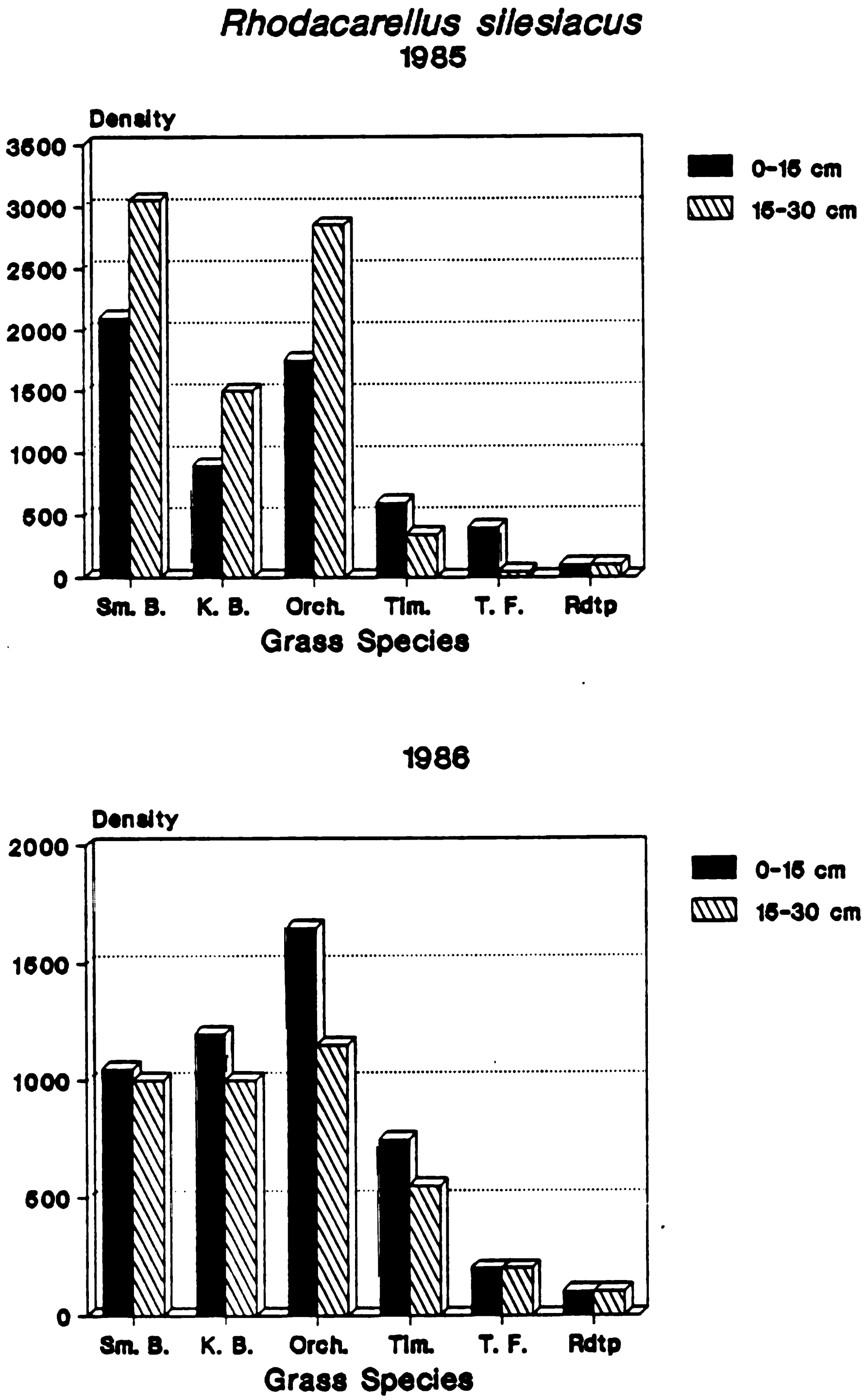


Figure 49. Rhodacarellus silesiacus densities /m^2 in both soil strata under different grass covers.

were recorded for redtop with 200/m^2. In 1986, orchardgrass, Kentucky bluegrass and smooth bromegrass all harbored large populations, while the lowest numbers again occurred under redtop with 200/m^2 (Table 22 and Figure 49). Between - year numerical relationships were thus relatively stable.

F.2. Biweekly fluctuation of Rhodacarellus silesiacus:

The species underwent large-scale numerical fluctuations during both years. In 1985 (Figure 50) densities peaked in October and November, but were low earlier in season. By contrast, highest abundances occurred in April and May in 1986 (Figure 51), followed by low densities during the remainder of the year.

Much as in M. leucohippeus, and equally difficult to explain without knowledge of the species' biological characteristics, seasonal density patterns of R silesiacus were thus very dissimilar from year to year. It is possible that the 1985 drought delayed reproduction of both species until the fall, and that the resulting population increase carried over into the spring of 1986.

F.3 Vertical distribution of Rhodacarellus silesiacus:

Only for 1986 could a significant effect of depth be shown for the species. In the first half of the 1985 season, R. silesiacus were more numerous in the upper stratum, while

Table 23: Mean seasonal density /m² ±SE of <u>Rhodacarellus silesiacus</u> in upper and lower soil strata; data from all grasses lumped.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Dates	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Aprl 1	---	---	---	---	1750	±450	3650	±1300
Aprl 15	650	±300	300	±150	2800	±800	2150	±600
May 1	1800	±900	600	±250	3100	±1200	850	±400
May 15	900	±250	400	±200	1400	±750	250	±100
June 1	300	±200	50	± 50	400	±250	400	±300
June 15	1700	±900	600	±250	600	±300	50	±50
July 1	900	±250	600	±200	400	±200	50	±50
July 15	900	±450	400	±150	350	±200	100	±50
Aug 1	1200	±500	1200	±500	600	±150	200	±50
Aug 15	600	±450	900	±400	800	±200	250	±100
Sept 1	550	±450	400	±150	400	±250	200	±150
Sept 15	950	±750	450	±200	600	±300	250	±350
Oct 1	2100	±700	2600	±1250	150	±100	150	±100
Oct 15	800	±200	4650	±2600	100	±50	450	±350
Nov 1	550	±200	4000	±1950	350	±200	300	±100
Nov 15	600	±200	1850	±550	200	±100	300	±300
Dec 1	1250	±750	2100	±600	50	±50	400	±150

N = 18 per date and depth

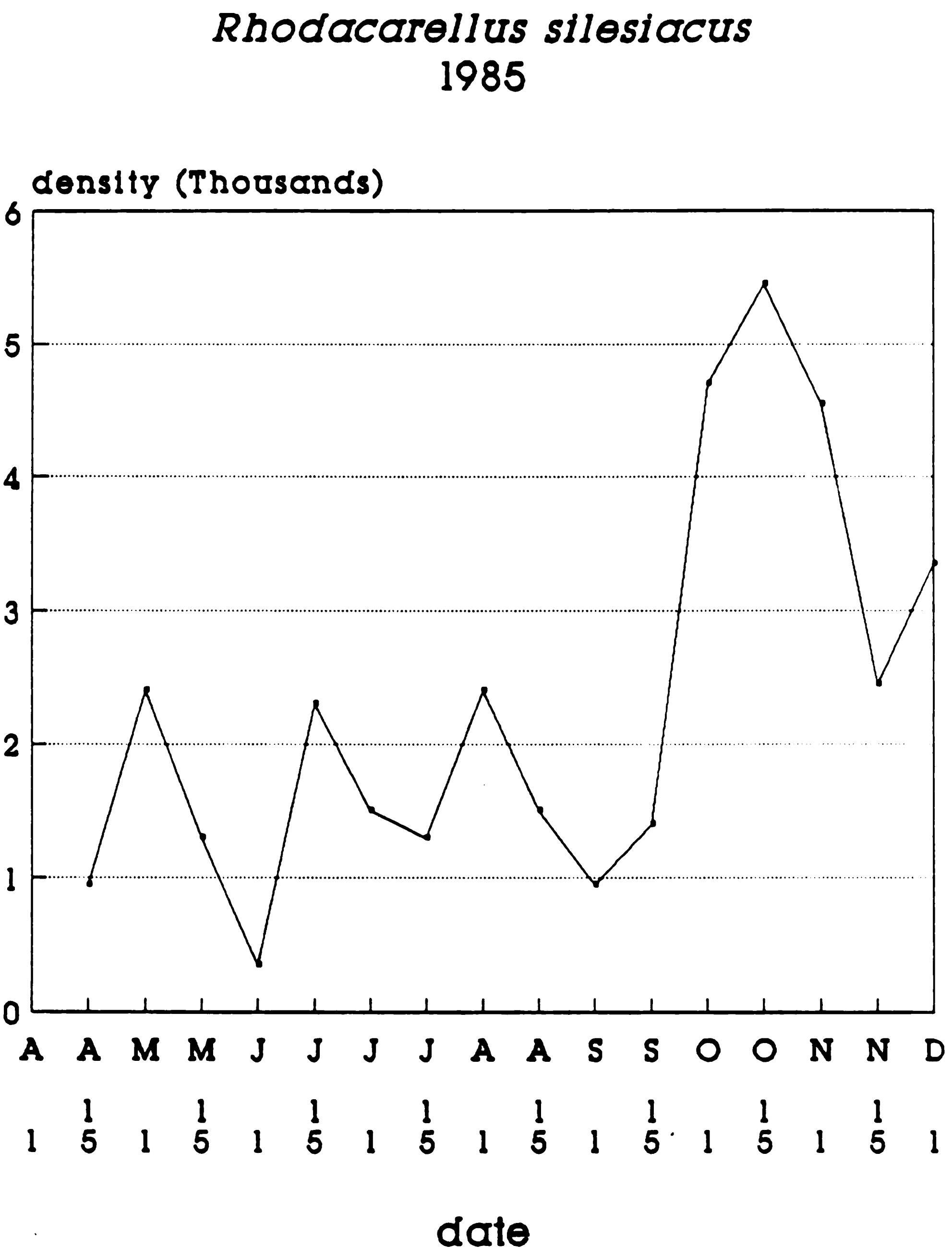


Figure 50. Biweekly fluctuation of Rhodacarellus silesiacus during 1985, all grasses combined.

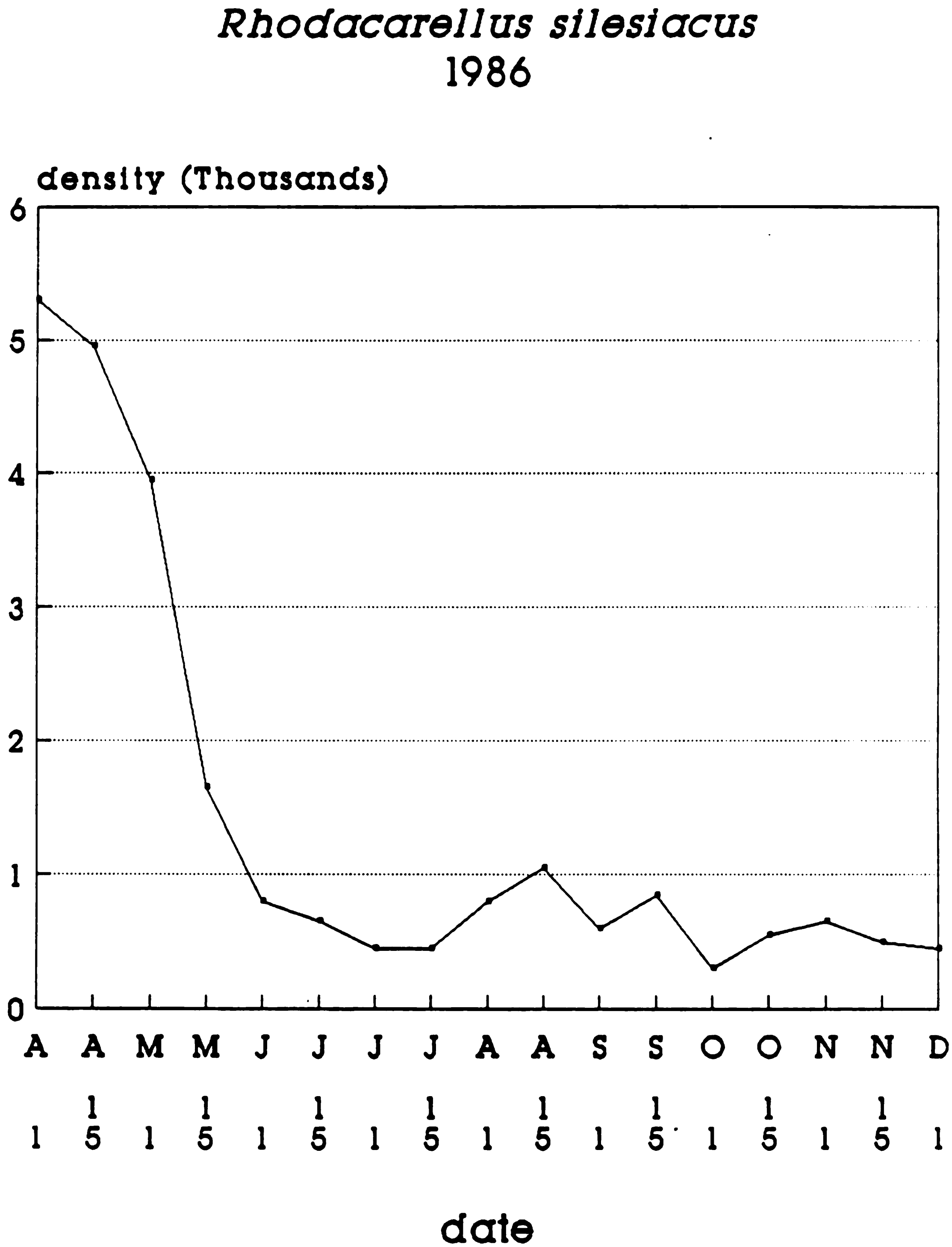


Figure 51. Biweekly fluctuation of Rhodacarellus silesiacus during 1986, all grasses combined.

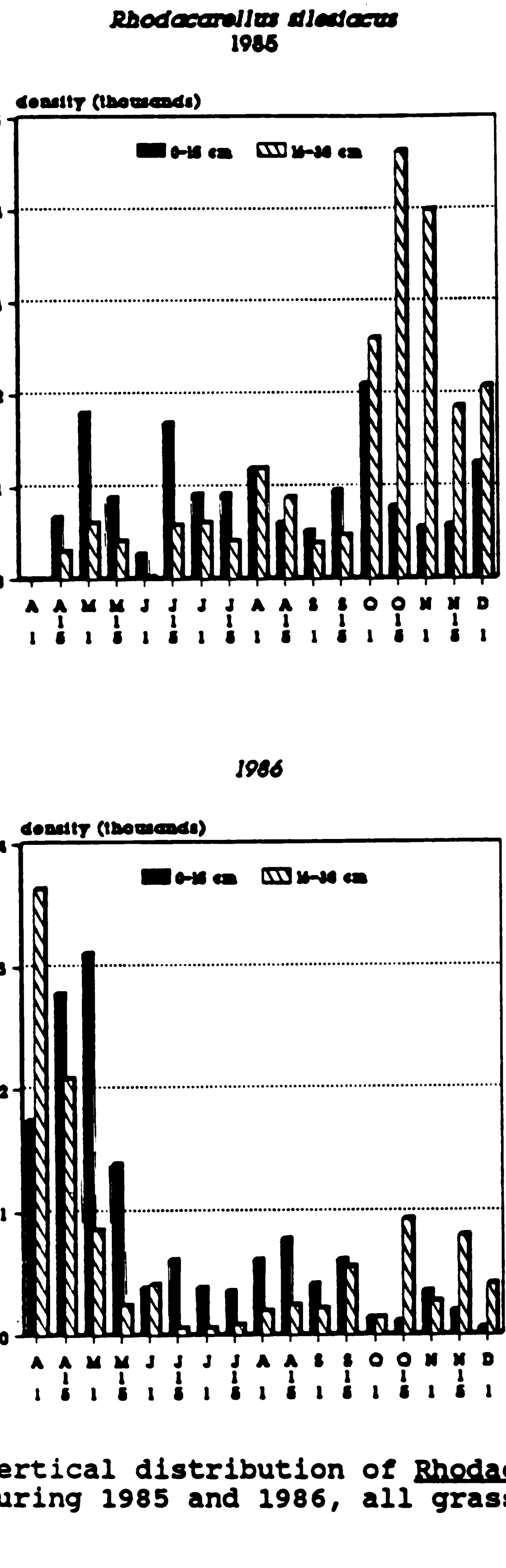


Figure 52. Vertical distribution of <u>Rhodacarellus silesiacus</u> during 1985 and 1986, all grasses combined.

the opposite was true in October and November (Table 23 and Figure 53). Throughout most 1986 dates, however, the species clearly preferred the upper layer (Figure 52).

To some degree edaphic variables can be used to explain differences in vertical distribution. Population density in the lower stratum in 1985 was positively correlated to soil moisture, and negatively to temperature. The negative density / temperature relationship was confirmed with 1986 data, indicating some sensitivity of the species to high temperature and low moisture.

Single data tests of mean numbers of R. silesiacus under each turf grass showed significant differences between grasses on several dates and at both depths. In general (Figures 53 and 54), smooth bromegrass, Kentucky bluegrass and orchardgrass were the three species which harbored larger populations than any of the other three.

F.4. Effect of grass covers on numbers of Hypoaspis aculeifer:

Grass species differed considerably in terms of H. aculifer populations associated with them (p <0.001) in both years. Tall fescue was clearly the leader, followed by redtop (Table 24 and Figure 55). Under all other grasses, numbers of H. aculeifer were insignificant.

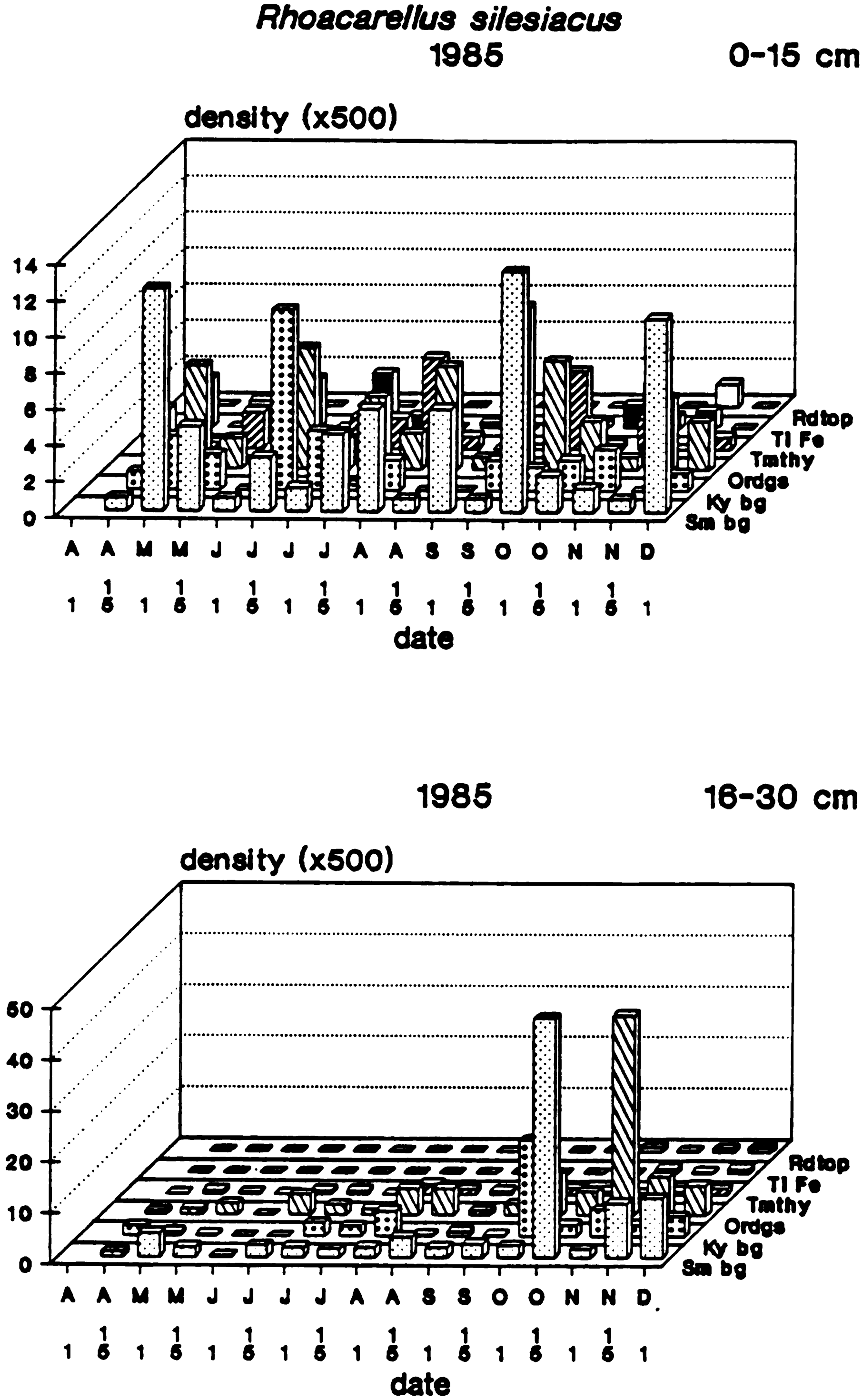


Figure 53. Mean seasonal densities of Rhodacarellus silesiacus under different grasses at each depth during 1985.

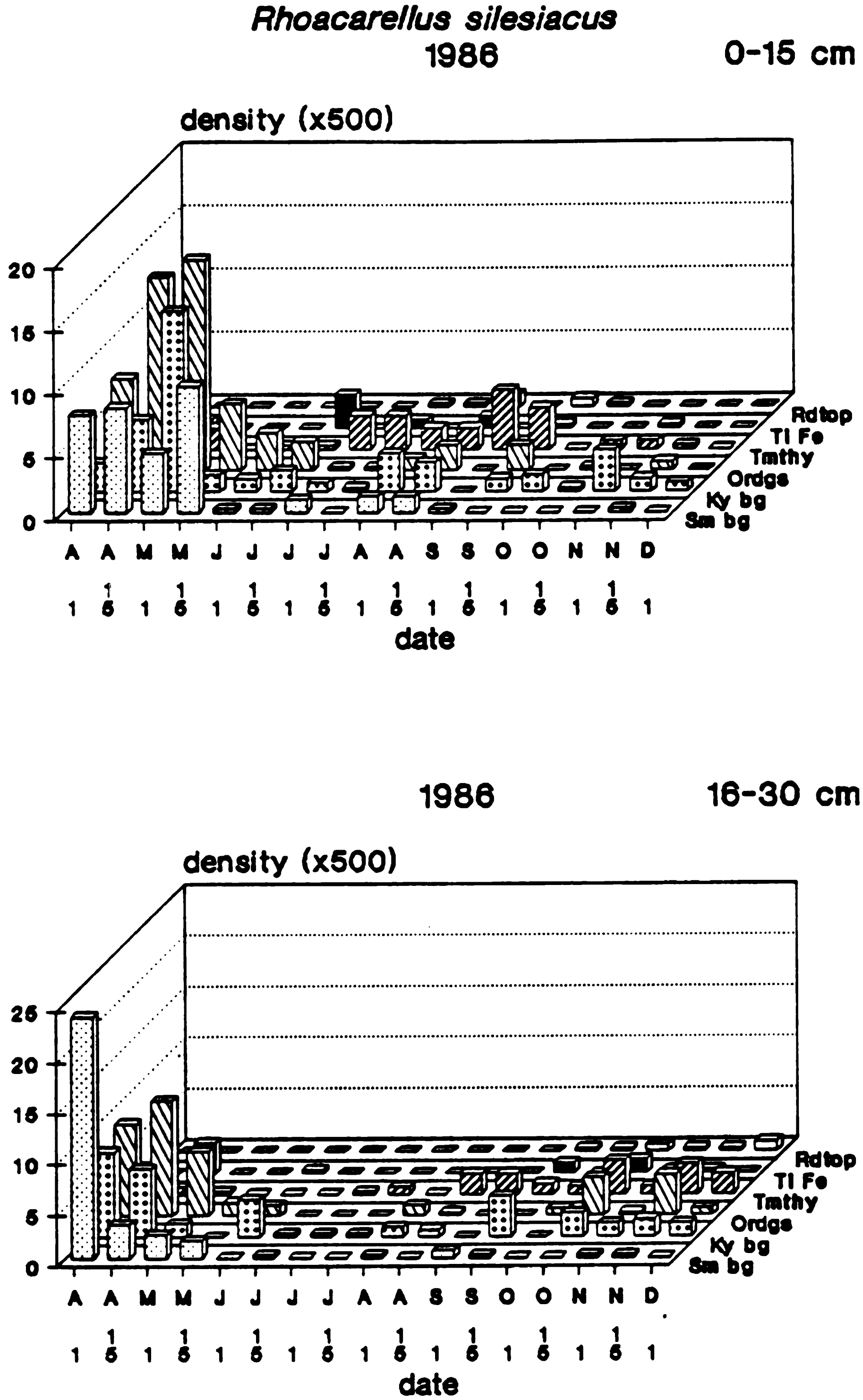


Figure 54. Mean seasonal densities of Rhodacarellus silesiacus under different grasses at each depth during 1986.

Hypoaspis aculeifer is a predator which feeds on mature and immature stages of small arthropods. Tall fescue has an extensive root system which penetrates deeply and may create spaces offering relatively free movement to a hunting species. Whether it also harbors large populations of potential prey such as Collembola would have to be clearified in more comprehensive studies.

F.5 Biweekly fluctuation of *Hypoaspis aculeifer* population:

Even under tall fescue, abundance of *H. aculeifer* was relatively low, which is not unusual for an obligatory predator. Using data from all grasses per date, *H. aculeifer* abundance was found to fluctuate almost randomly in both years, with no distinct or repeated pattern (Figures 56 and 57).

F.6 Vertical distribution of *Hypoaspis aculeifer*:

Poplation densities differed significantly between depths ($p < 0.001$). At virtually all times, the species preferred the 0-15 cm stratum (Table 25 and Figure 58). Further studies would be necessary in order to correlate this preference with the distribution of pore space and potential prey. The latter is probably an important determinant of the predator's vertical distribution, since neither temperature nor moisture were related to *H. aculeifer* densities at either depth.

Table 24: Population densities ±SE/m² of _Hypoaspis aculifer_ in each soil stratum under different grasses.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Grasses	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Sm. bg	0	--	0	--	0	--	0	--
Ky. bg	100	±50	50	--	50	--	0	--
Ordgrs	0	--	0	--	0	--	0	--
Timthy	0	--	50	--	50	±50	0	--
Tl Fse	850	±200	100	±50	400	±100	0	--
Redtop	100	±50	50	--	250	±50	0	--

N = 48 for 1985, 51 for 1986

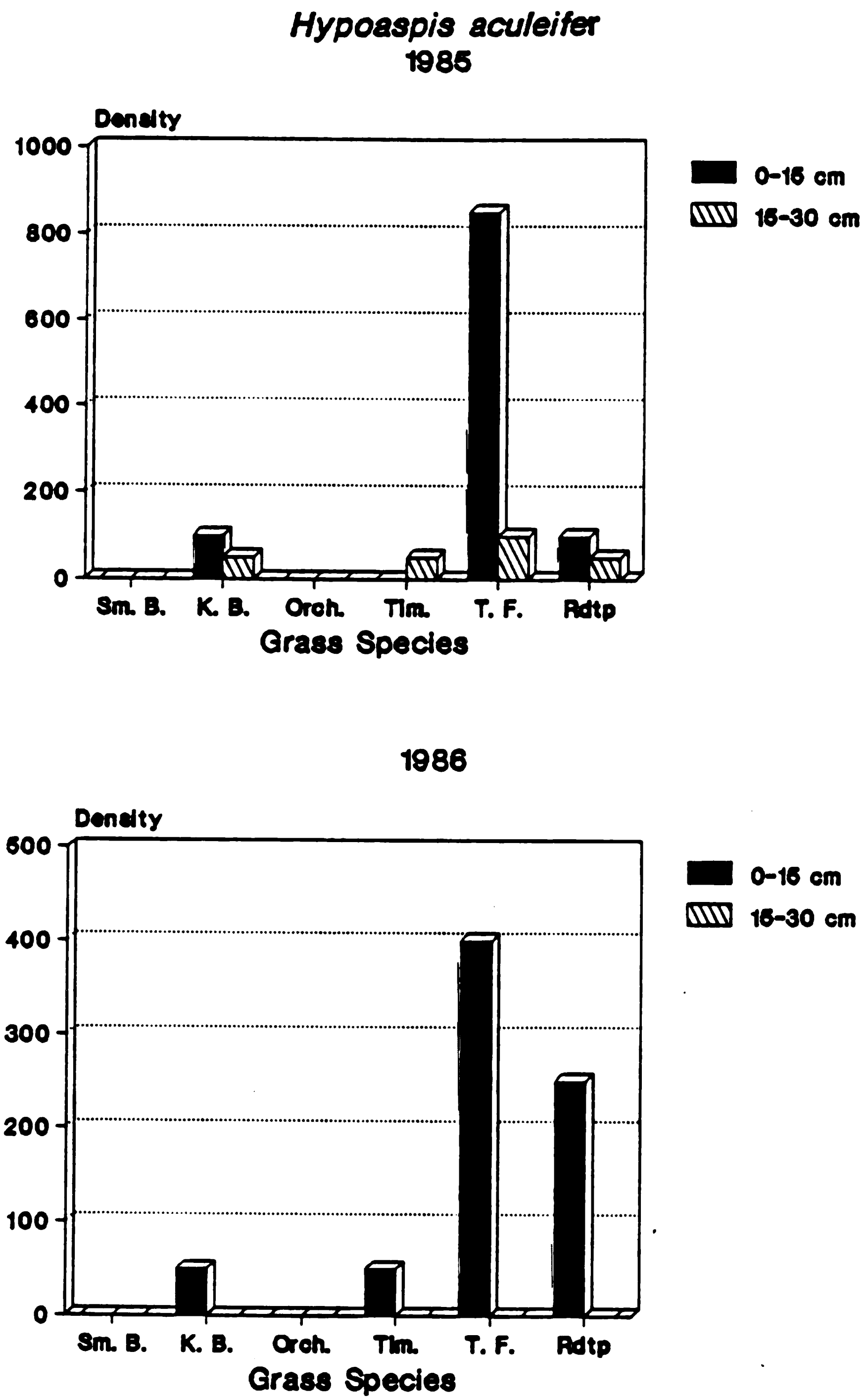


Figure 55. Hypoaspis aculifer densities /m^2 in both soil strata under different grass covers.

Table 25: Mean seasonal density /m² ±SE of <u>Hypoaspis</u> <u>aculifer</u> in upper and lower soil strata; data from all grasses lumped.

	1985				1986			
	0 - 15 cm		16 - 30 cm		0 - 15 cm		16 - 30 cm	
Dates	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Aprl 1	---	---	---	---	200	±100	50	±50
Aprl 15	50	±50	50	±50	100	±50	50	±50
May 1	100	±50	50	±50	50	±50	0	--
May 15	50	±50	50	±50	0	--	0	--
June 1	50	±50	0	--	100	±50	0	--
June 15	300	±150	50	±50	50	±50	0	--
July 1	0	--	50	±50	0	--	0	--
July 15	200	±150	50	±50	200	±100	0	--
Aug 1	0	--	0	--	200	±150	0	--
Aug 15	200	±150	50	±50	400	±200	50	±50
Sept 1	400	±350	0	--	350	±150	0	--
Sept 15	50	±50	50	±50	150	±100	0	--
Oct 1	500	±250	50	±50	0	--	0	--
Oct 15	400	±200	50	±50	150	±100	0	--
Nov 1	200	±150	50	±50	50	±50	0	--
Nov 15	200	±150	100	±50	0	--	0	--
Dec 1	50	±50	50	±50	150	±100	0	--

N = 18 per date and depth

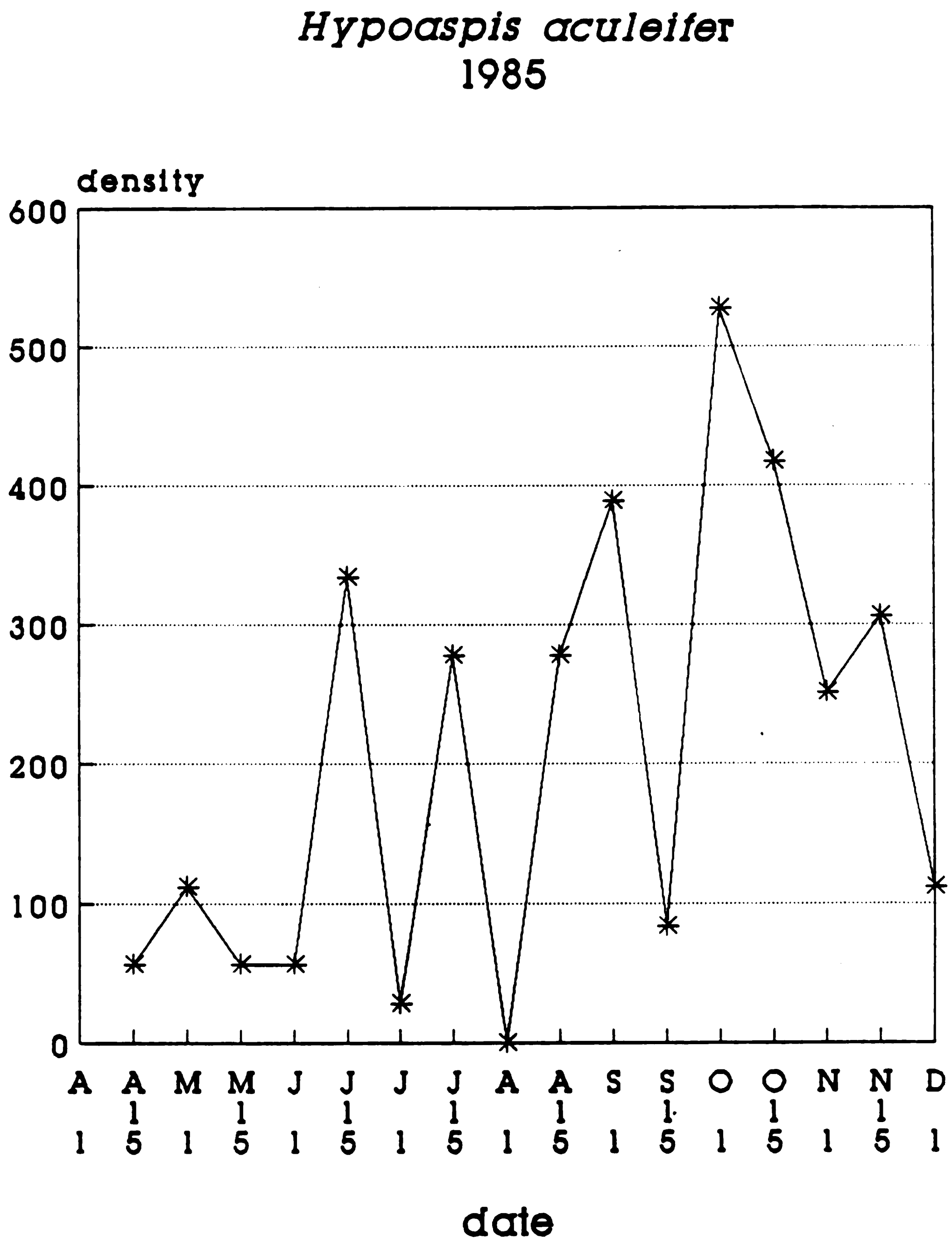


Figure 56. Biweekly fluctuation of <u>Hypoaspis</u> <u>aculifer</u> during 1985, all grasses combined.

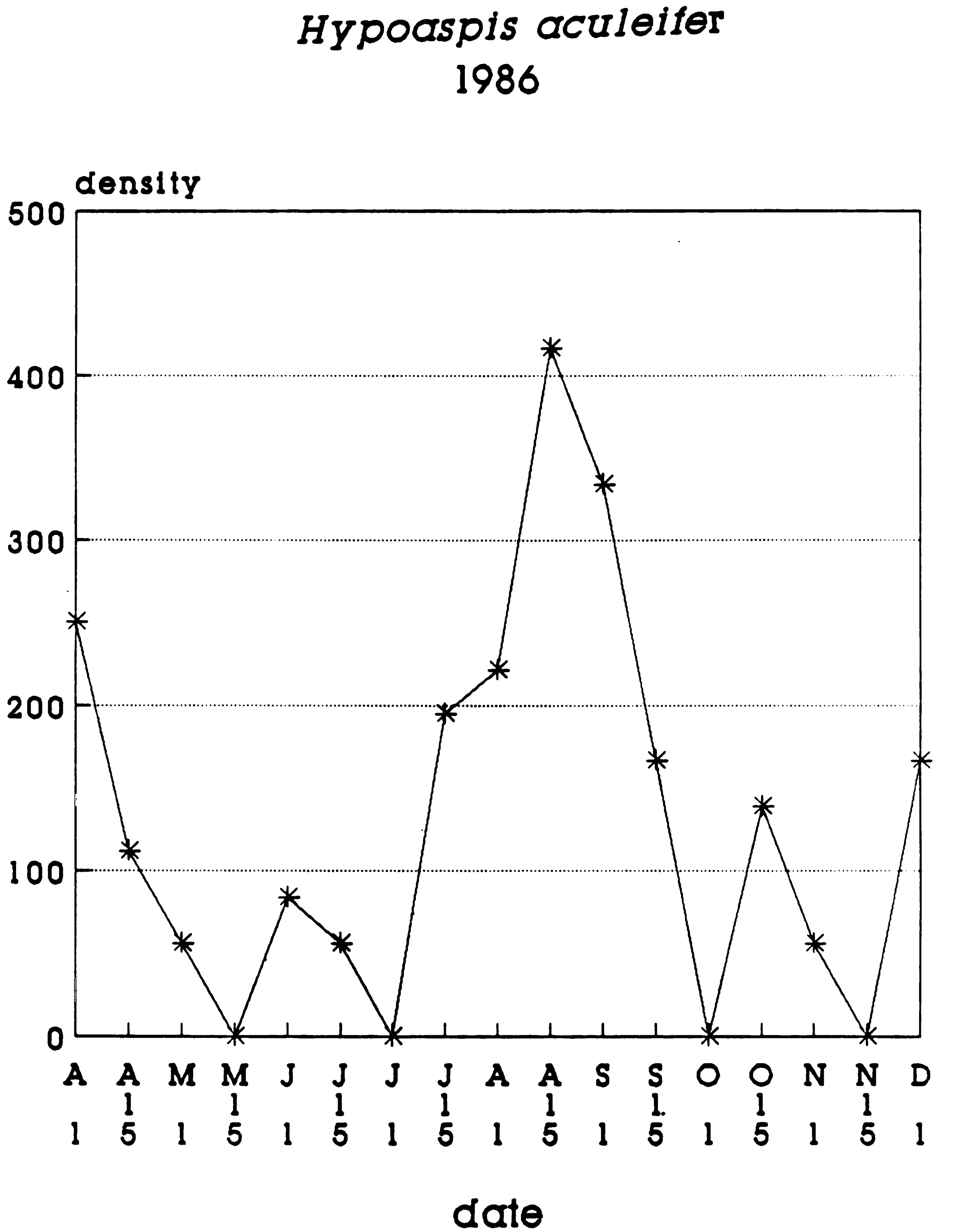


Figure 57. Biweekly fluctuation of <u>Hypoaspis aculifer</u> during 1986, all grasses combined.

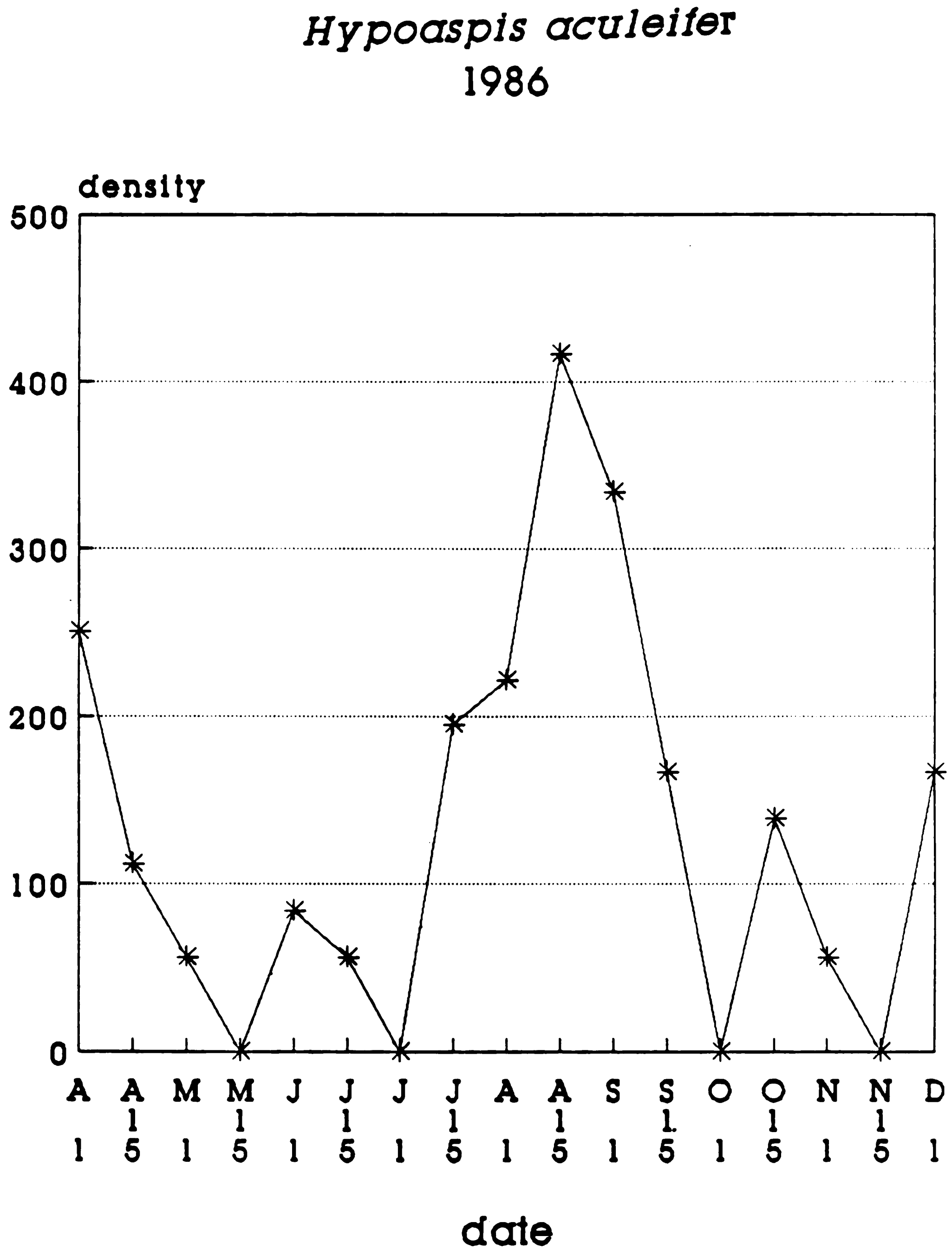


Figure 57. Biweekly fluctuation of <u>Hypoaspis aculifer</u> during 1986, all grasses combined.

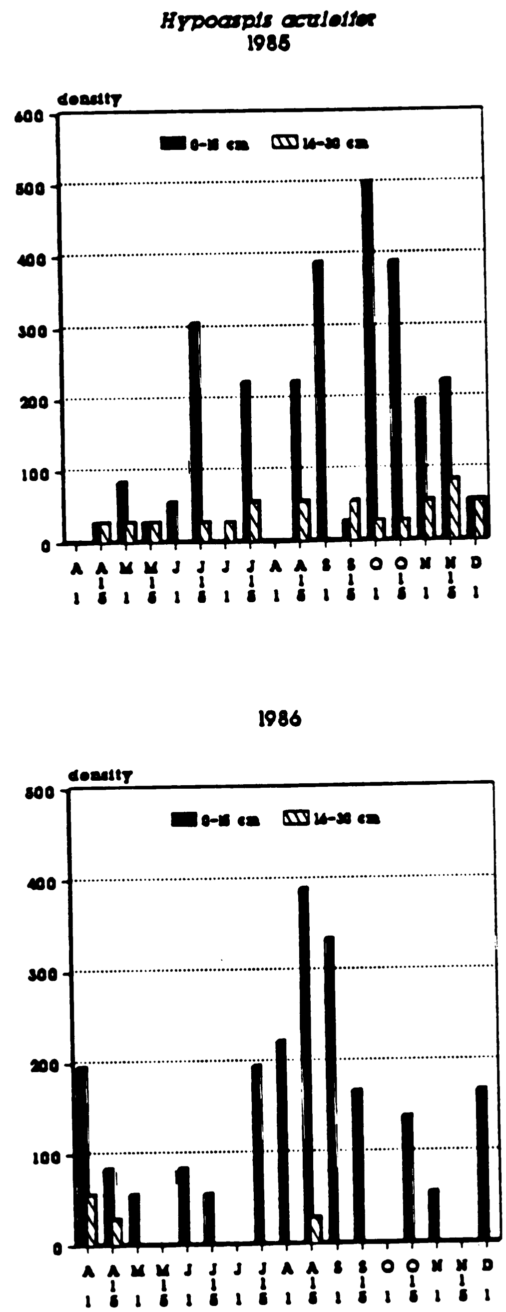
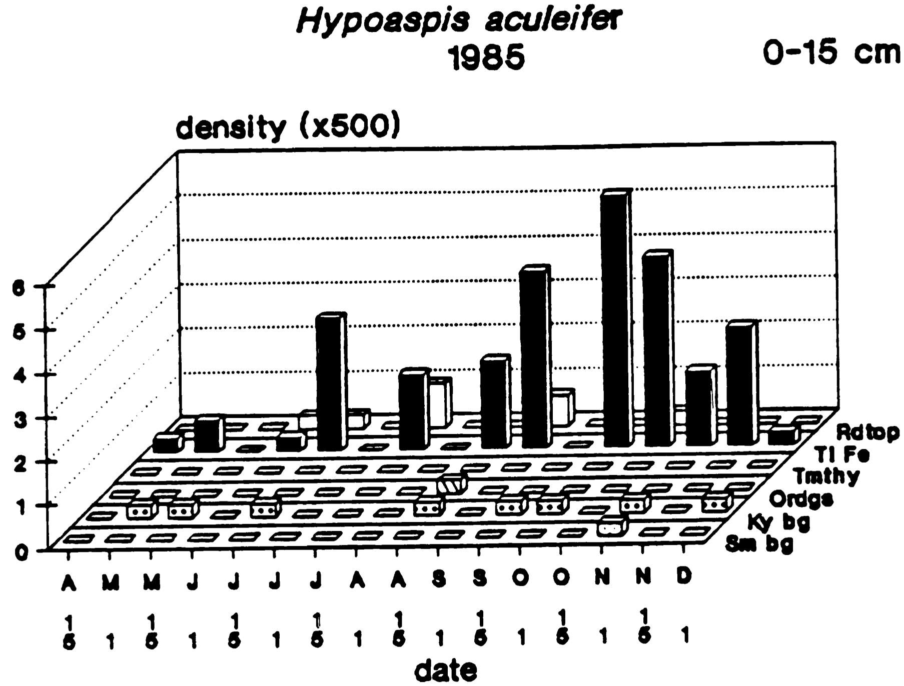


Figure 58. Vertical distribution of Hypoaspis aculifer during 1985 and 1986, all grasses combined.

Grass-specific mean densities (Figures 59 and 60) differed on more than 30% of all dates in each year. As expected, tall fescue was invariably associated with the highest densities of *H. aculeifer* on all occassions.



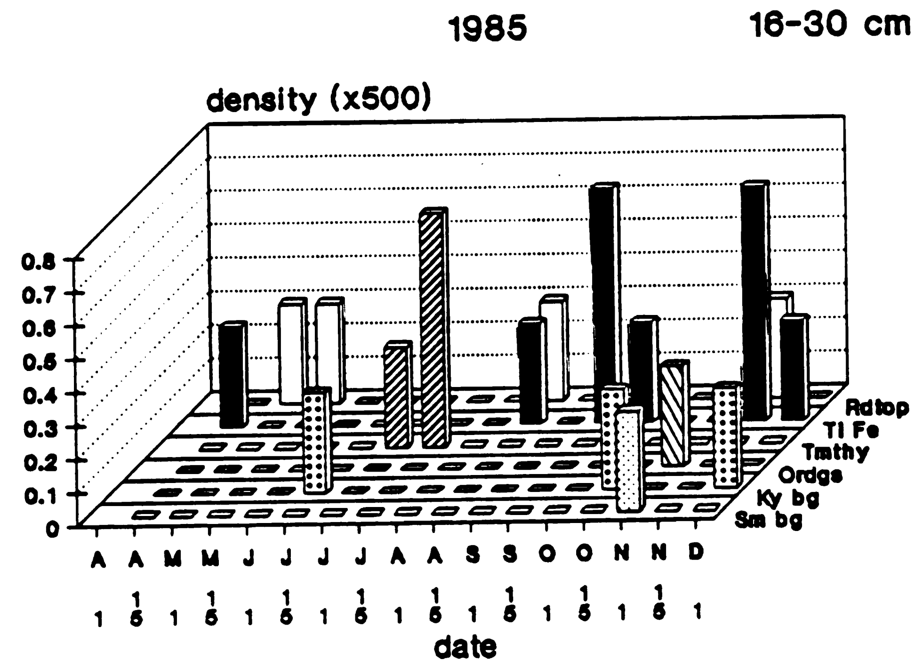
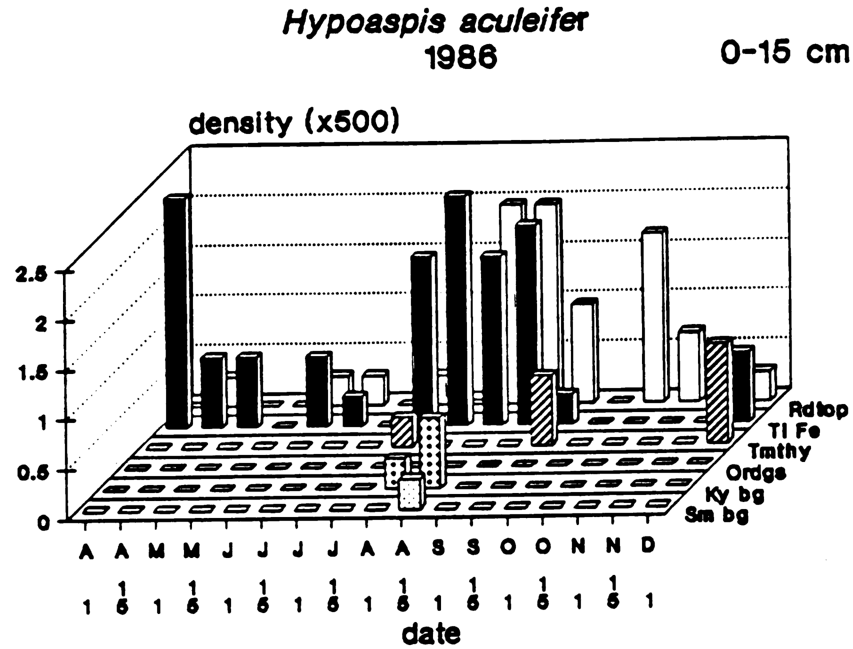


Figure 59. Mean seasonal densities of Hypoaspis aculifer under different grasses at each depth during 1985.



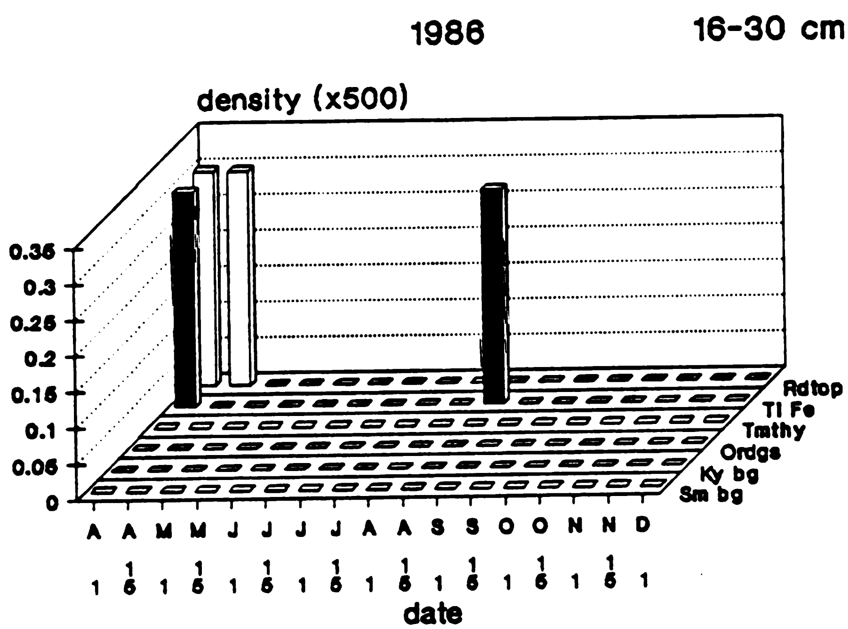


Figure 60. Mean seasonal densities of Hypoaspis aculifer under different grasses at each depth during 1986.

V. SUMMARY AND CONCLUSION

The present study presents data on the distribution and abundance of selected taxa of Acarina obtained from soil samples taken from plots planted with six turfgrasses. Data were gathered for a two-year period (1985 and 1986), with samples taken at biweekly intervals from April to December of each year. Soil temperature and moisture were monitored concurrently.

Acarina, more numerous than any other soil arthropods extracted from samples, were dominated by Prostigmata. Mesostigmata ranked second, while Cryptostigmata constituted less than 8% of all mites. Numbers of Astigmata were negligeable. Prostigmata have been shown to predominate in soils poor in organic matter. Soils in the study area were not particularly poor, but were certainly lower in organic matter than for instance, the A horizon of forest, where Cryptostigmata tend to dominate.

Mite densities were generally much higher in the second year. In agreement with Mukharji et al. (1970), this was probably due to increased rainfall and higher soil moisture. However, between-year discrepancies varied with taxon, ranging from very small differences in abundance (e.g. Eupodes spp.) to more than 20-fold increase in Tarsonemus spp. at the time of maximum population density.

Seasonal abundance patterns observed in 1985 were usually repeated in 1986. Prostigmata as a group showed two main density maxima, in June - July and september - October. In 1986, the second of these peaks seemed to be due mainly to one of the constituent prostigmata genera, namely Tarsonemus spp. Bakerdania spp.tended to be most numerous in April, while Eupodes spp. increased dramatically in mid-season.

Metapronematus leucohippeus provided an exception, in that the timing of population maxima differed between 1985 and 1986. Undoubtedly, some species thus reproduced at the same time each year, contributing to the synchronicety of population fluctuations. Others, prostigmatids as well as mesostigmatids, may have been either more flexible, or more dependent on suitable climatic conditions, resulting in irregular seasonal rhythms. Large fluctuations over time, as well as absence of a regular rhythm, have also been described by Dillon et al. (1962).

Clear preference for upper soil stratum, was exhibited by Eupodes spp. and the predaceous mesostigamtid Hypoaspis aculeifer. In other taxa, soil moisture deficits in 1985 (particularly in the 16-30 cm stratum, to which rainfall did not penetrate) contributed to slight shifts in vertical distribution. Although differences were not always significant, both downward movement in response to more evenly distributed moisture in 1986, and preference for the upper, relatively moister stratum in 1985, were observed. Migration of mites in reaction to moisture gradients has also been discussed by Sheals (1957) and Usher (1971). The latter author in particular concluded that Mesostigmata showed no distinct vertical stratification during periods of suitable climatic conditions.

Several authors have commented on the difficulty of distinguishing the relative importance of the many factors anad interactions which determine population fluctuations of mites (Wallwork 1976; Sheals 1957; Dillon et al. 1962). In the present study, temperature and /or moisture were frequently correlated to seasonal abundance.

These edaphic variables generally explained less than 30% of observed variation, and interpretaion must be cautious. In the case of Eupodes spp., for example, a positive relationship between temperature and abundance indicates that the animals were not adversely affected by high temperatures, but does imply a causative effect. In general, however, temperature and moisture were shown to contribute significantly to seasonal as well as year-to-year differences in density.

With regard to the central question, i.e., the potential effect of grass species on mite populations, there is almost no published work to draw on. Alejnikova et al. (1975) found that different plant covers greatly affected the structure of soil animal populations. More pertinent, Christen (1974) concluded that pasture crops with dense root systems supported the largest populations of soil arthropods.

The present study, given that soil type, climate, etc... were the same for all turf blocks, does not allow some general conclusions with respect to turfgrass effects. For several mite taxa, smooth bromegrass, Kentucky bluegrass and orchardgrass led in terms of supporting highest populations. Tall fescue was preferred by Hypoaspis aculeifer, and redtop by Tydeus bedfordiensis in both years.

The first three of these grasses have extensive root systems which may promote fungal and bacterial colonies on which microbial feeders could thrive. Tarsonemus spp. and Bakerdania spp. fall in this catagory (Kethley 1982). Interpretaion becomes tenuous in cases where yearly abundance shifted between grasses: this occurred in two taxa for which feeding preferences are not known, *Eupodes* spp. and *Metapronematus leucohippeus*. Apparently, interactions between climatic factors, root development and the mites' food sources allowed them to be more flexible in terms of population growth under different grasses.

Annual versus perennial root systems surely result in differing patterns of seasonal root distribution, turnover and decay. Redtop with its annual roots promoted populations of *Tydeus bedfordiensis*, a probable fungivore (Kethley 1982); a postulated system-specific fungal flora, differing from that under other grasses, may explain the tight link between this mite species and redtop.

The present study must be considered a pilot effort, aimed at a single faunal complement (Acarina). Without extensive investigation of other faunal and floral system components, any discussion remains conjectural, however, that significant three-way interactions (grass x dates x depths) existed for every single investigated taxon, in one or some times both years. These results again indicate that turfgrasses differ in the below-ground habitats they create, leading to grass-specific variability in vertical distribution, seasonal fluctualtion, and overall abundance of many mite taxa.

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APPENDIX A

Tables of sample means per grass and date

Order: Prostigmata

1985 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	7.0	19.0	8.0	1.0	6.3	13.3
May 1 :	12.7	5.3	4.7	6.7	1.3	8.3
May 15 :	9.7	15.0	11.7	16.7	1.3	0.7
June 1 :	10.7	20.0	5.3	16.3	4.0	6.7
June 15 :	11.0	21.0	8.0	8.0	9.7	2.7
July 1 :	4.7	10.7	31.3	12.0	24.3	23.3
July 15 :	21.7	6.0	10.0	2.7	9.0	20.7
Aug 1 :	8.0	6.0	7.7	5.0	8.0	8.7
Aug 15 :	7.3	3.7	16.7	7.0	4.7	2.0
Sept 1 :	13.0	0.0	0.7	3.0	5.7	2.0
Sept 15 :	3.0	2.3	13.0	1.0	6.3	6.7
Oct 1 :	17.0	12.3	13.7	8.0	12.0	9.3
Oct 15 :	4.7	9.7	7.7	5.7	33.0	8.0
Nov 1 :	4.0	3.0	4.0	8.7	6.3	12.7
Nov 15 :	6.7	3.7	9.0	8.0	7.7	6.0
Dec 1 :	16.3	1.3	9.7	3.7	1.7	4.7

1985 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	9.3	5.0	3.3	1.7	2.3	10.3
May 1 :	1.0	5.0	3.3	5.0	8.3	1.0
May 15 :	2.7	5.7	1.7	8.3	0.0	0.7
June 1 :	3.0	5.7	1.0	4.3	2.3	13.0
June 15 :	7.7	10.7	3.7	1.7	5.7	1.3
July 1 :	7.0	6.0	11.3	5.3	10.3	12.3
July 15 :	16.3	10.0	3.0	4.3	0.3	5.3
Aug 1 :	3.3	2.0	3.3	2.0	4.3	1.7
Aug 15 :	2.3	2.3	4.0	0.7	2.0	8.0
Sept 1 :	3.3	2.0	0.7	6.3	3.7	4.0
Sept 15 :	3.0	1.7	1.7	3.0	0.0	1.7
Oct 1 :	4.0	17.3	4.0	6.7	14.0	2.0
Oct 15 :	42.3	2.7	0.7	7.0	2.3	7.7
Nov 1 :	0.7	3.3	9.0	2.7	4.7	10.7
Nov 15 :	11.7	3.0	3.3	1.0	11.3	7.7
Dec 1 :	0.3	5.3	1.7	1.7	4.0	1.7

Tukey's MSD = 20

Order: Prostigmata
1986 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	69.0	20.3	6.7	6.3	12.0	7.0
April 15 :	8.3	9.3	3.0	5.7	4.0	1.0
May 1 :	2.7	5.0	7.0	7.0	3.7	6.0
May 15 :	11.0	2.0	2.3	5.7	5.3	5.3
June 1 :	17.7	17.7	4.7	4.3	2.7	6.0
June 15 :	17.7	25.0	12.3	13.3	35.7	15.7
July 1 :	26.0	8.7	7.7	19.3	10.3	26.7
July 15 :	21.7	12.7	24.3	57.7	31.7	110.7
Aug 1 :	30.3	30.0	33.0	33.3	20.0	17.7
Aug 15 :	13.0	30.7	10.7	32.0	18.3	21.0
Sept 1 :	4.0	4.3	20.3	18.3	4.0	1.3
Sept 15 :	22.3	18.3	31.3	24.0	4.0	24.0
Oct 1 :	13.7	335.3	8.7	7.7	7.7	75.0
Oct 15 :	19.3	29.7	7.7	6.7	1.7	4.3
Nov 1 :	12.7	8.0	4.3	24.7	4.3	6.3
Nov 15 :	8.0	2.3	8.3	11.0	1.3	2.3
Dec 1 :	1.7	10.3	0.3	10.0	2.0	0.7

1986 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	50.0	21.7	4.7	4.0	4.3	11.3
April 15 :	15.0	2.7	4.0	3.3	4.3	3.3
May 1 :	2.0	2.3	2.3	4.3	6.0	2.0
May 15 :	2.0	3.0	0.7	6.7	2.0	0.7
June 1 :	7.7	16.0	2.7	1.0	1.7	18.0
June 15 :	34.0	47.3	23.7	12.0	58.3	29.0
July 1 :	12.0	21.3	12.7	12.0	10.0	50.7
July 15 :	58.0	35.7	47.3	50.0	41.3	67.7
Aug 1 :	42.7	21.0	24.7	36.0	13.0	30.7
Aug 15 :	19.0	14.0	21.0	49.7	8.0	10.0
Sept 1 :	6.3	18.7	18.3	8.7	5.7	2.7
Sept 15 :	22.0	19.7	7.3	11.3	16.0	3.7
Oct 1 :	369.7	30.7	65.3	45.7	4.7	88.0
Oct 15 :	6.0	6.7	8.3	23.3	5.7	4.3
Nov 1 :	4.7	5.3	5.3	2.3	3.7	3.0
Nov 15 :	4.3	2.3	2.7	4.3	1.7	1.0
Dec 1 :	1.0	1.0	2.0	3.3	0.7	1.0

Tukey's MSD = 118

Genus: Tarsonemus

1985 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	1.3	2.0	1.3	0.7	1.3	5.3
May 1 :	4.0	0.7	1.7	2.3	0.3	2.0
May 15 :	0.7	3.0	3.3	3.3	1.3	0.3
June 1 :	2.7	5.7	0.0	3.3	1.7	3.0
June 15 :	6.3	10.0	2.0	2.0	2.0	1.0
July 1 :	1.0	1.3	2.3	2.7	4.3	4.7
July 15 :	10.7	1.0	0.7	0.0	1.7	3.3
Aug 1 :	0.7	0.0	0.0	0.3	2.7	0.0
Aug 15 :	0.0	0.3	0.7	0.0	0.0	0.3
Sept 1 :	11.0	0.0	0.3	0.0	0.3	1.3
Sept 15 :	0.7	0.3	4.0	0.0	0.3	0.3
Oct 1 :	0.7	2.3	2.7	1.7	3.3	4.0
Oct 15 :	3.0	3.0	1.3	1.3	3.3	1.7
Nov 1 :	1.0	2.0	0.3	1.7	0.3	2.7
Nov 15 :	0.7	1.3	3.7	1.3	1.0	1.3
Dec 1 :	0.3	0.3	1.7	0.0	0.3	0.0

1985 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	5.3	0.7	0.0	1.0	0.7	4.0
May 1 :	0.0	0.7	0.7	1.0	2.7	0.0
May 15 :	0.0	0.7	0.7	1.3	0.0	0.7
June 1 :	0.7	2.0	0.3	2.3	0.0	8.3
June 15 :	4.3	0.7	1.7	0.0	2.0	0.7
July 1 :	2.3	3.0	5.0	1.7	2.7	3.3
July 15 :	7.0	3.7	1.0	0.0	0.3	1.7
Aug 1 :	0.3	0.3	0.3	0.0	1.3	0.3
Aug 15 :	0.0	0.3	0.3	0.0	0.3	0.3
Sept 1 :	0.0	0.3	0.0	1.7	1.0	2.3
Sept 15 :	0.3	1.0	0.3	0.0	0.0	0.0
Oct 1 :	0.7	3.0	1.7	2.0	0.7	0.0
Oct 15 :	3.3	0.3	0.0	2.0	0.7	1.7
Nov 1 :	0.0	0.7	1.7	1.0	2.3	1.7
Nov 15 :	3.3	0.0	0.7	0.3	1.3	0.0
Dec 1 :	0.0	0.0	0.3	0.3	0.3	0.0

Tukey's MSD = 6.6

Genus: Tarsonemus

1986 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	1.7	3.7	0.7	1.0	2.0	0.3
April 15 :	0.7	1.0	0.7	1.0	0.3	0.3
May 1 :	0.0	0.0	2.0	2.3	0.3	0.0
May 15 :	0.3	0.3	0.3	3.3	3.3	0.7
June 1 :	11.7	6.0	1.7	1.3	0.0	1.7
June 15 :	6.7	12.7	3.7	5.3	22.0	6.0
July 1 :	18.7	4.0	6.0	9.0	5.7	14.0
July 15 :	16.7	9.3	18.7	40.0	22.7	77.0
Aug 1 :	9.3	15.3	20.3	13.3	7.7	7.0
Aug 15 :	3.3	9.7	3.7	12.0	9.0	7.7
Sept 1 :	0.7	1.0	9.0	3.0	0.0	0.7
Sept 15 :	11.0	10.3	21.7	10.3	2.3	8.3
Oct 1 :	8.7	278.7	5.7	5.7	3.3	64.0
Oct 15 :	4.7	10.7	3.3	4.3	1.0	0.7
Nov 1 :	5.0	4.0	2.3	17.0	0.7	2.0
Nov 15 :	3.7	1.0	4.0	2.3	0.7	0.3
Dec 1 :	0.0	2.0	0.0	0.3	0.3	0.0

1986 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	2.7	1.7	1.0	1.3	0.3	2.3
April 15 :	8.7	0.0	0.7	0.3	0.0	0.3
May 1 :	0.3	0.0	0.0	1.7	0.3	0.3
May 15 :	0.0	0.0	0.7	4.3	1.0	0.7
June 1 :	4.0	4.3	0.0	0.3	0.3	7.7
June 15 :	21.7	17.0	13.3	4.7	43.3	19.3
July 1 :	4.7	16.3	8.3	8.0	3.0	39.3
July 15 :	43.3	23.7	29.3	42.7	27.3	48.7
Aug 1 :	37.3	12.0	16.7	25.0	6.0	25.7
Aug 15 :	5.7	3.3	12.7	40.3	5.0	7.0
Sept 1 :	2.0	4.3	1.0	2.3	0.7	0.0
Sept 15 :	16.0	13.3	4.7	3.3	7.7	3.0
Oct 1 :	327.7	21.0	51.7	36.3	3.3	75.3
Oct 15 :	2.7	4.0	2.3	5.3	2.0	1.3
Nov 1 :	1.7	2.3	2.0	1.0	1.3	2.0
Nov 15 :	2.0	0.3	0.0	0.3	0.3	0.3
Dec 1 :	0.7	0.0	0.7	0.3	0.0	0.0

Tukey's MSD = 102

Genus: Bakerdania
1985 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	4.3	8.0	2.0	0.0	1.3	1.7
May 1 :	0.3	0.0	1.0	0.0	0.3	0.3
May 15 :	1.0	2.7	2.0	2.0	0.0	0.0
June 1 :	1.3	0.3	0.3	0.0	0.0	0.0
June 15 :	0.0	1.7	1.0	0.0	0.0	0.0
July 1 :	1.7	0.7	0.0	0.0	0.0	0.0
July 15 :	0.7	0.7	0.0	0.0	0.0	0.0
Aug 1 :	0.7	0.0	0.7	0.0	0.0	0.0
Aug 15 :	0.7	0.3	2.0	0.0	0.0	0.0
Sept 1 :	0.0	0.0	0.0	2.0	0.0	0.0
Sept 15 :	0.7	0.0	1.0	0.0	0.0	0.3
Oct 1 :	1.3	1.0	1.0	1.3	1.7	0.0
Oct 15 :	2.7	1.0	1.0	1.3	3.0	0.0
Nov 1 :	1.0	0.3	0.0	1.3	0.7	0.3
Nov 15 :	1.7	0.7	1.0	0.7	1.7	2.3
Dec 1 :	8.0	1.0	3.3	0.3	0.3	0.0

1985 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	1.3	1.7	2.0	0.0	0.7	1.0
May 1 :	0.7	2.7	0.3	1.7	0.7	0.0
May 15 :	0.0	0.3	0.0	1.0	0.0	0.0
June 1 :	1.3	1.0	0.0	0.0	0.3	0.0
June 15 :	1.0	7.3	0.0	0.0	1.0	0.0
July 1 :	1.7	0.3	0.0	0.0	0.0	0.0
July 15 :	1.0	1.0	0.0	0.0	0.0	0.0
Aug 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Aug 15 :	0.3	0.3	0.0	0.0	0.0	0.0
Sept 1 :	0.3	0.3	0.0	0.0	1.7	0.0
Sept 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Oct 1 :	0.3	3.0	0.3	0.0	0.0	0.3
Oct 15 :	0.3	0.7	0.0	0.0	0.0	0.3
Nov 1 :	0.7	1.7	0.3	0.0	0.0	0.0
Nov 15 :	1.0	0.7	0.7	0.0	0.7	0.0
Dec 1 :	0.0	3.3	0.0	0.0	0.7	0.3

Tukey's MSD = 3.6

Genus: Bakerdania
1986 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	4.7	8.7	0.3	1.7	4.7	1.3
April 15 :	5.0	5.3	0.3	0.3	1.7	0.0
May 1 :	0.0	3.0	2.3	0.0	1.0	0.3
May 15 :	1.0	0.3	0.3	0.3	0.0	0.0
June 1 :	0.7	2.7	0.3	0.7	0.3	0.0
June 15 :	0.3	0.0	0.3	0.0	0.3	0.0
July 1 :	1.0	2.0	0.0	0.3	0.3	0.0
July 15 :	0.0	0.0	0.0	2.0	0.0	0.3
Aug 1 :	1.7	0.0	1.0	0.3	0.0	0.0
Aug 15 :	0.0	7.3	0.0	0.3	0.7	0.7
Sept 1 :	0.0	0.0	0.0	1.7	0.0	0.0
Sept 15 :	0.0	1.0	1.3	6.0	0.0	0.3
Oct 1 :	0.3	1.3	0.0	0.3	0.0	0.0
Oct 15 :	0.0	1.0	0.0	0.3	0.0	0.3
Nov 1 :	1.3	0.7	0.0	0.0	0.0	0.3
Nov 15 :	1.0	1.0	0.3	5.3	0.0	0.0
Dec 1 :	0.3	7.0	0.0	5.0	0.3	0.3

1986 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	3.7	5.0	0.0	0.0	0.0	0.3
April 15 :	2.0	2.3	0.7	0.0	0.0	0.0
May 1 :	1.0	1.0	0.0	0.0	0.7	0.0
May 15 :	0.0	1.7	0.0	0.3	0.0	0.0
June 1 :	1.7	3.7	0.7	0.0	0.0	1.7
June 15 :	0.0	1.7	0.0	0.0	0.0	0.3
July 1 :	1.7	0.0	0.3	1.0	0.0	0.0
July 15 :	0.0	0.7	0.0	0.0	0.0	0.0
Aug 1 :	0.0	0.3	0.0	0.3	0.0	0.0
Aug 15 :	0.7	0.3	0.0	1.0	0.0	0.0
Sept 1 :	0.0	0.7	0.0	1.7	0.0	0.0
Sept 15 :	0.0	0.0	0.0	1.3	0.3	0.0
Oct 1 :	0.3	0.0	0.0	0.3	0.0	0.0
Oct 15 :	0.0	0.0	0.0	0.7	0.0	0.0
Nov 1 :	0.3	0.3	0.0	0.0	0.0	0.0
Nov 15 :	1.0	1.0	0.0	2.7	0.0	0.0
Dec 1 :	0.0	0.0	0.0	0.0	0.0	0.0

Tukey's MSD = 4.7

Genus: Eupodes

1985 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	0.0	1.0	0.7	0.0	0.0	0.0
May 1 :	0.0	0.7	0.3	0.7	0.0	0.0
May 15 :	0.0	1.3	1.3	1.3	0.0	0.0
June 1 :	0.3	3.3	3.3	6.3	0.0	0.0
June 15 :	1.0	1.0	1.7	0.0	1.3	0.0
July 1 :	0.3	2.0	7.0	2.7	10.0	0.0
July 15 :	3.0	1.0	3.0	0.0	4.0	0.7
Aug 1 :	1.7	0.0	1.0	1.0	0.0	0.0
Aug 15 :	0.7	3.3	1.7	0.0	1.3	1.3
Sept 1 :	0.0	0.0	0.0	0.0	2.0	0.7
Sept 15 :	0.3	0.7	1.7	0.0	1.3	0.3
Oct 1 :	0.7	0.0	1.3	0.3	0.7	0.0
Oct 15 :	0.3	0.0	1.3	0.0	1.3	0.3
Nov 1 :	0.0	0.3	0.3	0.0	0.0	1.7
Nov 15 :	0.0	0.3	0.7	0.0	0.7	0.7
Dec 1 :	1.0	0.0	2.3	1.0	0.3	0.0

1985 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	0.0	0.0	0.0	0.0	0.0	0.0
May 1 :	0.0	0.3	0.0	0.3	0.0	0.0
May 15 :	0.0	0.7	0.0	0.7	0.0	0.0
June 1 :	0.0	0.0	0.0	0.0	0.0	0.0
June 15 :	0.7	0.0	0.0	0.0	0.0	0.3
July 1 :	0.3	0.0	0.0	0.0	0.0	0.0
July 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Aug 1 :	0.0	0.0	0.0	0.0	0.3	0.0
Aug 15 :	0.7	0.0	0.0	0.0	0.0	0.0
Sept 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Sept 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Oct 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Oct 15 :	0.0	0.0	0.0	0.0	0.0	0.3
Nov 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 15 :	0.0	0.0	0.0	0.0	0.3	0.0
Dec 1 :	0.0	0.0	0.0	0.0	0.7	0.7

Tukey's MSD = 2.5

Genus: Eupodes
1986 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	0.0	0.0	0.7	0.7	1.0	0.0
April 15 :	0.0	0.0	0.0	0.0	0.0	0.0
May 1 :	0.0	0.3	0.3	0.7	0.0	0.0
May 15 :	0.0	0.0	0.0	0.0	0.0	1.0
June 1 :	0.3	0.0	0.3	0.0	0.0	0.0
June 15 :	0.0	0.0	0.0	0.0	0.0	0.0
July 1 :	0.0	0.0	0.7	0.0	0.3	0.7
July 15 :	0.0	0.0	0.0	0.0	0.3	2.0
Aug 1 :	3.0	0.3	0.3	0.7	2.0	1.7
Aug 15 :	1.3	0.0	0.3	3.0	1.7	6.0
Sept 1 :	0.0	0.0	1.3	1.0	2.0	0.0
Sept 15 :	0.3	0.0	0.0	0.7	0.0	1.3
Oct 1 :	0.0	0.0	0.0	0.0	0.3	0.0
Oct 15 :	0.0	0.0	0.0	0.0	0.3	0.0
Nov 1 :	0.0	0.3	0.0	0.0	0.0	0.0
Nov 15 :	0.0	0.0	0.3	1.0	0.0	1.0
Dec 1 :	0.0	0.0	0.0	1.7	0.0	0.3

1986 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	0.0	0.3	0.0	0.0	0.0	0.0
April 15 :	0.0	0.0	0.0	0.0	0.0	0.0
May 1 :	0.0	0.0	0.0	0.3	0.7	0.0
May 15 :	0.0	0.0	0.0	0.0	0.0	0.0
June 1 :	0.0	0.0	0.0	0.0	0.0	0.0
June 15 :	0.0	0.0	0.0	0.0	0.0	0.0
July 1 :	0.0	0.0	0.0	0.0	0.0	0.0
July 15 :	0.0	0.0	0.0	0.0	0.3	0.0
Aug 1 :	0.0	0.0	0.0	0.0	0.0	0.3
Aug 15 :	0.3	1.0	0.0	0.7	0.0	0.3
Sept 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Sept 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Oct 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Oct 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Dec 1 :	0.0	0.0	0.0	0.0	0.0	0.0

Tukey's MSD = 1.99

Tyeus bedfordiensis

1985 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	0.7	1.0	0.0	0.3	0.7	0.7
May 1 :	0.7	0.7	1.0	0.0	0.0	1.0
May 15 :	0.0	2.0	0.0	1.0	0.0	0.0
June 1 :	0.7	0.0	0.0	0.0	0.0	0.7
June 15 :	0.0	0.0	0.0	0.0	0.0	0.0
July 1 :	0.7	0.0	0.3	1.0	1.0	9.0
July 15 :	1.0	0.7	0.0	0.0	0.0	1.0
Aug 1 :	1.3	0.0	1.7	0.3	0.0	0.7
Aug 15 :	1.3	0.3	0.0	0.3	0.0	0.3
Sept 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Sept 15 :	0.0	0.0	0.0	0.0	0.3	0.0
Oct 1 :	0.3	0.0	0.3	1.0	0.0	0.3
Oct 15 :	0.0	0.0	0.0	0.0	0.7	0.3
Nov 1 :	0.0	0.0	0.0	0.0	0.0	0.3
Nov 15 :	0.3	0.3	0.0	0.0	0.0	0.0
Dec 1 :	0.3	0.0	0.0	0.0	0.0	0.7

1985 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	0.3	0.0	0.0	0.0	0.3	0.7
May 1 :	0.0	0.3	0.7	0.3	0.7	0.0
May 15 :	0.0	1.0	0.0	0.3	0.0	0.0
June 1 :	0.0	0.0	0.0	0.0	0.0	0.0
June 15 :	0.0	0.3	0.0	0.0	0.0	0.0
July 1 :	0.0	0.0	1.0	2.3	3.0	4.0
July 15 :	0.7	0.7	0.3	0.0	0.0	0.0
Aug 1 :	0.3	0.3	0.3	0.3	0.3	0.7
Aug 15 :	0.0	0.0	1.0	0.7	0.0	0.0
Sept 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Sept 15 :	0.7	0.0	0.0	1.0	0.0	0.3
Oct 1 :	0.0	0.3	0.0	0.3	0.0	0.3
Oct 15 :	0.7	0.0	0.0	0.0	0.0	0.0
Nov 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Dec 1 :	0.0	0.0	0.0	0.0	0.0	0.0

Tukey's MSD = 2.2

Tyeus bedfordiensis
1986 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	0.0	0.3	0.3	0.3	0.0	0.0
April 15 :	0.0	0.7	0.0	0.0	0.0	0.0
May 1 :	0.0	0.3	0.0	0.0	0.0	0.7
May 15 :	0.0	0.0	0.0	0.3	0.0	0.7
June 1 :	0.3	0.7	0.3	0.3	0.0	0.3
June 15 :	0.7	2.0	1.3	0.7	0.0	3.3
July 1 :	0.0	0.7	0.0	0.3	2.0	3.0
July 15 :	0.3	0.3	1.7	0.7	2.3	2.7
Aug 1 :	2.0	0.0	3.7	2.3	2.3	1.7
Aug 15 :	0.0	0.0	0.3	0.0	2.3	0.7
Sept 1 :	0.0	0.0	0.0	0.3	0.0	0.0
Sept 15 :	0.0	0.0	0.0	0.0	0.3	0.0
Oct 1 :	0.0	0.0	0.3	0.0	1.0	0.3
Oct 15 :	0.7	0.0	0.0	0.0	0.0	0.7
Nov 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 15 :	0.3	0.0	0.3	0.7	0.0	0.0
Dec 1 :	0.0	0.3	0.0	0.0	0.0	0.0

1986 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	0.3	0.0	0.0	0.3	0.0	0.3
April 15 :	0.3	0.0	0.0	0.3	0.3	0.3
May 1 :	0.0	0.0	0.7	0.3	0.0	0.0
May 15 :	0.0	0.0	0.0	0.0	0.0	0.0
June 1 :	0.7	0.0	0.3	0.0	0.0	1.3
June 15 :	0.7	1.0	0.7	4.3	3.0	0.3
July 1 :	1.7	0.3	0.0	0.3	1.0	0.7
July 15 :	1.0	0.0	1.3	0.3	3.7	1.0
Aug 1 :	0.0	0.0	0.0	0.0	1.7	3.0
Aug 15 :	0.7	0.3	0.3	1.0	0.3	0.7
Sept 1 :	1.0	3.0	0.0	0.0	0.0	0.7
Sept 15 :	0.0	0.0	0.0	0.0	1.0	0.0
Oct 1 :	0.0	1.0	0.0	0.0	0.0	1.3
Oct 15 :	0.0	0.0	0.0	0.3	0.3	0.0
Nov 1 :	0.0	0.0	0.3	0.0	0.7	0.3
Nov 15 :	0.0	0.0	0.0	0.0	0.0	0.3
Dec 1 :	0.0	0.0	0.0	0.3	0.0	0.0

Tukey's MSD = 2.4

Metapronematus Leucohippeus
1985 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	0.3	0.7	0.0	0.0	0.3	0.3
May 1 :	0.0	0.0	0.0	0.7	0.0	0.7
May 15 :	0.0	1.0	1.0	0.7	0.0	0.0
June 1 :	2.7	0.3	0.0	0.0	0.0	0.3
June 15 :	0.3	0.0	0.0	0.0	0.3	0.0
July 1 :	0.0	0.0	1.7	0.0	1.0	2.0
July 15 :	0.3	1.0	0.0	0.0	0.0	0.0
Aug 1 :	1.3	0.3	0.0	1.0	0.0	0.0
Aug 15 :	0.7	0.0	0.0	0.3	0.3	0.0
Sept 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Sept 15 :	0.3	0.0	0.0	0.0	0.0	0.0
Oct 1 :	0.0	1.3	0.0	0.3	0.0	0.0
Oct 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 1 :	0.3	0.0	0.3	0.7	0.3	0.0
Nov 15 :	0.0	0.3	0.0	0.0	0.0	0.0
Dec 1 :	0.0	0.0	0.0	0.0	0.0	0.0

1985 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	0.0	0.0	0.0	0.3	0.0	0.3
May 1 :	0.0	0.0	0.0	0.0	0.0	0.3
May 15 :	0.0	0.0	0.0	0.3	0.0	0.0
June 1 :	0.3	0.7	0.3	1.0	1.0	0.7
June 15 :	0.0	0.0	0.3	1.3	0.3	0.0
July 1 :	1.3	0.0	0.3	0.3	1.0	2.7
July 15 :	1.0	1.0	0.3	3.0	0.0	1.0
Aug 1 :	0.3	0.0	1.0	0.3	0.3	0.3
Aug 15 :	0.0	0.0	0.7	0.0	0.7	4.3
Sept 1 :	0.0	0.0	0.0	1.3	0.0	0.0
Sept 15 :	0.3	0.3	0.0	0.3	0.0	0.0
Oct 1 :	0.0	0.0	0.0	0.3	0.7	0.0
Oct 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Dec 1 :	0.0	0.0	0.0	0.0	0.0	0.0

Tukey's MSD = 1.9

Metapronematus Leucohippeus

1986 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	0.0	0.0	0.0	0.3	0.0	0.0
April 15 :	0.3	0.0	0.0	0.0	0.0	0.0
May 1 :	0.0	0.0	0.3	0.7	0.7	0.3
May 15 :	0.0	0.0	0.0	0.0	0.0	0.0
June 1 :	0.0	0.0	0.0	0.0	0.0	0.0
June 15 :	0.0	0.0	0.0	0.3	0.7	0.3
July 1 :	0.0	0.0	0.0	0.0	0.0	0.3
July 15 :	0.0	0.0	0.7	0.3	0.0	0.3
Aug 1 :	2.0	0.0	0.7	0.3	0.0	0.7
Aug 15 :	0.7	0.0	0.0	0.0	0.0	0.7
Sept 1 :	2.0	1.7	6.7	0.0	0.0	0.0
Sept 15 :	0.3	2.7	1.0	0.3	0.0	0.3
Oct 1 :	0.7	0.7	0.0	0.0	0.3	1.0
Oct 15 :	8.7	11.7	1.7	1.0	0.0	1.3
Nov 1 :	1.3	1.0	0.0	0.0	0.7	0.7
Nov 15 :	0.3	0.0	0.0	0.0	0.0	0.0
Dec 1 :	0.0	0.0	0.0	0.0	0.0	0.0

1986 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	0.0	0.0	0.0	0.0	0.0	0.3
April 15 :	0.0	0.0	0.0	0.0	0.7	0.0
May 1 :	0.0	0.3	0.0	0.0	0.3	0.3
May 15 :	0.0	0.3	0.0	0.0	0.0	0.0
June 1 :	0.0	0.0	0.0	0.0	0.0	0.7
June 15 :	0.0	0.0	0.0	0.0	0.0	0.0
July 1 :	0.0	0.0	0.0	0.3	0.0	0.0
July 15 :	0.0	0.3	0.3	0.7	0.3	0.0
Aug 1 :	0.0	0.3	0.0	0.0	0.3	0.0
Aug 15 :	0.0	0.3	0.7	0.0	0.3	0.3
Sept 1 :	0.0	2.0	1.7	0.0	0.7	0.3
Sept 15 :	0.0	2.0	0.3	0.3	0.0	0.0
Oct 1 :	0.0	1.3	2.7	0.7	0.0	3.3
Oct 15 :	2.3	2.3	5.0	14.0	1.3	1.0
Nov 1 :	0.7	0.3	1.0	0.0	0.3	0.3
Nov 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Dec 1 :	0.0	0.0	0.0	0.0	0.0	0.0

Tukey's MSD = 3.9

Rhoacarellus silesiacus
1985 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	0.7	1.0	3.3	0.3	2.7	0.0
May 1 :	12.3	3.0	5.7	0.3	0.0	0.3
May 15 :	4.7	2.0	1.7	2.0	0.0	0.3
June 1 :	0.7	0.0	0.0	0.0	2.7	0.0
June 15 :	3.0	10.0	6.7	0.7	0.0	0.0
July 1 :	1.3	3.3	1.7	1.7	3.0	0.0
July 15 :	4.3	0.3	4.0	1.7	0.7	0.0
Aug 1 :	5.7	1.7	2.0	5.0	0.0	0.0
Aug 15 :	0.7	0.0	5.7	0.7	0.3	0.0
Sept 1 :	5.7	0.0	0.7	0.0	0.0	0.0
Sept 15 :	0.7	1.7	9.0	0.0	0.0	0.0
Oct 1 :	13.3	1.3	6.0	4.3	0.3	0.0
Oct 15 :	2.0	1.7	2.7	0.3	1.3	1.3
Nov 1 :	1.3	2.3	0.7	1.7	0.7	0.0
Nov 15 :	0.7	0.0	4.0	0.0	1.0	1.3
Dec 1 :	10.7	1.0	2.7	0.7	0.0	0.0

1985 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	1.0	2.0	0.7	0.0	0.0	0.0
May 1 :	4.7	0.7	1.3	0.7	0.0	0.0
May 15 :	2.0	0.3	2.3	0.3	0.0	0.0
June 1 :	0.3	0.0	0.0	0.0	0.0	0.0
June 15 :	2.3	0.0	4.0	0.7	0.0	0.0
July 1 :	2.0	2.7	2.0	0.7	0.0	0.0
July 15 :	1.7	2.0	1.3	0.0	0.0	0.0
Aug 1 :	2.0	5.0	5.3	2.0	0.0	0.0
Aug 15 :	4.0	0.3	5.3	1.0	0.0	0.0
Sept 1 :	2.0	1.0	1.0	0.7	0.0	0.0
Sept 15 :	2.7	0.3	2.3	0.3	0.0	0.0
Oct 1 :	2.3	19.0	8.3	1.3	0.0	0.3
Oct 15 :	47.0	2.3	4.7	0.7	0.0	1.0
Nov 1 :	1.7	5.3	39.3	0.3	1.0	0.3
Nov 15 :	10.7	2.3	7.7	0.7	0.3	0.7
Dec 1 :	11.7	4.0	6.0	1.3	1.0	1.0

Tukey's MSD = 11.7

Rhoacarellus silesiacus
1986 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	7.7	2.3	7.3	2.0	1.0	0.7
April 15 :	8.3	5.7	15.3	3.3	0.7	0.0
May 1 :	4.7	14.3	16.7	1.7	0.0	0.0
May 15 :	10.0	1.3	5.3	0.0	0.0	0.0
June 1 :	0.3	1.0	3.0	0.3	0.0	0.0
June 15 :	0.3	1.7	2.3	0.3	2.7	0.0
July 1 :	1.0	0.7	0.3	2.7	0.0	0.0
July 15 :	0.0	0.3	0.3	2.7	0.7	0.3
Aug 1 :	1.3	3.0	1.0	1.7	0.0	0.3
Aug 15 :	1.3	2.3	2.0	1.7	1.0	1.0
Sept 1 :	0.3	0.0	0.0	4.7	0.0	0.0
Sept 15 :	0.0	1.0	2.0	3.3	0.3	0.7
Oct 1 :	0.0	1.3	0.0	0.0	0.0	0.3
Oct 15 :	0.0	0.3	0.3	0.7	0.0	0.0
Nov 1 :	0.0	3.3	0.0	0.7	0.3	0.0
Nov 15 :	0.3	1.0	0.7	0.3	0.0	0.0
Dec 1 :	0.0	0.7	0.0	0.0	0.0	0.0

1986 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	23.7	8.3	9.0	2.7	0.0	0.0
April 15 :	3.3	6.7	11.3	0.7	3.0	0.0
May 1 :	2.3	1.3	6.3	0.3	0.0	0.0
May 15 :	1.7	0.0	1.3	0.0	0.0	0.0
June 1 :	0.0	3.7	1.0	0.0	0.3	0.0
June 15 :	0.3	0.3	0.0	0.0	0.0	0.0
July 1 :	0.0	0.3	0.0	0.3	0.0	0.0
July 15 :	0.0	0.3	0.0	0.7	0.0	0.0
Aug 1 :	0.3	1.0	1.0	0.0	0.0	0.0
Aug 15 :	0.0	0.7	0.3	2.0	0.0	0.0
Sept 1 :	0.7	0.0	0.0	2.0	0.0	0.0
Sept 15 :	0.3	4.0	0.0	1.0	1.0	0.3
Oct 1 :	0.0	0.0	0.7	0.7	0.0	0.3
Oct 15 :	0.0	2.3	3.7	3.3	1.3	0.7
Nov 1 :	0.3	1.3	0.3	0.7	0.3	0.3
Nov 15 :	0.3	1.7	4.0	3.0	0.3	0.3
Dec 1 :	0.0	1.3	0.7	2.0	0.0	1.0

Tukey's MSD = 7

Hypoaspis aculifer
1985 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	0.0	0.0	0.0	0.0	0.3	0.0
May 1 :	0.0	0.3	0.0	0.0	0.7	0.0
May 15 :	0.0	0.3	0.0	0.0	0.0	0.0
June 1 :	0.0	0.0	0.0	0.0	0.3	0.3
June 15 :	0.0	0.3	0.0	0.0	3.0	0.3
July 1 :	0.0	0.0	0.0	0.0	0.0	0.0
July 15 :	0.0	0.0	0.0	0.0	1.7	1.0
Aug 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Aug 15 :	0.0	0.3	0.3	0.0	2.0	0.0
Sept 1 :	0.0	0.0	0.0	0.0	4.0	0.7
Sept 15 :	0.0	0.3	0.0	0.0	0.0	0.0
Oct 1 :	0.0	0.3	0.0	0.0	5.7	0.0
Oct 15 :	0.0	0.0	0.0	0.0	4.3	0.3
Nov 1 :	0.3	0.3	0.0	0.0	1.7	0.0
Nov 15 :	0.0	0.0	0.0	0.0	2.7	0.0
Dec 1 :	0.0	0.3	0.0	0.0	0.3	0.0

1985 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :						
April 15 :	0.0	0.0	0.0	0.0	0.3	0.0
May 1 :	0.0	0.0	0.0	0.0	0.0	0.3
May 15 :	0.0	0.0	0.0	0.0	0.0	0.3
June 1 :	0.0	0.0	0.0	0.0	0.0	0.0
June 15 :	0.0	0.3	0.0	0.0	0.0	0.0
July 1 :	0.0	0.0	0.0	0.3	0.0	0.0
July 15 :	0.0	0.0	0.0	0.7	0.0	0.0
Aug 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Aug 15 :	0.0	0.0	0.0	0.0	0.3	0.3
Sept 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Sept 15 :	0.0	0.0	0.0	0.0	0.7	0.0
Oct 1 :	0.0	0.0	0.0	0.0	0.3	0.0
Oct 15 :	0.0	0.3	0.0	0.0	0.0	0.0
Nov 1 :	0.3	0.0	0.3	0.0	0.0	0.0
Nov 15 :	0.0	0.0	0.0	0.0	0.7	0.3
Dec 1 :	0.0	0.3	0.0	0.0	0.3	0.0

Tukey's MSD = 1.8

Hypoaspis aculifer
1986 0 - 15 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	0.0	0.0	0.0	0.0	2.3	0.0
April 15 :	0.0	0.0	0.0	0.0	0.7	0.3
May 1 :	0.0	0.0	0.0	0.0	0.7	0.0
May 15 :	0.0	0.0	0.0	0.0	0.0	0.0
June 1 :	0.0	0.0	0.0	0.0	0.7	0.3
June 15 :	0.0	0.0	0.0	0.0	0.3	0.3
July 1 :	0.0	0.0	0.0	0.0	0.0	0.0
July 15 :	0.0	0.0	0.0	0.3	1.7	0.3
Aug 1 :	0.0	0.3	0.0	0.0	2.3	0.0
Aug 15 :	0.3	0.7	0.0	0.0	1.7	2.0
Sept 1 :	0.0	0.0	0.0	0.0	2.0	2.0
Sept 15 :	0.0	0.0	0.0	0.7	0.3	1.0
Oct 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Oct 15 :	0.0	0.0	0.0	0.0	0.0	1.7
Nov 1 :	0.0	0.0	0.0	0.0	0.0	0.7
Nov 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Dec 1 :	0.0	0.0	0.0	1.0	0.7	0.3

1986 16-30 cm

	Sm bg	Ky bg	Ordgr	Tmthy	Tl Fe	Rdtop
April 1 :	0.0	0.0	0.0	0.0	0.3	0.3
April 15 :	0.0	0.0	0.0	0.0	0.0	0.3
May 1 :	0.0	0.0	0.0	0.0	0.0	0.0
May 15 :	0.0	0.0	0.0	0.0	0.0	0.0
June 1 :	0.0	0.0	0.0	0.0	0.0	0.0
June 15 :	0.0	0.0	0.0	0.0	0.0	0.0
July 1 :	0.0	0.0	0.0	0.0	0.0	0.0
July 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Aug 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Aug 15 :	0.0	0.0	0.0	0.0	0.3	0.0
Sept 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Sept 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Oct 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Oct 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 1 :	0.0	0.0	0.0	0.0	0.0	0.0
Nov 15 :	0.0	0.0	0.0	0.0	0.0	0.0
Dec 1 :	0.0	0.0	0.0	0.0	0.0	0.0

Tukey's MSD = 1.1

APPENDIX B

ANOVA Tables

Factor A: grass type
Factor B: date
Factor C: core # (replicate)
Factor D: depth

Order: Prostigmata 1985

A N A L Y S I S O F V A R I A N C E T A B L E

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	481.306	96.261	1.2984	0.2229
Factor B	15	4013.882	267.592	3.5953	0.0000
AB	75	7643.306	101.911	1.3711	0.0156
E1(C/AB)	192	14294.333	74.450		
Factor D	1	2025.000	2025.000	29.6289	0.0000
AD	5	265.938	53.188	0.7782	
BD	15	673.389	44.893	0.6568	
ABD	75	7137.340	95.165	1.3924	0.0373
E2	192	13122.333	68.345		
Total	575	49656.826			

1986

A N A L Y S I S O F V A R I A N C E T A B L E

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	23251.778	4650.356	1.8489	0.1228
Factor B	16	257824.882	16114.055	6.4030	0.0000
AB	80	221482.667	2768.533	1.1000	0.3918
E1(C/AB)	204	513380.333	2516.570		
Factor D	1	221.281	221.281	0.0837	
AD	5	19363.464	3872.693	1.4648	0.2028
BD	16	9483.163	592.698	0.2242	
ABD	80	326833.758	4085.422	1.5453	0.0077
E2	204	539340.333	2643.825		
Total	611	1911181.660			

Factor A: grass type
Factor B: date
Factor C: core # (replicate)
Factor D: depth

Tarsonemus spp. 1985

A N A L Y S I S O F V A R I A N C E T A B L E

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	86.813	17.363	1.8310	0.0280
Factor B	15	394.000	26.267	2.7714	0.0000
AB	75	834.854	11.131	1.1745	0.0034
E1(C/AB)	192	1820.333	9.481		
Factor D	1	65.340	65.340	9.6825	0.0021
AD	5	10.931	2.186	0.3240	
BD	15	59.549	3.970	0.5883	
ABD	75	573.514	7.647	1.1332	0.2477
E2	192	1295.667	6.748		
Total	575	5141.000			

1986

A N A L Y S I S O F V A R I A N C E T A B L E

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	10318.596	2063.719	1.1111	0.3848
Factor B	16	190463.042	11903.940	6.4091	0.0000
AB	80	153937.487	1924.219	1.0366	
E1(C/AB)	204	378896.333	1897.334		
Factor D	1	1177.779	1177.779	0.6039	
AD	5	17327.289	3465.458	1.7768	0.1191
BD	16	6796.304	424.769	0.2178	
ABD	80	242394.461	3029.931	1.5535	0.0071
E2	204	397885.667	1950.420		
Total	611	1399196.959			

Factor A: grass type
Factor B: date
Factor C: core # (replicate)
Factor D: depth

<u>Bakerdania</u> spp. 1985

A N A L Y S I S O F V A R I A N C E T A B L E

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	94.938	18.988	7.6117	0.0000
Factor B	15	135.194	9.013	3.6133	0.0000
AB	75	234.618	3.128	1.2547	0.0559
E1(C/AB)	192	479.333	2.495		
Factor D	1	19.507	19.507	8.3788	0.0042
AD	5	28.556	5.711	2.4531	0.0350
BD	15	78.493	5.233	2.2477	0.0063
ABD	75	236.444	3.153	1.3541	0.0513
E2	192	447.000	2.328		
Total	575	1753.750			

1986

A N A L Y S I S O F V A R I A N C E T A B L E

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	191.366	38.273	8.8931	0.0000
Factor B	16	212.418	13.276	3.0856	0.0000
AB	80	451.190	5.640	1.3100	0.0232
E1(C/AB)	204	877.999	4.304		
Factor D	1	49.471	49.471	12.5522	0.0005
AD	5	27.392	5.478	1.3900	0.2294
BD	16	82.418	5.151	1.3070	0.1952
ABD	80	228.719	2.859	0.7254	
E2	204	804.000	3.941		
Total	611	2924.974			

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Factor A: grass type
Factor B: date
Factor C: core # (replicate)
Factor D: depth

Eupodes spp. 1985

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	29.175	5.835	5.0831	0.0004
Factor B	15	112.512	7.501	6.5347	0.0000
AB	75	203.186	2.709	2.3608	0.0000
E1(C/AB)	192	220.333	1.148		
Factor D	1	120.085	120.085	99.2382	0.0000
AD	5	35.592	7.118	5.8826	0.0000
BD	15	116.054	7.737	6.3938	0.0000
ABD	75	206.436	2.752	2.2746	0.0000
E2	192	232.333	1.210		
Total	575	1275.707			

1986

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	9.078	1.816	2.5031	0.0317
Factor B	16	54.493	3.406	4.6947	0.0000
AB	80	59.310	0.741	1.0213	0.4430
E1(C/AB)	204	148.333	0.726		
Factor D	1	20.497	20.497	28.2523	0.0000
AD	5	9.229	1.846	2.5441	0.0293
BD	16	30.781	1.924	2.6517	0.0008
ABD	80	61.493	0.769	1.0595	0.3678
E2	204	148.000	0.725		
Total	611	540.882			

Factor A: grass type
Factor B: date
Factor C: core # (replicate)
Factor D: depth

Tydeus bedfordiensis 1985

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	13.583	2.717	2.7717	0.0400
Factor B	15	105.771	7.051	9.7860	0.0000
AB	75	189.250	2.523	3.5012	0.0000
E1(C/AB)	192	138.334	0.720		
Factor D	1	2.507	2.507	2.1979	0.1398
AD	5	7.931	1.586	1.3906	0.2295
BD	15	3.215	0.214	0.1879	
ABD	75	60.347	0.805	0.7054	
E2	192	219.000	1.141		
Total	575	739.938			

1986

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	15.714	3.143	2.8930	0.0121
Factor B	16	136.951	8.559	7.8788	0.0000
AB	80	93.147	1.164	1.0261	0.2694
E1(C/AB)	204	221.667	1.087		
Factor D	1	0.132	0.132	0.1268	
AD	5	4.054	0.811	0.7765	
BD	16	21.729	1.358	1.3007	0.1991
ABD	80	123.585	1.545	1.4795	0.0147
E2	204	213.000	1.044		
Total	611	829.979			

Factor A: grass type
Factor B: date
Factor C: core # (replicate)
Factor D: depth

<u>*Metapronematus leucohippeus*</u> 1985

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	4.467	0.893	1.2865	0.2574
Factor B	15	36.679	2.445	3.5215	0.0000
AB	75	64.894	0.865	1.2469	0.0933
E1(C/AB)	192	133.333	0.694		
Factor D	1	0.766	0.766	1.1308	0.2889
AD	5	7.286	1.457	2.1523	0.0610
BD	15	14.262	0.951	1.4043	0.1483
ABD	75	61.186	0.816	1.2049	0.1570
E2	192	130.000	0.677		
Total	575	452.873			

1986

A N A L Y S I S   O F   V A R I A N C E   T A B L E

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	23.765	4.753	1.8711	0.1878
Factor B	16	582.526	36.408	14.3339	0.0000
AB	80	360.846	4.511	1.7840	0.0226
E1(C/AB)	204	518.333	2.541		
Factor D	1	0.418	0.418	0.1330	
AD	5	35.503	7.101	2.2575	0.0501
BD	16	19.859	1.241	0.3946	
ABD	80	493.552	6.169	1.9614	0.0001
E2	204	641.667	3.145		
Total	611	2676.471			

Factor A: grass type
Factor B: date
Factor C: core # (replicate)
Factor D: depth

Rhodacarellus silesiacus 1985

A N A L Y S I S   O F   V A R I A N C E   T A B L E

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	2234.625	446.925	17.6043	0.0000
Factor B	15	1201.438	80.096	3.1552	0.0001
AB	75	4535.042	60.467	2.3829	0.0000
E1(C/AB)	192	4878.331	25.387		
Factor D	1	65.340	65.340	2.5577	0.1114
AD	5	185.389	37.078	1.4514	0.2077
BD	15	1125.882	75.059	2.9381	0.0003
ABD	75	5386.389	71.819	2.8112	0.0000
E2	192	4905.000	25.547		
Total	575	24513.437			

1986

A N A L Y S I S   O F   V A R I A N C E   T A B L E

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	561.459	112.292	11.9434	0.0000
Factor B	16	1485.059	92.816	9.8730	0.0000
AB	80	2259.902	28.249	3.0052	0.0000
E1(C/AB)	204	1918.331	9.402		
Factor D	1	16.668	16.668	1.8635	0.1737
AD	5	17.577	3.515	0.3930	
BD	16	437.137	27.321	3.0545	0.0001
ABD	80	816.451	10.206	1.1410	0.2298
E2	204	1824.667	8.944		
Total	611	9336.920			

Factor A: grass type
Factor B: date
Factor C: core # (replicate)
Factor D: depth

Hypoaspis aculifer 1985

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	59.431	11.886	20.1376	0.0000
Factor B	15	14.215	0.948	1.6322	0.0816
AB	75	65.514	0.874	1.5034	0.0210
E1(C/AB)	192	111.667	0.582		
Factor D	1	10.563	10.563	17.6348	0.0000
AD	5	43.958	8.792	14.6783	0.0000
BD	15	14.049	0.937	1.5637	0.0870
ABD	75	65.431	0.872	1.4565	0.0213
E2	192	115.000	0.599		
Total	575	499.826			

1986

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob
Factor A	5	15.270	3.054	14.4100	0.0000
Factor B	16	8.641	0.540	2.5533	0.0061
AB	80	26.536	0.332	1.5733	0.0465
E1(C/AB)	204	43.300	0.212		
Factor D	1	8.708	8.708	35.5267	0.0000
AD	5	12.028	2.406	9.8147	0.0000
BD	16	7.209	0.451	1.8383	0.0283
ABD	80	24.556	0.307	1.2523	0.1057
E2	204	50.000	0.245		
Total	611	196.279			

A P P E N D I X C

Correlation and multiple regression analysis

```
        Data file : PRO85
        Title : Prostigmata 1985 depth 1

        Function : CORR
        Data case no. 1 to 192
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      12.96
Variance =       12.80

core means
Variable    9   Average =       8.83
Variance =       41.79

Number = 96

Covariance =        -5.33    Correlation =   -0.230

Intercept =    14.22    Slope =   -0.416    Standard Error =    0.181

Student's T value =     2.295    Probability =  0.024
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      16.76
Variance =       49.34

core means
Variable    9   Average =       8.83
Variance =       41.79

Number = 96

Covariance =         5.20    Correlation =    0.114

Intercept =     7.07    Slope =    0.105    Standard Error =    0.094

Student's T value =     1.117    Probability =  0.267
--------------------------------------------------------------------------------

        Data file : PRO85
        Title : Prostigmata 1985 depth 2

        Function : CORR
        Data case no. 1 to 192
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      11.44
Variance =        9.65

core means
Variable    9   Average =       5.08
Variance =       29.13

Number = 96

Covariance =        -0.02    Correlation =   -0.001

Intercept =     5.11    Slope =   -0.002    Standard Error =    0.179

Student's T value =     0.014    Probability =  0.989
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      14.81
Variance =       38.75

core means
Variable    9   Average =       5.08
Variance =       29.13

Number = 96

Covariance =        -0.45    Correlation =   -0.013

Intercept =     5.25    Slope =   -0.012    Standard Error =    0.089

Student's T value =     0.129    Probability =  0.897
--------------------------------------------------------------------------------
```

```
        Data file : PRO86
        Title : Prostigmata 1986 depth 1

        Function : CORR
        Data case no. 1 to 204
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =       15.24
Variance =        10.07

core means
Variable    9   Average =       18.12
Variance =      1273.68

Number = 102

Covariance =        23.39    Correlation =     0.207

Intercept =   -17.29    Slope =     2.324    Standard Error =     1.101

Student's T value =     2.111    Probability =  0.037
--------------------------------------------------------------------------------
temperature
Variable    8   Average =       15.35
Variance =        52.32

core means
Variable    9   Average =       18.12
Variance =      1273.68

Number = 102

Covariance =        39.76    Correlation =     0.154

Intercept =     6.45    Slope =     0.760    Standard Error =     0.488

Student's T value =     1.559    Probability =  0.122
--------------------------------------------------------------------------------

        Data file : PRO86
        Title : Prostigmata 1986 depth 2

        Function : CORR
        Data case no. 1 to 204
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =       14.05
Variance =         4.56

core means
Variable    9   Average =       19.32
Variance =      1558.81

Number = 102

Covariance =        14.00    Correlation =     0.166

Intercept =   -23.80    Slope =     3.069    Standard Error =     1.823

Student's T value =     1.684    Probability =  0.095
--------------------------------------------------------------------------------
temperature
Variable    8   Average =       14.18
Variance =        43.68

core means
Variable    9   Average =       19.32
Variance =      1558.81

Number = 102

Covariance =        59.79    Correlation =     0.229

Intercept =    -0.09    Slope =     1.369    Standard Error =     0.581

Student's T value =     2.354    Probability =  0.021
--------------------------------------------------------------------------------
```

Data file : PRO85
Title : Prostigmata 1985 depth 1

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	228.259973	2	114.12999	2.84	0.064
Residual	3741.569890	93	40.23193		
Total	3969.829863	95			

Data file : PRO85
Title : Prostigmata 1985 depth 2

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	1.235773	2	0.61789	0.02	0.979
Residual	2766.262757	93	29.74476		
Total	2767.498531	95			

Data file : PRO86
Title : Prostigmata 1986 depth 1

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	14611.674291	2	7305.83715	6.34	0.003
Residual	114029.727938	99	1151.81543		
Total	128641.402229	101			

Data file : PRO86
Title : Prostigmata 1986 depth 2

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	17906.378353	2	8953.18918	6.35	0.003
Residual	139533.594898	99	1409.43025		
Total	157439.973252	101			

Data file : TARS85
Title : Tarsonemus 1985 depth 1

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 12.96
Variance = 12.80

core means
Variable 9 Average = 1.88
Variance = 4.50

Number = 96

Covariance = -0.49 Correlation = -0.064

Intercept = 2.37 Slope = -0.038 Standard Error = 0.061

Student's T value = 0.621 Probability = 0.536

---

temperature
Variable 8 Average = 16.76
Variance = 49.34

core means
Variable 9 Average = 1.88
Variance = 4.50

Number = 96

Covariance = 1.30 Correlation = 0.088

Intercept = 1.44 Slope = 0.026 Standard Error = 0.031

Student's T value = 0.852 Probability = 0.397

Data file : TARS85
Title : Tarsonemus 1985 depth 2

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 11.44
Variance = 9.65

core means
Variable 9 Average = 1.20
Variance = 2.38

Number = 96

Covariance = -0.81 Correlation = -0.169

Intercept = 2.16 Slope = -0.084 Standard Error = 0.051

Student's T value = 1.660 Probability = 0.100

---

temperature
Variable 8 Average = 14.81
Variance = 38.75

core means
Variable 9 Average = 1.20
Variance = 2.38

Number = 96

Covariance = 1.28 Correlation = 0.133

Intercept = 0.72 Slope = 0.033 Standard Error = 0.025

Student's T value = 1.301 Probability = 0.196

Data file : TARS86
Title : Tarsonemus 1986 depth 1

Function : CORR
Data case no. 1 to 204

% moisture
Variable 7 Average = 15.24
Variance = 10.07

core means
Variable 9 Average = 9.60
Variance = 850.54

Number = 102

Covariance = 22.76 Correlation = 0.246

Intercept = -24.84 Slope = 2.261 Standard Error = 0.891

Student's T value = 2.538 Probability = 0.013

---

temperature
Variable 8 Average = 15.35
Variance = 52.32

core means
Variable 9 Average = 9.60
Variance = 850.54

Number = 102

Covariance = 25.71 Correlation = 0.122

Intercept = 2.06 Slope = 0.491 Standard Error = 0.400

Student's T value = 1.228 Probability = 0.222

Data file : TARS86
Title : Tarsonemus 1986 depth 2

Function : CORR
Data case no. 1 to 204

% moisture
Variable 7 Average = 14.05
Variance = 4.56

core means
Variable 9 Average = 12.38
Variance = 1199.79

Number = 102

Covariance = 12.35 Correlation = 0.167

Intercept = -25.64 Slope = 2.706 Standard Error = 1.599

Student's T value = 1.693 Probability = 0.094

---

temperature
Variable 8 Average = 14.18
Variance = 43.68

core means
Variable 9 Average = 12.38
Variance = 1199.79

Number = 102

Covariance = 45.56 Correlation = 0.199

Intercept = -2.41 Slope = 1.043 Standard Error = 0.514

Student's T value = 2.031 Probability = 0.045

Data file : TARS85
Title : Tarsonemus 1985 depth 1

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	3.274534	2	1.63727	0.36	0.699
Residual	423.757789	93	4.55654		
Total	427.032323	95			

Data file : TARS85
Title : Tarsonemus 1985 depth 2

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	6.490968	2	3.24548	1.37	0.258
Residual	219.754219	93	2.36295		
Total	226.245187	95			

Data file : TARS86
Title : Tarsonemus 1986 depth 1

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	10531.555803	2	5265.77790	6.92	0.002
Residual	75373.442769	99	761.34791		
Total	85904.998572	101			

Data file : TARS86
Title : Tarsonemus 1986 depth 2

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	11703.541025	2	5851.77051	5.29	0.007
Residual	109474.790499	99	1105.80596		
Total	121178.331523	101			

Data file : BAK85
Title : Bakerdania 1985 depth 1

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 12.96
Variance = 12.80

core means
Variable 9 Average = 0.87
Variance = 1.87

Number = 96

Covariance = 1.31 Correlation = 0.268

Intercept = -0.46 Slope = 0.103 Standard Error = 0.038

Student's T value = 2.699 Probability = 0.008

---

temperature
Variable 8 Average = 16.76
Variance = 49.34

core means
Variable 9 Average = 0.87
Variance = 1.87

Number = 96

Covariance = -3.62 Correlation = -0.377

Intercept = 2.10 Slope = -0.073 Standard Error = 0.019

Student's T value = 3.944 Probability = 0.000

Data file : BAK85
Title : Bakerdania 1985 depth 2

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 11.44
Variance = 9.65

core means
Variable 9 Average = 0.50
Variance = 0.97

Number = 96

Covariance = 0.46 Correlation = 0.151

Intercept = -0.04 Slope = 0.048 Standard Error = 0.032

Student's T value = 1.479 Probability = 0.143

---

temperature
Variable 8 Average = 14.81
Variance = 38.75

core means
Variable 9 Average = 0.50
Variance = 0.97

Number = 96

Covariance = -1.18 Correlation = -0.192

Intercept = 0.95 Slope = -0.030 Standard Error = 0.016

Student's T value = 1.899 Probability = 0.061

```
        Data file : BAK86
        Title : Bakerdania 1986  depth 1

        Function : CORR
        Data case no. 1 to 204
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      15.24
Variance =      10.07

core means
Variable    9   Average =       1.01
Variance =       3.18

Number = 102

Covariance =        0.31    Correlation =    0.054

Intercept =     0.55    Slope =    0.030    Standard Error =    0.056

Student's T value =     0.542    Probability =  0.589
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      15.35
Variance =      52.32

core means
Variable    9   Average =       1.01
Variance =       3.18

Number = 102

Covariance =       -2.50    Correlation =   -0.194

Intercept =     1.74    Slope =   -0.048    Standard Error =    0.024

Student's T value =     1.974    Probability =  0.051
--------------------------------------------------------------------------------

        Data file : BAK86
        Title : Bakerdania 1986 depth 2

        Function : CORR
        Data case no. 1 to 204
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      14.05
Variance =       4.56

core means
Variable    9   Average =       0.44
Variance =       0.77

Number = 102

Covariance =       -0.07    Correlation =   -0.039

Intercept =     0.67    Slope =   -0.016    Standard Error =    0.041

Student's T value =     0.391    Probability =  0.696
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      14.18
Variance =      43.68

core means
Variable    9   Average =       0.44
Variance =       0.77

Number = 102

Covariance =       -0.41    Correlation =   -0.071

Intercept =     0.58    Slope =   -0.009    Standard Error =    0.013

Student's T value =     0.715    Probability =  0.476
--------------------------------------------------------------------------------
```

Data file : BAK85
Title : Bakerdania 1985 depth 1

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	25.224584	2	12.61229	7.70	0.001
Residual	152.427411	93	1.63900		
Total	177.651995	95			

Data file : BAK85
Title : Bakerdania 1985 depth 2

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	3.410317	2	1.70516	1.79	0.172
Residual	88.371215	93	0.95023		
Total	91.781532	95			

Data file : BAK86
Title : Bakerdania 1986 depth 1

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	12.326013	2	6.16301	1.98	0.144
Residual	308.445622	99	3.11561		
Total	320.771635	101			

Data file : BAK86
Title : Bakerdania 1986 depth 2

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	0.708368	2	0.35418	0.46	0.634
Residual	76.584558	99	0.77358		
Total	77.292926	101			

Data file : EUPOD85
Title : Eupodes 1985 depth 1

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 12.96
Variance = 12.80

core means
Variable 9 Average = 0.98
Variance = 2.43

Number = 96

Covariance = -1.83 Correlation = -0.327

Intercept = 2.83 Slope = -0.143 Standard Error = 0.043

Student's T value = 3.358 Probability = 0.001

---

temperature
Variable 8 Average = 16.76
Variance = 49.34

core means
Variable 9 Average = 0.98
Variance = 2.43

Number = 96

Covariance = 3.07 Correlation = 0.280

Intercept = -0.06 Slope = 0.062 Standard Error = 0.022

Student's T value = 2.825 Probability = 0.006

Data file : EUPOD85
Title : Eupodes 1985 depth 2

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 11.44
Variance = 9.65

core means
Variable 9 Average = 0.07
Variance = 0.03

Number = 96

Covariance = -0.03 Correlation = -0.046

Intercept = 0.10 Slope = -0.003 Standard Error = 0.006

Student's T value = 0.450 Probability = 0.654

---

temperature
Variable 8 Average = 14.81
Variance = 38.75

core means
Variable 9 Average = 0.07
Variance = 0.03

Number = 96

Covariance = -0.15 Correlation = -0.136

Intercept = 0.12 Slope = -0.004 Standard Error = 0.003

Student's T value = 1.332 Probability = 0.186

```
        Data file : EUPOD86
        Title : Eupodes 1986 depth 1

        Function : CORR
        Data case no. 1 to 204
--------------------------------------------------------------------------------
%-moisture
Variable    7   Average =      15.24
Variance =      10.07

core means
Variable    9   Average =       0.41
Variance =       0.72

Number = 102

Covariance =        -0.47    Correlation =    -0.174

Intercept =     1.11    Slope =   -0.046    Standard Error =     0.026

Student's T value =     1.764    Probability =  0.081
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      15.35
Variance =      52.32

core means
Variable    9   Average =       0.41
Variance =       0.72

Number = 102

Covariance =         1.35    Correlation =     0.221

Intercept =     0.01    Slope =    0.026    Standard Error =     0.011

Student's T value =     2.266    Probability =  0.026
--------------------------------------------------------------------------------

        Data file : EUPOD86
        Title : Eupodes 1986 depth 2

        Function : CORR
        Data case no. 1 to 204
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      14.05
Variance =       4.56

core means
Variable    9   Average =       0.04
Variance =       0.02

Number = 102

Covariance =        -0.10    Correlation =    -0.296

Intercept =     0.34    Slope =   -0.021    Standard Error =     0.007

Student's T value =     3.103    Probability =  0.002
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      14.18
Variance =      43.68

core means
Variable    9   Average =       0.04
Variance =       0.02

Number = 102

Covariance =         0.17    Correlation =     0.168

Intercept =    -0.01    Slope =    0.004    Standard Error =     0.002

Student's T value =     1.709    Probability =  0.090
--------------------------------------------------------------------------------
```

Data file : EUPOD85
Title : Eupodes 1985 depth 1

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	25.891795	2	12.94590	5.86	0.004
Residual	205.345776	93	2.20802		
Total	231.237572	95			

Data file : EUPOD85
Title : Eupodes 1985 depth 2

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	0.195179	2	0.09759	3.19	0.046
Residual	2.843137	93	0.03057		
Total	3.038316	95			

Data file : EUPOD86
Title : Eupodes 1986 depth 1

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	4.107435	2	2.05372	2.97	0.056
Residual	68.342847	99	0.69033		
Total	72.450282	101			

Data file : EUPOD86
Title : Eupodes 1986 depth 2

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	0.223976	2	0.11199	5.17	0.007
Residual	2.144259	99	0.02166		
Total	2.368235	101			

Data file : TYD85
Title : Tydeus bedfordiensis 1985 depth 1

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 12.96
Variance = 12.80

core means
Variable 9 Average = 0.39
Variance = 0.98

Number = 96

Covariance = -0.83 Correlation = -0.235

Intercept = 1.23 Slope = -0.065 Standard Error = 0.028

Student's T value = 2.340 Probability = 0.021

---

temperature
Variable 8 Average = 16.76
Variance = 49.34

core means
Variable 9 Average = 0.39
Variance = 0.98

Number = 96

Covariance = 1.29 Correlation = 0.186

Intercept = -0.05 Slope = 0.026 Standard Error = 0.014

Student's T value = 1.833 Probability = 0.070

Data file : TYD85
Title : Tydeus bedfordiensis 1985 depth 2

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 11.44
Variance = 9.65

core means
Variable 9 Average = 0.26
Variance = 0.36

Number = 96

Covariance = -0.54 Correlation = -0.289

Intercept = 0.89 Slope = -0.056 Standard Error = 0.019

Student's T value = 2.927 Probability = 0.004

---

temperature
Variable 8 Average = 14.81
Variance = 38.75

core means
Variable 9 Average = 0.26
Variance = 0.36

Number = 96

Covariance = 1.16 Correlation = 0.312

Intercept = -0.19 Slope = 0.030 Standard Error = 0.009

Student's T value = 3.188 Probability = 0.002

Data file : TYD86
Title : Tydeus bedfordiensis 1986 depth 1

Function : CORR
Data case no. 1 to 204

% moisture
Variable 7 Average = 15.24
Variance = 10.07

core means
Variable 9 Average = 0.47
Variance = 0.67

Number = 102

Covariance = -0.66 Correlation = -0.253

Intercept = 1.47 Slope = -0.065 Standard Error = 0.025

Student's T value = 2.616 Probability = 0.010

---

temperature
Variable 8 Average = 15.35
Variance = 52.32

core means
Variable 9 Average = 0.47
Variance = 0.67

Number = 102

Covariance = 2.51 Correlation = 0.425

Intercept = -0.26 Slope = 0.048 Standard Error = 0.010

Student's T value = 4.694 Probability = 0.000

Data file : TYD86
Title : Tydeus bedfordiensis 1986 depth 2

Function : CORR
Data case no. 1 to 204

% moisture
Variable 7 Average = 14.05
Variance = 4.56

core means
Variable 9 Average = 0.44
Variance = 0.64

Number = 102

Covariance = -0.18 Correlation = -0.108

Intercept = 1.01 Slope = -0.040 Standard Error = 0.037

Student's T value = 1.088 Probability = 0.279

---

temperature
Variable 8 Average = 14.18
Variance = 43.68

core means
Variable 9 Average = 0.44
Variance = 0.64

Number = 102

Covariance = 2.05 Correlation = 0.389

Intercept = -0.22 Slope = 0.047 Standard Error = 0.011

Student's T value = 4.220 Probability = 0.000

Data file : TYD85
Title : Tydeus bedfordiensis 1985 depth 1

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	5.184013	2	2.59201	2.75	0.069
Residual	87.577983	93	0.94170		
Total	92.761996	95			

Data file : TYD85
Title : Tydeus bedfordiensis 1985 depth 2

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	3.573563	2	1.78678	5.48	0.006
Residual	30.313570	93	0.32595		
Total	33.887133	95			

Data file : TYD86
Title : Tydeus bedfordiensis 1986 depth 1

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	9.728057	2	4.86403	8.82	0.000
Residual	54.591595	99	0.55143		
Total	64.319652	101			

Data file : TYD86
Title : Tydeus bedfordiensis 1986 depth 2

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	12.619627	2	6.30981	11.39	0.000
Residual	54.822701	99	0.55376		
Total	67.442329	101			

Data file : META85
Title : Metapronematus leucohippeus 1985 depth 1

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 12.96
Variance = 12.80

core means
Variable 9 Average = 0.24
Variance = 0.22

Number = 96

Covariance = -0.40 Correlation = -0.235

Intercept = 0.64 Slope = -0.031 Standard Error = 0.013

Student's T value = 2.347 Probability = 0.021

---

temperature
Variable 8 Average = 16.76
Variance = 49.34

core means
Variable 9 Average = 0.24
Variance = 0.22

Number = 96

Covariance = 0.57 Correlation = 0.172

Intercept = 0.05 Slope = 0.012 Standard Error = 0.007

Student's T value = 1.692 Probability = 0.094

Data file : META85
Title : Metapronematus leucohippeus 1985 depth 2

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 11.44
Variance = 9.65

core means
Variable 9 Average = 0.32
Variance = 0.44

Number = 96

Covariance = -0.61 Correlation = -0.298

Intercept = 1.05 Slope = -0.064 Standard Error = 0.021

Student's T value = 3.026 Probability = 0.003

---

temperature
Variable 8 Average = 14.81
Variance = 38.75

core means
Variable 9 Average = 0.32
Variance = 0.44

Number = 96

Covariance = 1.62 Correlation = 0.392

Intercept = -0.30 Slope = 0.042 Standard Error = 0.010

Student's T value = 4.135 Probability = 0.000

Data file : META86
Title : Metapronematus leucohippeus 1986 depth 1

Function : CORR
Data case no. 1 to 204

% moisture
Variable 7 Average = 15.24
Variance = 10.07

core means
Variable 9 Average = 0.56
Variance = 2.57

Number = 102

Covariance = 0.51 Correlation = 0.101

Intercept = -0.22 Slope = 0.051 Standard Error = 0.050

Student's T value = 1.015 Probability = 0.313

---

temperature
Variable 8 Average = 15.35
Variance = 52.32

core means
Variable 9 Average = 0.56
Variance = 2.57

Number = 102

Covariance = -0.67 Correlation = -0.058

Intercept = 0.75 Slope = -0.013 Standard Error = 0.022

Student's T value = 0.580 Probability = 0.563

Data file : META86
Title : Metapronematus leucohippeus 1986 depth 2

Function : CORR
Data case no. 1 to 204

% moisture
Variable 7 Average = 14.05
Variance = 4.56

core means
Variable 9 Average = 0.50
Variance = 2.44

Number = 102

Covariance = 0.59 Correlation = 0.178

Intercept = -1.33 Slope = 0.130 Standard Error = 0.072

Student's T value = 1.810 Probability = 0.073

---

temperature
Variable 8 Average = 14.18
Variance = 43.68

core means
Variable 9 Average = 0.50
Variance = 2.44

Number = 102

Covariance = -0.98 Correlation = -0.095

Intercept = 0.82 Slope = -0.022 Standard Error = 0.024

Student's T value = 0.952 Probability = 0.343

Data file : META86
Title : Metapronematus leucohippeus 1986 depth 1

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	2.720023	2	1.36001	0.52	0.594
Residual	256.906296	99	2.59501		
Total	259.626319	101			

Data file : META86
Title : Metapronematus leucohippeus 1986 depth 2

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	8.252352	2	4.12618	1.72	0.185
Residual	237.689479	99	2.40090		
Total	245.941831	101			

Data file : META85
Title : Metapronematus leucohippeus 1985 depth 1

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	1.164362	2	0.58218	2.73	0.071
Residual	19.845688	93	0.21339		
Total	21.010050	95			

Data file : META85
Title : Metapronematus leucohippeus 1985 depth 2

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	6.435465	2	3.21773	8.48	0.000
Residual	35.302509	93	0.37960		
Total	41.737974	95			

Data file : RHOD85
Title : Rhodacarellus silesiacus 1985 depth 1

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 12.96
Variance = 12.80

core means
Variable 9 Average = 1.97
Variance = 7.58

Number = 96

Covariance = 0.24 Correlation = 0.024

Intercept = 1.73 Slope = 0.019 Standard Error = 0.079

Student's T value = 0.233 Probability = 0.816

---

temperature
Variable 8 Average = 16.76
Variance = 49.34

core means
Variable 9 Average = 1.97
Variance = 7.58

Number = 96

Covariance = -1.40 Correlation = -0.072

Intercept = 2.44 Slope = -0.028 Standard Error = 0.040

Student's T value = 0.702 Probability = 0.485

Data file : RHOD85
Title : Rhodacarellus silesiacus 1985 depth 2

Function : CORR
Data case no. 1 to 192

% moisture
Variable 7 Average = 11.44
Variance = 9.65

core means
Variable 9 Average = 2.64
Variance = 43.90

Number = 96

Covariance = 4.38 Correlation = 0.213

Intercept = -2.56 Slope = 0.454 Standard Error = 0.215

Student's T value = 2.110 Probability = 0.037

---

temperature
Variable 8 Average = 14.81
Variance = 38.75

core means
Variable 9 Average = 2.64
Variance = 43.90

Number = 96

Covariance = -7.37 Correlation = -0.179

Intercept = 5.45 Slope = -0.190 Standard Error = 0.108

Student's T value = 1.761 Probability = 0.081

```
Data file : RHOD86
Title : Rhodacarellus silesiacus 1986 depth 1

Function : CORR
Data case no. 1 to 204
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      15.24
Variance =       10.07

core means
Variable    9   Average =       1.65
Variance =        9.49

Number = 102

Covariance =        -0.71    Correlation =   -0.072

Intercept =      2.73    Slope =    -0.070    Standard Error =    0.097

Student's T value =     0.726    Probability =  0.469
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      15.35
Variance =       52.32

core means
Variable    9   Average =       1.65
Variance =        9.49

Number = 102

Covariance =        -0.07    Correlation =   -0.003

Intercept =      1.67    Slope =    -0.001    Standard Error =    0.043

Student's T value =     0.031    Probability =  0.976
--------------------------------------------------------------------------------


Data file : RHOD86
Title : Rhodacarellus silesiacus 1986 depth 2

Function : CORR
Data case no. 1 to 204
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      14.05
Variance =        4.56

core means
Variable    9   Average =       1.32
Variance =        8.92

Number = 102

Covariance =         0.26    Correlation =    0.041

Intercept =      0.52    Slope =     0.057    Standard Error =    0.140

Student's T value =     0.410    Probability =  0.683
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      14.18
Variance =       43.68

core means
Variable    9   Average =       1.32
Variance =        8.92

Number = 102

Covariance =        -4.99    Correlation =   -0.253

Intercept =      2.94    Slope =    -0.114    Standard Error =    0.044

Student's T value =     2.613    Probability =  0.010
--------------------------------------------------------------------------------
```

Data file : RHOD85
Title : Rhodacarellus silesiacus 1985 depth 1

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	4.767810	2	2.38391	0.31	0.734
Residual	715.581552	93	7.69443		
Total	720.349362	95			

Data file : RHOD85
Title : Rhodacarellus silesiacus 1985 depth 2

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	193.465039	2	96.73252	2.26	0.110
Residual	3977.333892	93	42.76703		
Total	4170.798931	95			

Data file : RHOD86
Title : Rhodacarellus silesiacus 1986 depth 1

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	6.356084	2	3.17804	0.33	0.719
Residual	952.290545	99	9.61910		
Total	958.646629	101			

Data file : RHOD86
Title : Rhodacarellus silesiacus 1986 depth 2

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	58.855384	2	29.42769	3.46	0.035
Residual	841.818774	99	8.50322		
Total	900.674158	101			

```
        Data file : HYPA85
        Title : Hypaspis aculifer 1985 depth 1

        Function : CORR
        Data case no. 1 to 192
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      12.96
Variance =       12.80

core means
Variable    9   Average =       0.34
Variance =        0.90

Number = 96

Covariance =        0.20    Correlation =    0.060

Intercept =     0.13    Slope =    0.016    Standard Error =    0.027

Student's T value =     0.581    Probability =  0.563
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      16.76
Variance =       49.34

core means
Variable    9   Average =       0.34
Variance =        0.90

Number = 96

Covariance =       -0.13    Correlation =   -0.020

Intercept =     0.38    Slope =   -0.003    Standard Error =    0.014

Student's T value =     0.195    Probability =  0.846
--------------------------------------------------------------------------------

        Data file : HYPA85
        Title : Hypaspis aculifer 1985 depth 2

        Function : CORR
        Data case no. 1 to 192
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      11.44
Variance =        9.65

core means
Variable    9   Average =       0.07
Variance =        0.03

Number = 96

Covariance =        0.05    Correlation =    0.099

Intercept =     0.01    Slope =    0.005    Standard Error =    0.005

Student's T value =     0.961    Probability =  0.339
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      14.81
Variance =       38.75

core means
Variable    9   Average =       0.07
Variance =        0.03

Number = 96

Covariance =       -0.08    Correlation =   -0.076

Intercept =     0.10    Slope =   -0.002    Standard Error =    0.003

Student's T value =     0.739    Probability =  0.462
--------------------------------------------------------------------------------
```

```
        Data file : HYPA86
        Title : Hypaspis aculifer 1986 depth 1

        Function : CORR
        Data case no. 1 to 204
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      15.24
Variance =      10.07

core means
Variable    9   Average =      0.25
Variance =       0.31

Number = 102

Covariance =        0.01    Correlation =    0.007

Intercept =     0.23    Slope =    0.001    Standard Error =    0.017

Student's T value =     0.072    Probability =  0.943
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      15.35
Variance =      52.32

core means
Variable    9   Average =      0.25
Variance =       0.31

Number = 102

Covariance =        0.53    Correlation =    0.132

Intercept =     0.10    Slope =    0.010    Standard Error =    0.008

Student's T value =     1.327    Probability =  0.188
--------------------------------------------------------------------------------

        Data file : HYPA86
        Title : Hypaspis aculifer 1986 depth 2

        Function : CORR
        Data case no. 1 to 204
--------------------------------------------------------------------------------
% moisture
Variable    7   Average =      14.05
Variance =       4.56

core means
Variable    9   Average =      0.01
Variance =       0.00

Number = 102

Covariance =       -0.01    Correlation =   -0.077

Intercept =     0.05    Slope =   -0.002    Standard Error =    0.003

Student's T value =     0.770    Probability =  0.443
--------------------------------------------------------------------------------
temperature
Variable    8   Average =      14.18
Variance =      43.68

core means
Variable    9   Average =      0.01
Variance =       0.00

Number = 102

Covariance =       -0.02    Correlation =   -0.042

Intercept =     0.02    Slope =   -0.000    Standard Error =    0.001

Student's T value =     0.424    Probability =  0.672
--------------------------------------------------------------------------------
```

Data file : HYPA85
Title : Hypaspis aculifer 1985 depth 1

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	0.386077	2	0.19304	0.21	0.810
Residual	84.882119	93	0.91271		
Total	85.268196	95			

Data file : HYPA85
Title : Hypaspis aculifer 1985 depth 2

Function : MULTIREG
Data case no. 1 to 192

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	0.024148	2	0.01207	0.46	0.634
Residual	2.451452	93	0.02636		
Total	2.475600	95			

Data file : HYPA86
Title : Hypaspis aculifer 1986 depth 1

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	0.684911	2	0.34246	1.12	0.331
Residual	30.315637	99	0.30622		
Total	31.000548	101			

Data file : HYPA86
Title : Hypaspis aculifer 1986 depth 2

Function : MULTIREG
Data case no. 1 to 204

% moisture
temperature
core means

ANALYSIS OF VARIANCE TABLE

	Sum of Squares	df	Mean Square	F	Signif
Regression	0.004460	2	0.00223	0.53	0.588
Residual	0.414058	99	0.00418		
Total	0.418518	101			