8 VERTICAL DISTRIBUTION

The occurrence of high arthropod population densities in the surface strata of soils, is a well known phenomenon. Results of investigations such as those of Trägardh (1928), Weis-Foch (1948), Evans (1950), Van der Drift (1951) and Haarlov (1960), indicate that most of the mesofaunal arthropods in habit the litter layers, or the extreme surface part of mineral soil, and comparatively few species are truly subterranean in habit.

For the interpretation of the vertical distribution of the mesofauna in plots A - E (fig. 121), tables 30 to 49 were constructed, which display: numbers, numbers/m^2 and percentages of numbers and biomass. The percentages given are "seasonal percentages" thus a seasonal mesofaunal total, compiled of the subtotals of the four soil layers would represent 100%. Biomass recordings were recorded in gramme.

8.1 SEASONAL RECORDING OF THE MESOFAUNAL VERTICAL DISTRIBUTION IN PLOTS A - E

8.11 Plot A

During the July 1965 sample, the populations were maintained at about the same level throughout the first 16 cm of soil. The four subsample layers registered 29,585%, 23.274%, 24.457% and 22.681% of the seasonal total respectively, which is equal to one arthropod to 4.506 cc soil in the first 4 cm layer;

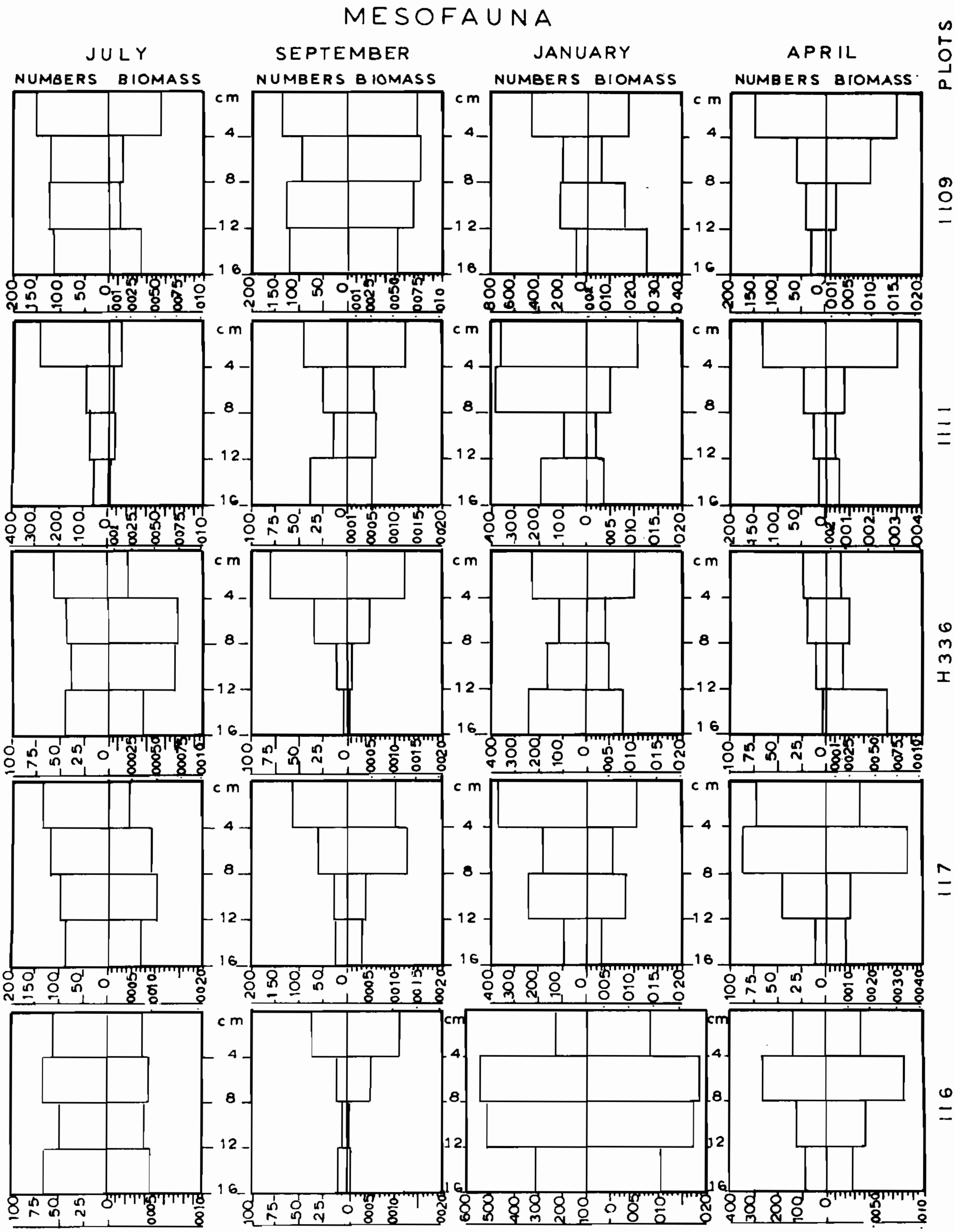

Fig. 121 Vertical distribution of the mesofauna, plots A - E.

1:5.728 cc; 1:5.451 cc and 1:5.878 cc soil in the ensuing three layers.

The highest biomass recordings were made in the first and fourth subsample levels, with 46.362% and 29.491% of the seasonal total respectively. The recorded arthropod weight (mg) per cc of soil were : 0.0080 / cc; 0.0023 / cc; 0.0018 / cc and 0.0051 / cc for layers 1 to 4. This seasonal sample had the lowest biomass total; as compared to the totals of the other three seasons. In the last mentioned respect, this season contributed only 8.870% of the sampling year's biomass value.

SEPTEMBER (table 31)

Although the total mesofaunal numbers were slightly below that of July, still the same vertical distributional pattern as the former, was recognised, with the numbers / m^2 at : 8,098.836; 5,793,329; 7,448.566 and 7,152.988 for the subsample levels 1 to 4 respectively. The recorded arthropod soil ratio was: 1 : 4.934 cc; 1 : 6.898 cc; 1 : 5.365 cc and 1 : 5.586 for the layers 1 to 4 respectively.

The total biomass for this season recorded was 20.546% against the 8.870% recorded for July. Within the September sample, the highest biomass percentages occurred in the first 12 cm of soil, as a result of concentrations of arthropods with higher biomass values per individual in that level. The recorded arthropod weight (mg) per cc soil was: 0.0108/cc; 0.011/cc; 0.0101/cc and 0.0078/cc for the successive layers

1 to 4 respectively.

JANUARY (table 32)

The biggest concentration of arthropods was most definitely extracted from the first subsample layer. A total of 468 arthropods were recorded, which represented 46.018% of the seasonal sample numbers, in comparison with the 206 (20.254%), 226 (22.222%) and 117 (11,503%) of subsample levels two, three and four. The above mentioned arthropod quantities equally represents the following arthropod : soil ratio : 1 : 1.444 cc; 1 : 3.281 cc; 1 : 2.991 cc and 1 : 5.777 cc respectively. The numbers per square metre were: 27,666.099; 12,177.812; 13,360.125 and 6,916.527 for subsample levels 1 to 4 respectively.

As the diplopods dictated the biomass values for this plot, the highest biomass values were naturally recorded in the subsample levels where they were more abundant. Thus the 12-16 cm layer of soil had the highest biomass value, which represented 38.173% of the seasonal value, in accordance with the 35 diplopods which recorded a biomass value of 36.326% of the seasonal biomass value. The first and the third subsample layers recorded 26.152% and 25.141% of the seasonal biomass value against the 10.533% of the second layer. The recorded arthropod weight (mg) per cc soil for the subsample levels 1 to 4 were: 0.0253/cc; 0.0102/cc; 0.0243/cc and 0.0369/cc. The total seasonal biomass recorded for January, was the highest recorded, with 49.787% of the total mesofaunal biomass value.

APRIL (table 33)

In this season, the arthropods had their highest concentration of numbers and biomass in the top 4 cm soil, with a gradual decrease towards the fourth subsample level. A hundred and fifty arthropods were extracted in the first subsample level, which represented 53.005% and 54.331% of the numbers and biomass of the seasonal total. The arthropod : soil ratio were: 1 : 4.506 cc; 1 : 10.819 cc; 1 : 16.095 cc and 1 : 25.333 cc for subsample levels 1 to 4 successively, and the numbers / m^2: 8,867.339; 3,606.051; 2,482.855 and 1,773.468.

8.12 Plot B

The highest population concentration occurred in the 1-4 cm and 4-8 cm soil layers during all the seasons, though in both September and January, substantial population recordings were made in the 14-16 cm level.

JULY (table 34)

A top concentration of 292 arthropods (17,261.753/m^2) in the first subsample level was followed by 90 arthropods (5,320.405/m^2), 80 (4,729.249/m^2) and 61 (3,606.051/m^2) respectively, by subsample layers 2, 3 and 4. The above mentioned arthropod quantities equally represent the following arthropod:soil ratio: 1 : 2.315 cc; 1 : 7.511 cc; 1 : 8.450 cc and 1 : 10.819 cc respectively.

The top layer also had the highest biomass value. The recorded weight (mg) per cc soil for subsample levels 1 to 4 were: 0.0021:cc; 0.0009/cc; 0.0010/cc and 0.0004/cc, which expressed in percentages are: 46.911%; 19.465%; 22.997% and 10.626% of this season's recording.

SEPTEMBER (table 35)

Though the population as a whole decreased considerably, the first subsample level still had a dominant 46 arthropods (2,719.317/m^2), followed by the 26 arthropods (1,537.007/m^2) and 23 (1,359.658/m^2), respectively, by subsample layers 2 and 3. The fourth subsample level, however, recorded the second highest population numbers with a total of 39 arthropods (2,305.508/m^2). The recorded arthropod:soil ratio for the four successive layers were: 1 : 14.695 cc; 1 : 26.000 cc; 1 : 29.391 cc and 1 : 17.333 cc.

Stratificationally, the first 1-4 cm level had the highest biomass value with 42.037% of the seasonal biomass recovery. The other three levels revealed an even biomass distribution, with recordings of 19.571%, 20.388% and 18.003%. The recorded arthropod weight (mg) per cc soil was: 0.0018/cc; 0.0008/cc; 0.0008/cc and 0.0007/ cc for subsample layers 1 to 4 respectively.

JANUARY (table 36)

The highest numbers occurred in the 1-4 cm and 4-8 cm soil layers. In this season 22,523.041 arthropods per square metre were recorded in the last mentioned layer, in comparison with the 21,340.730/m^2 of the top layer. The numbers extracted for subsample layers 1 to 4 were: 361, 381, 98 and 191 respectively and the arthropod to soil ratio: 1 : 1.872 cc; 1 : 1.774 cc; 1 : 6.897 cc and 1 : 3.539 cc.

Layer 1-4 cm had a definite higher biomass value as a result of a concentration of insects, which had a higher biomass value per individual than for instance the Acari. The seasonal biomass recorded expressed as percentages was 49.817; 22.706; 9.639 and 17.837 for their equivalent values of 0.0108360 g; 0.0049390 g; 0.0020965 g and 0.0038800 g respectively. Expressed in weight (mg) per cc of soil, the abovementioned biomass recorded was: 0.0160/cc; 0.0073/cc; 0.0031/cc and 0.0057/cc.

APRIL (table 37)

The highest numbers occurred in the top 4 cm of soil and the lowest in the last 16 cm soil level. A total of 134 arthropods was recorded for the first subsample layer, which constituted 61.187% and 61.132% of the total seasonal numbers and biomass values. The numbers per m^2 were: 7,921.491; 2,660.200; 1,418,775 and 945,850 for the subsample levels 1 to 4 respectively. The arthropod to soil ratio for these abovementioned four levels were: 1 : 5.044 cc; 1 : 15.022 cc; 1 : 28.166 cc and 1 : 42.250 cc respectively.

The biomass values recorded all revealed the same gradual decline in arthropod weight from the top soil level downwards, with the exception of subsample layer four which had a higher biomass value than the third. The seasonal biomass percentages were: 61.132%; 16.854%; 8.502% and 13.511% . The recorded arthropod weight (mg) per cc of soil was: 0.0045/cc; 0.0012/cc; 0.0006/cc and 0.0009/cc for the subsample levels 1 to 4.

8.13 Plot C

Though some of the seasonal samples recorded a decline in the arthropod populations with increasing depth, others seemed to increase with depth.

JULY (table 38)

The top 1-4 cm soil had the most arthropods, followed by the 12-16 cm level and then the second and third subsample layers. The numbers were generally small, and recorded numbers per square metre were: 3,369.590; 2,541.971; 2,246.392 and 2,778.433 respectively for subsample layers 1 to 4. The arthropod to soil ratio for the four levels was: 1 : 11.859 cc; 1 : 15.720 cc; 1 : 17.789 cc and 1 : 14.382 cc respectively.

Higher biomass recordings were made in the deeper soil strata, as more individuals of the "Other Arthropods" section occurred there. The seasonal biomass percentages were: 11.066%; 35.740%; 35,051% and 18.142% for the subsample levels 1 to 4. The recorded arhtropod weight (mg) in the stratigraphical 1 to 4 were: 0.0003/cc; 0.0010/cc; 0.0010/cc and 0.0005/cc respectively.

SEPTEMBER (table 39)

The top soil had the most arthropods in this particular season. Eighty arthropods were recorded in the 1-4 cm subsample layer, which was equal to 62.500% and 60.971% of this season's total numbers and biomass values. The arthropods gradually diminished towards the fourth subsample layer with totals of 34, 10 and 4 specimens for subsamples 2, 3 and 4 respectively. The numbers per m^2 were 4,729.246; 2,009.932; 591.156 and 236.462 and the arthropod to soil ratio: 1 : 8.450 cc; 1 : 19.882 cc; 1 : 67.600 and 1 : 169.000 cc for the subsample layers 1 to 4.

The biomass figures also revealed the decline in values from the top subsample level downwards. The seasonal percentages recorded were: 60.971%; 24.590%; 6.711% and 7.726% for subsample layers 1 to 4 respectively. The weight of the arthropods (mg) per cc soil recorded was: 0.0018/cc; 0.0007/cc; 0.0002/cc and 0.0002/cc.

JANUARY (table 40)

In this particular season, the highest population numbers were recorded in the deepest layer. For the 12-16 cm level, a total of 241 arthropods was recorded which was equal to 32.089$ of this season's total number, in comparison with the 30.493% of the top 1-4 cm layer. This last mentioned layer, however, had the highest biomass value. Except for the first subsample level, the numbers of the arthropods seemed to accumulate with increase in dept. The numbers per m^2 were: 13,537.472; 6,857.410; 9,754.073 and 14,246.860. The recorded arthropod:soil ratio for the four stratigraphical layers was: 1 : 2.951 cc; 1 : 5.827 cc; 1 : 4.096 cc and 1 : 2.804 cc respectively.

The biomass values revealed the same sequence as the numbers. For the successive levels 1 to 4, the following biomass values were recorded: 0.0099350 g; 0.0039715 g; 0.0048350 g and 0.0075335 g which was equal to 37.812%; 15.114%; 18.401% and 28.671% of the total seasonal value respectively. The weight (mg) of the arthropods per cc soil recorded was: 0.0146/cc; 0.0058/cc; 0.0071/cc and 0.0111/cc for subsample levels 1 to 4 respectively.

APRIL (table 41)

Very low numbers were recorded in this season. The numbers decreased with depth, but as a few insects with bigger-biomass values were found in the deeper layers, a subsequent higher biomass value was recorded. The numbers for the successive four layers were: 24, 18, 10 and 3, and the recorded artropod:soil ratios were: 1 : 28.166 cc; 1 : 37.555 cc; 1 : 67.600 cc and 1 : 225.000 cc. The numbers per m^2 were: 1,418.776;

1,064.080; 591.155 and 177.347 for the subsample layers 1 to 4.

The weight (mg) of the arthropods per cc of soil were: 0.0002/cc; 0.0003/cc; 0.0002/cc and 0.0010/cc for subsample levels 1 to 4.

8.14 Plot D

From the extraction recordings, populations in plot D revealed a general faunal decline from the top subsample to the 12-16 cm level, but very often high numbers and biomass values also occurred in the deeper soil levels. The collembolan population, which dominated the mesofauna as a whole, had high population numbers in the second and third subsample level during July, January and April.

JULY (table 42)

The numbers exhibited a gradual decline from 137 arthropods in the first subsample layer, 120 in the second, 99 in the third, to 87 in the fourth and deepest layer. The numbers per m^2 for these figures were: 8,098.837; 7,093.872; 5,852.444 and 5,143.957 respectively, while the arthropod:soil ratios in the same sequence were: 1 : 4.934; 1 : 5.633; 1 : 6.828 and 1 : 7.770.

The biomass, however, had higher concentrations in subsamples two and three. The weight (mg) of the arthropods per cc of soil in the different subsample layers 1 to 4 was:

0.0006/cc; 0.0013/cc; 0.0014/cc and 0.0010/cc.

SEPTEMBER (table 43)

Just as in the previously described season, the numbers per subsample layer decreased with depth. The total numbers per layer were: 116, 60, 28 and 26 respectively for strata 1 to 4. The recorded arthropod to soil ratios for layers 1 to 4 were: 1 : 5.827 cc; 1 : 11.266 cc; 1 : 24.142 cc and 1 : 26.000 cc. The numbers /m^2 were: 6,857.408; 3,546.936; 1,655.237 and 1,537.005 for subsample layers 1 to 4 respectively.

The biomass, however, had its highest recording of 40.584% of the seasonal biomass value in the 4-8 cm layer. The arthropod weight (mg) per cc soil in levels 1 to 4 was: 0.0015/cc; 0.0018/cc; 0.0006/cc and 0.0005/cc. The seasonal biomass percentages were: 33.755%; 40.584%; 14.274% and 11.386%.

JANUARY (table 44)

The 1-4 cm of soil registered the highest concentration of arthropods, namely 373 (22,050.118/m^2). In sequence the third, second and fourth subsample layers recorded the highest population numbers with 14,424.206/m^2, 10.759.939/m^2 and 5,793/m^2. The arthropod to soil ratios were: 1 : 1.812 cc; 1 : 3.714 cc; 1 : 2.770 cc and 1 : 6.897.

The different subsample layers recorded the following biomass figures: 0.0106320 g; 0.0054230 g; 0.0082090 g and

0.0030620 g, which could equally be expressed as: 38.908% 19.846%; 30.040% and 11.205% of the seasonal biomass value. The arthropod weight (mg) per cc of soil in the different stratigraphical layers 1 to 4 was: 0.0157/cc; 0.0080/cc; 0.0121/cc and 0.0045/cc respectively.

APRIL (table 45)

The population in the first 1-4 cm subsample layer were smaller than in the second level, but only by so much as to suggest an onset of reductions as a result of unfavourable conditions. The actual numbers recorded for the successive levels were: 73, 86, 45 and 12 while the corresponding numbers per square metre were: 4,315.439; 5,083.940; 2,660.201 and 709.388. The arthropod to soil ratios were: 1 : 9.260 cc; 1 : 7.860 cc; 1 : 15.022 cc and 1 : 56.33 cc respectively for layers 1 to 4. The arthropod weight (mg) per cc soil in the different subsample layers was: 0.0021/cc; 0.0051/cc; 0.0015/cc and 0.0012/cc.

8.15 Plot E

In general, all the population numbers decreased relative to increased depth, but the highest numbers were nevertheless recorded in the second and third layers for some seasons.

JULY (table 46)

The highest numerical and biomass values were recorded in the 4-8 cm and 12-16 cm subsample level, representing 28.083% and 27.660% of the seasonal numbers respectively and

26.341% and 27.422% of the seasonal biomass values respectively. The actual numbers recorded for the different subsample levels, were: 56, 66, 48 and 65 while the numbers per m^2 for these figures are: 3,310.474; 3.901.629; 2.837.549 and 3, 3,842.513 respectively. The arthropod to soil ratios were: 1 : 12.071 cc. 1 : 10.242 cc; 1 : 14.083 cc and 1 : 10.400 cc respectively for the subsample levels 1 to 4.

The arthropod weight (mg) per cc of soil in layers 1 to 4 was: 0.0005/cc; 0.0006/cc; 0.0005/cc and 0.0006/cc.

SEPTEMBER (table 47)

Apart from the drastic reduction in general population numbers, the highest number of arthropods recorded came from the first and second subsample layers. The number per square metre for layers 1 to 4 was: 2,187.277; 768.502; 236.462 and 591.157. The arthropod to soil ratios were: 1 : 18.270 cc; 1 : 52.000 cc; 1 : 169 cc and 1 : 67.600 cc for subsample layers 1 to 4 respectively.

The arthropod weight (mg) per cc of soil in the different subsample layers 1 to 4 was: 0.0016/cc; 0.0007/cc; 0.00003/cc and 0.00009/cc respectively.

JANUARY (table 48)

Though enormous numbers were registered in all the subsample layers, the population peak was most definitely concentrated in layers two and three. The actual numbers recorded for layers 1 to 4 were: 235, 545, 513 and 315 arthropods respectively and the numbers/m^2 for these abovementioned figures were: 13,892.167; 32,218.002; 30,326.302 and 18,621.413. The arthropod to soil ratios were: 1 : 2,876 cc; 1 : 1.240 cc; 1 : 1.317 cc and 1 : 2.146 respectively for stratigraphical levels 1 to 4.

At the subsample layers 1 to 4, the following biomass figures were recorded: 0.0083825 g; 0.0186305 g; 0.0172195 g and 0.0104125 g which could equally be expressed as: 15.338%; 34.094% ; 31.510% and 19.955% of the seasonal biomass value. The arthropod weight (mg) per cc soil in layers 1 to 4 was: 0.0124/cc; 0.0275/cc; 0.0254/cc and 0.0154/cc respectively.

APRIL (table 49)

Notwithstanding the overall population reduction in all the layers, the 4-8 cm level still attained the peak population density. The actual numbers recorded for the layers 1 to 4 were: 143, 270, 126 and 88 arthropods respectively and the numbers /m^2 for these abovementioned figures were: 8,453.529; 15,961.212; 7,448.565 and 5,202.174. The arthropods to soil ratios were: 1 : 4.727 cc; 1 : 2.503 cc; 1 : 5.365 cc and 1 : 7.681 cc.

The arthropod weight (mg) per cc soil in the layers 1 to 4 was: 0.0053/cc; 0.0121/cc; 0.0060/cc and 0.0041/cc. The April season represented 24.377% of the year's biomass recovery, in comparison with the 71.210% recorded for January 1966.

8.16 General vertical distribution pattern

Most frequently the arthropods were found to concentrate in the top layer of the soil, with a gradual decrease in numbers towards the fourth subsample level. This tendency could be ascribed to the population's reaction to physical factors, such as pore space, food, air supply and more specifically, moisture and temperature.

It was, however, not the only distributional pattern observed, in fact, the mesofauna of some plots had their peak populations in the 4 - 8 cm and 8 - 12 cm subsample layers and there were substantial populations in the 12 - 16 cm layer. Here again, it was the physical factors that extended their influence. To mention an example, the huge collembolan concentrations that occurred in January had their biggest population density in the lower soil layers at that time of the year, when surface temperature was extremely high and soil moisture naturally lower.

The depth to which soil organisms penetrate depends, among other things, upon the depth at which food, either roots of plants or humus is found, and upon the lightness and heaviness of the soil. In connection with the pore space factor, it has been emphasized that the large species such as the predators Erythraeidae, Cunaxidae and Bdellidae were found to be predominant in the surface litter layers. The space conditions are therefore of importance for the occurrence and frequency of species.

The highest organic material content naturally occurres on the soil surface. Organic material forms the basis of the life of most soil organisms, and is therefore of great importance. However, a high content of humus is by no means equivalent to a rich mite and Collembola fauna. This fact is proved by the occurrence of extraordinary high Collembola populations in the orchards of Section 2, where the calculated organic material of the soil is a mere 2 - 3%. Forsslund (1943) mentioned that apart form the amount of food available, the nature of it may be a descisive factor for the occurrence of some species.

Apart form abiotical factors, the biotical factors such as irrigation, cultivation and chemical applications most certainly must also have influenced vertical distribution.

The population quantity and quality varied from plot to plot as a result of differences in soil and other conditions, but the general vertical distributional pattern was the same. If the different subsample levels of all the plots were added up, the following totals of mesofaunal arthropods would be registered for the different soil levels:

1 - 4 cm	4 - 8 cm	8 - 12 cm	12 - 16 cm
3298	2578	2073	1685

The abovementioned figured could equally be expressed as a yearly mean of: 9,754/m^2, 7,625/m^2, 6,148/m^2 and 4,965/m^2 arthropods for subsample levels 1 - 4.

8.2 STRATIGRAPHY OF ECOLOGICALLY IMPORTANT FAMILIES AND SPECIES

Stratigraphical analyses were made of the dominant families and species, as well as certain orther ecologically important species.

TROMBIDIFORMES

TYDEIDAE

Representatives of this family, and especially its species Tydaeolus sp., was the most dominant trombidiform mites in all the plots investigated (fgi. 122). With a few exceptions, the seasonal recordings for all plots were in line with the general vertical distributional pattern. The highest recording for this family occurred on plot A, followed by plots B, D, E and C respectively. The yearly mean vertical distribution for strata 1 - 4 for all plots was: 2,601/m^2, 1,359/m^2, 1,064/m^2 and 1,123/m^2 respectively. The occurrence of slightly higher values in subsample 4 than in subsample 3 was observed on plots A, B, C and E.

Tydaeolus sp. (fig.s 123-127)

As mentioned before, Tydaeolus sp. was the dominant species of this family. In general the species diminished numerically from the surface to the fourth subsample layer, but it also occurred that higher numbers were recorded in subsample levels 3 and 4, than in the more superficial soil

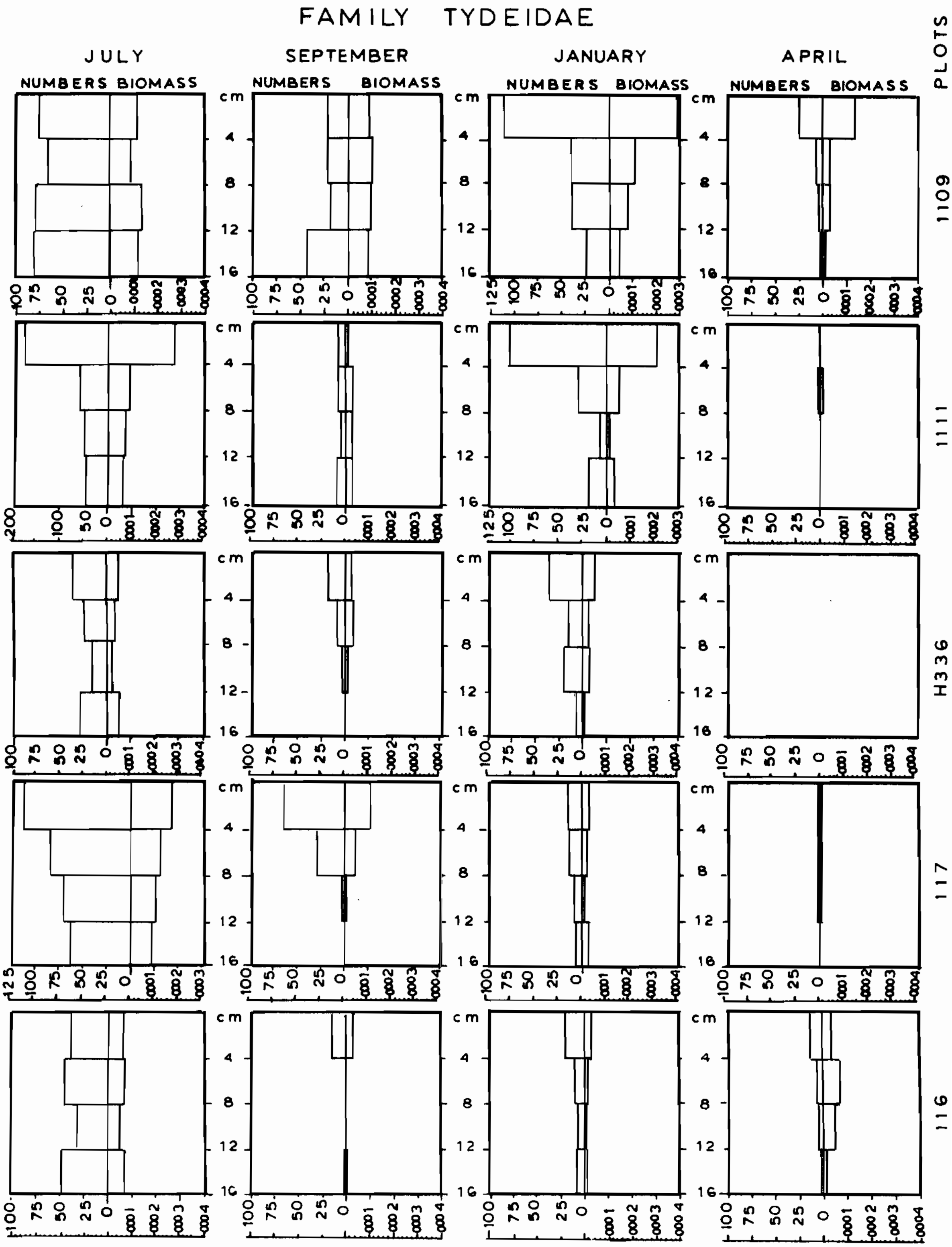

Fig. 122 Vertical distribution of the family Tydeidae, plots A - E.

PLOT 1109

FAMILY. TYDEIDAE

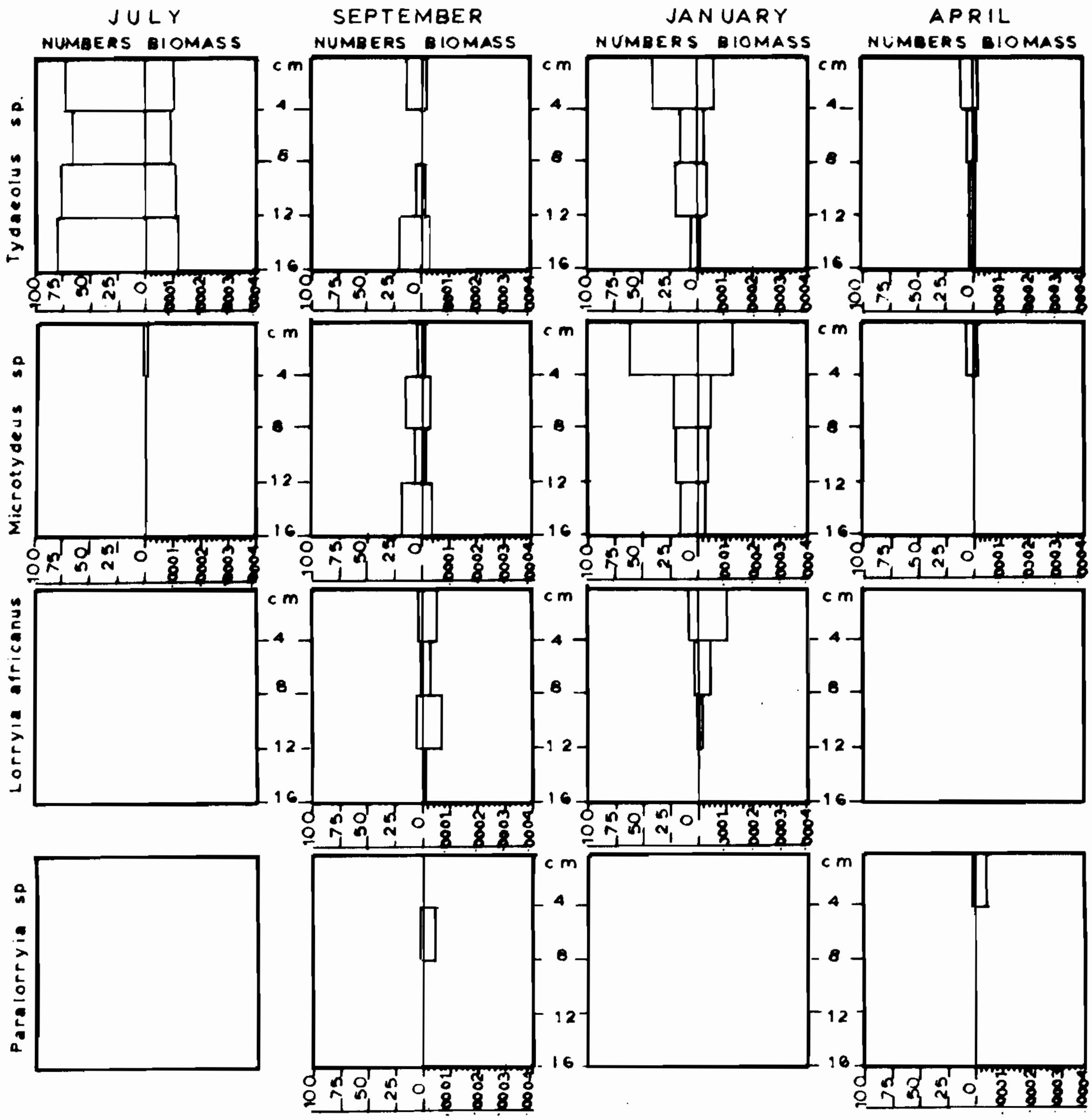

Fig. 12: Vertical distribution of the species of Tydeidae, plot A.

PLOT 1111

FAMILY TYDEIDAE

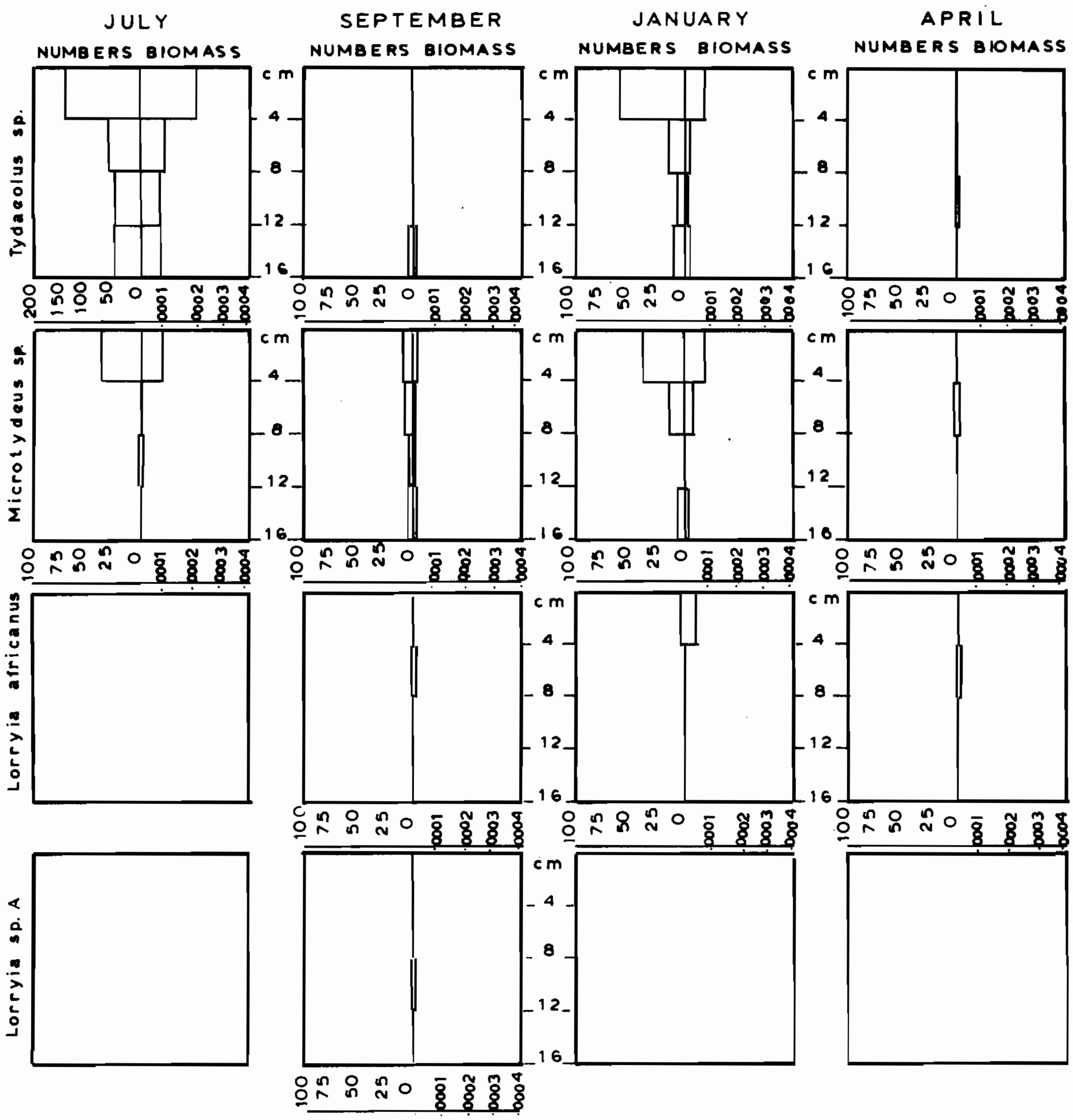

Fig. 124 Vertical distribution of the species of Tydeidae, plot B.

PLOT H336
FAMILY TYDEIDAE

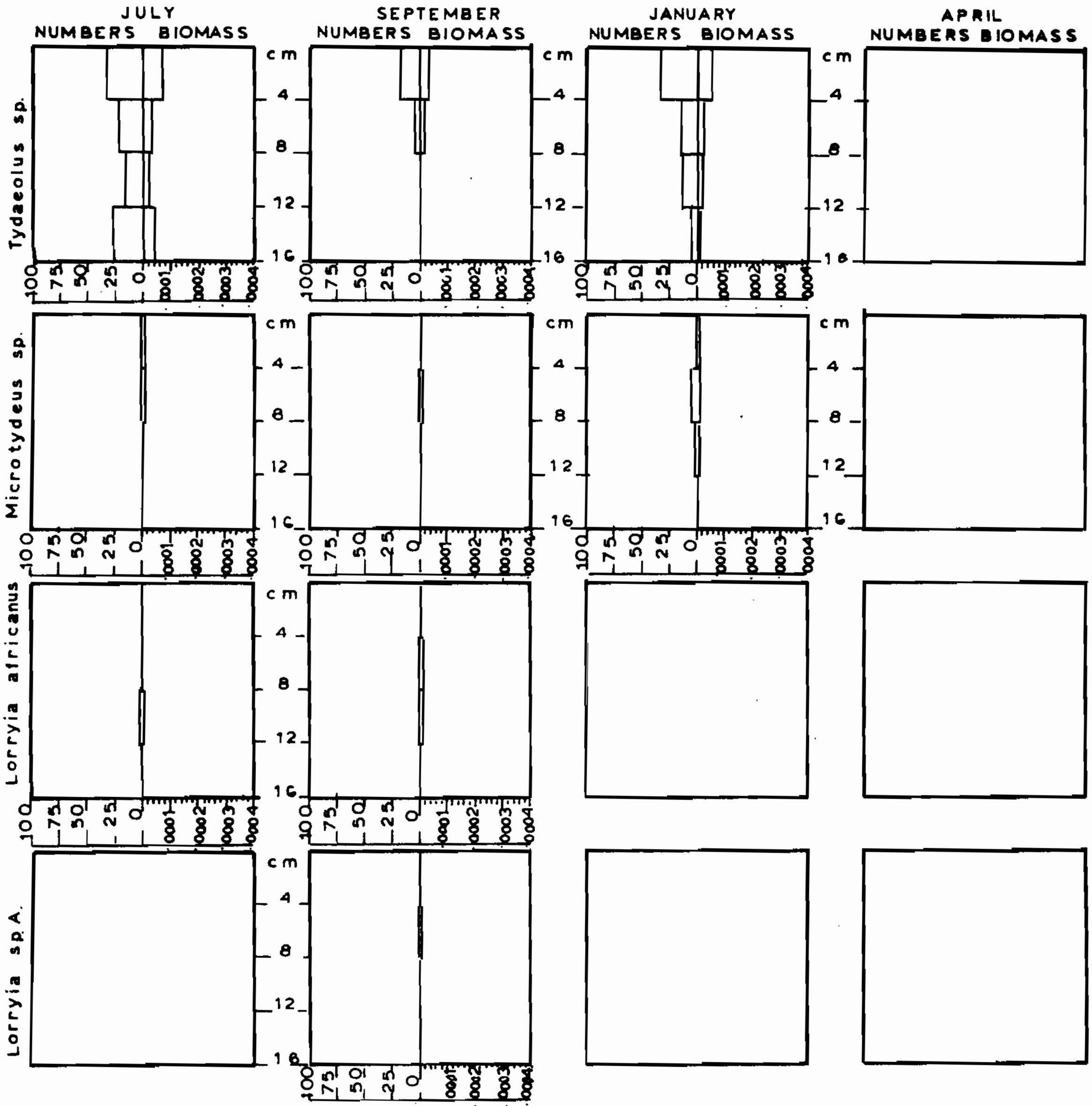

Fig. 125 Vertical distribution of the species of Tydeidae, plot C.

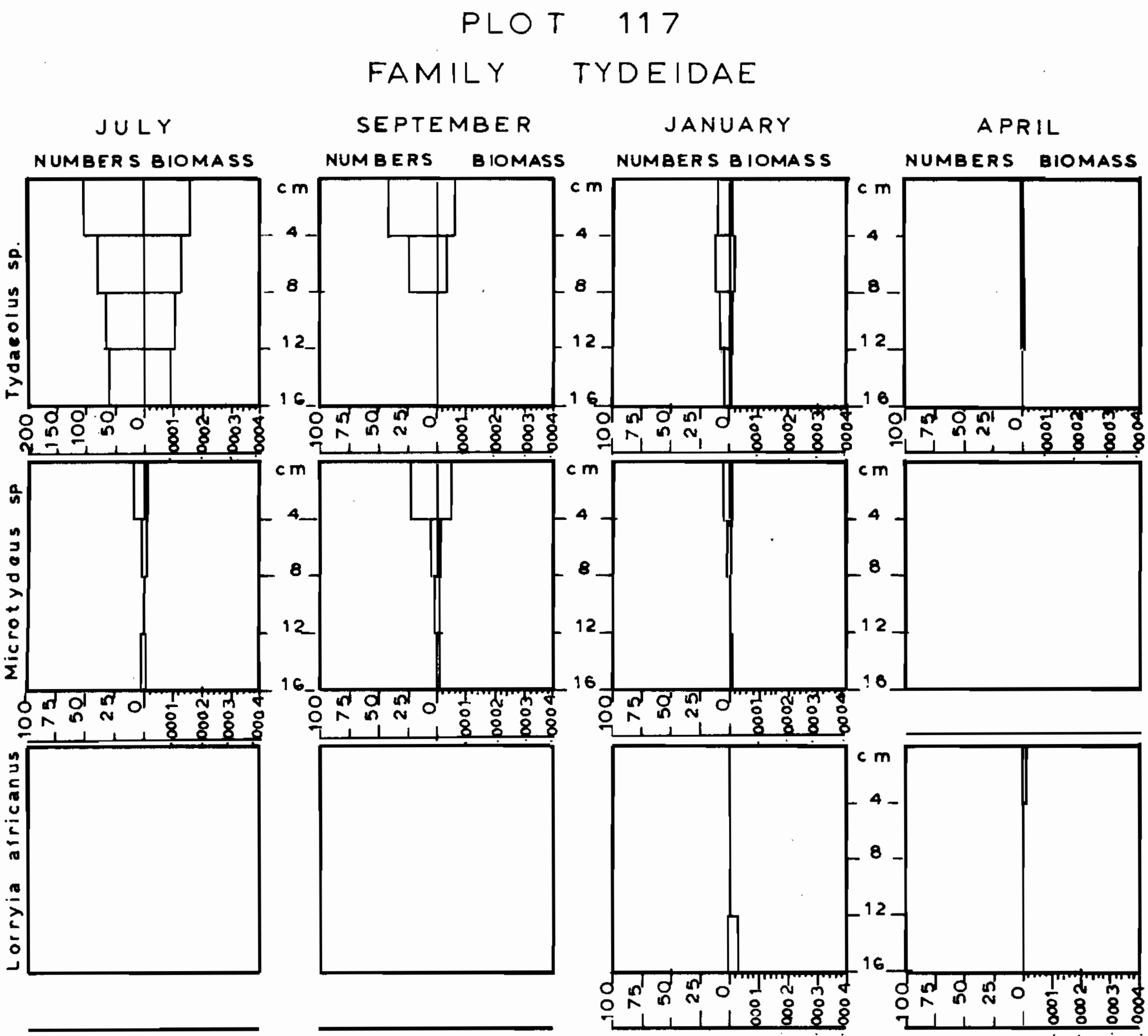

Fig. 126 Vertical distribution of the species of Tydeidae, plot D.

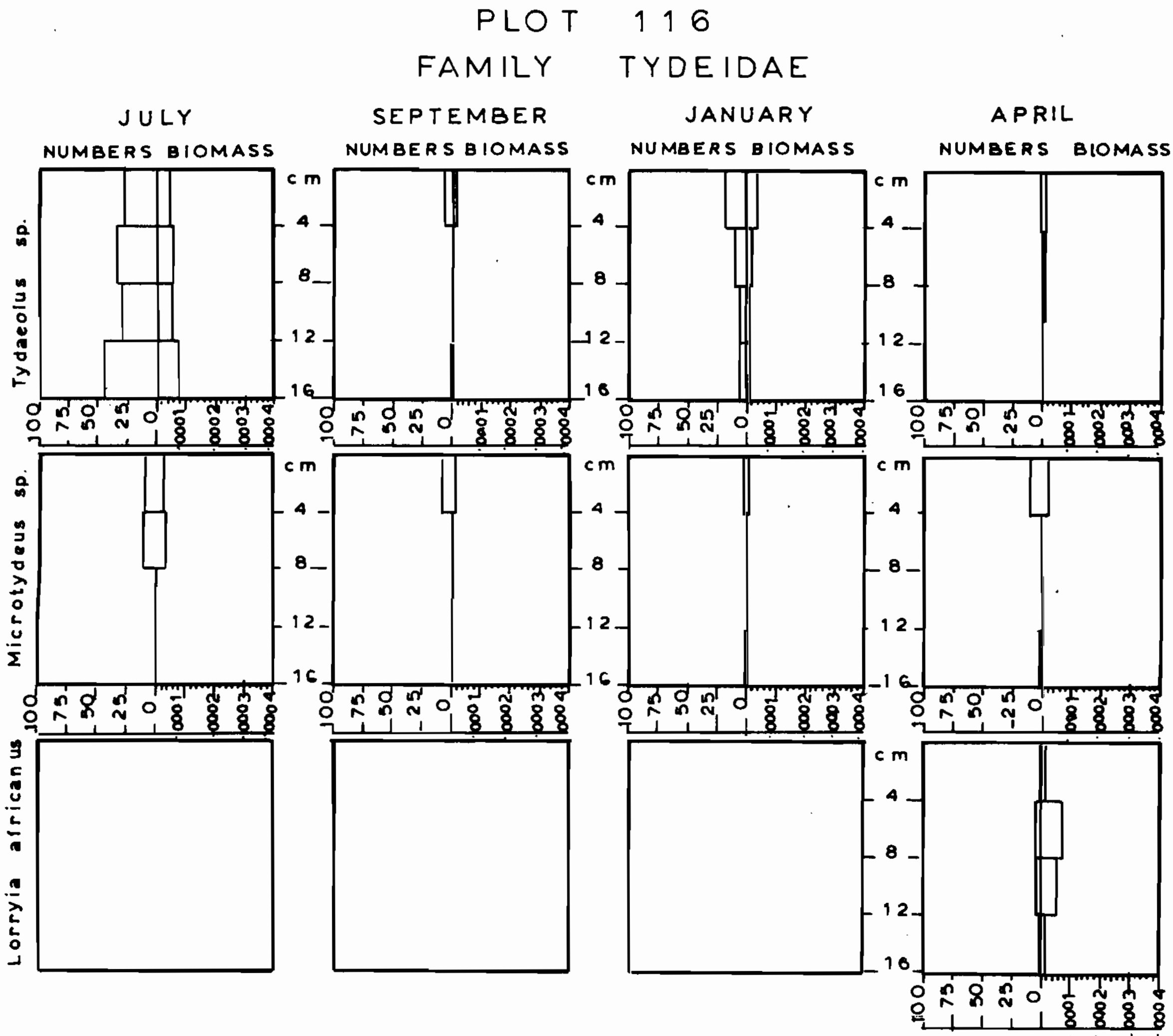

Fig. 127 Vertical distribution of the species of Tydeidae, plot E.

strata. As Van Jaarsveld (1965) also indicates, these minute arthropods are well adapted to live in the lower soil strata. Van Jaarsveld (1965) found the biggest concentrations ($16{,}188/m^2$) of Tydaeolus sp. in the 15 - 20 cm. soil level during his investigation on an agricultural soil. The present plots investigated never reached the concentrations mentioned by Van Jaarsveld (1965). The highest recording of $8{,}000/m^2$ specimens, which occurred in the first subsample level of plot B, was made during the July sampling. The highest recording for the fourth subsample level was $4{,}670/m^2$ during July on plot A.

Microtydeus sp. (figs. 123-127)

This species also had its highest population concentration in the upper soil levels. The 12-16 cm level, however revealed a bigger concentration than the 8-12 cm level. The yearly mean vertical distribution for strata 1 - 4 for all plots was: $2{,}601/m^2$, $886/m^2$, $472/m^2$ and $650/m^2$.

The bigger Lorryia africanus (Baker) and Paralorryia sp. occurred predominantly in the first 12 cm of soil.

NANORCHESTIDAE (fig. 128)

The greater abundance of eu-edaphic Speleorchestes sp. in the control plot was very conspicious. The smaller numbers extracted at the citrus plots could most definitely be ascribed to cultivation practices. The citrus plots at Section 2 re-

FAMILY NANORCHESTIDAE

Speleorchestes sp.

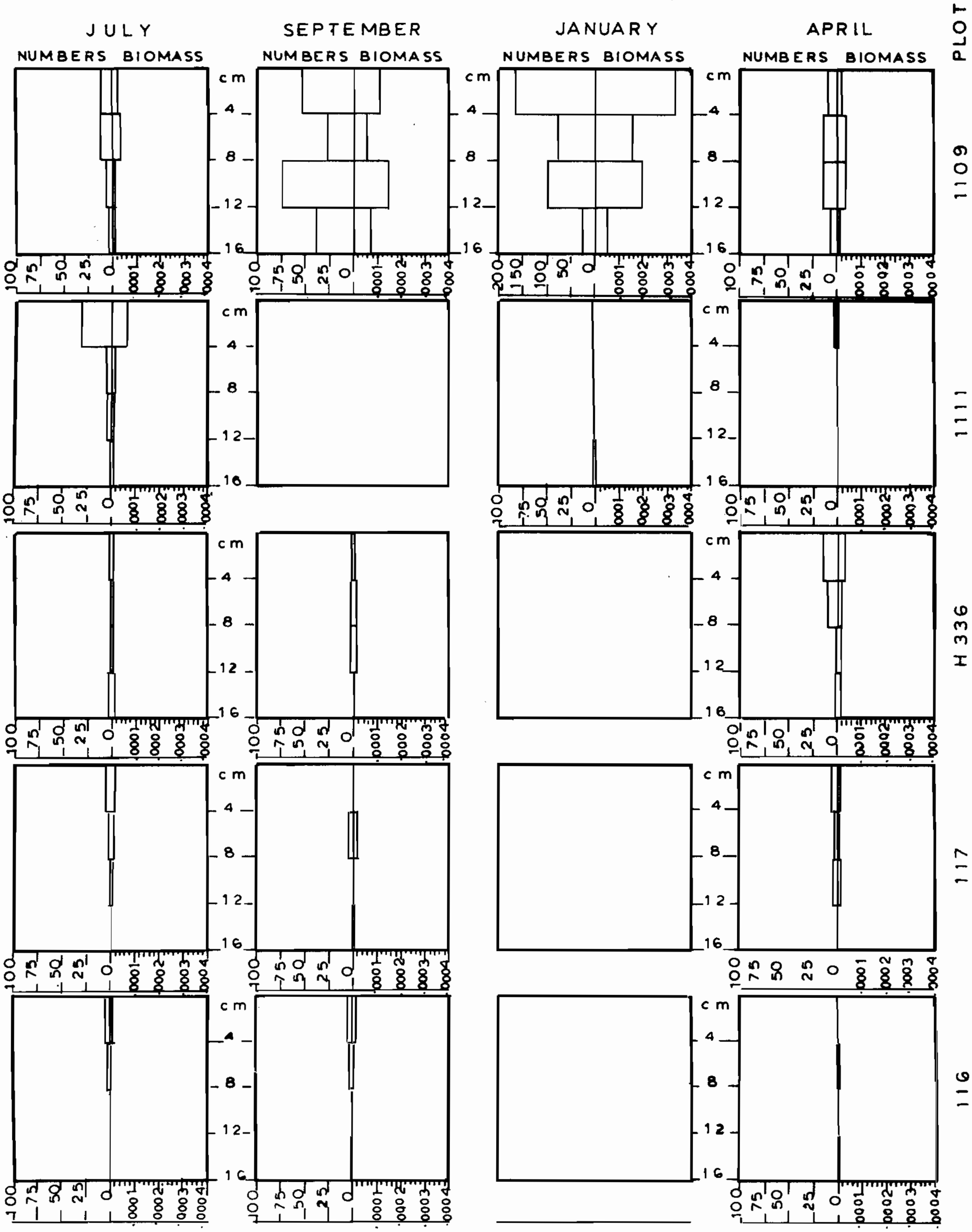

Fig. 128 Vertical distribution of *Speleorchestes* sp., plots A - E.

corded a yearly mean of 354 specimens per m^2 and those of Section 3 B, 655/m^2 while the control plot registered 9,399/m^2. In connection with the vertical distribution, it has been observed that the 1-4 cm and 4-8 cm soil levels had the highest population density, but considerable numbers were also recorded for the second and fourth subsample layers. Van Jaarsveld (1965) recorded the biggest population density of this species in the upper 10 cm of soil.

The numbers per m^2 recorded from the respective subsamples 1 - 4 on plot A were: 3,133/m^2, 1,596/m^2, 4,256/m^2 and 2,187/m^2 in September and 9,754/m^2, 4,611/m^2, 5,734/m^2 and 1,596/m^2 in January. The population peak occurred in summer and the numbers for subsamples 1 - 4 again declined to 532/m^2, 827/m^2, 827/m^2 and 354/m^2 respectively in April. During investigations, Olivier & Ryke (1965), Den Heyer & Ryke (1966) and Loots & Ryke (1966) also recorded a summer peak for this species.

CUNAXIDAE (fig. 129)

Except for a few specimens recorded at the biological control plot and the old citrus plot, most specimens of <u>Cunaxa</u> sp. occurred on the control plot, most probably as a result of agricultural practices. The population peak occurred in summer, and as could be expected these relatively large trombidiform mites were predominant in the upper soil strata. As a result of thick organic material accumulation at various places in plot A, the F-layer of the A-horizon sometimes streched

FAMILY CUNAXIDAE

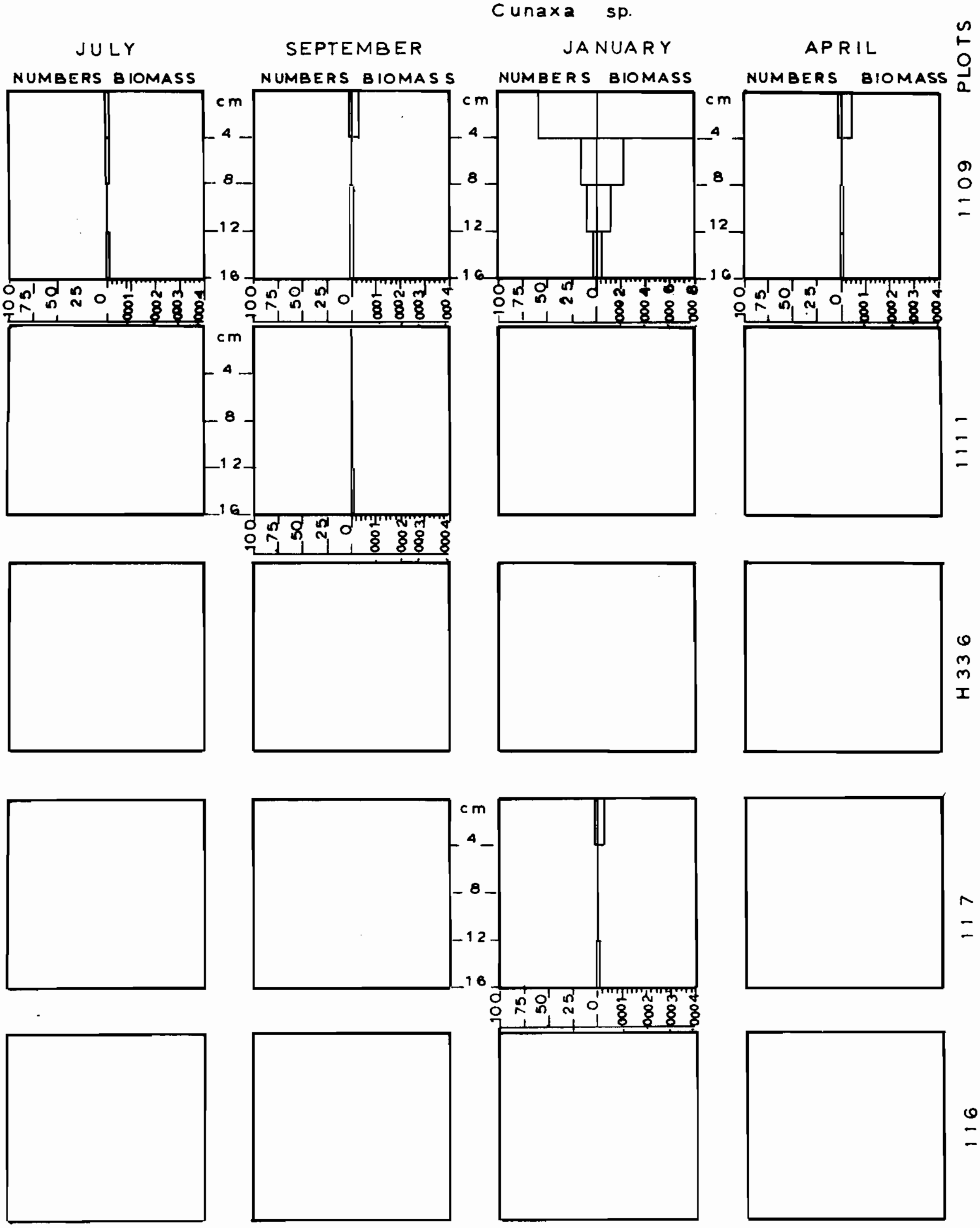

Fig. 129 Vertical distribution of Cunaxa sp., plots A - E.

down to the 16 cm level and thus permitted larger, non-burrowing predators to migrate deeper into the soil than is usual. The recorded numbers per m^2 for <u>Cunaxa</u> sp. during January on plot A were:

1 - 4 cm	:	3,487/m^2
4 - 8 cm	:	945/m^2
8 -12 cm	:	532/m^2
12 -16 cm	:	177/m^2

PYEMOTIDAE (fig. 130)

<u>Pygmephorus</u> sp. is an eu-edaphic trombidiform mite and was recorded on all the plots investigated. By far the biggest concentrations occurred on plot B.

During July, the highest concentration of this species (3,428/m^2) was recorded at the 1-4 cm soil level of plot B. The September sample revealed a considerable population reduction, probably as a result of factors such as chemical application, but the peak population (768/m^2) was still present in the 1 - 4 cm level. The January sample reveals an enormous increase. The population peak shifted to the 4 - 8 cm level, but other soil strata also had significant population numbers. The numbers per m^2 for <u>Pygmephorus</u> sp. for January in the different strata of plot B were:

1 - 4 cm	:	3,546/m^2
4 - 8 cm	:	10,877/m^2
8 -12 cm	:	827/m^2
12-16 cm	:	6,983/m^2

FAMILY PYEMOTIDAE

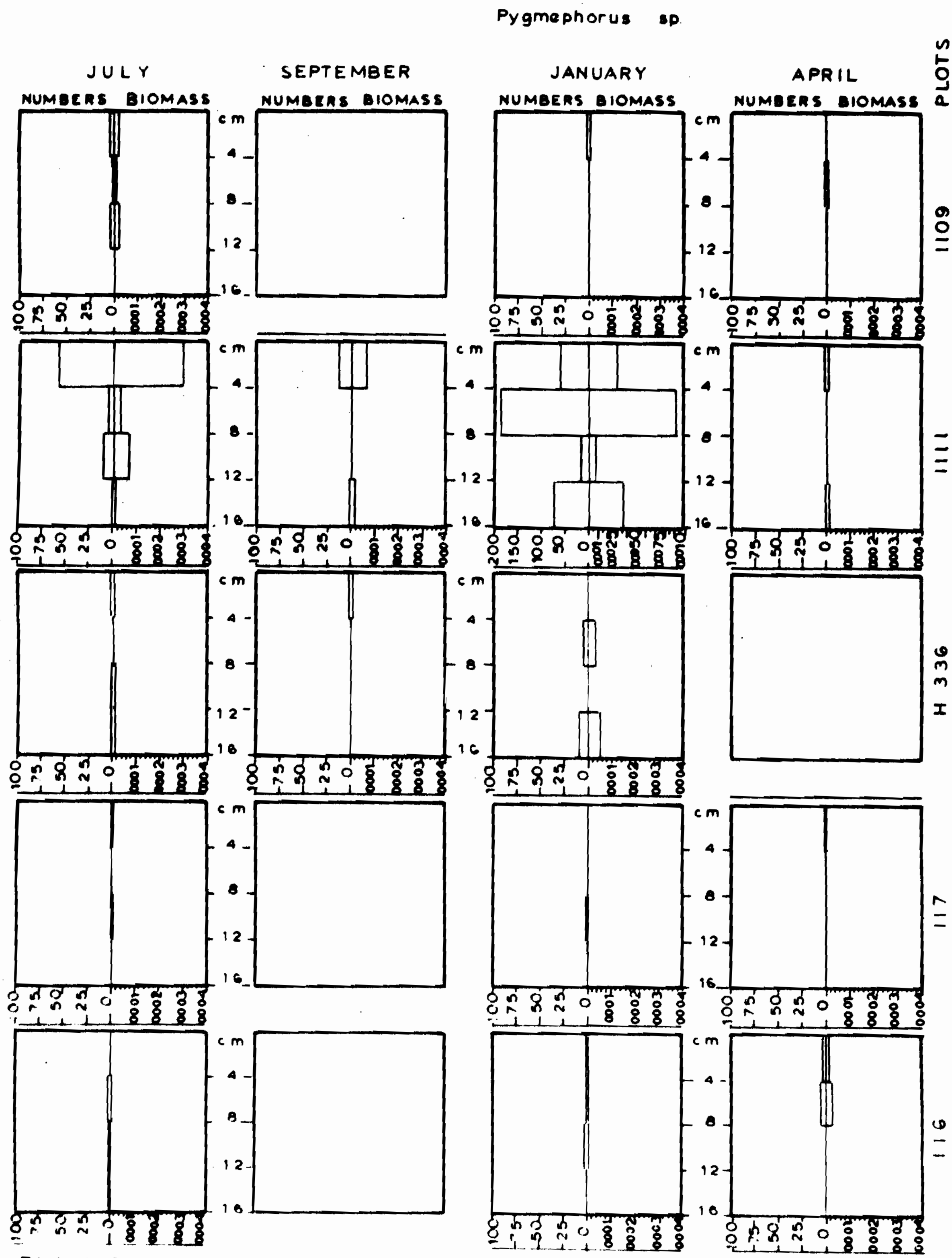

Fig. 130 Vertical distribution of *Pygmephorus sp.*, plots A - E.

In April the population again decreased to 118/m^2.

ORIBATEI

ORIBATULIDAE (fig. 131)

The Oribatulidae was the dominant family of this order in all the plots investigated. With a few exceptions, the seasonal recordings of all the plots were in line with the general vertical distributional pattern. The highest numbers for this family were extracted from the citrus soils of plot B, followed by those of plots D, C and E respectively. The yearly mean vertical distribution for soil strata 1 - 4 of all the plots was: 945/m^2, 709/m^2, 354/m^2 and 295/m^2. respectively.

Scheloribates spp. A and B (figs. 132 A and B)

Both species followed the general vertical distribution pattern. Though sp. A was more abundant than sp. B, they apparently lived in close relation. The yearly mean vertical distribution for sp. A in levels 1 - 4 was: 2,069/m^2, 1,891/m^2, 1,004/m^2 and 768/m^2. The yearly mean vertical distribution for sp. B in levels 1 - 4 was: 1,714/m^2, 1,004/m^2, 650/m^2 and 413/m^2.

COLLEMBOLA

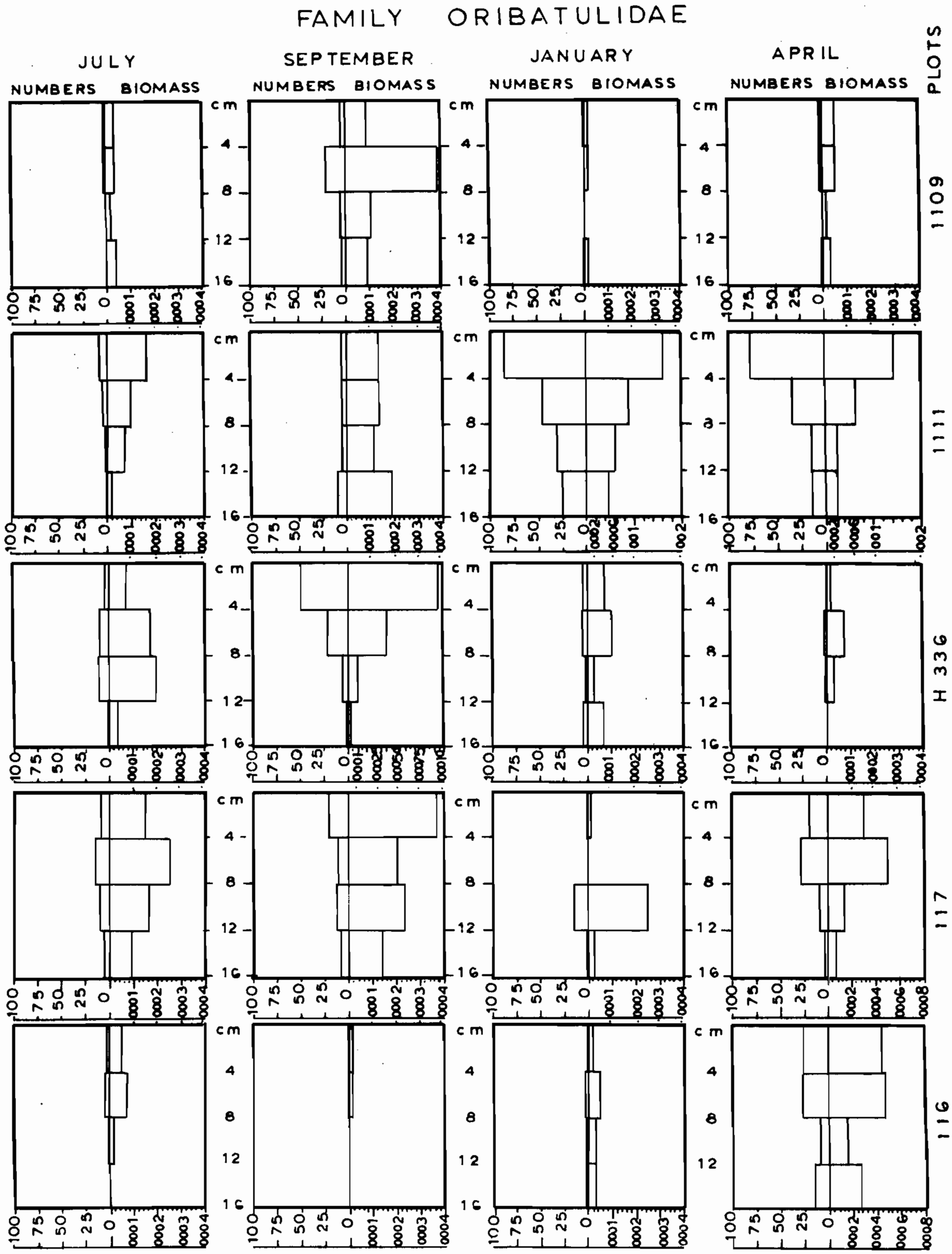

Fig. 131 Vertical distribution of the family Oribatulidae, plots A - E.

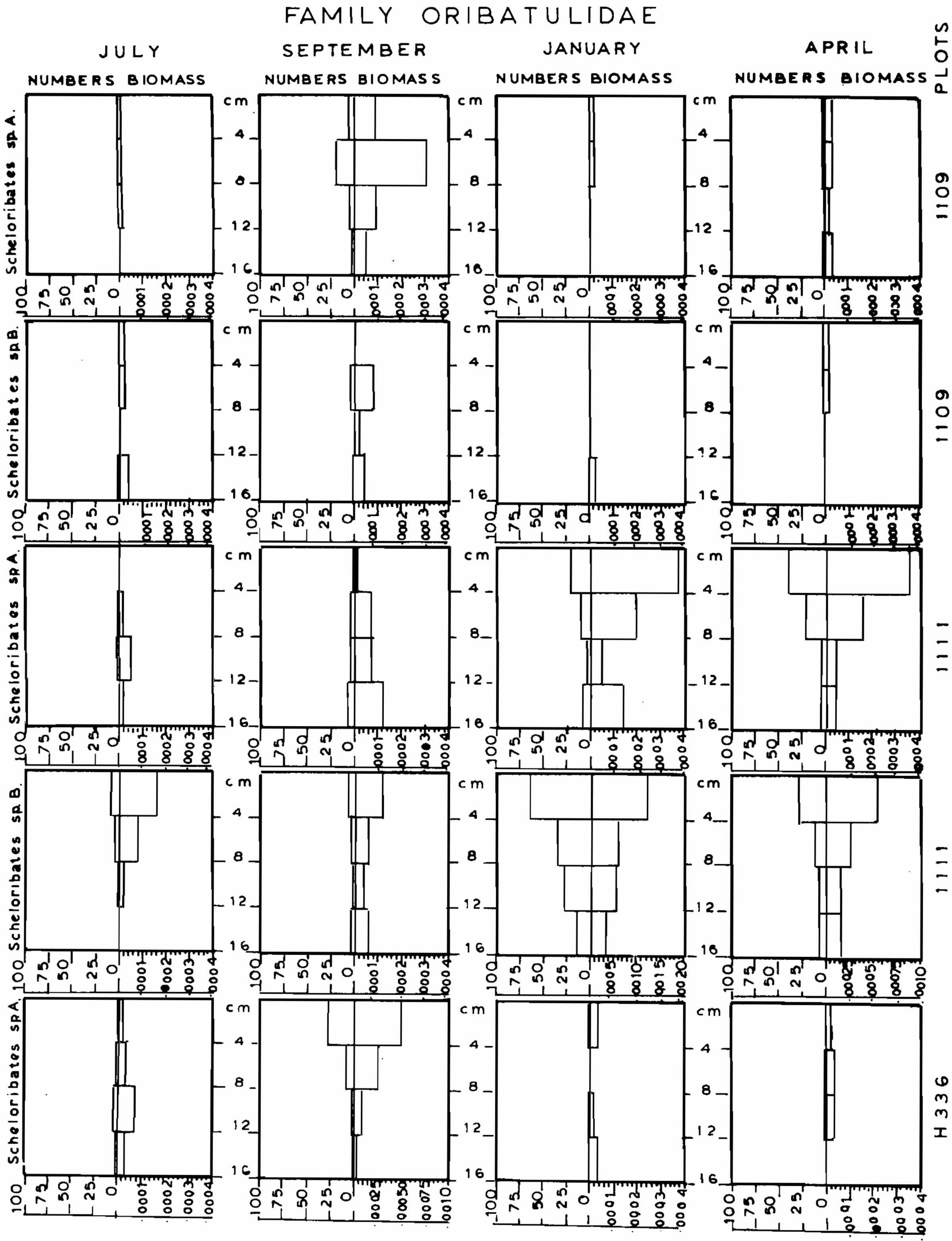

Fig. 132 A Vertical distribution of the species of Oribatulidae, plots A – E.

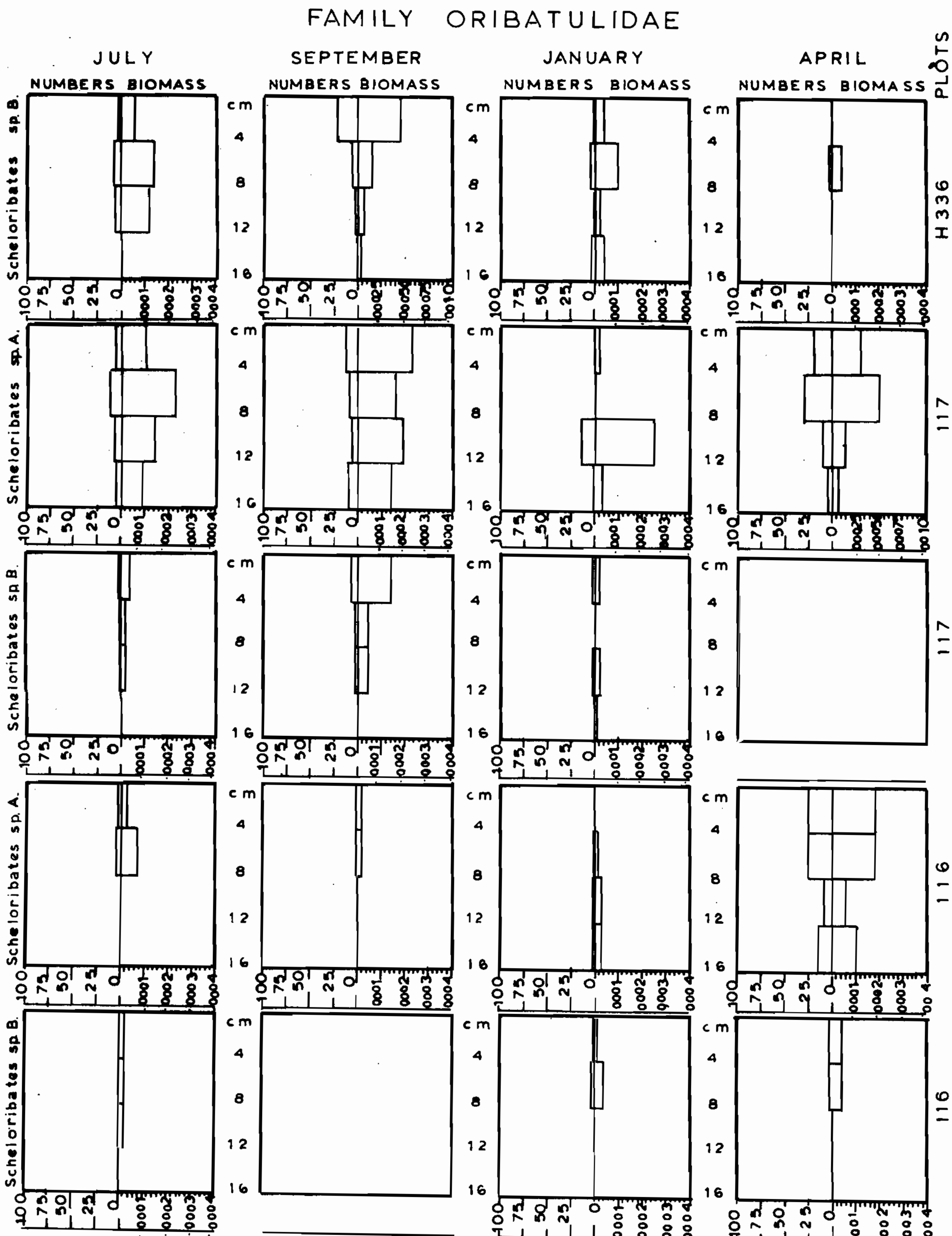

Fig. 132 B Vertical distribution of the species of Oribatulidae, plots A - E (continued) .

ISOTOMIDAE (fig. 133)

A general review of the dominant Isotomina termophila (Axelson) in all five plots revealed peak populations for all of them in January 1966. Stratigraphically, the populations apparently had higher numbers in the deeper soil strata, though fair numbers were also recorded in the top 1 - 4 cm. In contrast to the few specimens extracted on the control plot, the citrus plots produced enormous numbers. The peak population for plot B (in January) maintained a high density throughout the four soil layers. The largest numbers occurred at the second and fourth subsample levels. The numbers per m^2 for January were: 3,014/m^2, 4,374/m^2, 2,187/m^2 and 3,842/m^2 in layers 1 to 4 respectively. With the exception of three specimens extracted, the whole population of Isotomina termophila (Axelson) recorded on plot C was recovered in January. The numbers recorded for levels 1 - 4 were: 9,517/m^2, 3,724/m^2, 6,975/m^2 and 11,172/m^2 respectively. The few specimens found in the July sample of plot D suggested an aggregation in the lower soil levels. On the other hand, a few species from the September sample were associated with the three upper soil strata. The greater abundance of the animals in the January peak populations gave a better indication of the population densities in the different soil levels. The numbers per m^2 recorded for the last mentioned seasonal sample of plot D were: 2,541/m^2, 7,034/m^2, 10,759/m^2 and 4,551/m^2 respectively for soil strata 1 - 4. Though the numbers diminished considerably, more or less the same proportions were maintained in April. The numbers per m^2 were:

FAMILY ISOTOMIDAE

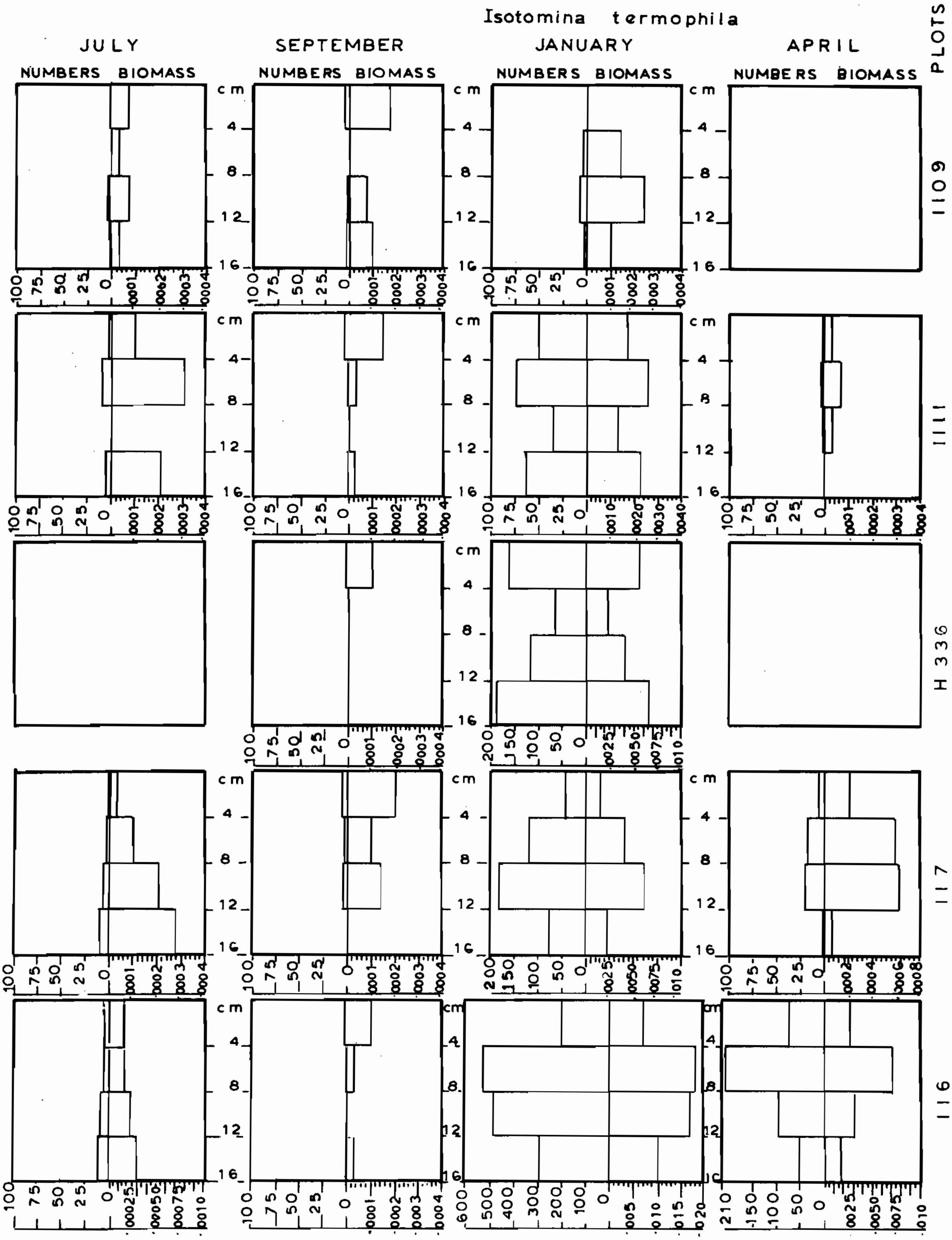

Fig. 133 Vertical distribution of Isotomina termophila, plots A - E.

$354/m^2$, $1{,}004/m^2$, $1{,}064/m^2$ and $118/m^2$. Just as described for plot D, the numbers of the July sample of plot E increased with depth up to the 3rd level. The biggest population density for a single species to be recorded in this investigation occurred in the January sample of the last mentioned plot. The numbers per m^2 were: $11{,}823/m^2$, $30{,}444/m^2$, $31{,}671/m^2$ and $17{,}202/m^2$ for levels 1 - 4 respectively. Though the population had a considerable decrease, the April numbers were still very high in comparison with those of other plots, being $4{,}374/m^2$, $12{,}177/m^2$, $5{,}556/m^2$ and $3{,}014/m^2$ for levels 1 - 4 respectively.

ONYCHIURIDAE (fig. 134)

This family, with its representative species *Onychiurus camerunensis* (Schött) though considerably smaller in numbers than *Isotomina termophila* (Axelson), lived in co-existence with the latter. Peak populations occurred in January and moderate numbers were also recorded in April 1966.

This species is able to inhabit the deeper levels of the soil. They reveal the typical adaptations to a subterranean mode of existence, such as the reduction of the body and the tendency toward loss of pigment, eyes and furca. On several occasions, *Onychiurus camerunensis* (Schött) were found to be more abundant in the lower levels of the soil, as for instance in the January sample of plot C. The numbers recovered during the last mentioned sample were:

FAMILY ONYCHIURIDAE

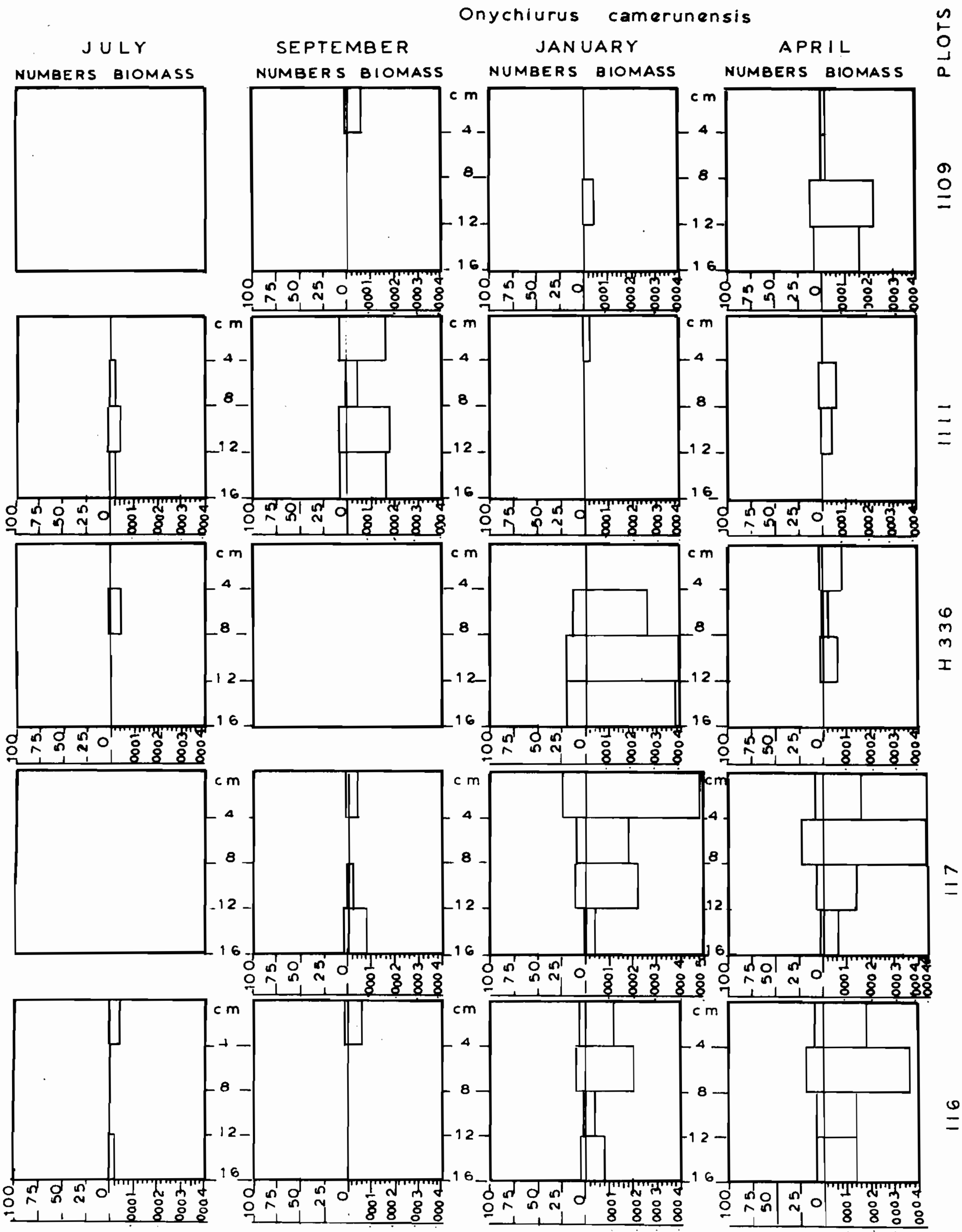

Fig. 134 Vertical distribution of *Onychiurus camerunensis*, plots A - E.

1 - 4 cm -

4 - 8 cm : $768/m^2$

8 -12 cm : $1,182/m^2$

12 -16 cm : $1,123/m^2$

The yearly mean vertical distribution for strata 1 - 4 for all plots was: $1,123/m^2$, $2,305/m^2$, $2,955/m^2$ and $1,596/m^2$ respectively. It was thus entirely in contrast with the general vertical distributional pattern. Simular recordings for Onychiurus species were also made by Strenzke (1949), Glasgow (1939) and Sheals (1957).

ACHORUTIDAE (fig. 135)

With the exception of the few specimens found in plots B and E, the most important population numbers were extracted in the January sample of the biological control plot. As the numbers per m^2 indicate, Brachystomella parvula (Schaeffer) had its population peak in the first four cm of soil. The numbers per m^2 for January were: $16,138/m^2$, $1,950/m^2$, $1,182/m^2$ and $413/m^2$ for subsample layers 1 - 4 respectively. The population again declined considerably towards April, but nevertheless had a fair population peak of $1,182/m^2$ in the upper 4 cm of soil.

SPIROSTREPTIDAE (fig. 136)

Of the various other population components, which could be compared, the diplopods were the most important. It was

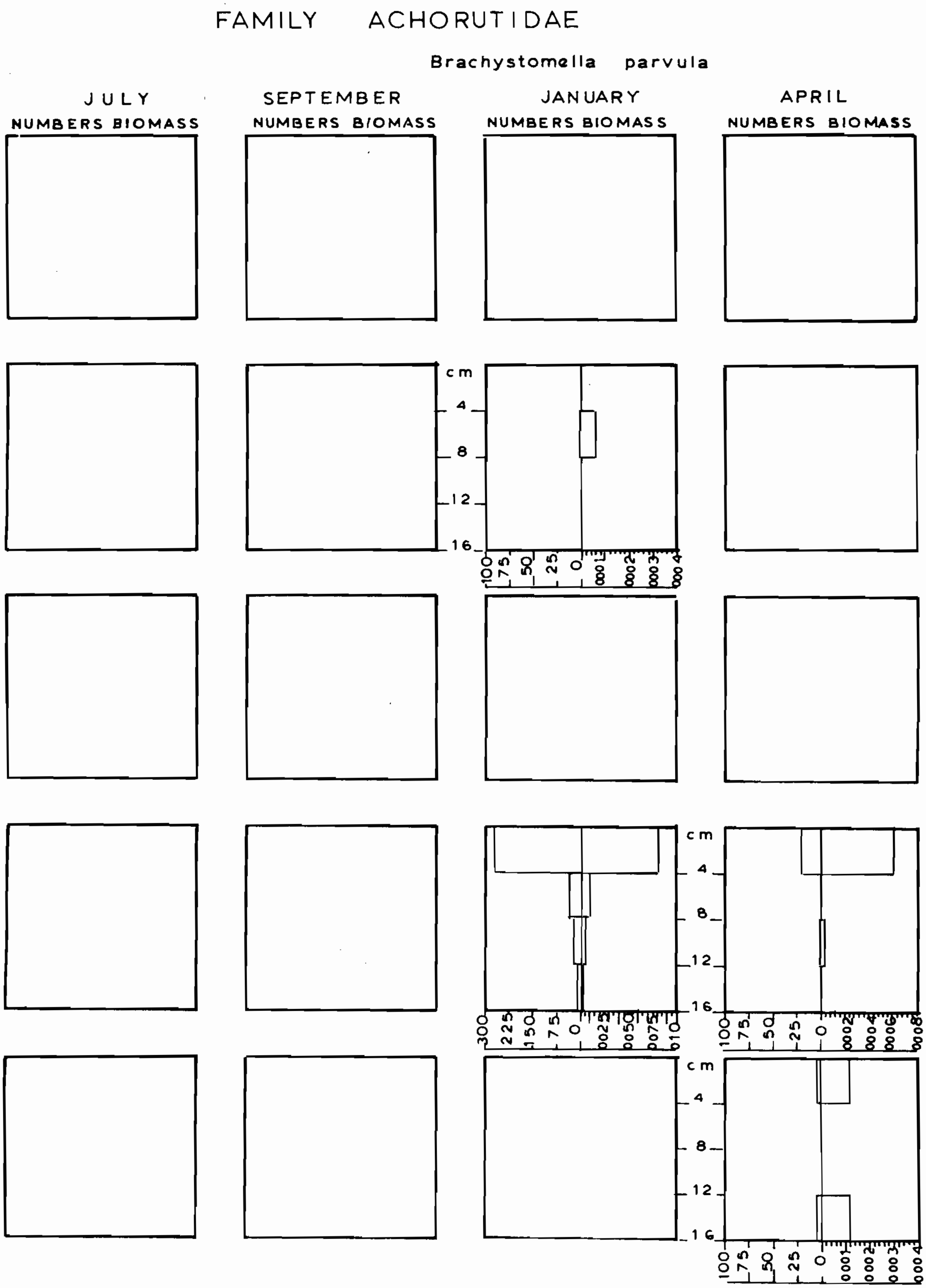

Fig. 135 Vertical distribution of Brachystomella parvula, plots A - E.

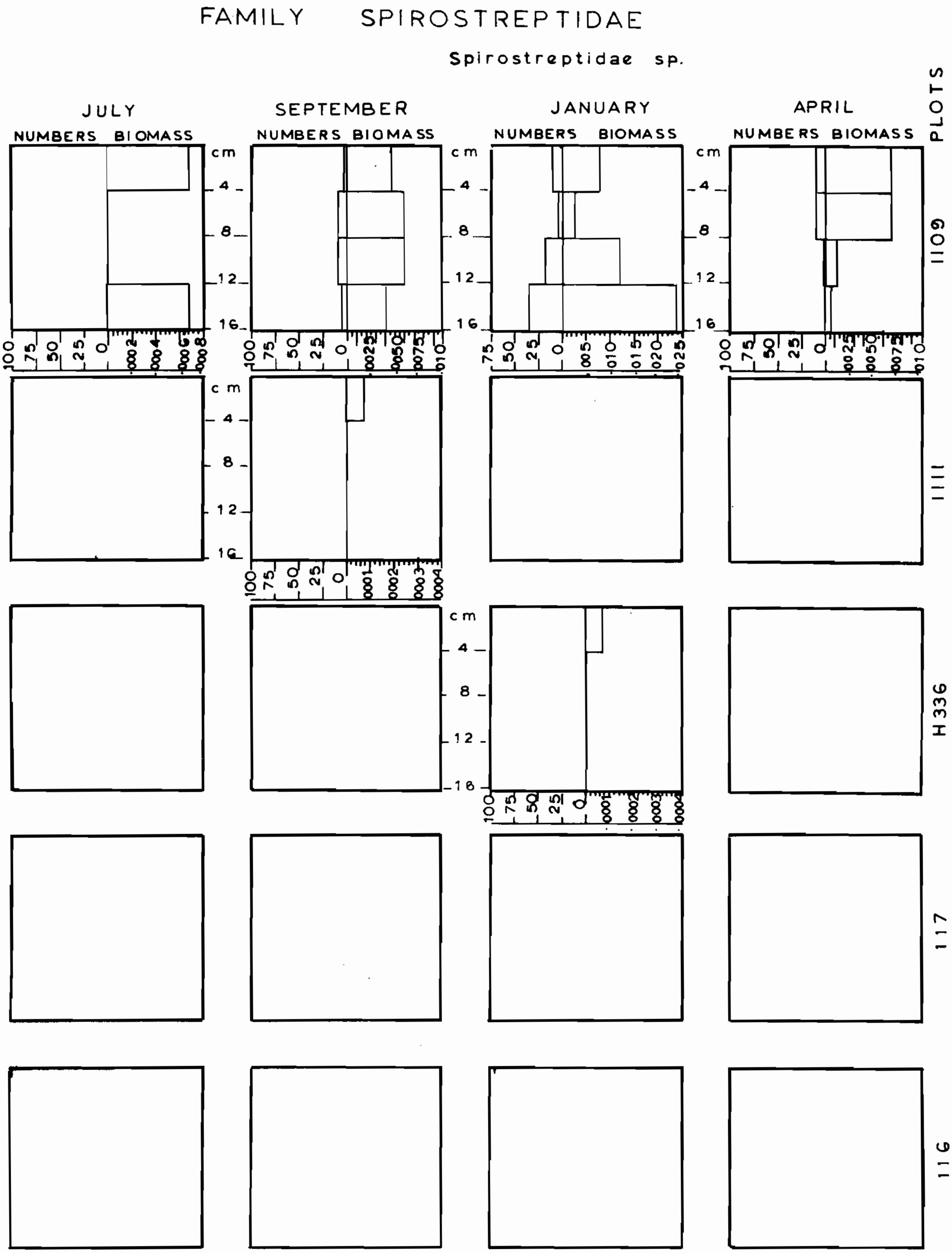

Fig. 136 Vertical distribution of Spirostreptidae sp., plots A - E.

especially of importance for its high biomass value. Apart from a few specimens extracted at plots B and C, the biggest concentration was found on plot A. As mentioned previously, the scarcity of diplopods in the citrus soils could be attached to cultivation practices. During July only two diplopods were found at plot A. The seasons September, January and April, however, contributed 31 (1,832/m^2), 68 (4,019/m^2) and 23 (1,359/m^2) respectively. The diplopods of the September sample had their highest population density in the third and second soil levels. In January, most diplopods obviously migrated deeper. The top subsample level recorded 650/m^2 in comparison with the 2,069/m^2 in the 12 -16 cm layer.

The density of mesofaunal arthropods revealed a general pattern of higher concentrations in the first 1 - 4 layer. The mesofaunal density of the control plot could also be expressed as: 1 mesofaunal arthropod to 5 cc of soil for all four stratigraphical layers and for all four seasons. This, however, does not happen in practise, as ratios as high as 1 mesofaunal arthropod per 1 cc of soil were recorded in January and 1 to 25 cc of soil occurred in April 1966. Although high collembolan numbers were recorded in the citrus plots, the arthropods never exceeded 1 per cc of soil in the different stratigraphical layers.

The control plot, which recorded the highest mesofaunal biomass values of all the plots investigated, reached a value of 0.0369 mg/cc in the fourth subsample layer of the January sample. In comparison, the highest mesofaunal biomass value recorded in the citrus plots was 0.0275 mg/cc in the second subsample layer of the January sample of plot E. Though very high numbers were registered in all the soil layers in the January sample of the last mentioned plot, the population peak was most definitely concentrated in the second and third subsample layer. The numbers per m^2 for subsample layers 1 to 4 were: $13,893/m^2$, $32,218/m^2$, $30,326/m^2$ and $18,621/m^2$. This was the biggest population density recorded.