

## 7 SEASONAL FLUCTUATIONS OF THE MESOFAUNA

One of the first phases in the study of a field population is often an attempt to discover which factors are mainly responsible for variations in abundance. We need to know about them in order to carry the analysis to the stage of understanding population dynamics, to say nothing of the needs of economic entomology and the importance of being able to predict increases in numbers. Abundance in a particular habitat may be influenced by an annual breeding season, with annually varying reproductive success, followed by a period of variable decline in numbers due to factors such as weather conditions, food shortage, natural enemies and disease, until the next breeding season. Migratory, dispersive or aggregative movements are other causes of population fluctuations.

Comparing the mesofaunal numbers with the different factors involved, it was obvious that the mesofaunal population growth was in accordance with the summer rainfall and temperature increases. The summer could be regarded as the breeding season of the majority of mesofaunal arthropods encountered. The seasonal totals of all five plots (figs. 42 & 43), revealed exactly the same fluctuation tendencies, namely:

- 1 A drop in mesofaunal numbers from July 1965 to September 1965.
- 2 A steep increase to the highest mesofaunal recordings in January 1966.

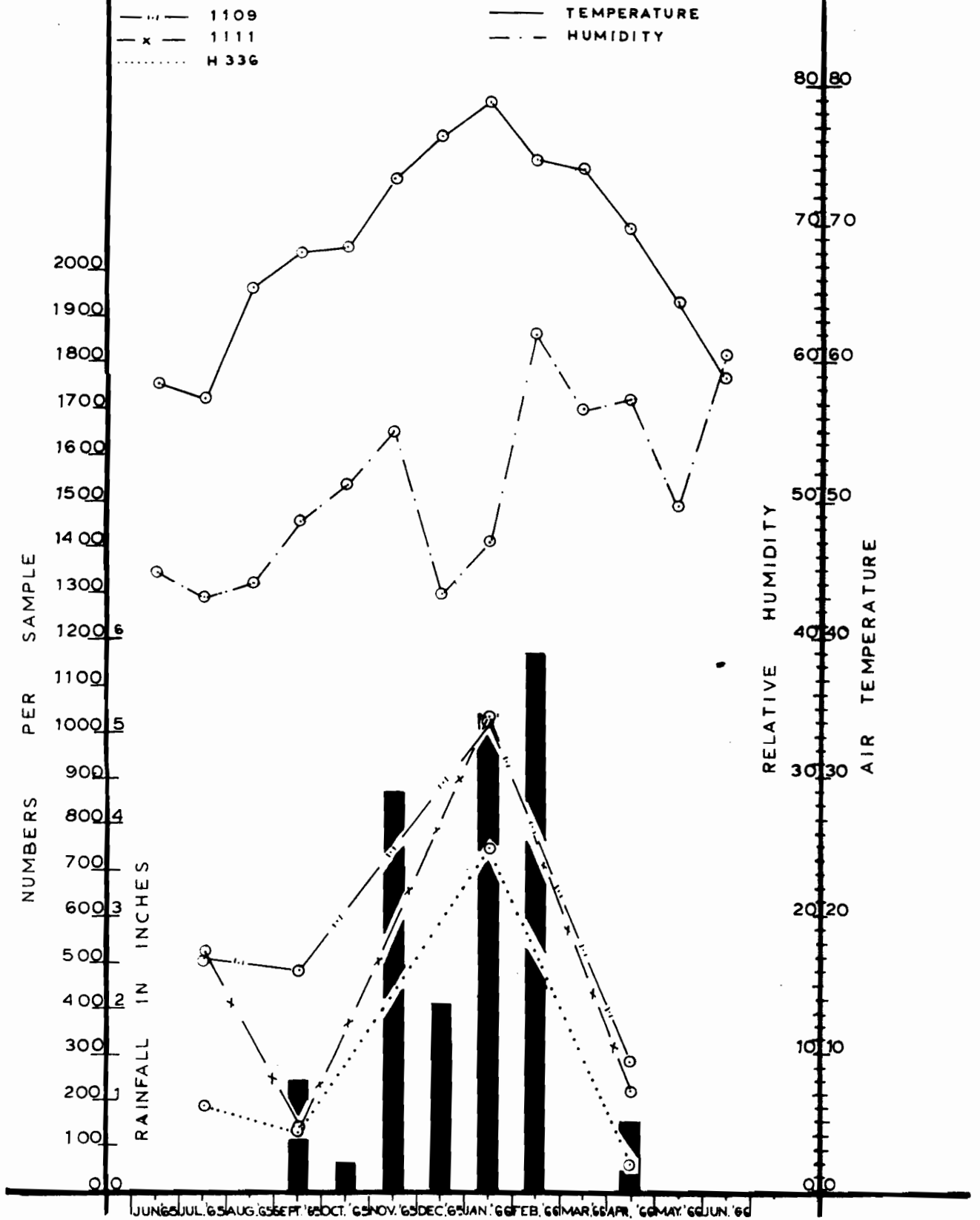


Fig. 42 Seasonal fluctuations in mesofaunal numbers of plots A, B and C and the recorded monthly mean of air temperatures and relative humidity. Rainfall histograms representing monthly totals.

3 A relatively sharp decline in numbers from January 1966 to April 1966.

For the investigation of the biotic effects on the seasonal numerical variation, various factors were compiled in figures 44 to 48. The mesofauna were recorded as "Acari", "Collembola" and "Other Arthropoda".

The soil moisture percentages taken during samplings were very low, as recorded in table 9. During January 1966, a mean soil moisture percentage of 3% was recorded, which was exceptionally low in the midst of the summer rain season, but due to high temperature and short spells of drought that time of the year, this phenomenon is not uncommon. Nevertheless, the soil moisture content recorded was obviously still adequate to support peak soil populations.

Irrigation practised on all four citrus plots had no conspicuous promoting effect on the soil mesofauna; on the contrary, the irrigation done in September 1965 and April 1966 depicts a deleterious effect, which may possibly be as a result of drowning. The January 1966 irrigation occurred just after the sampling, and its influences were thus not recorded.

As the parathion spraying programme co-incided with a period of low mesofaunal numbers, it was difficult to define the short term effect of the chemical. In comparison, the September sample totals of the plots investigated revealed a decline in all of them. These results affirm the retarding effect of the physical - abiotical factors, which brought

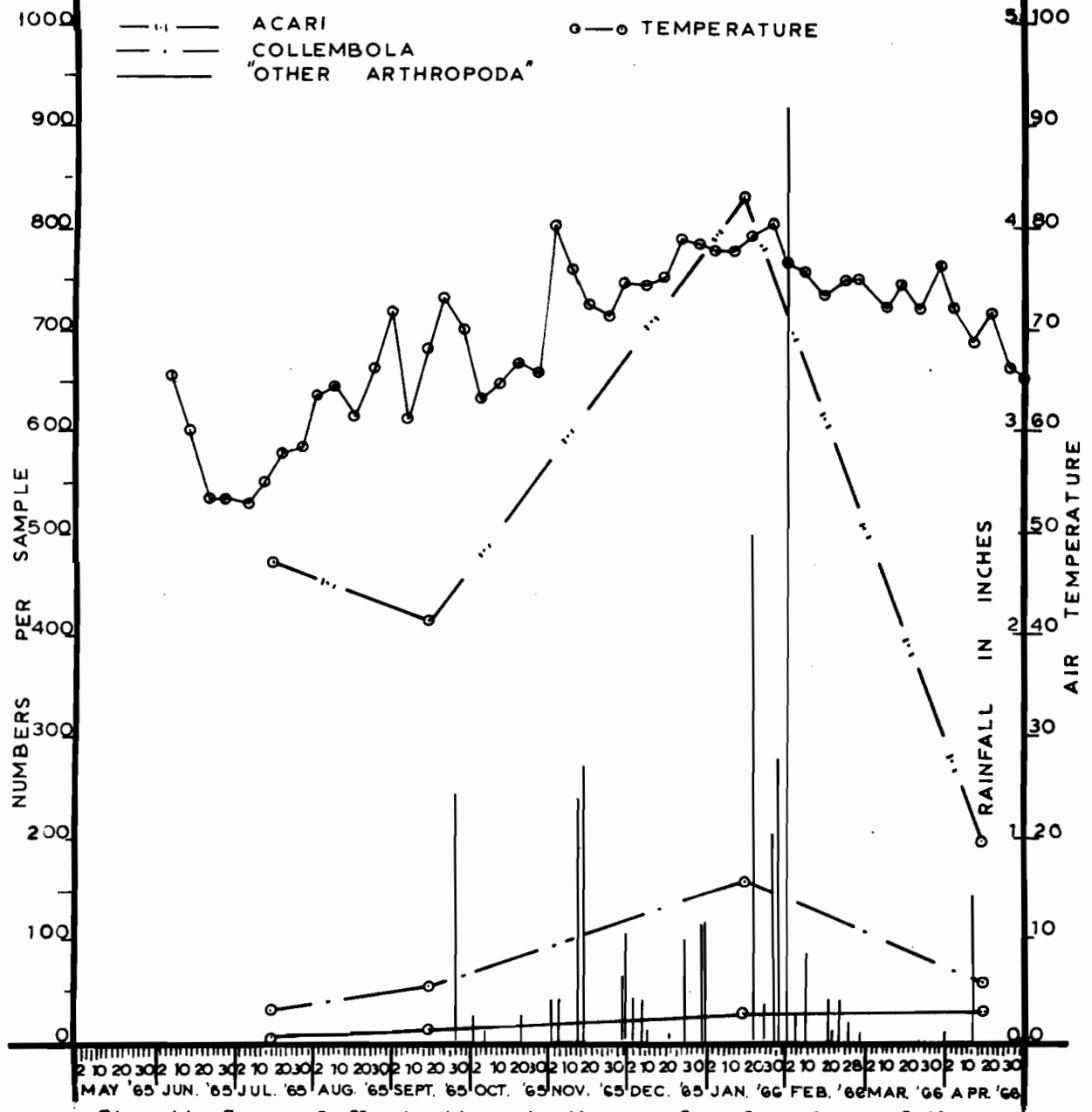


Fig. 44 Seasonal fluctuations in the mesofaunal numbers of the microarthropod fauna of plot A, with recorded air temperatures. Rainfall histograms representing 2-day totals.

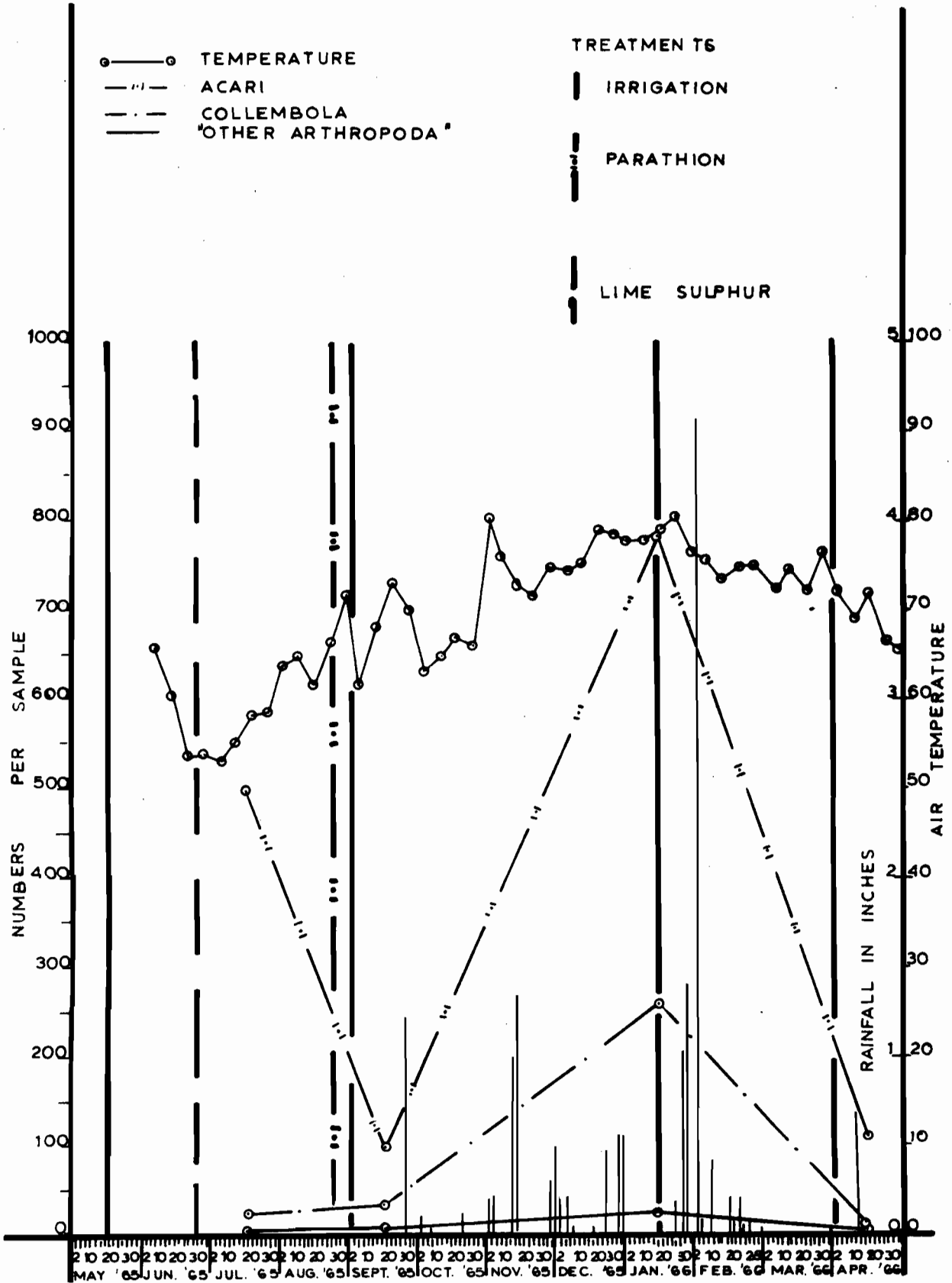


Fig. 45 Seasonal fluctuations in the mesofaunal numbers of plot B with recordings of air temperatures, irrigation, Parathion and lime sulphur treatments. Rainfall histograms representing 2-day totals.

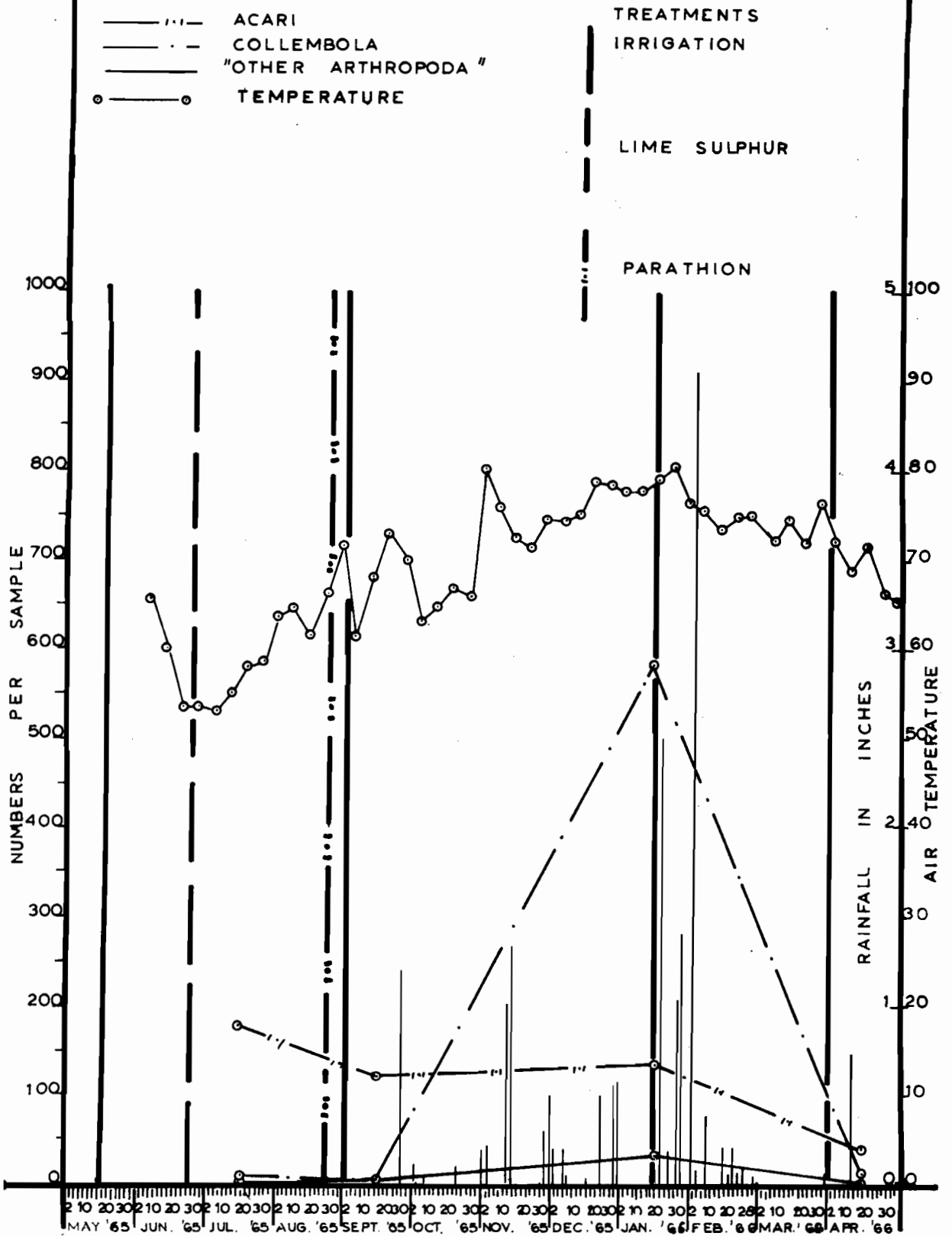


Fig. 46 Seasonal fluctuations in the mesofaunal numbers of plot C with recordings of air temperatures, irrigation, Parathion and lime sulphur treatments. Rainfall histograms representing 2-day totals.

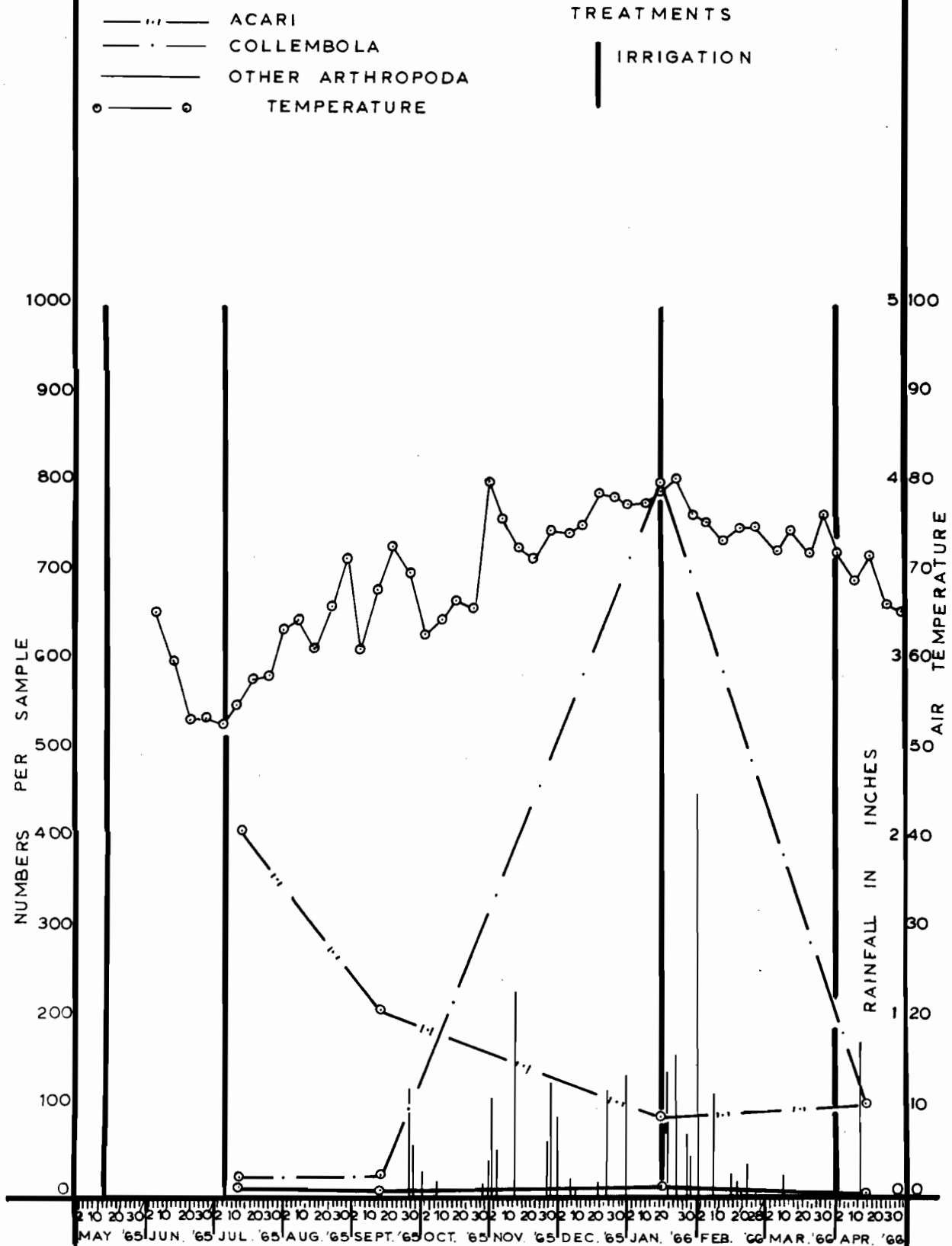


Fig. 47 Seasonal fluctuations in the mesofaunal numbers of plot D with recordings of air temperatures and irrigation. Rainfall histograms representing 2-day totals.

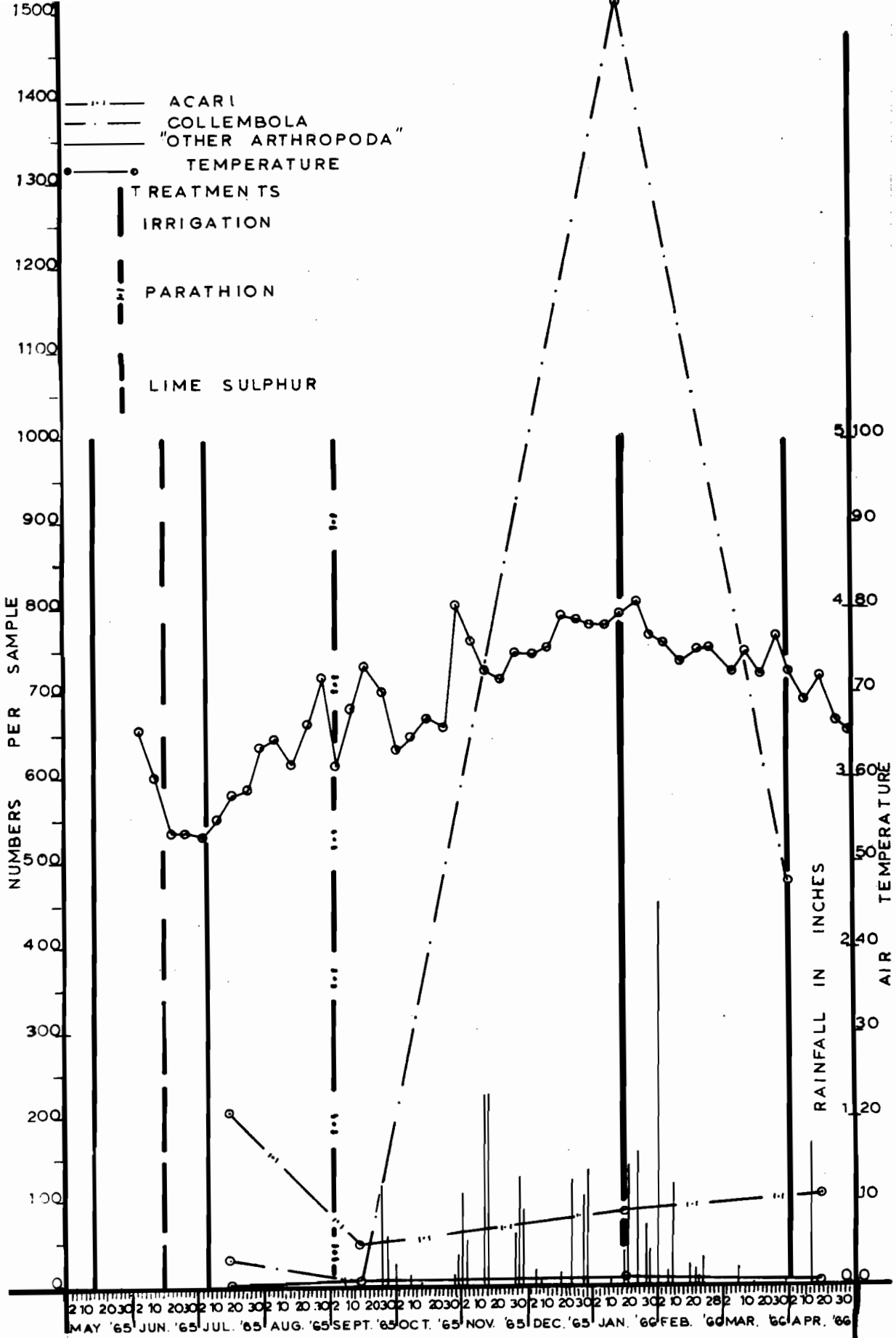


Fig. 48 Seasonal fluctuations in the mesofaunal numbers of plot E with recordings of air temperatures, irrigation, Parathion and lime sulphur treatments. Rainfall histograms representing 2-day totals.

about a reduction in animal productivity, but a more pronounced decline in productivity, in the parathion treated plots, could, however, be the result of chemical poisoning.

## 7.1 SEASONAL FLUCTUATIONS IN THE DIFFERENT PLOTS

### 7.11 The Mesofauna (figs. 49 to 53, tables 25 to 29)

Though the numbers in the investigated plots varied considerably, they all had the same seasonal pattern.

The results of the winter sampling in July 1965 indicated that all the plots, and most probably the fauna in the whole area, had a small winter peak. Plots B and C recorded 30,913 and 10,936 arthropods per  $m^2$  respectively for the winter season, while plots D and E had 26,188 and 13,892 per  $m^2$  during the same period. The seasonal biomass values for the respective citrus plots were: 9.617%, 6.417%, 7.606% and 2.172%, of the total biomass values. The control plot recorded 29,971/ $m^2$  which was equal to 22.149% of the total mesofaunal numbers and 8.870% of the total biomass values. The soil populations of the citrus and natural soils thus varied between 10,000 and 30,000 per  $m^2$  during July 1965.

The September sample revealed a drastic reduction in numbers for the citrus and control plots. Both plots B and C recorded 7,000 arthropods per  $m^2$ , but, whereas only 3,783 arthropods per  $m^2$  were recorded at plot E, plot D had 13,596 per  $m^2$ . It is obvious that the biological control plot in-

creased its advantage which it had during the July sampling in this season, in spite of the general seasonal "ebb" period, while the routine plots, and especially plot E had heavy reductions. The effect of the chemical application are further demonstrated in the mesofaunal numbers of plot B. Whereas the latter plot had an advantage of 20,000 arthropods per m<sup>2</sup> over plot C during July, this advantage was wiped out and both plots B and C had further reductions to 7,921 and 7,566 arthropods per m<sup>2</sup>, in September, respectively. It was interesting to note that it was the Acari and particularly the Trombidiformes that had reductions in numbers in all the plots. Except for the control plot, the soil moisture percentages of the September sample were higher than that of July. Plots B and C received irrigation on 2/9/65, twelve days before sampling. Plots D and E received no irrigation in September. Nevertheless, the plots with, and without irrigation revealed a September population reduction. Soil temperature was already extremely high at noon and temperatures up to 45°C were recorded in the open top soil.

PLOT 1109 MESOFAUNA

BIOMASS HISTOGRAMS

- 1 ACARI
- 2 COLLEMBOLA
- 3 'OTHER ARTHROPODA'

BIOMASS ———  
 NUMBERS ———

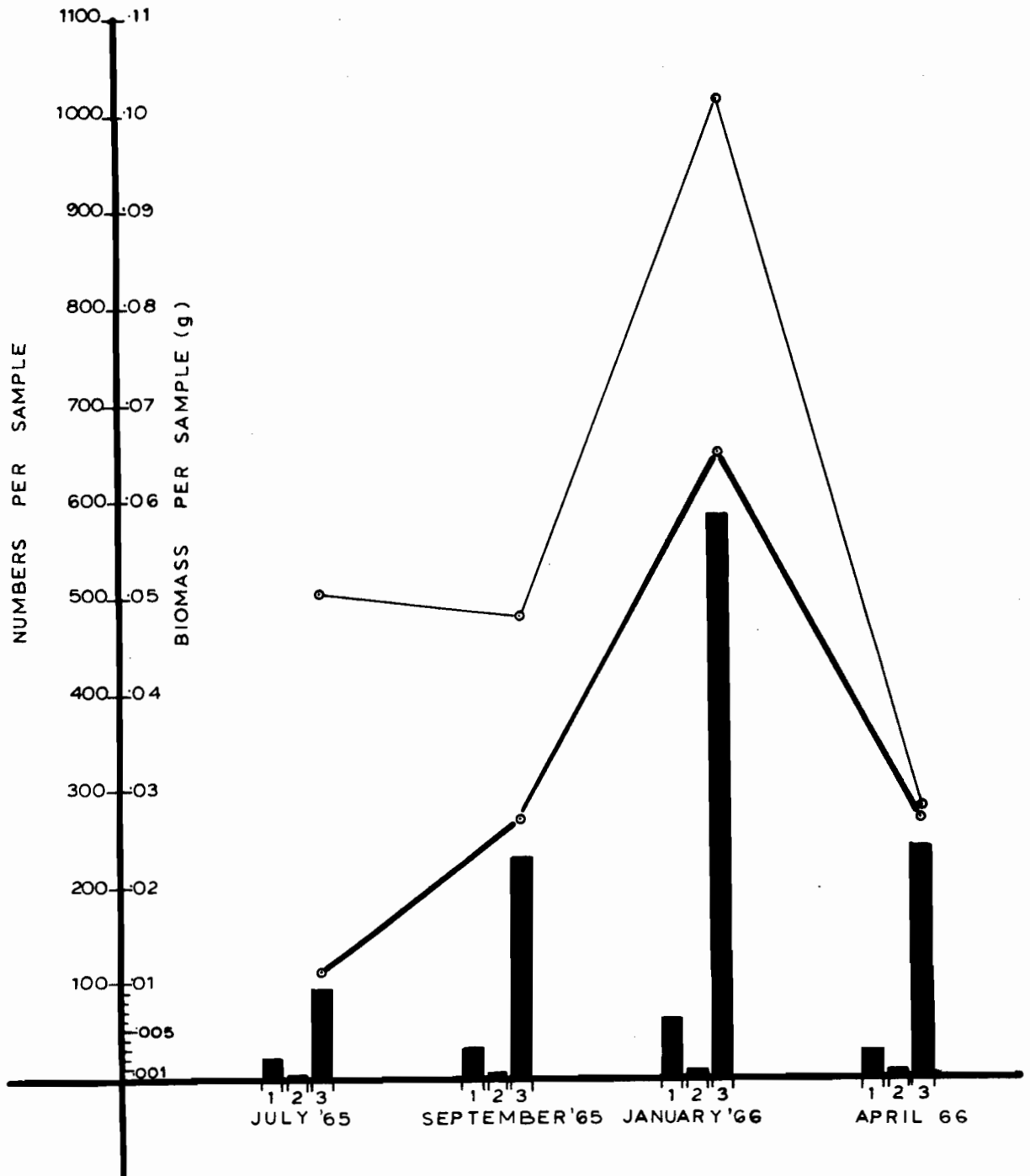


Fig. 49 Seasonal fluctuations in numbers and biomass of the mesofauna of plot A.

# PLOT 1111 MESOFAUNA

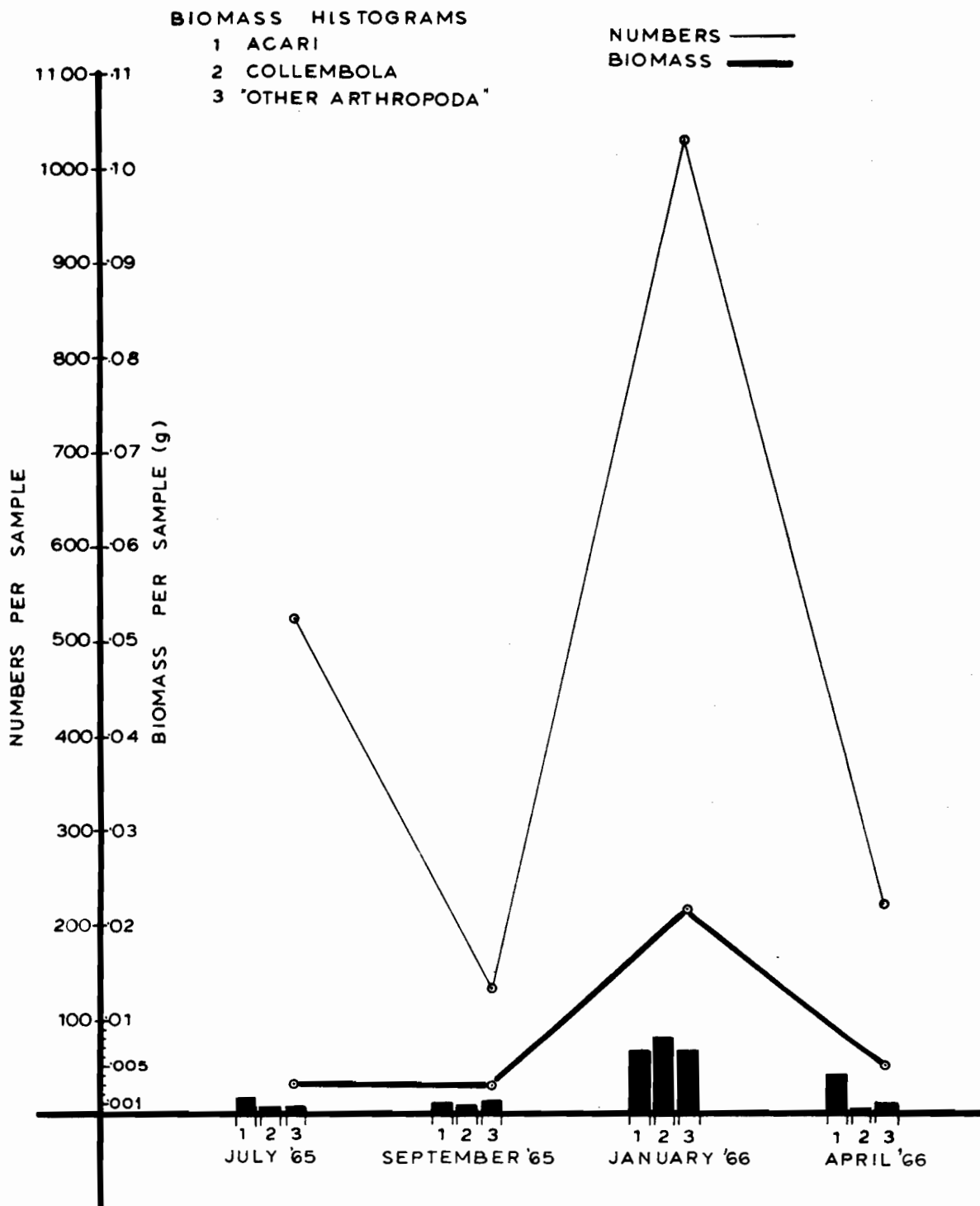


Fig. 50 Seasonal fluctuations in numbers and biomass of the mesofauna of plot B.

# PLOT H336 MESOFAUNA

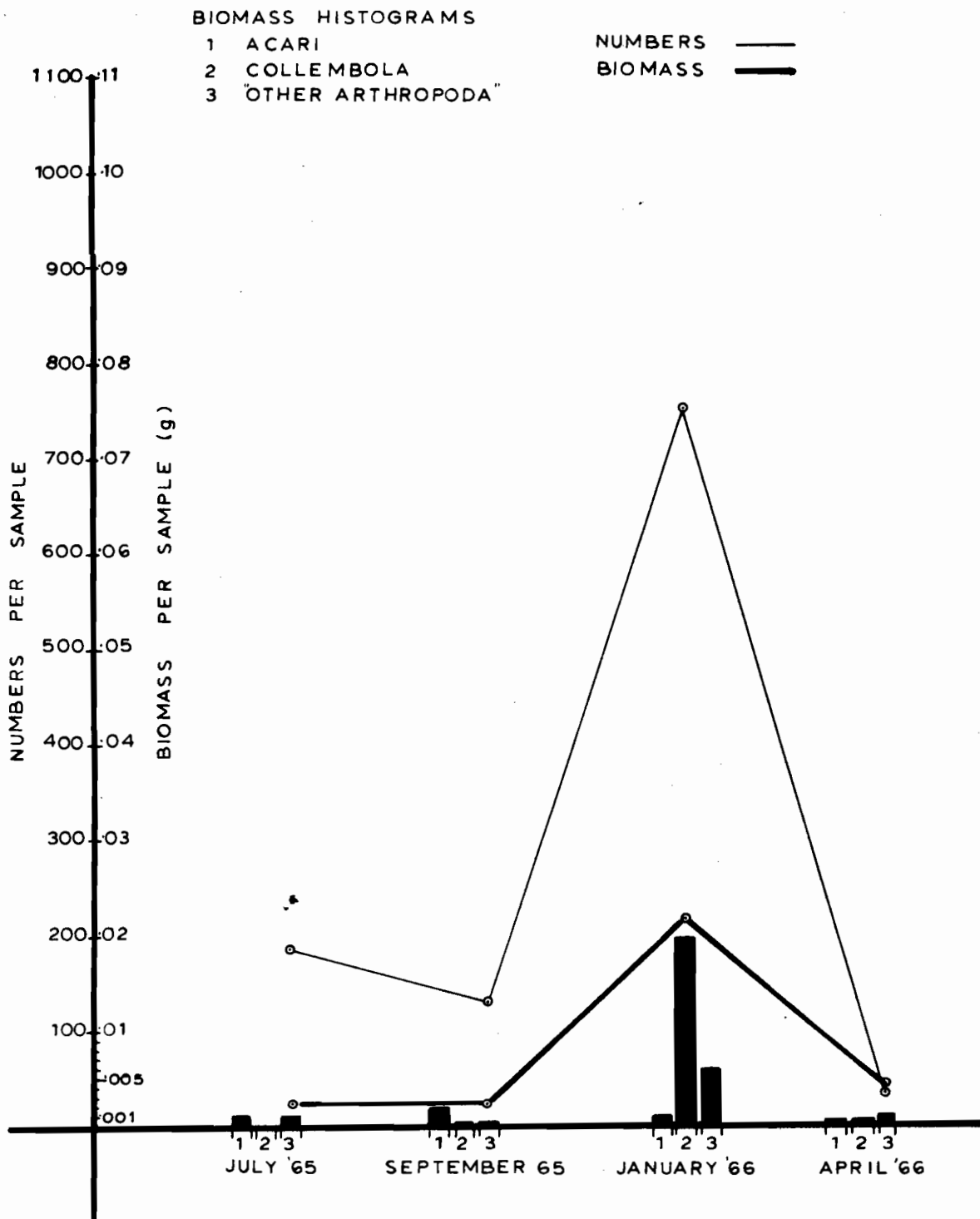


Fig. 51 Seasonal fluctuations in numbers and biomass of the mesofauna of plot C.

PLOT 117 MESOFAUNA

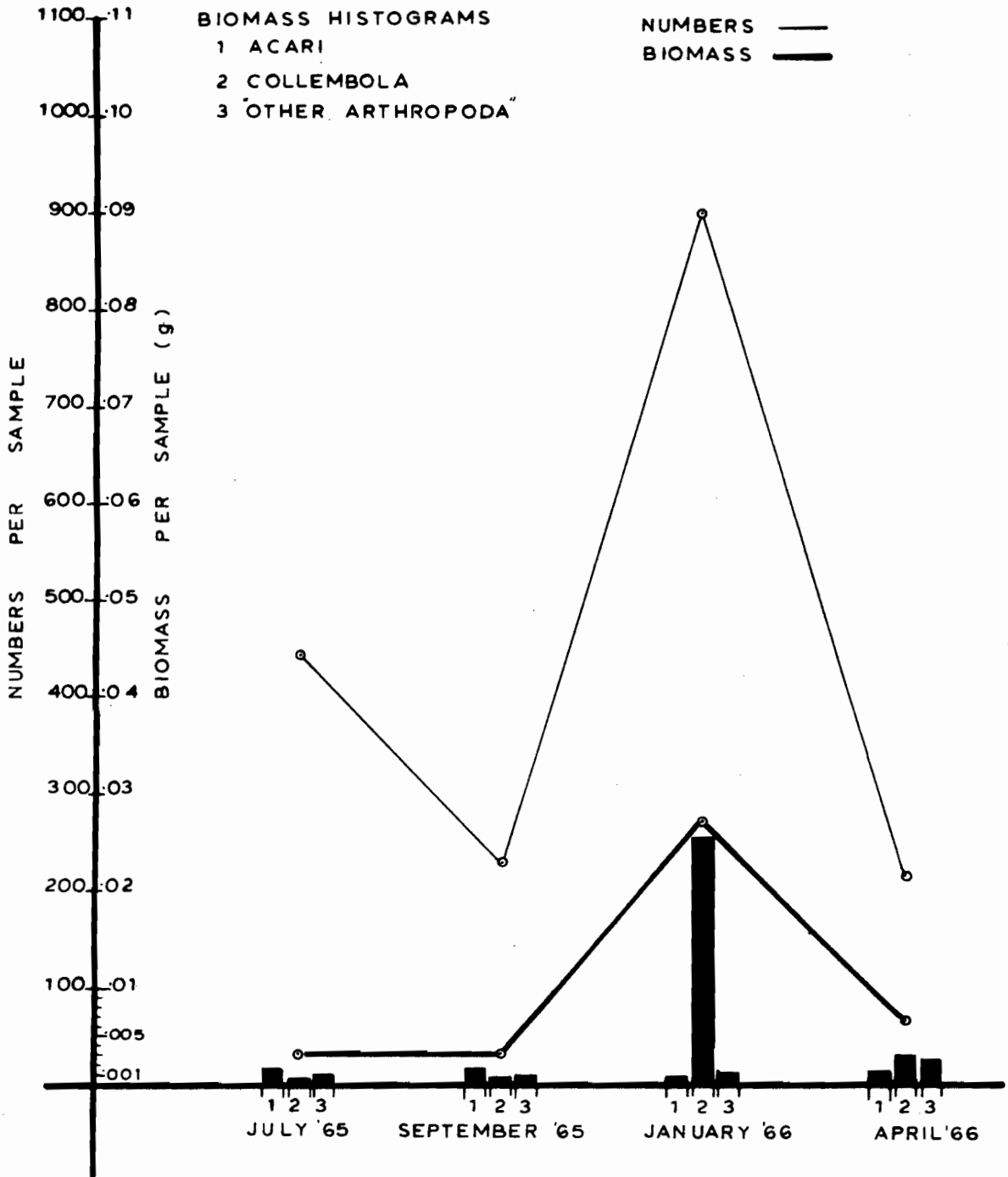


Fig. 52 Seasonal fluctuations in numbers and biomass of the mesofauna of plot D.

# PLOT 116 MESOFAUNA

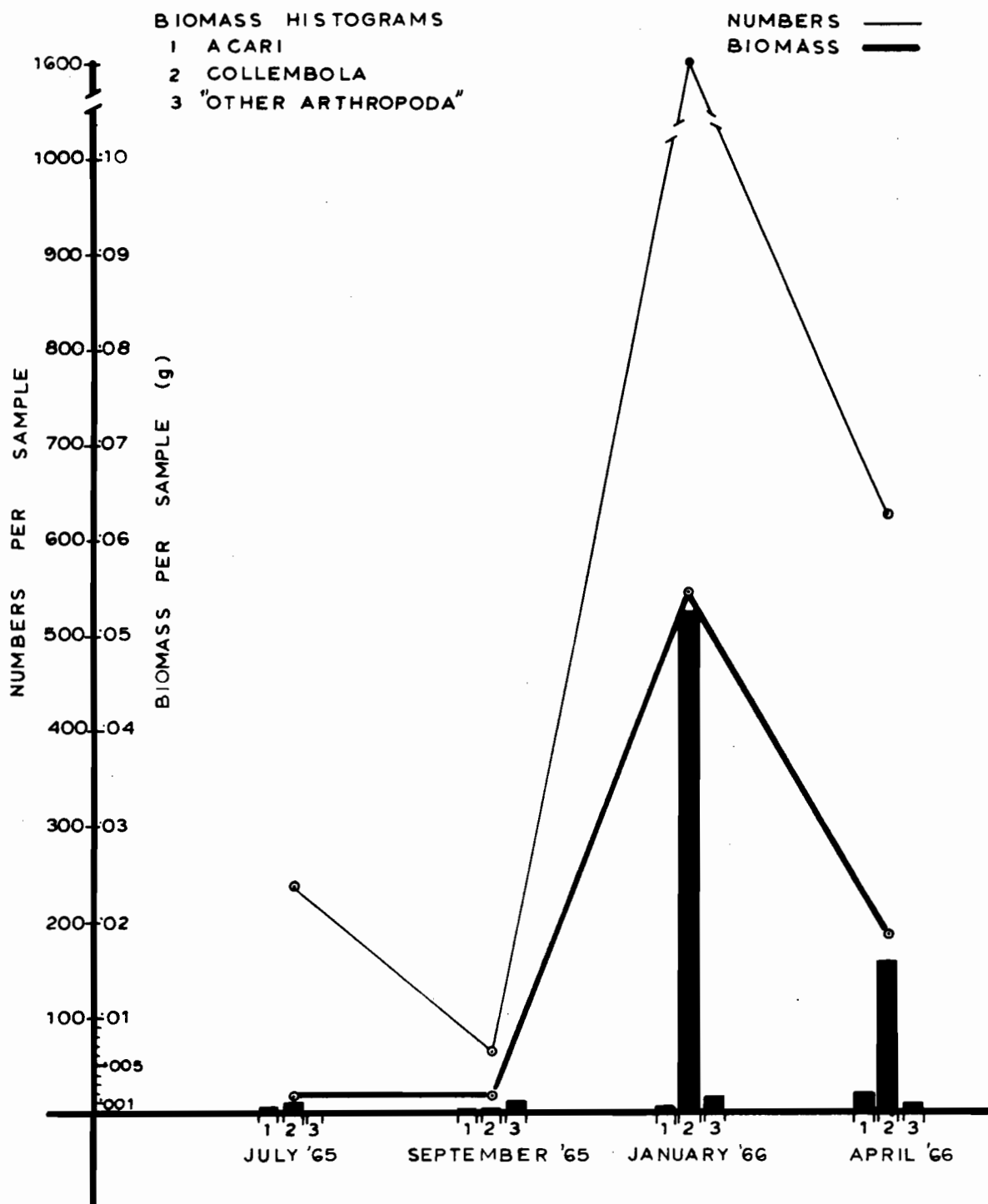


Fig. 53 Seasonal fluctuations in numbers and biomass of the mesofauna of plot E.

TABLE 25 : Numbers and biomass values of microarthropods,  
plot A

	Numb.	Numb. %	Biom.	Biom.%	Numb./m <sup>2</sup>
<u>July 1965</u>					
Trombidiformes	371	73.174	0.0010220	8.754	21,931.887
Mesostigmata	1	.197	0.0000020	.017	59.116
Oribatei	100	19.724	0.0010390	8.901	5,911.558
"Other Arthropoda"	35	6.902	0.0096100	82.327	2,069.047
Total	507	99.997	0.0116730	99.999	29,971.608
<u>September 1965</u>					
Trombidiformes	335	69.501	0.0014535	5.376	19,803.725
Mesostigmata	12	2.491	0.0000940	.347	709.387
Oribatei	68	14.108	0.0017100	6.324	4,019.862
Acaridiae	1	.208	0.0000140	.052	59.116
"Other Arthropoda"	66	13.692	0.0237660	87.900	3,901.629
Total	482	100.000	0.0270375	99.999	28,493.719
<u>January 1966</u>					
Trombidiformes	778	76.498	0.0047910	7.312	45,991.937
Mesostigmata	1	.098	0.0000020	.003	59.116
Oribatei	47	4.621	0.0012310	1.879	2,778.434
Acaridiae	4	.393	0.0000560	.085	236.462
"Other Arthropoda"	187	18.387	0.0594380	90.720	11,054.616
Total	1017	99.997	0.0655180	99.999	60,120.565
<u>April 1966</u>					
Trombidiformes	151	53.355	0.0015120	5.524	8,926.456
Mesostigmata	12	4.240	0.0001460	.533	709.387
Oribatei	32	11.308	0.0010190	3.723	1,891.699
Acaridiae	2	.706	0.0000160	.058	118.231
"Other Arthropoda"	86	30.388	0.0246760	90.161	5,083.939
Total	283	99.997	0.0273690	99.999	16,729.713

TABLE 26 : Numbers and biomass values of micro-arthropods,  
Plot B

	Numb.	Numb. %	Biom.	Biom. %	Numb./m <sup>2</sup>
<u>July 1965</u>					
Trombidiformes	461	88.146	0.0010680	33.829	27,252.291
Mesostigmata	3	.573	0.0000220	.696	177.348
Oribatei	26	6.501	0.0004300	13.620	1,537.634
Acaridiae	8	1.529	0.0001120	3.548	472.295
"Other Arthropoda"	25	4.780	0.0015250	48.305	1,477.890
Total	523	100.000	0.0031570	99.998	30,917.458
<u>September 1965</u>					
Trombidiformes	53	39.522	0.0002495	8.499	3,133.127
Mesostigmata	9	6.716	0.0001260	4.292	532.040
Oribatei	34	25.373	0.0005970	20.337	2,009.930
"Other Arthropoda"	38	28.358	0.0019630	66.871	2,246.393
Total	134	99.999	0.0029355	99.999	7,921.490
<u>January 1966</u>					
Trombidiformes	499	48.400	0.0020275	9.321	29,498.685
Mesostigmata	53	5.141	0.0009700	4.459	3,133.126
Oribatei	228	22.114	0.0038740	17.811	13,478.355
"Other Arthropoda"	251	24.345	0.0148800	68.409	14,838.016
Total	1031	100.000	0.0217515	100.000	60,948.183
<u>April 1966</u>					
Trombidiformes	28	12.786	0.0001580	3.171	1,655.237
Mesostigmata	28	12.786	0.0010140	20.357	1,655.237
Oribatei	151	68.948	0.0027390	54.989	8,926.455
"Other Arthropoda"	12	5.479	0.0010700	21.482	709.387
Total	219	99.999	0.0049810	99.999	12,946.316

TABLE 27 : Numbers and biomass values of micro-arthropods,  
Plot C

	Numb.	Numb. %	Biom.	Biom. %	Numb./m <sup>2</sup>
<u>July 1965</u>					
Trombidiformes	133	71.892	0.0003035	14.962	7,862.374
Mesostigmata	1	.541	0.0000020	.098	59.116
Oribatei	43	23.241	0.0006720	33.128	2,541.970
Acaridiae	1	.541	0.0000140	.690	59.116
"Other Arthropoda"	7	3.785	0.0010370	51.121	413.810
Total	185	100.000	0.0020285	99.999	10,936.386
<u>September 1965</u>					
Trombidiformes	40	31.250	0.0001360	6.736	2,364.623
Mesostigmata	3	2.344	0.0001500	7.429	177.347
Oribatei	79	61.718	0.0014900	73.799	4,670.132
"Other Arthropoda"	6	4.688	0.0002430	12.036	354.694
Total	128	100.000	0.0020190	100.000	7,566.796
<u>January 1966</u>					
Trombidiformes	96	12.783	0.0002260	.860	5,675.097
Mesostigmata	12	1.598	0.0001620	.617	709.387
Oribatei	25	3.328	0.0003640	1.385	1,477.891
Acaridiae	2	.266	0.0000280	.106	118.231
"Other Arthropoda"	616	82.023	0.0254950	97.031	36,415.209
Total	751	99.998	0.0262750	99.999	44,395.815
<u>April 1966</u>					
Trombidiformes	28	50.909	0.0000660	5.140	1,655.236
Mesostigmata	3	5.454	0.0000060	.467	177.347
Oribatei	10	18.181	0.0001520	11.837	591.157
"Other Arthropoda"	14	25.453	0.0010600	82.555	827.618
Total	55	99.997	0.0012840	99.999	3,251.358

TABLE 28 : Numbers and biomass values of micro-arthropods,  
Plot D

	<u>Numb.</u>	<u>Numb. %</u>	<u>Biom.</u>	<u>Biom.%</u>	<u>Numb./m<sup>2</sup></u>
<u>July 1965</u>					
Trombidiformes	346	78.103	0.0005790	18.927	20,453.998
Mesostigmata	16	3.611	0.0001220	3.989	945.849
Oribatei	40	9.029	0.0007040	23.014	3,014.895
Acaridiae	11	2.483	0.0001060	3.465	650.271
"Other Arthropoda"	30	6.772	0.0015480	50.604	1,773.468
<b>Total</b>	<b>443</b>	<b>99.998</b>	<b>0.0030590</b>	<b>99.999</b>	<b>26,188.210</b>
<u>September 1965</u>					
Trombidiformes	106	46.087	0.0002195	7.120	6,266.253
Mesostigmata	15	6.522	0.0000660	2.142	886.735
Oribatei	76	33.044	0.0012460	40.422	4,492.785
Acaridiae	9	3.913	0.0000260	4.087	532.040
"Other Arthropoda"	24	10.434	0.0014250	46.229	1,418.773
<b>Total</b>	<b>230</b>	<b>100.000</b>	<b>0.0030825</b>	<b>100.000</b>	<b>13,596.586</b>
<u>January 1966</u>					
Trombidiformes	52	5.797	0.0001810	.662	3,074.010
Mesostigmata	13	1.449	0.0001340	.490	768.503
Oribatei	23	2.564	0.0003710	1.358	1,359.658
"Other Arthropoda"	809	90.190	0.0266400	97.490	47,824.520
<b>Total</b>	<b>897</b>	<b>100.000</b>	<b>0.0273260</b>	<b>100.000</b>	<b>53,026.691</b>
<u>April 1966</u>					
Trombidiformes	23	10.648	0.0000820	1.214	1,359.659
Mesostigmata	7	3.241	0.0000680	1.007	413.809
Oribatei	73	33.796	0.0011910	17.639	4,315.439
Acaridiae	4	1.852	0.0000560	.829	236.462
"Other Arthropoda"	109	50.462	0.0053550	79.310	6,443.598
<b>Total</b>	<b>216</b>	<b>99.999</b>	<b>0.0067520</b>	<b>99.999</b>	<b>12,768.968</b>

TABLE 29 : Numbers and biomass values of micro-arthropodsPlot E

	Numb.	Numb. %	Biom.	Biom. %	Numb./m <sup>2</sup>
<u>July 1965</u>					
Trombidiformes	172	73.190	0.0002865	17.191	10,167.882
Mesostigmata	8	3.403	0.0000700	4.200	472.925
Oribatei	25	10.638	0.0003250	19.502	1,477.890
"Other Arthropoda"	30	12.766	0.0009850	59.105	1,773.468
Total	235	99.997	0.0016665	99.998	13,892.165
<u>September 1965</u>					
Trombidiformes	32	50.000	0.0000600	3.490	1,891.698
Mesostigmata	3	3.687	0.0000240	1.396	177.347
Oribatei	14	21.876	0.0001310	7.620	827.618
"Other Arthropoda"	15	23.437	0.0015040	87.493	886.735
Total	64	100.000	0.0017190	99.999	3,783.398
<u>January 1966</u>					
Trombidiformes	52	3.234	0.0000970	.178	3,074.011
Mesostigmata	10	.621	0.0000560	.103	591.157
Oribatei	26	1.617	0.0003470	.634	1,537.005
"Other Arthropoda"	1520	94.526	0.0541450	99.085	89,855.711
Total	1608	99.998	0.0546450	100.000	95,057.884
<u>April 1966</u>					
Trombidiformes	39	6.220	0.0002265	1.211	2,305.508
Mesostigmata	16	2.552	0.0001220	.652	945.849
Oribatei	94	14.991	0.0015860	8.487	5,556.866
"Other Arthropoda"	478	76.234	0.0167730	89.659	28,257.257
Total	627	99.997	0.0187075	100.000	37,065.481

Despite the numerical reductions in the citrus plots, the biomass values remained constant. Plot B, which had a total biomass value of 9.6% in July 1965 still had 8.9% of the total value in September. Plot C had 6.4% in July and 6.3% in September. Plot D had 7.6% of the total biomass value in July and still recorded 7.6% for September. Plot E recorded 2.2% in July and still had 2.2% in September. The reason for this phenomenon was that the bigger, and thus heavier Oribatei and Collembola were not reduced by seasonal factors and chemical application, but actually multiplied and thus cancelled the weight loss of the more numerous but lighter Trombidiformes.

The control plot on the other hand, despite small numerical reductions, revealed a sharp rise in biomass from 8.8% to 20.5% of the total biomass values. When consulting the tables, it is evident that it was not the Collembola and Oribatei which provided the bulk biomass, such as in the citrus plots, but the diplopods in the "Other Arthropod" section, as well as the Trombidiformes.

In January 1966, the Oribatei, and especially the more productive Collembola, which were already multiplying during the September survey, were responsible for high population peaks in all the citrus plots. The control plot also had its highest peak in this season. The main contributors to the control plot were Trombidiformes and the "Other Arthropoda" division. Plots B and C recorded 60,948 and 44,395 arthropods per  $m^2$  during January, while plots D and E of

Section 2 had 53,026 and 95,057 arthropods per  $m^2$  for the same period. The control plot recorded 60,120 arthropods per  $m^2$  for January.

The Collembola was the biggest biomass contributor in all the citrus plots. At plot B, however, substantial contributions were also made by the Acari and "Other Arthropoda". At the control plot, the "Other Arthropoda" section was always in the lead in all the seasonal samplings.

In April, however, all the populations reduced drastically. In this month, plots B and C recorded seasonal totals of 12,946 and 3,251 arthropods per  $m^2$  respectively. From plots D and E 12,768 and 37,065 arthropods per  $m^2$  were extracted respectively in April 1966. The reason for this steep decline could not be pinpointed definitely, but it could be assumed that reductions were brought about by the population itself or by some of the physical factors. It has been ascertained that Collembola could reduce their numbers automatically when very high population peaks occur, by decreasing the production of eggs. This usually happens when food becomes less available. To describe the effect of the physical factors on the April sample would be very difficult. The climatic conditions were apparently more favourable for high population numbers than during the previous seasons. It has been observed that the highest of all the soil moisture percentages was recorded in April 1966 for all the plots. The relative humidity at that time of the year was relatively high, while the temperature was moderate.

The biomass values also reduced drastically in April. In some citrus plots such as plots B and C, the collembolan biomass advantage disappeared, but plots D and E still had a distinguished biomass dominancy.

#### 7.111 Trombidiformes

This order was numerically a subdominant group in the citrus plots, except in plot B, where these mites attained a dominant position. In the control plot, Trombidiformes was by far the numerically dominant group, with 71.4% of the total mesofaunal numbers. All the citrus plots revealed a dominant winter peak for Trombidiformes. Plots B, C and E had 27,252, 7,862 and 13,892 trombidiform mites per  $m^2$  for July 1965. In accordance with the other citrus plots, the biological control plot also exhibited a winter peak (20,453/ $m^2$ ) for the trombidiform mites, but differed in that no summer peak was recorded in January. The control plot on the other hand had a dominant summer peak of 45,991 mites per  $m^2$ .

The routine citrus plots revealed a sharp decline in trombidiform numbers for September 1965. Plots B, C and E recorded 3,133, 2,364 and 1,891 Trombidiformes per  $m^2$  respectively during September. The biological control plot and the control plot, on the other hand, had 6,2666 and 19,803 mites respectively per  $m^2$  for the same month. This last mentioned numbers per  $m^2$  reveal a decrease in the trombidiform population, but it was nevertheless not as drastic as in the case of the routine plots. The phenomenal reduc-

tions in the routine plots were probably due to normal physical factors as well as to the effect of the spring chemical application, while the populations of the biological control plot and the control plot had only to cope with abiotic physical factors and biotical factors other than chemical application.

In accordance with the general mesofaunal pattern, all the plots, except the biological control plot, recorded an increase in trombidiform numbers for January 1966. The biological control plot nevertheless still attained fair numbers of trombidiform predators such as Acheles aethiopica (Meyer & Ryke), Eupodes variegatus (Meyer & Ryke) and Cunaxa sp. Plots B, C, D and E recorded 29,498, 5,675, 3,074 and 3,074 trombidiform mites respectively for January 1966. The old citrus plot (B) had an extraordinary high number per  $m^2$  as a result of large Pygmephorus sp. numbers. The recorded number per  $m^2$  for this species was 19,508 in January 1966. As mentioned before, the control plot had a summer peak of 45,991 Trombidiformes per  $m^2$ . Seventeen trombidiform families were found in the control plot, as depicted in figure 54. In this respect plot B recorded 10 families (fig. 55); plot C, 9 families (fig. 56); plot D, 12 families (fig. 57) and plot E, 3 families (fig. 58). Here again, the biological control plot reveals its relation to the control plot, being in an intermediate position between natural soil populations and the populations of the routine citrus plots.

Carson (1965) mentioned that populations of light

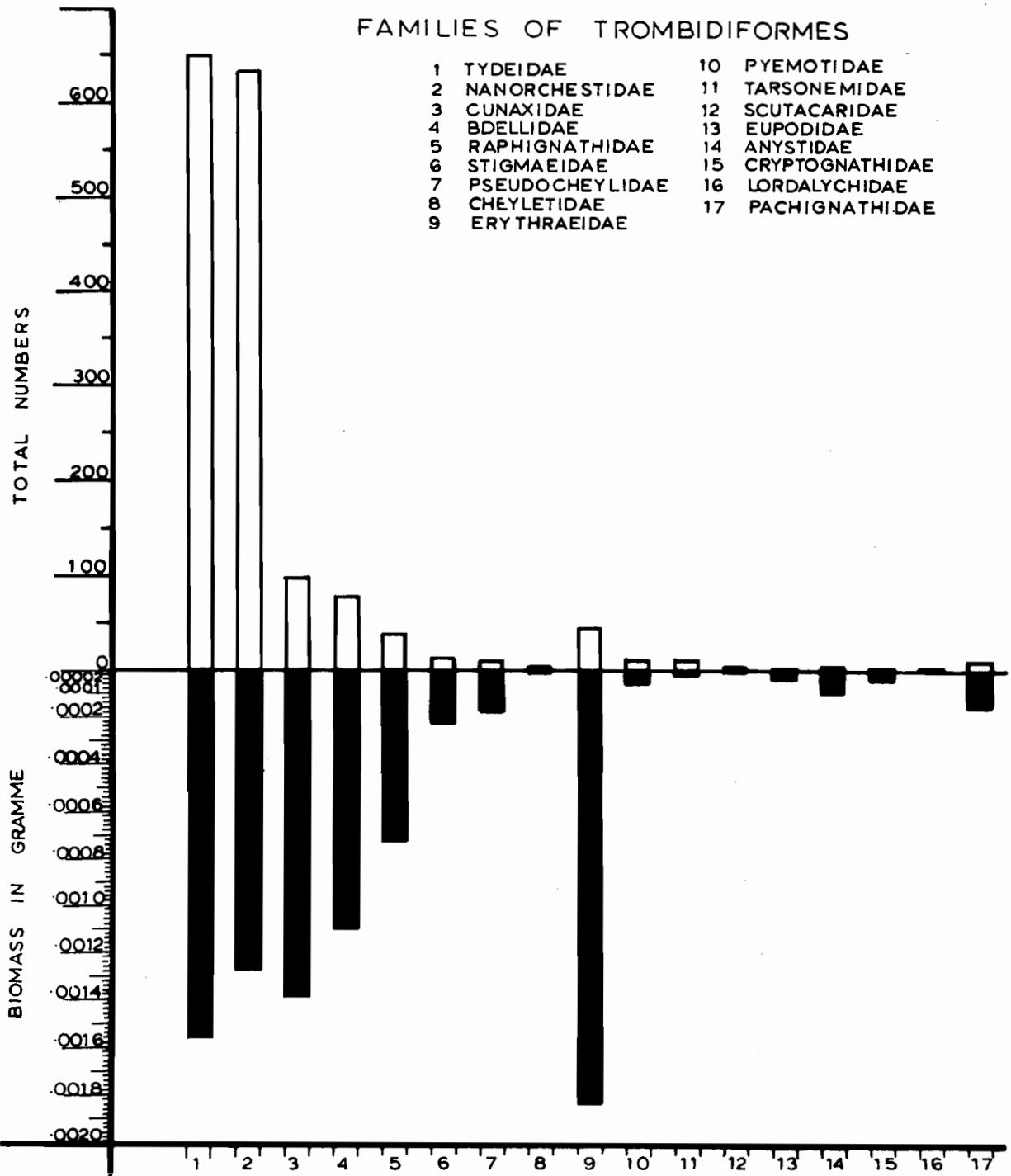


Fig. 54 Numbers and biomass of the families of Trombidiformes, plot A.

# FAMILIES OF TROMBIDIFORMES

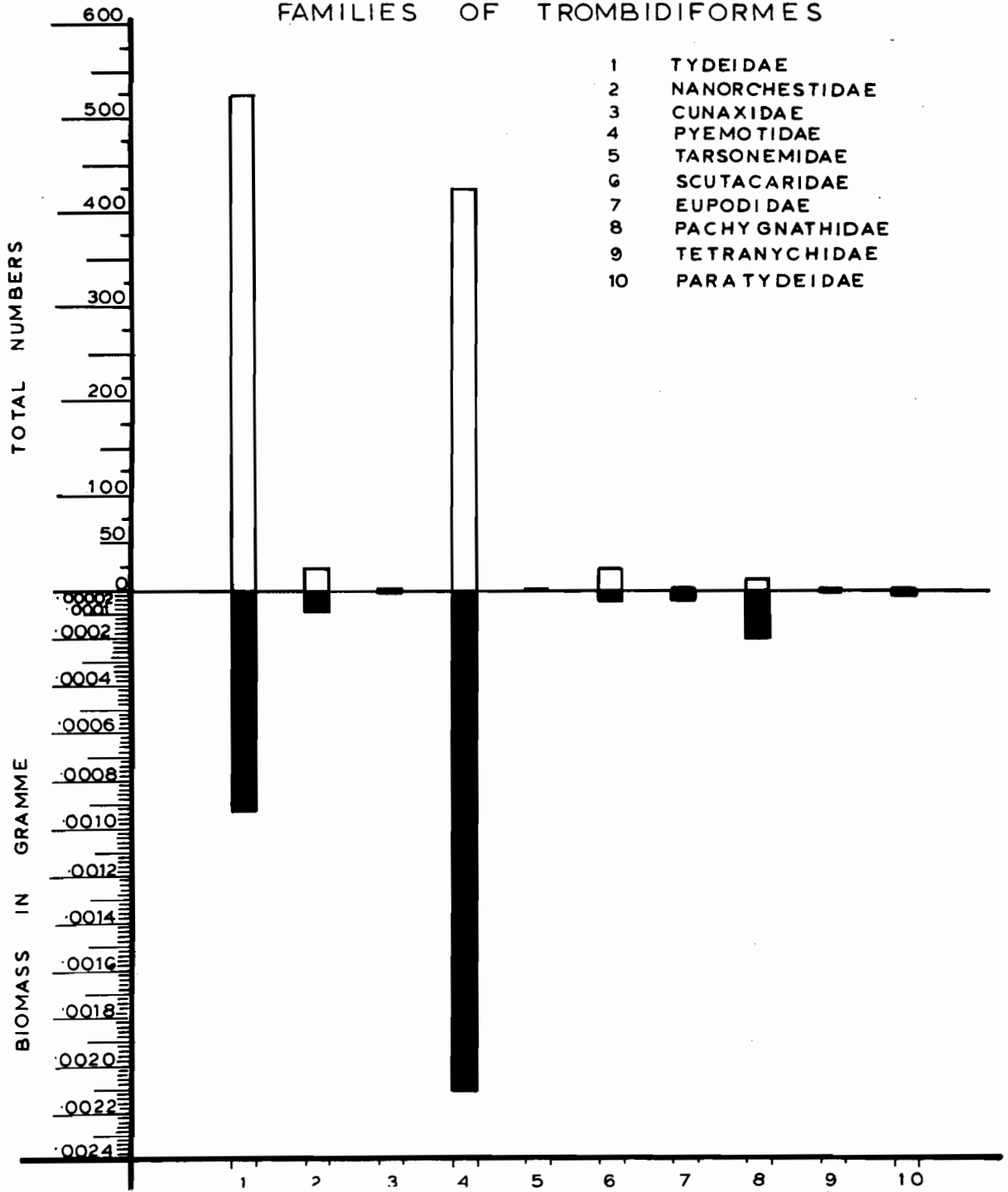


Fig. 55 Numbers and biomass of the families of Trombidiformes plot B.

# FAMILIES OF TROMBIDIFORMES

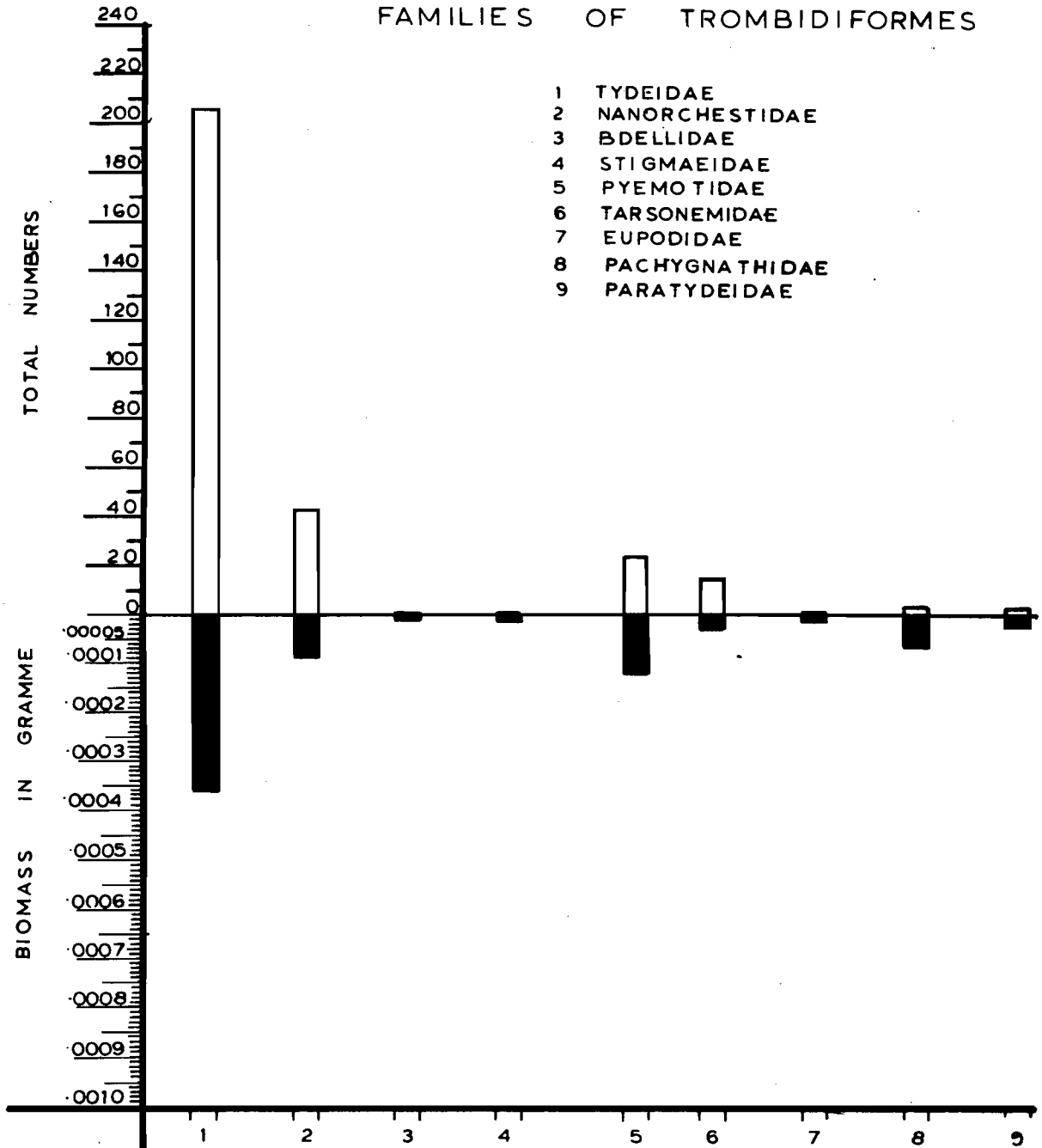


Fig. 56 Numbers and biomass of the families of Trombidiformes plot C.

# FAMILIES OF TROMBIDIFORMES

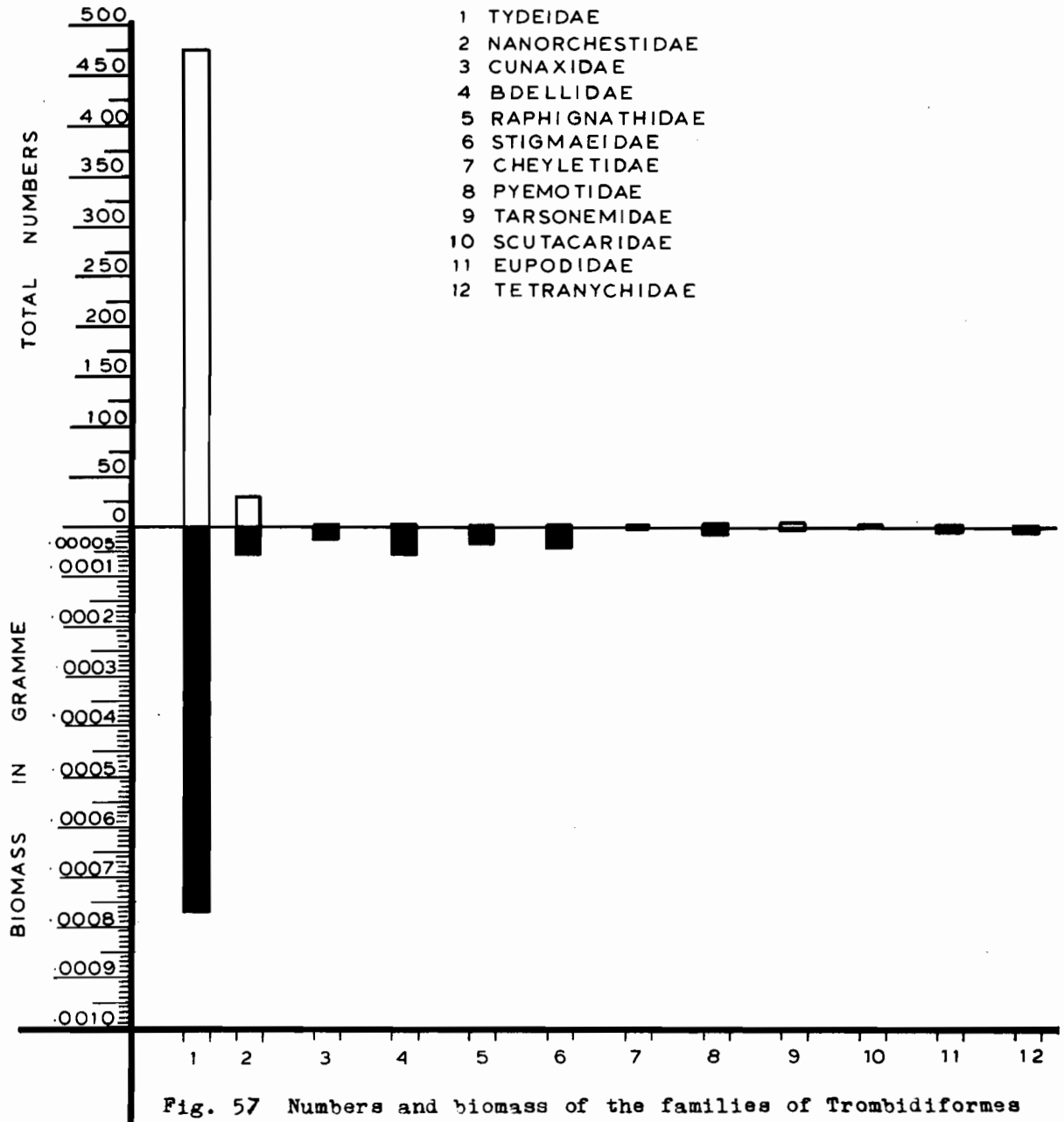


Fig. 57 Numbers and biomass of the families of Trombidiformes plot D.

# FAMILIES OF TROMBIDIFORMES

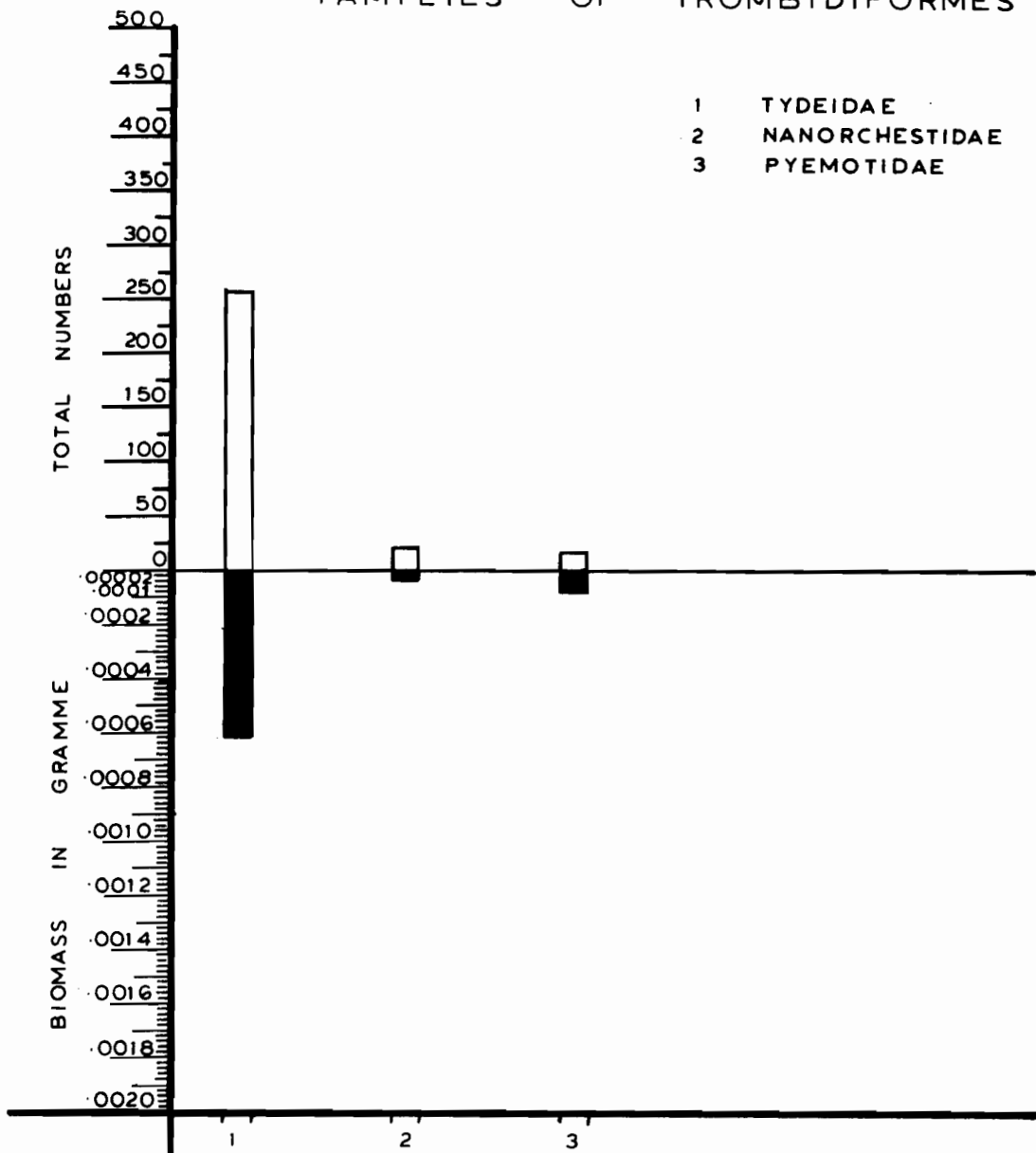


Fig. 58 Numbers and biomass of the families of Trombidiformes plot E.

sandy soils are more easily affected by poisons than those in soils with a higher humus content. This probably also happened at the plots investigated. Smaller numbers of trombidiform families were very prominent in plot E, which had an organic material content of 2.2% contrasted with the 7.6% and 11.0% of plots B and C.

#### TYDEIDAE (figs. 59 to 63, table 20)

In accordance with the general Trombidiformes pattern, all the plots had a winter peak population. With the exception of the biological control plot, a smaller summer peak was recorded for all plots during January 1966. The highest seasonal recording for Tydeidae was made on plot B, which had 19,685 mites per m<sup>2</sup> during July 1965. Plots D and A followed with 19,329 and 17,498 mites per m<sup>2</sup> for the same period. Tydeidae was the dominant Trombidiformes family in all the plots investigated. The dominant species in this family was beyond doubt Tydaeus sp. In all four citrus plots, as well as in the control plot, it attained the dominant position, both in relation to numbers and biomass. Winter peak populations for this species were registered in all plots. Microtydeus sp. was also recorded in all five plots, where it held a numerically subdominant position, but was surpassed in plots E, C and A in biomass value by the bigger Lorryia africanus (Baker). This last mentioned species was also found in all the citrus plots as well as in the control plot. Though small numbers were registered,

# TYDEIDAE

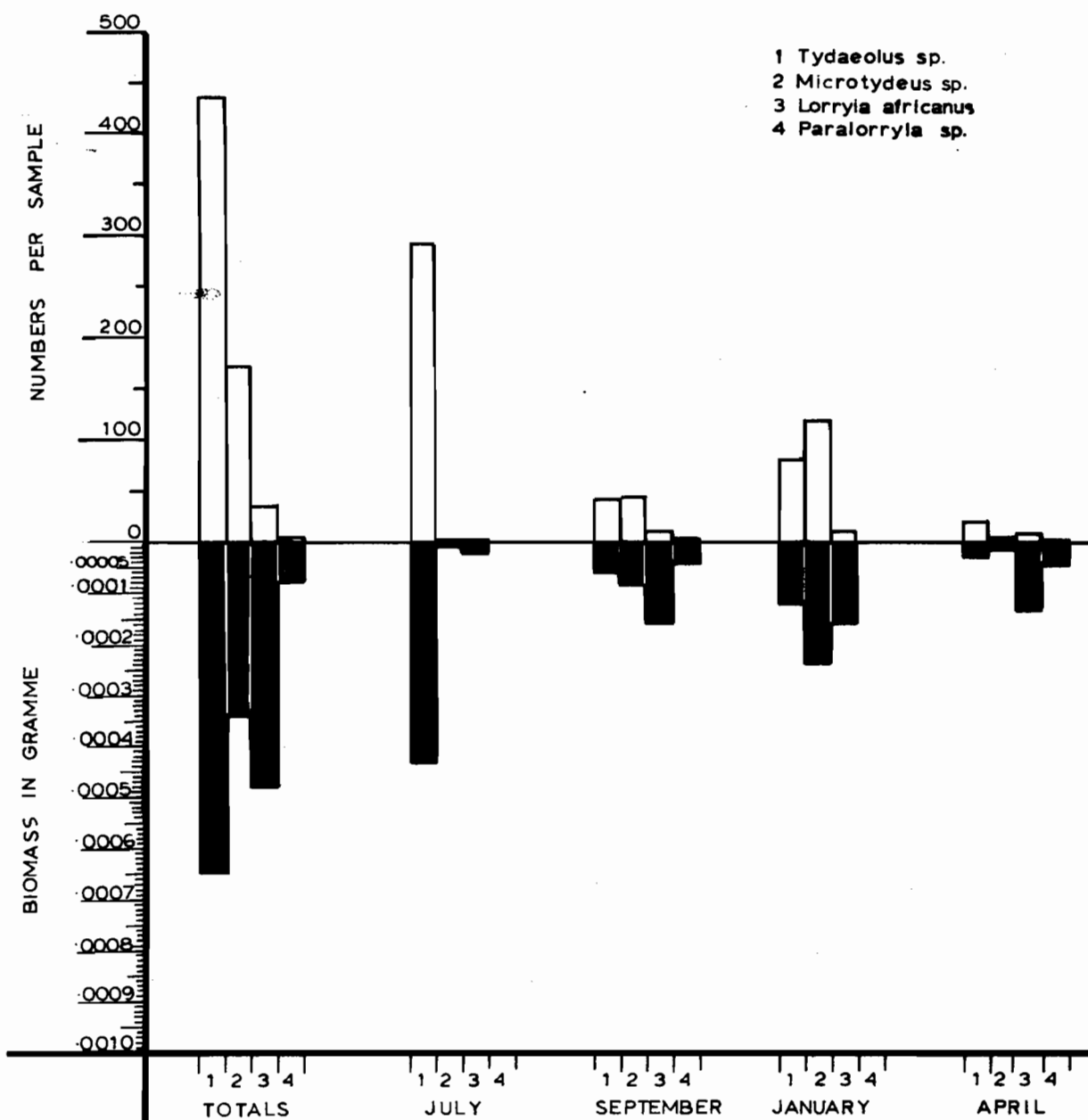


Fig. 59 Seasonal fluctuations in numbers and biomass of the family Tydeidae, plot A.

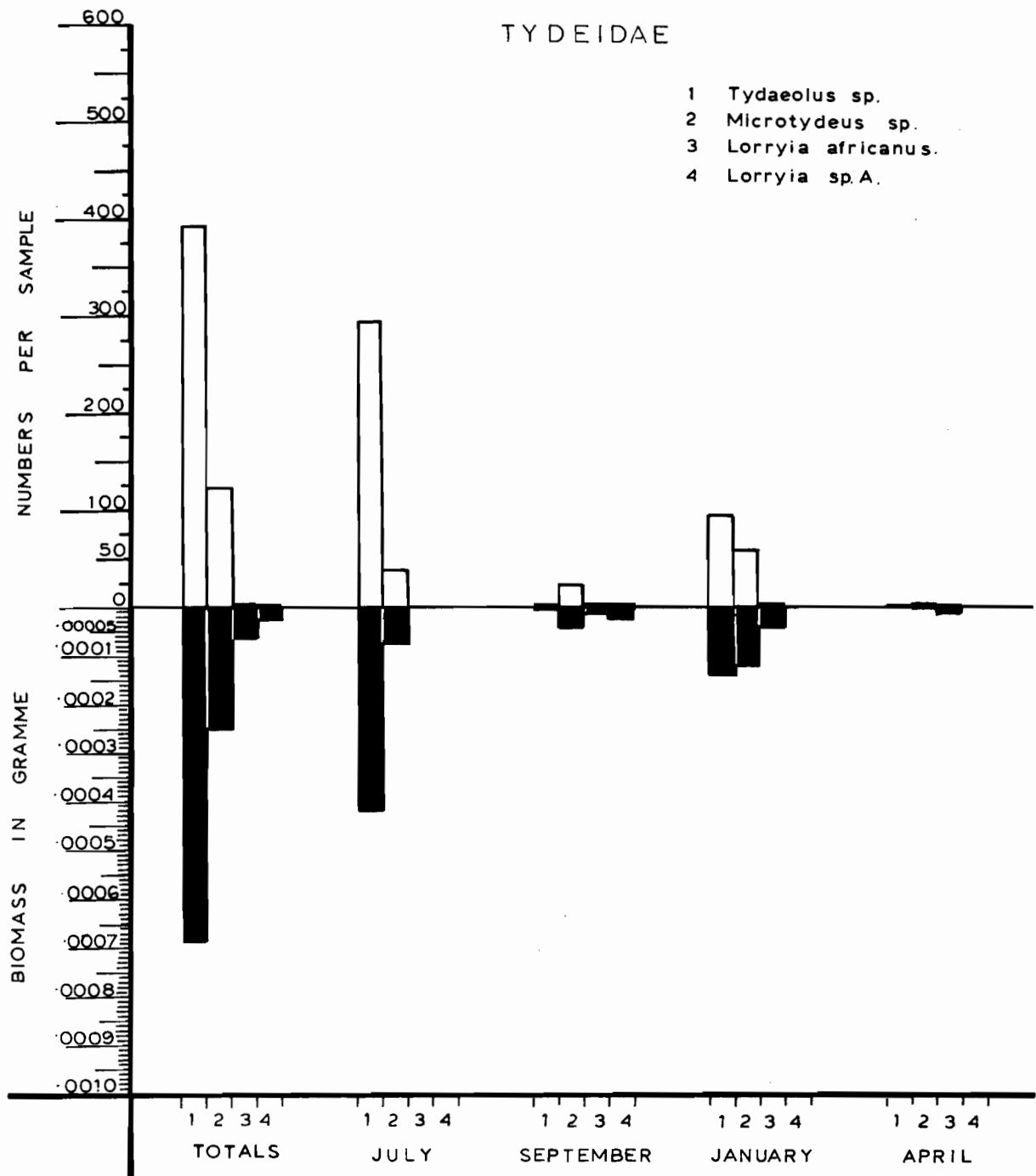


Fig. 60 Seasonal fluctuations in numbers and biomass of the family Tydeidae, plot B.

TYDEIDAE

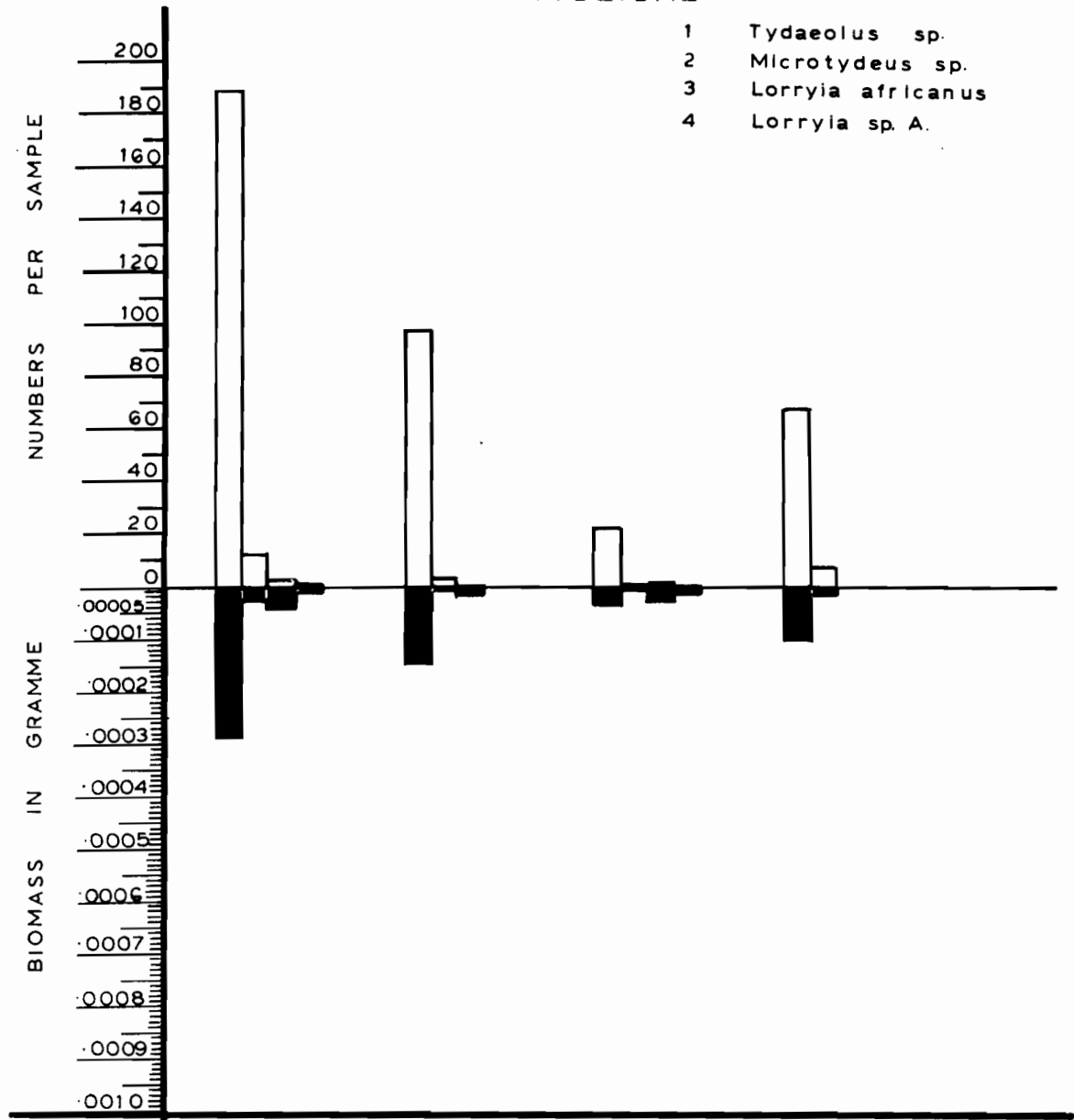


Fig. 61 Seasonal fluctuations in numbers and biomass of the family Tydeidae, plot C.

# TYDEIDAE

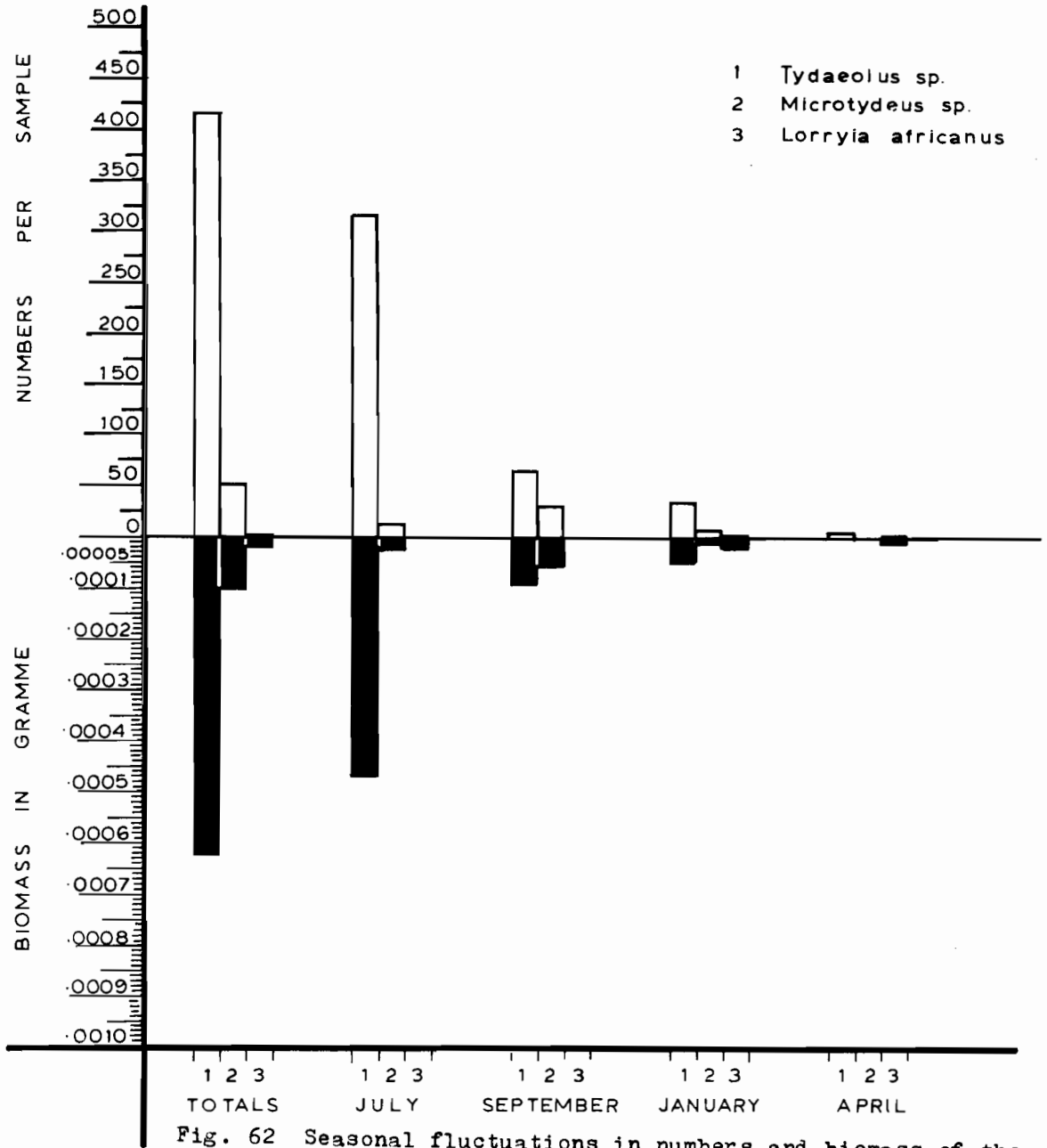


Fig. 62 Seasonal fluctuations in numbers and biomass of the family Tydeidae, plot D.

# TYDEIDAE

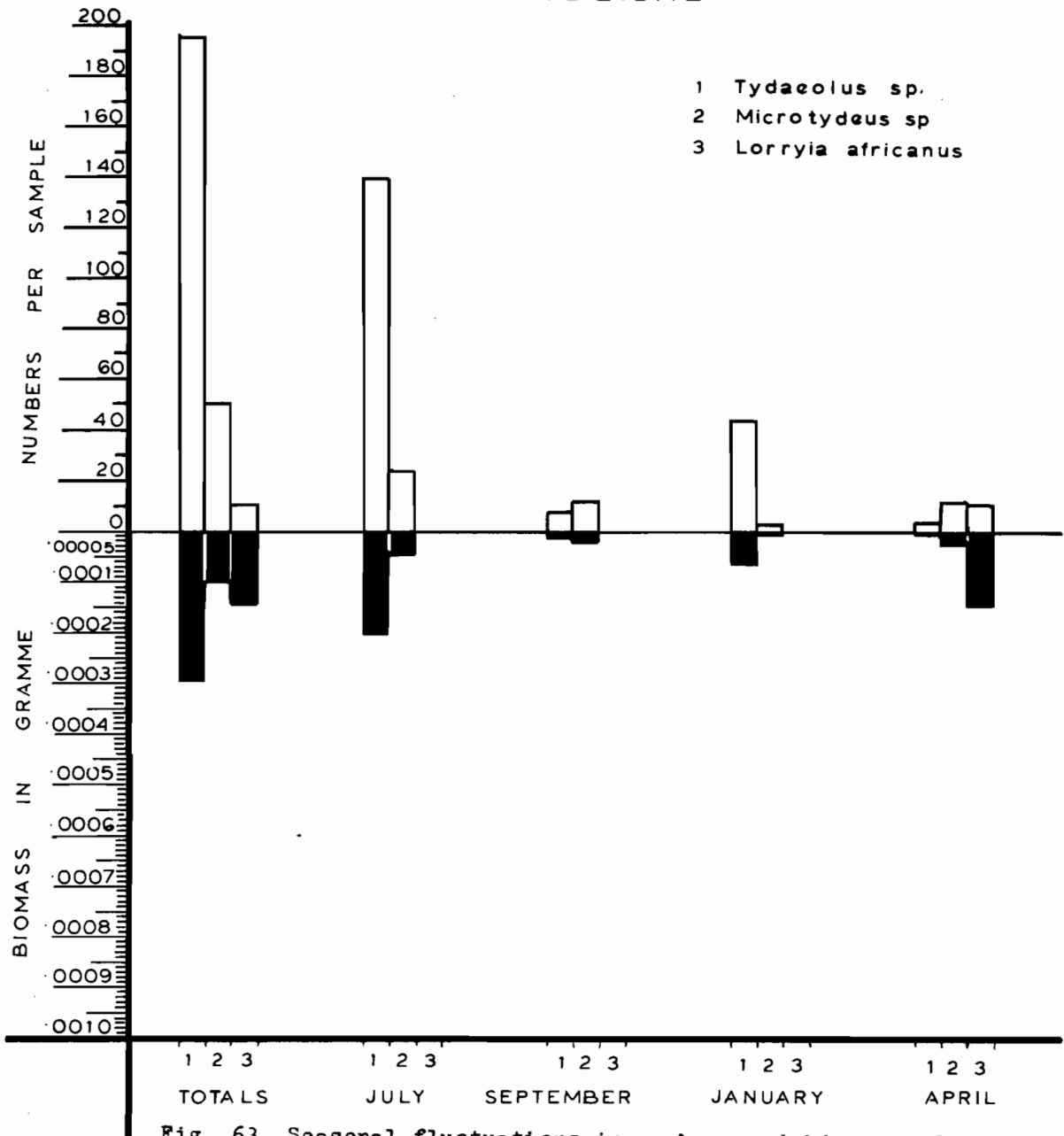


Fig. 63 Seasonal fluctuations in numbers and biomass of the family Tydeidae, plot E.

their biomass contributions were significant. Of the new genus Paralorryia (Baker), only a few specimens were recorded on plot A, while the new species, Lorryia sp. A was extracted at plots B and C only. This new species occurred only in the September survey of both plots, where population densities of 59 and 118 per m<sup>2</sup> were registered respectively on plots B and C.

Various authors are still speculating about the food preference of the smaller Tydaelolus sp. and Microtydeus sp. The bigger Tydeidae must be either phytophagous or predators on the smaller arthropoda. Karg (1965) illustrated their prominent piercing-sucking mouthparts.

#### NANORCHESTIDAE (figs. 64 and 68, table 20)

By far the biggest recording of this family was made on the control plot. Numerically, this family came very near to the dominant Tydeidae at the last mentioned plot. The Tydeidae, however, reached higher biomass values with a total of .001566 g against the .0012700 g for Nanorchestidae. Speleorchestes sp. showed a steady increase from 2,129 per m<sup>2</sup> in July 1965 to 21,695 per m<sup>2</sup> in January 1966. A comparatively steep decline occurred in April 1966 when a total of 2,541 per m<sup>2</sup> was recorded. Plot D and E of Section 2 recorded a mean of about 295 per m<sup>2</sup> for the whole year, while plots B and C had a mean of 591 per m<sup>2</sup> during the same period. Karg (1967) recently ascertained that the Nanorchestidae is highly sensitive to agricultural poisons. This discovery

# NANORCHESTIDAE

*Speleorchestes* sp.

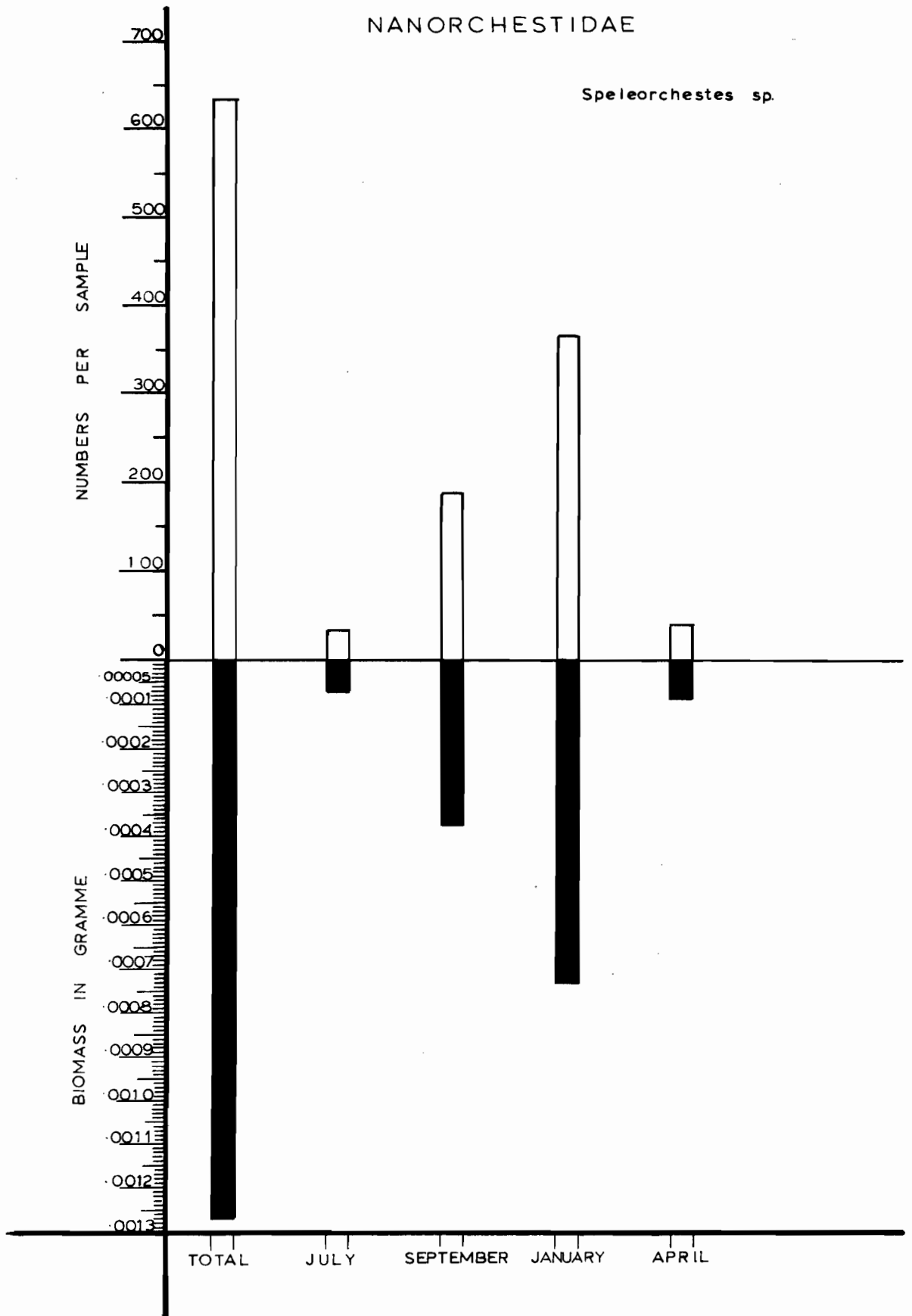


Fig. 64 Seasonal fluctuations in numbers and biomass of the family Nanorchestidae, plot A.

# NANORCHESTIDAE

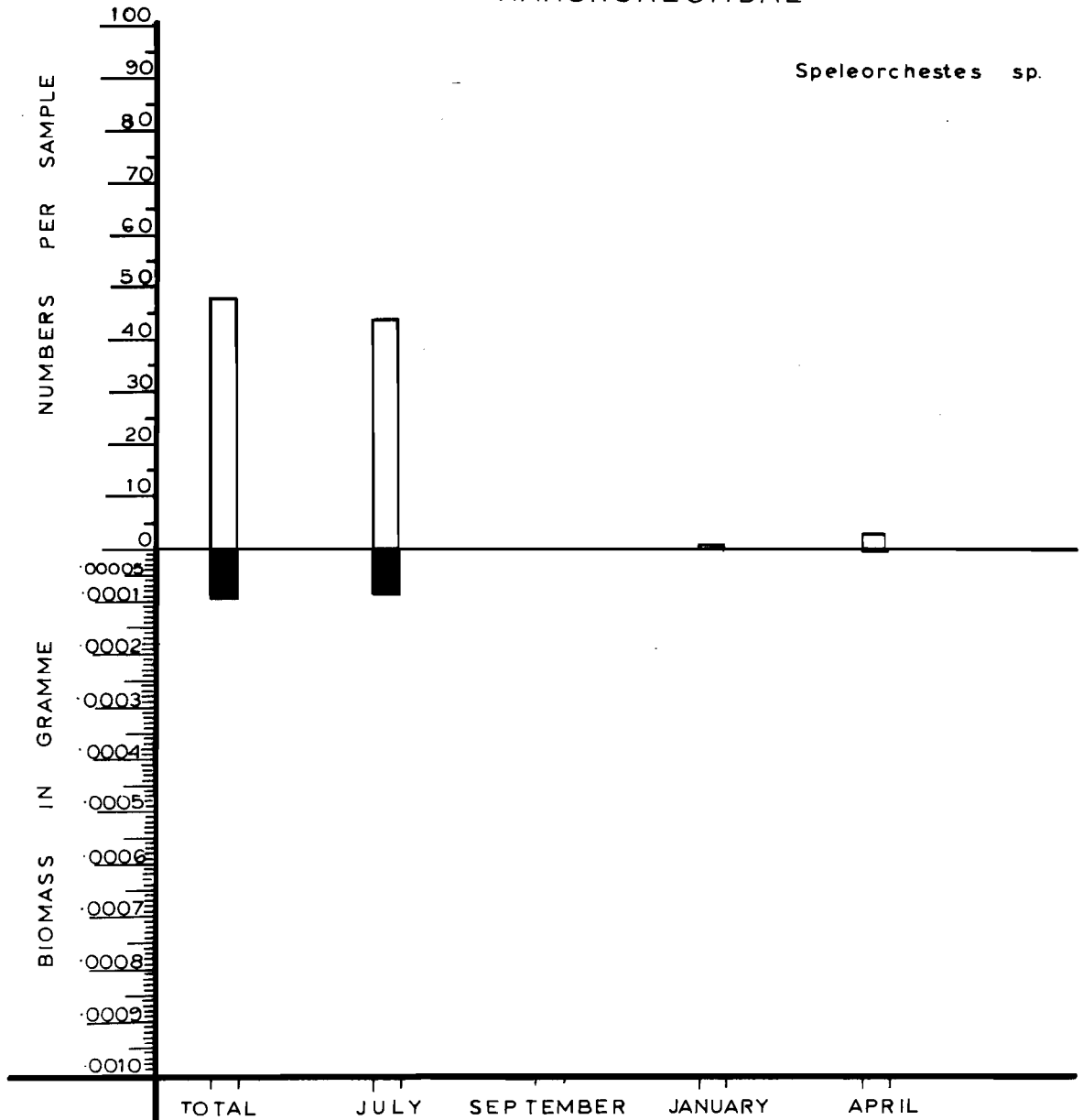


Fig. 65 Seasonal fluctuations in numbers and biomass of the family Nanorchestidae, plot B.

# NANORCHESTIDAE

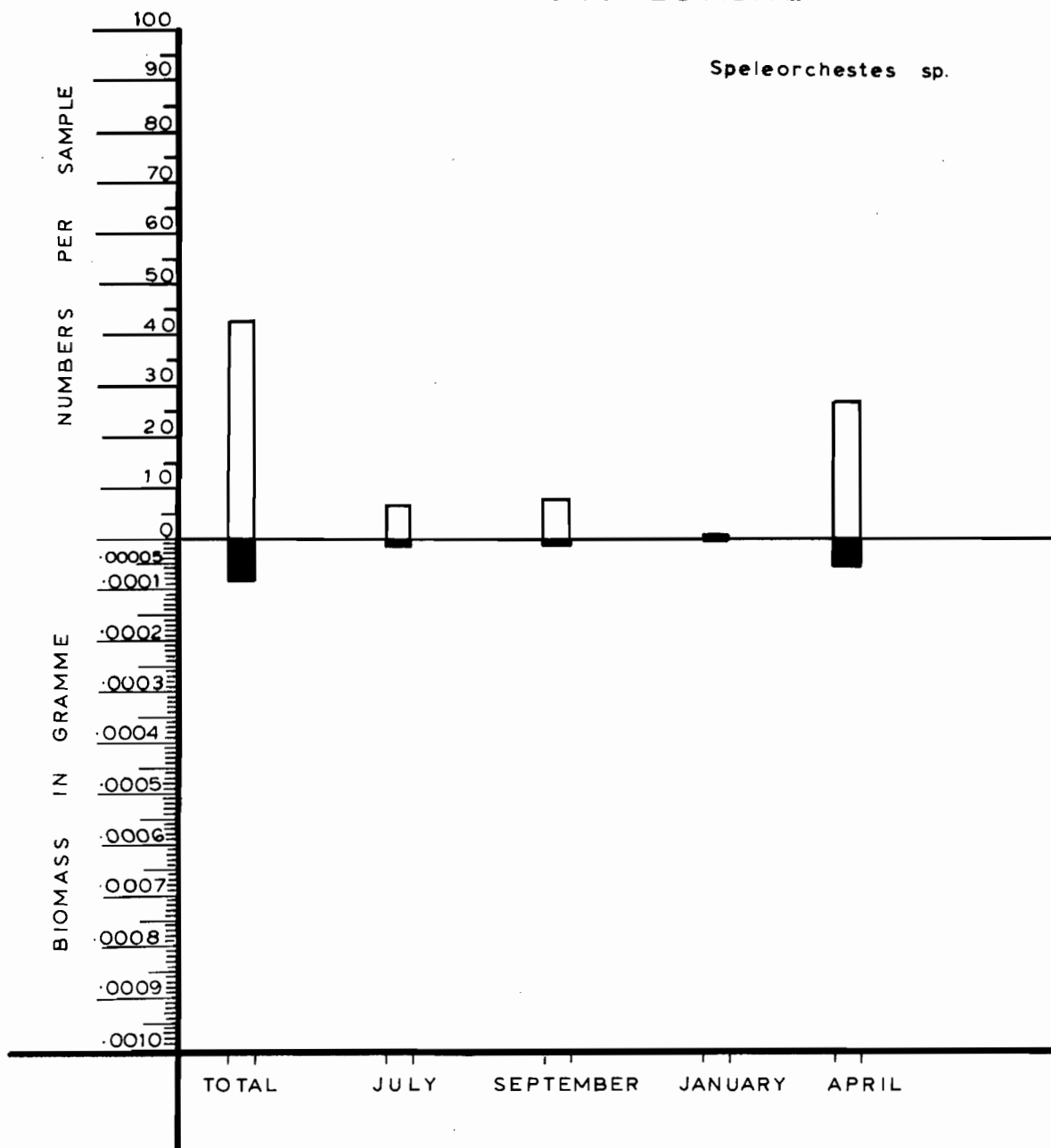


Fig. 66 Seasonal fluctuations in numbers and biomass of the family Nanorchestidae, plot C.

# NANORCHESTIDAE

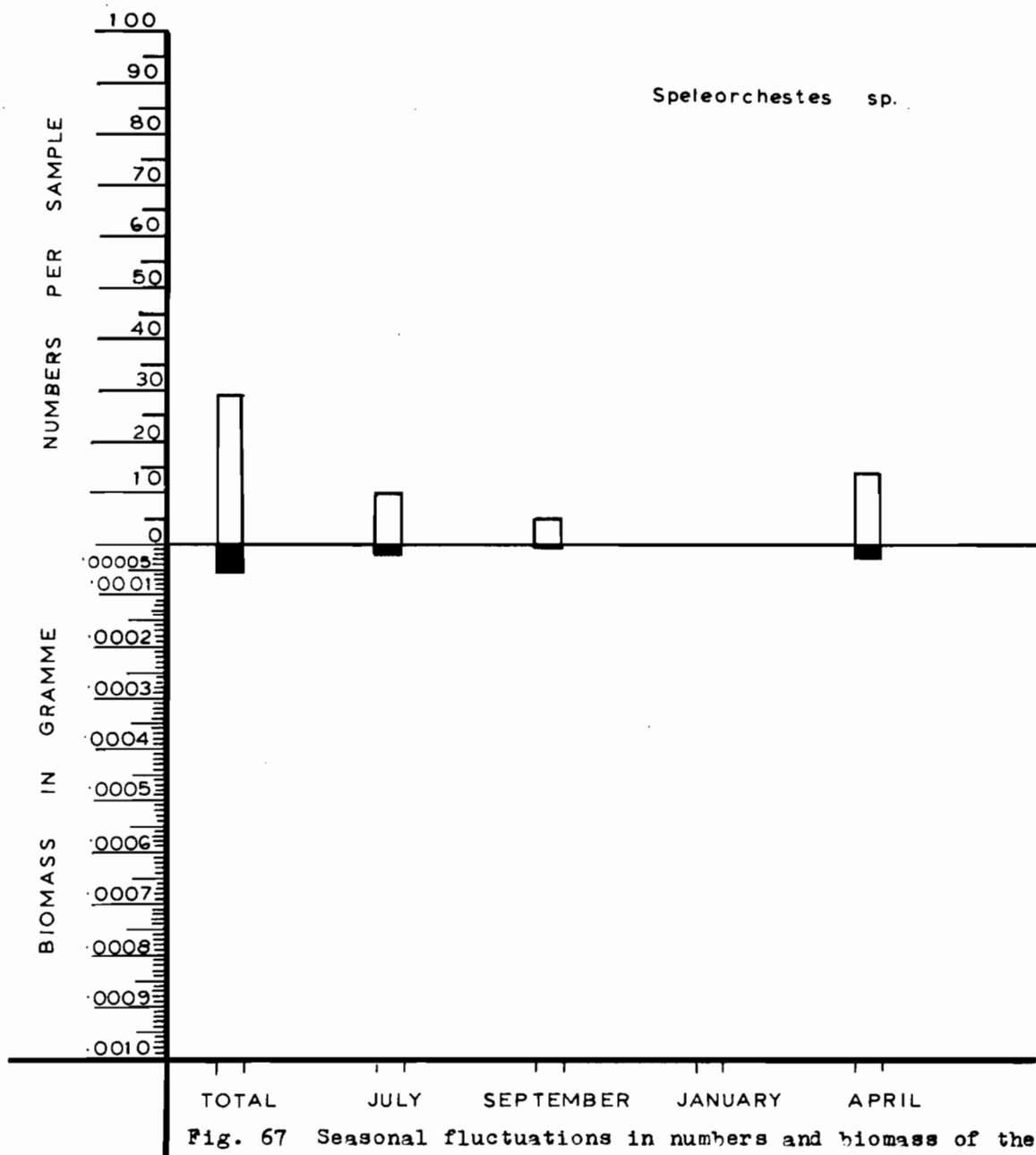


Fig. 67 Seasonal fluctuations in numbers and biomass of the family Nanorchestidae, plot D.

# NANORCHESTIDAE

*Speleorchestes* sp.

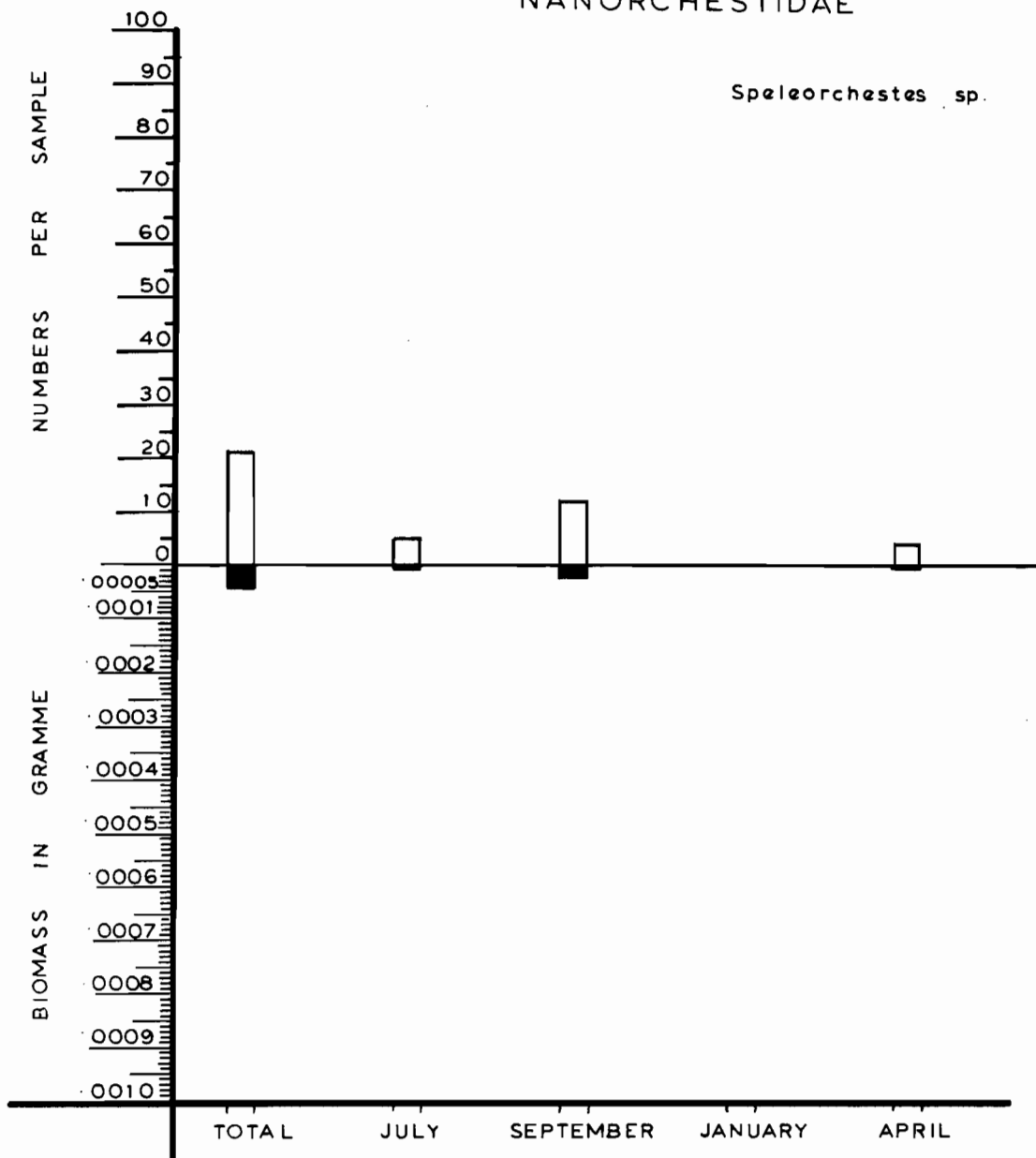


Fig. 68 Seasonal fluctuations in numbers and biomass of the family Nanorchestidae, plot E.

explains the described population distribution for Speleorchestes sp. in the investigated plots.

#### CUNAXIDAE (fig. 69, table 20)

Representative specimens of these predatory mites were extracted in the citrus plots B and D, and in the control plot only, of which the latter had by far the largest numbers. Except for one specimen of Cunaxoides sp. which was found in plot B, all the other specimens belonged to Cunaxa sp.

In two successive samplings, Cunaxa sp. had unimpressively small numbers in the control plot. The numbers per m<sup>2</sup> were 177 and 326, for the July and September samplings. In January, however, they suddenly arrested attention by their relatively high numbers of 5,143 per m<sup>2</sup>. The numbers again decreased to 295 per m<sup>2</sup> in April. At the biological control plot a recording of 118 per m<sup>2</sup> was made for the summer season.

#### BDELLIDAE (fig. 70, table 20)

Representatives of this family were recorded at plots C, D and A. As in the case of the previously described Cunaxa sp., this predator species had its largest concentrations in the control plot. Whereas its competitor had small numbers during the greater part of the sampling year, the bdellids, and particularly Bdella sp. had a more even distribution in the control plot, but nevertheless revealed an increase to the January climax of 2,541 per m<sup>2</sup>. Cyta sp. was

# CUNAXIDAE

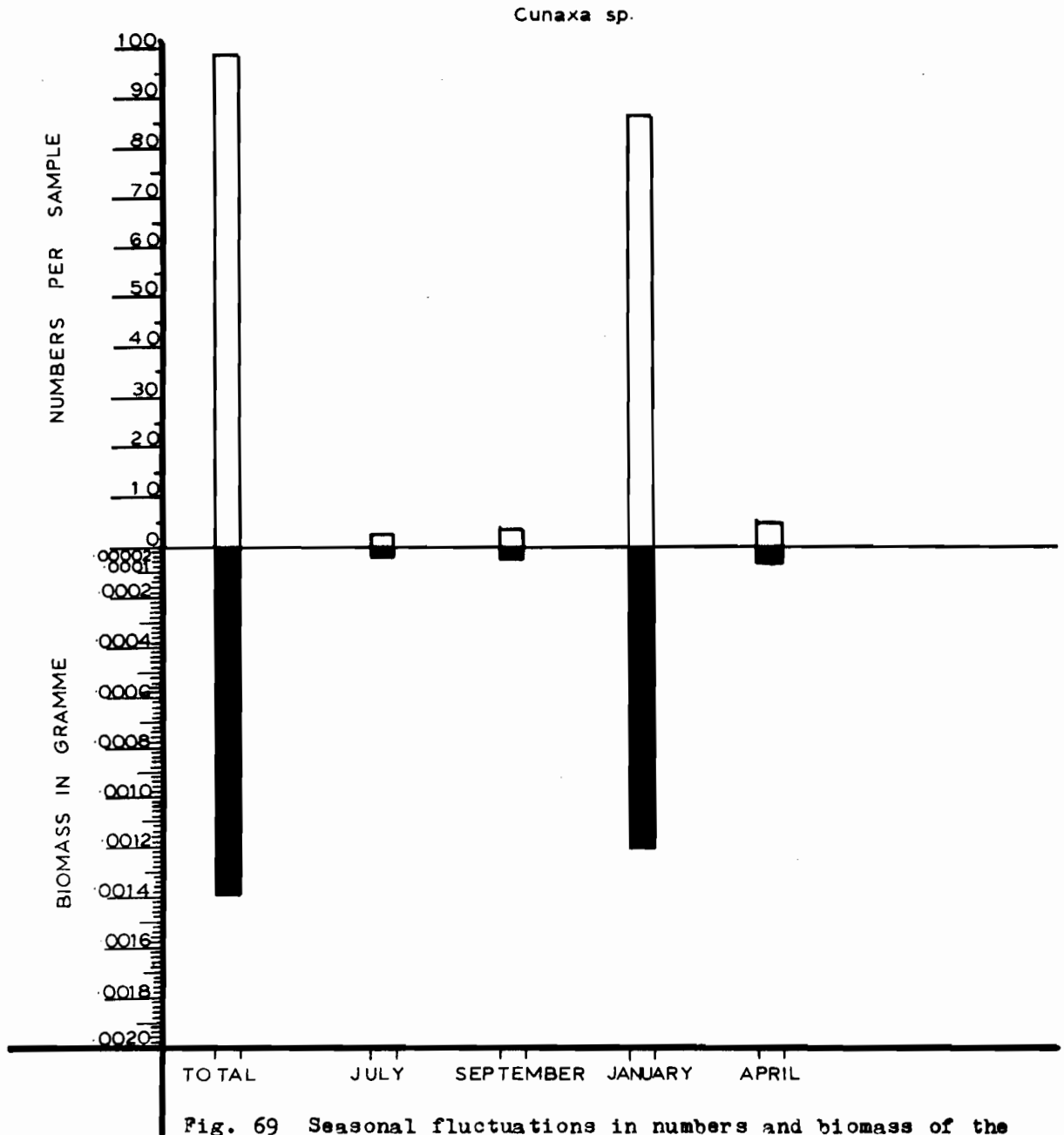


Fig. 69 Seasonal fluctuations in numbers and biomass of the family Cunaxidae, plot A.

# BDELLIDAE

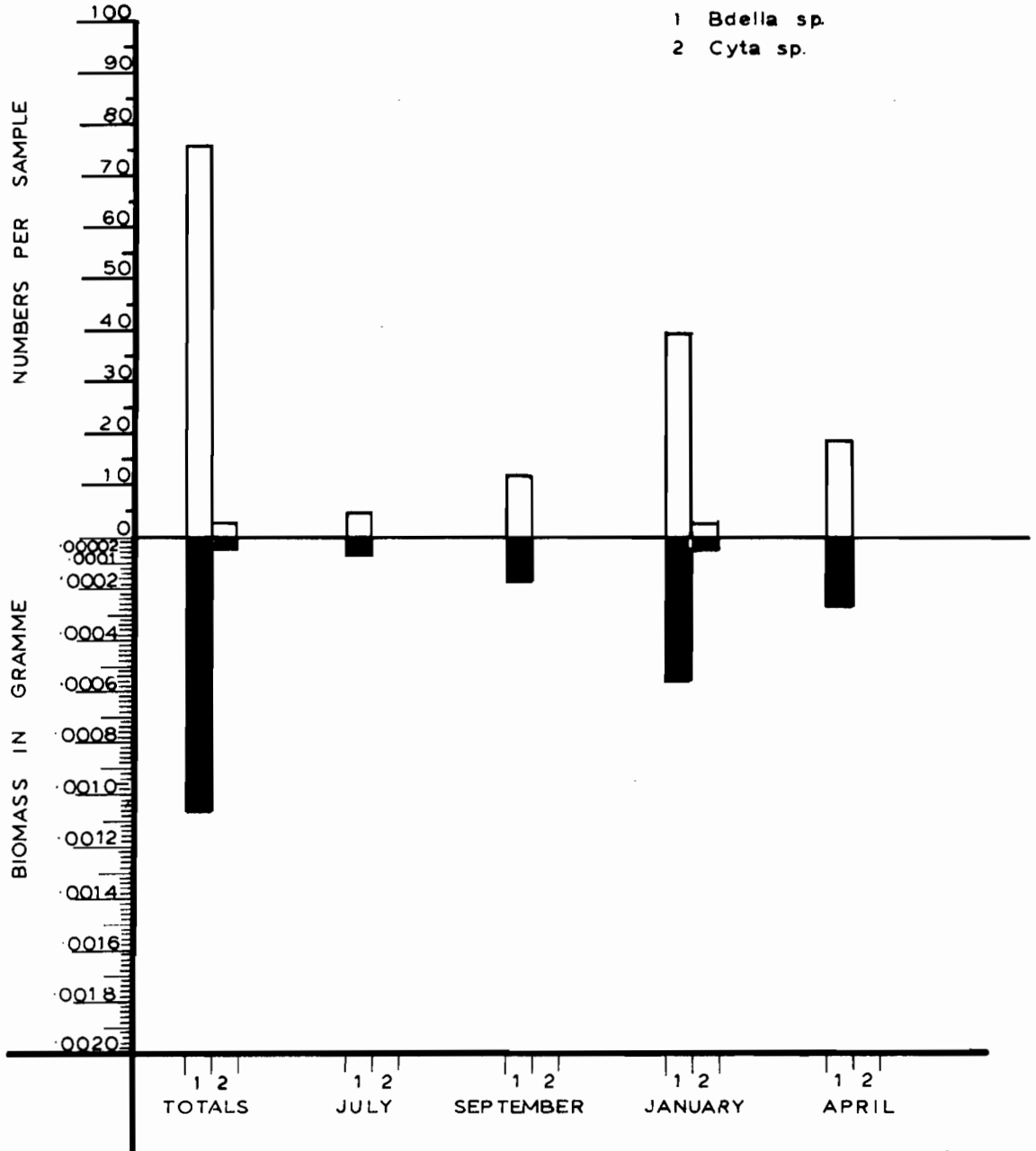


Fig. 70 Seasonal fluctuations in numbers and biomass of the family Bdellidae, plot A.

extracted at the control plot only. As only three specimens, or a density of 177 per  $m^2$  occurred during the peak season, they most probably had very low numbers in general. A yearly mean of 19 specimens per  $m^2$  were recorded for Bdella sp. in plot C while the biological control plot had a yearly mean of 59 specimens per  $m^2$ . The larger concentrations of Bdella sp. at the biological control plot gave an indication of higher predator population numbers in the absence of chemical control.

#### RAPHIGNATHIDAE (fig. 71, table 20)

Acheles aethiopica (Meyer & Ryke) occurred at the control plot and biological control plot only. Just as in the case of the previously described predator species, the biggest population densities were found at the control plot. During July 1965, 59 specimens per  $m^2$  were recorded at the latter plot. In September 1965, 118 per  $m^2$  were registered and finally 2,069 mites per  $m^2$  in January 1966. The numbers again diminished to 177 per  $m^2$  in April 1966. The biological control plot recorded 118 specimens per  $m^2$  during January 1966. The absence of this species in the routine plots is probably a further indication of its sensitivity to agricultural poisons.

#### STIGMAEIDAE (fig. 72, table 20)

Although the Stigmaeidae had unimpressively small numbers, they were important as probable indicator species. Four pre-

# RAPHIGNATHIDAE

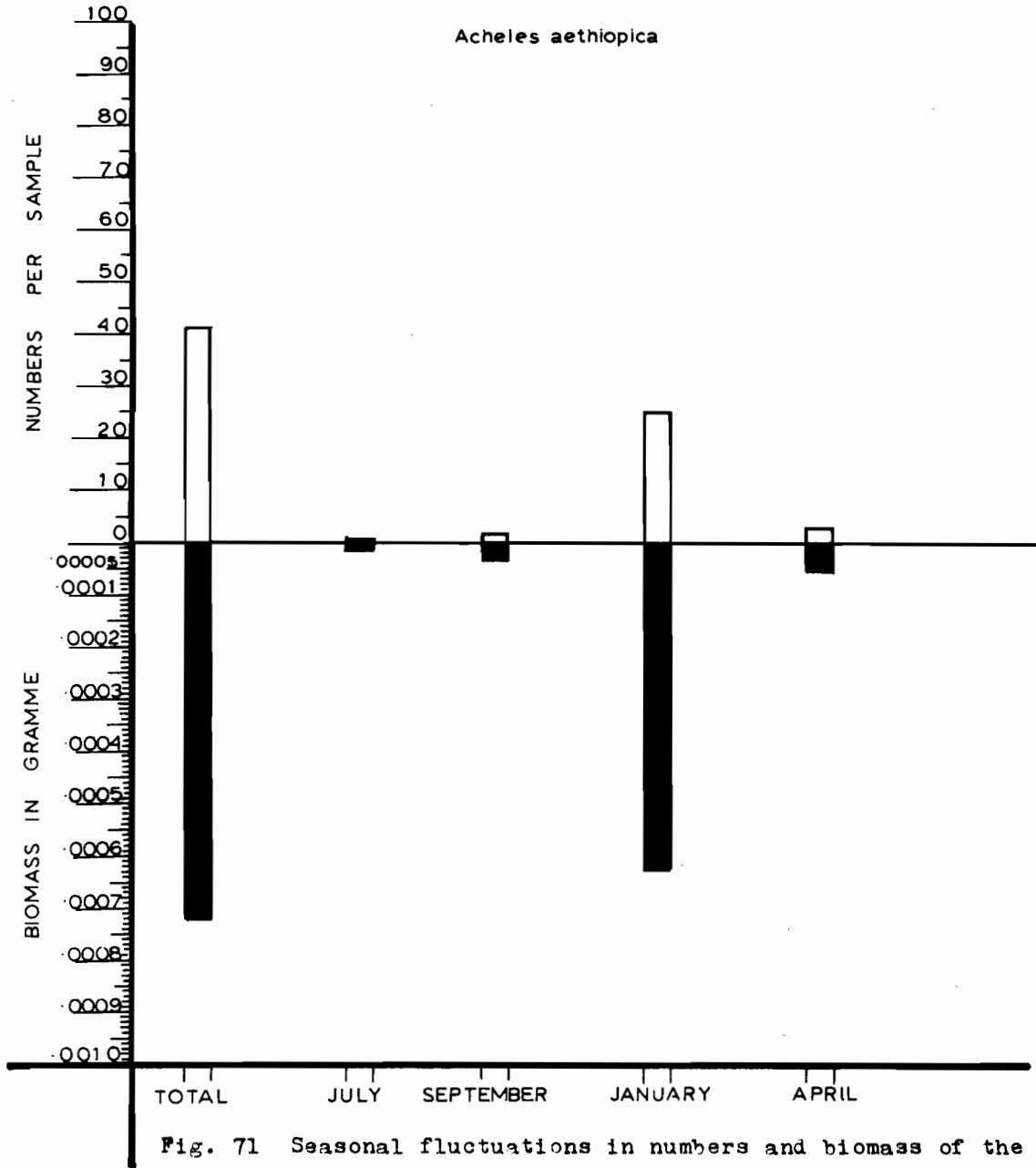


Fig. 71 Seasonal fluctuations in numbers and biomass of the family Raphignathidae, plot A.

# STIGMAEIDAE

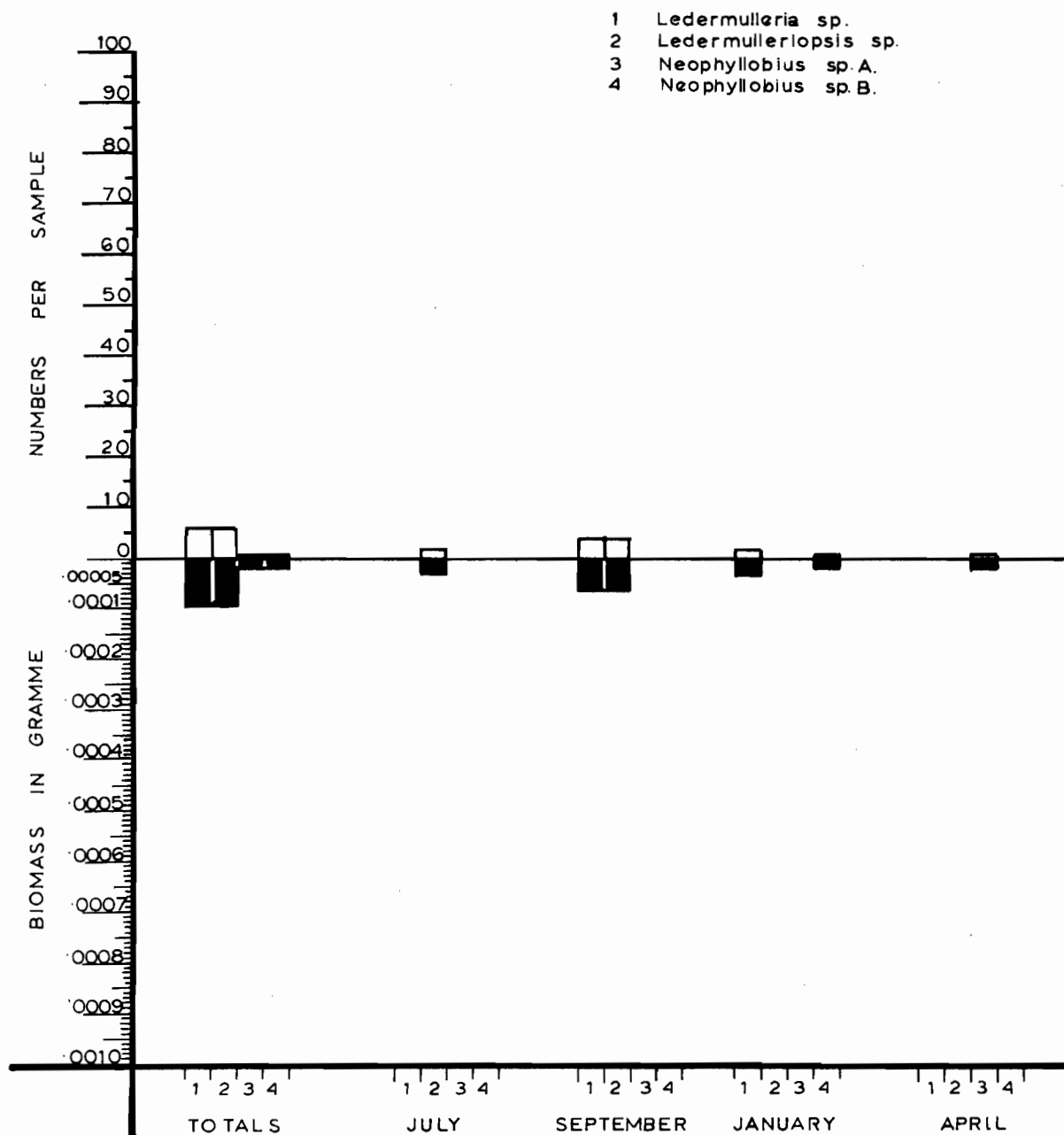


Fig. 72 Seasonal fluctuations in numbers and biomass of the family Stigmaeidae, plot A.

dator species were recovered, namely Ledermulleria sp., Ledermulleriopsis sp., Neophyllobius sp. nov. A., and Neophyllobius sp. nov. B. The last mentioned two species occurred at the control plot only. According to Baker and Wharton (1959) this genus is a predator of crawler stages of Scales, as observed in southern California, U.S.A. It would be interesting to find out whether representatives of this genus occur in the citrus tree fauna of the estates. At plot C, a recording of 59 Ledermulleria sp. per m<sup>2</sup> were made in July 1965. It was the only representative recording, in the routine plots, of this family. The biological control plot on the other hand recorded 59 specimens per m<sup>2</sup> for both the July and September samples. Ledermulleriopsis sp. occurred at the biological control and control plots only. A density of 59 per m<sup>2</sup> was recorded for both plots in September.

#### EUPODIDAE (table 20)

These mites are commonly believed to be saprophagous or predacious and were extracted in plots A, B, C and D. All recordings were made from September to April and the mean number per m<sup>2</sup> was 59 specimens. The dominant species E. variegatus (Meyer & Ryke) occurred in all the mentioned plots, while only one specimens of E. parafusifer (Meyer & Ryke) was recorded in plots A and B.

#### ANYSTIDAE (table 20)

Anystis baccharum (Linn.) was found at the control plot

only. During July 1965, a concentration of 236 specimens per  $m^2$  was recovered and again 59 per  $m^2$  during January 1966. From den Heyer's collection, specimens were collected from the trees at the biological control plot as well.

These long legged, fast moving mites are predacious on Acari and small insects. They are soil surface dwellers, living in the litter layers of the soil. Due to cultivation practices, they are now generally confined to the natural vegetation. The fact that they do occur in the biological control plot is a possible indication of general conditions there.

#### CRYPTOGNATHIDAE (table 20)

The red predator mite, Cryptognathus cucurbita cucurbitella (Meyer & Ryke) was recorded at the control plot only. These mites are also considered to be surface dwelling predators. Due to cultivation practices they are now confined to the natural soil only. A concentration of 177 per  $m^2$  was recorded in January 1966.

#### LORDALYCHIDAE (table 20)

Lordalychus sp. occurred at the control plot only. These globular, medium sized mites were frequently found in natural pasture soils in Potchefstroom. Though only small numbers occurred at the control plot, the absence of this species in the citrus plots is an indication of its sensitivity to agricultural practices and their effects.

## PACHYGNATHIDAE (fig. 73, table 20)

Representatives of the family Pachygnathidae were recorded at the three plots A, B and C of Section 3 B. Specimens of both Pachygnathus sp. and Bimichealia sp. occurred at the mentioned plots, at a general yearly mean of 59 per m<sup>2</sup>.

## PARATYDEIDAE (table 20)

Scolotydeus sp. was extracted occasionally from soil samples of plots B and C. A concentration of 118 per m<sup>2</sup> were recorded in July 1965 on plot B, while plot C registered 59 specimens per m<sup>2</sup> for both the September and April samples.

## PSEUDOCHEYLIDAE (table 20)

Specimens of Pseudocheylus sp. were recorded on the control plot only. This predator also prefers natural soil conditions. General agricultural practices, and chemical applications in particular, obviously restrict their occurrence in citrus soils. During July 1965, 413 specimens per m<sup>2</sup> were recorded at the control plot, while for both the September and January seasons a density of 59 per m<sup>2</sup> were recorded. The population density for April 1966 was 177 specimens per m<sup>2</sup>.

## CHEYLETIDAE (table 20)

This predator species occurred on the control plot and biological control plot only. A population density of 59

# PACHYGNATHIDAE

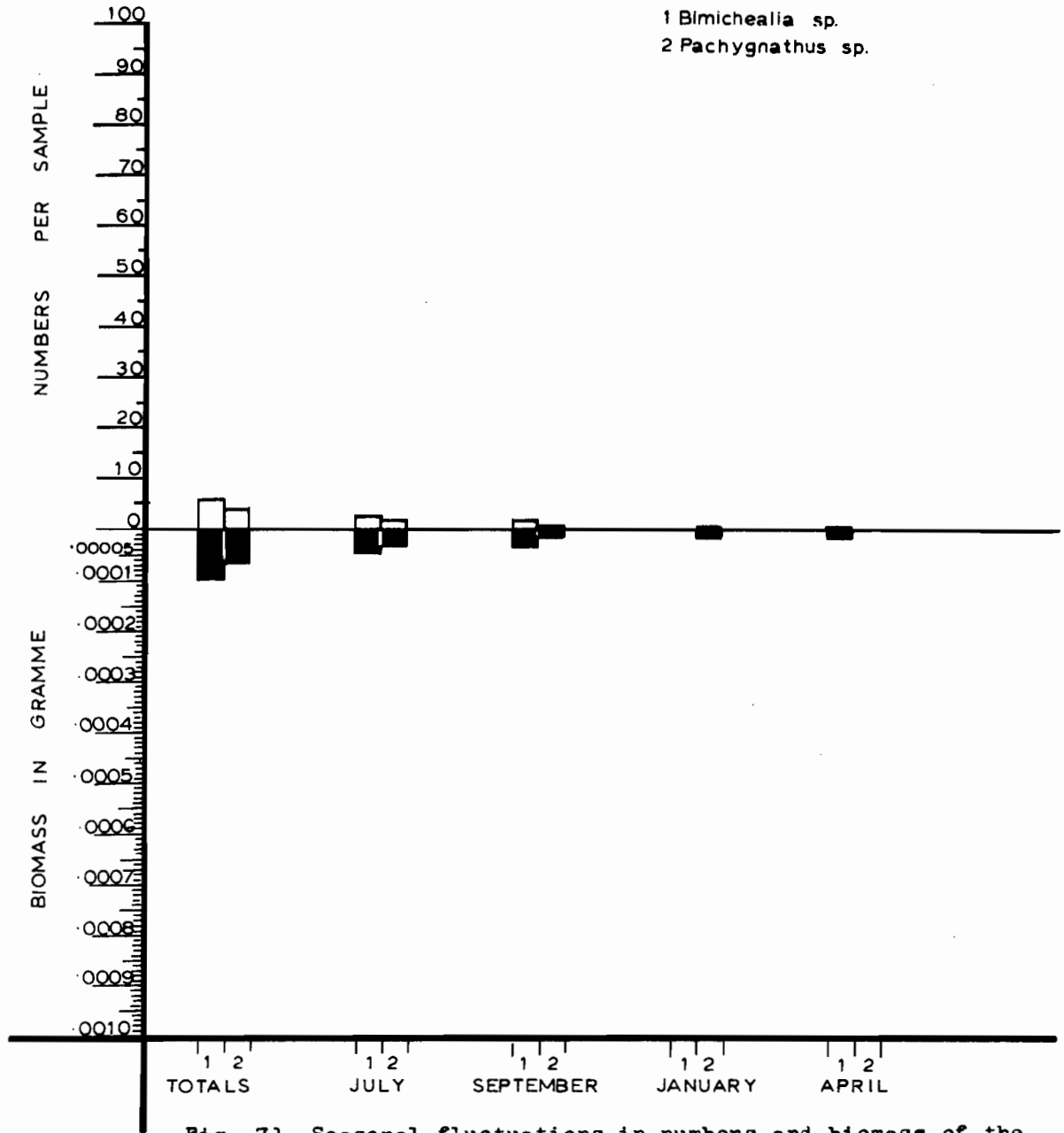


Fig. 73 Seasonal fluctuations in numbers and biomass of the family Pachygnathidae, plot A.

per m<sup>2</sup> was recorded for both plots during July 1965. The September sample revealed an increase to 295 mites per m<sup>2</sup> at the control plot, while no further specimens occurred at the biological control plot. The occurrence of this species again depicts the relation between the control plot and the biological control plot, the latter representing an intermediate stage between natural soil conditions and the routine citrus plot conditions. Kevan (1962) considered the Cheyletidae as "formidable" predatory mites, living in soil and litter.

#### ERYTHRAEIDAE (fig. 74, table 20)

These conspicuous colourful mites were collected at the control plot only. They are in fact large surface dwelling predators of the Acari and smaller insects. Smaris biscutatus (Meyer & Ryke) was the dominant Erythraeidae species. A concentration of 295 specimens per m<sup>2</sup> was extracted from the September samples, 1,418 per m<sup>2</sup> from those in January 1966 and 1,004 per m<sup>2</sup> from the April samples. They were the largest biomass contributors to the Trombidiformes of plot A. Erythraeidae is a typical natural soil inhabitant, living in the loose litter layer, but was also observed to penetrate the deeper soil levels at places with a more porous structure and high organic material content. They are most probably one of the first families to disappear from newly developed agricultural lands. It is further speculated that they might be highly sensitive to agricultural poisons because of their

# ERYTHRAEIDAE

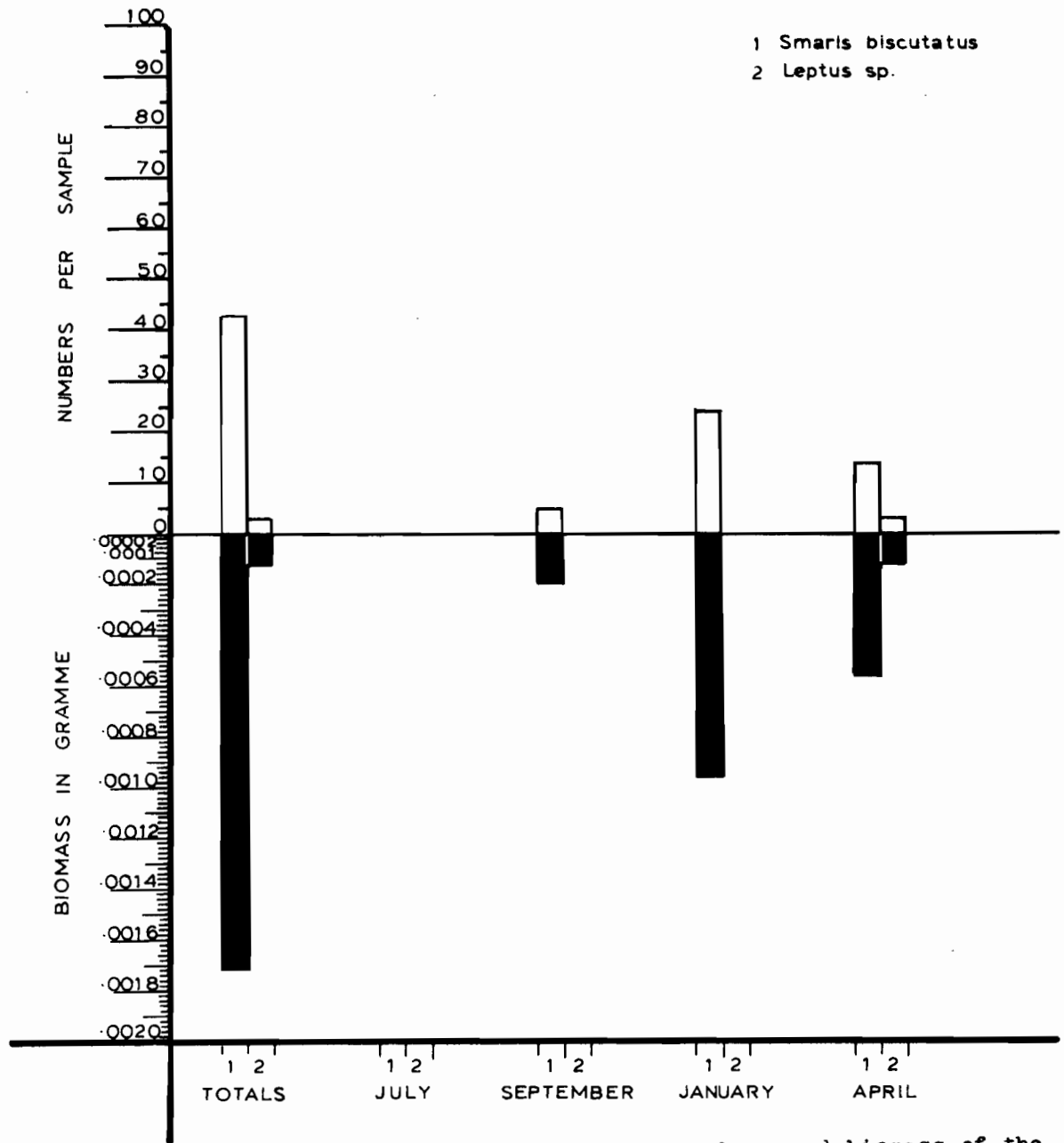


Fig. 74 Seasonal fluctuations in numbers and biomass of the family Erythraeidae, plot A.

natural habitat in the top soil.

PYEMOTIDAE (fig. 75 to 77, table 20)

With the exception of plot B, small numbers of Pygmephorus sp. were recorded in all the plots. At plot B, however, this eu-edaphic mite maintained fair to high population numbers throughout the sampling year. During the first sampling in July 1965, 4,551 specimens per m<sup>2</sup> were extracted. This number decreased to 886 per m<sup>2</sup> in September but then increased to 19,508 per m<sup>2</sup> in January 1966. The April survey reveals a sharp population reduction to 177 per m<sup>2</sup>. During the course of an investigation concerning the effect of DNOC (Dinitro-orthokresol) on agricultural soils, Karg (1964) also encountered a pronounced population increase of Pyemotidae after poison application. As Pyemotidae feeds on bacteria and simple fungi, Karg suspects an increase in the activities of the bacteria and unicellular microbes, as a result of chemical application.

The other plots, on the other hand, revealed no population expansions. The different yearly means for plot C, D, E and A were 354, 59, 250 and 221 per m<sup>2</sup> respectively.

TARSONEMIDAE (table 20)

No conclusions concerning the effect of agricultural activities could be drawn from the figures of Tarsonemus sp. It is an eu-edaphic mite that occurred on all plots, except plot E. The yearly mean for the different plots was:

PYEMOTIDAE

*Pygmephorus* sp.

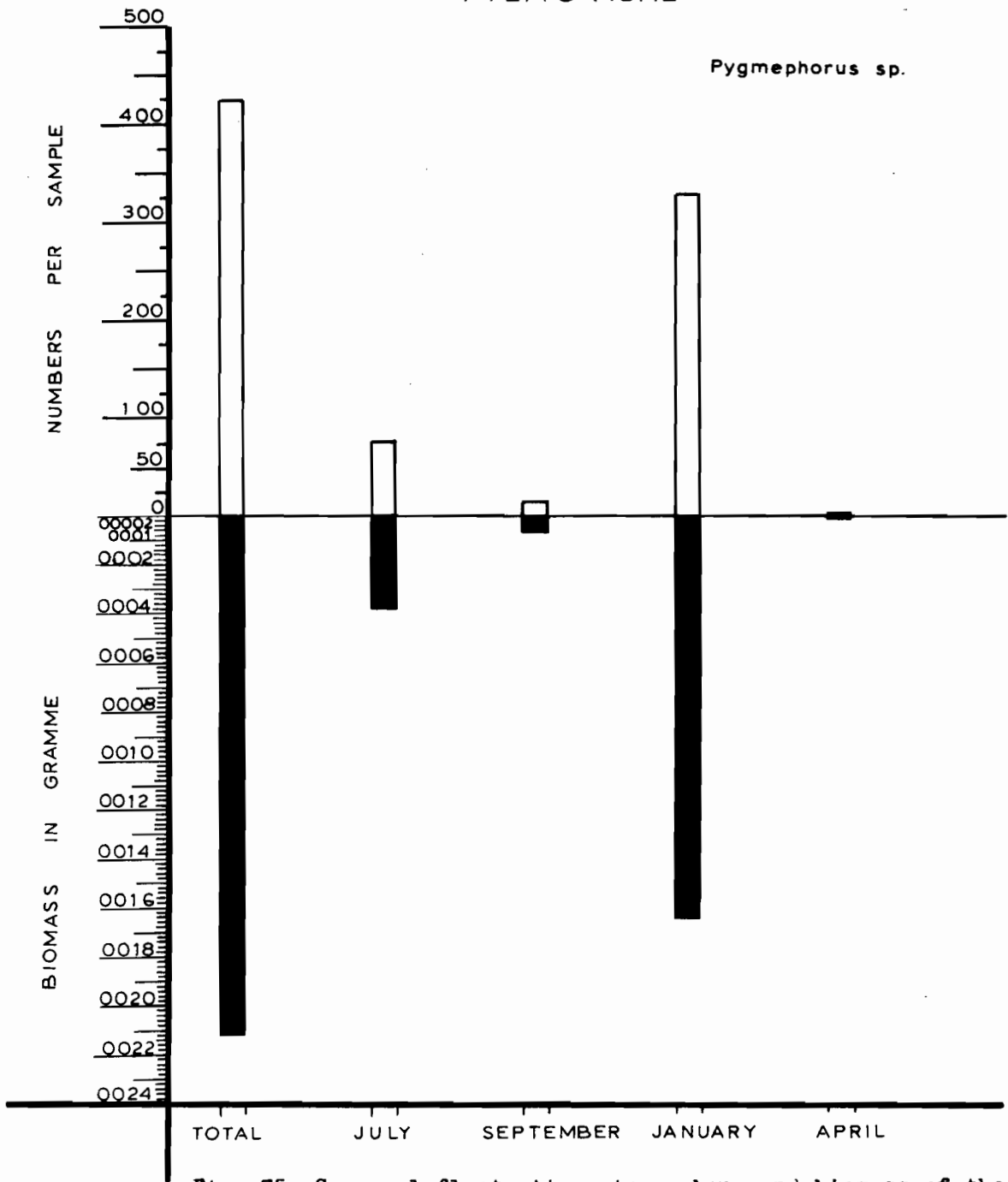


Fig. 75 Seasonal fluctuations in numbers and biomass of the family Pyemotidae, plot B.

# PYEMOTIDAE

*Pygmephorus* sp.

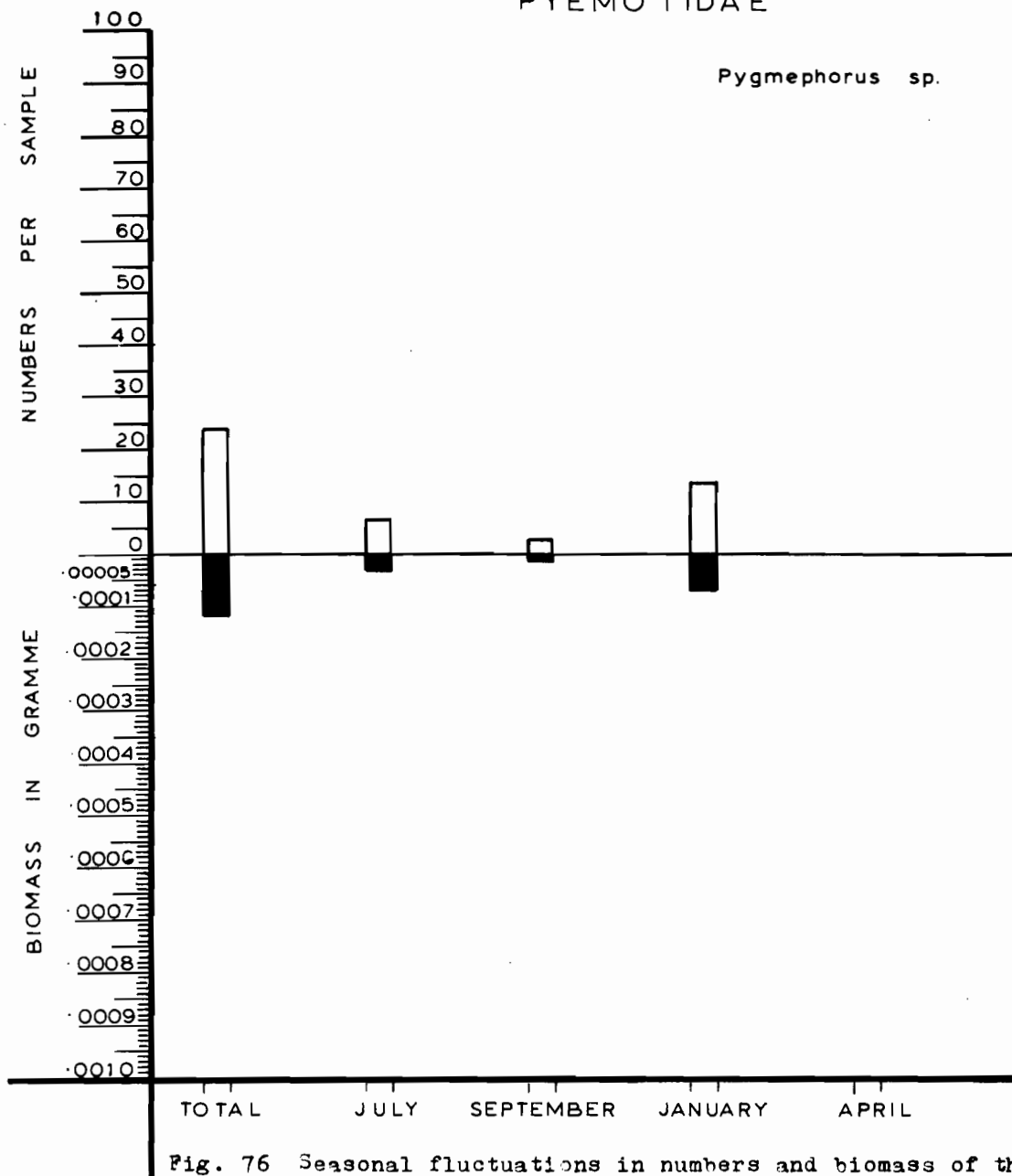


Fig. 76 Seasonal fluctuations in numbers and biomass of the family Pyemotidae, plot C.

PYEMOTIDAE

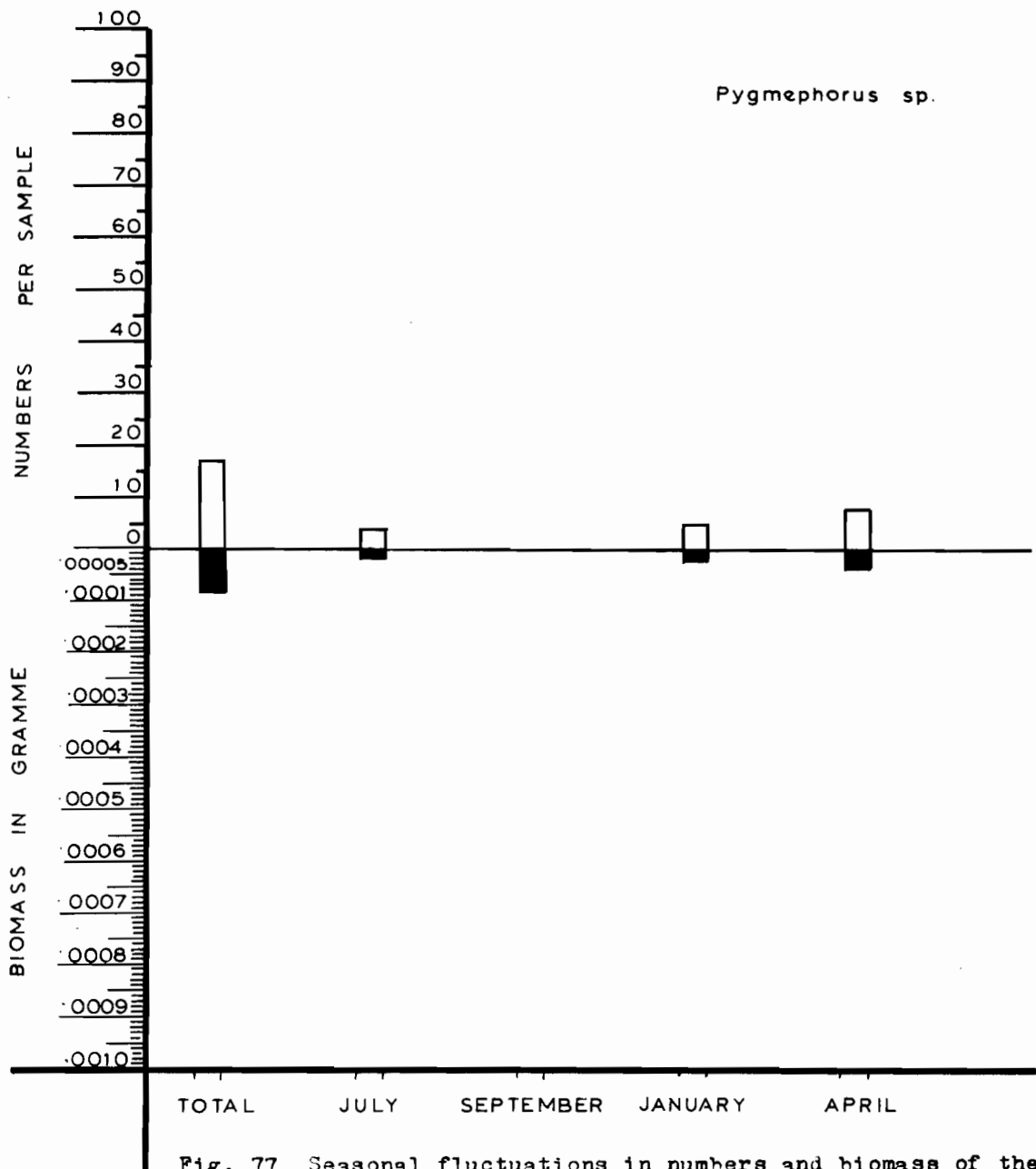


Fig. 77 Seasonal fluctuations in numbers and biomass of the family Pyemotidae, plot E.

Plot B	-	14	specimens	per	m <sup>2</sup>
Plot C	-	22	"	"	"
Plot D	-	73	"	"	"
Plot A	-	177	"	"	"

## SCUTACARIDAE (table 20)

Representative specimens of Scutacarus sp. were collected on plots B, D and A. In comparison with the two control plots, the old citrus plot had representative specimens throughout the sampling year. The numbers per m<sup>2</sup> were:

July 1965	-	118/m <sup>2</sup> ;	September 1965	-	118/m <sup>2</sup>
January 1966	-	354/m <sup>2</sup> ;	April 1966	-	709/m <sup>2</sup> .

## TETRANYCHIDAE (table 20)

Brevipalpus obovatus (Donn.) is a true plant parasite, which is commonly observed in citrus trees. The specimens found in the samples must have fallen from the trees. One specimen each were extracted on plot B and D.

## 7.112 Mesostigmata (figs. 78 to 82)

The Mesostigmata was one of the smallest orders of Acari encountered. The mites of this order are all believed to be predacious and were with few exceptions present in all the citrus plots as well as in the control plot. The Mesostigmata constituted 1 to 2% of the total mesofaunal numbers of the various plots. Six families were recorded altogether.

# FAMILIES OF MESOSTIGMATA

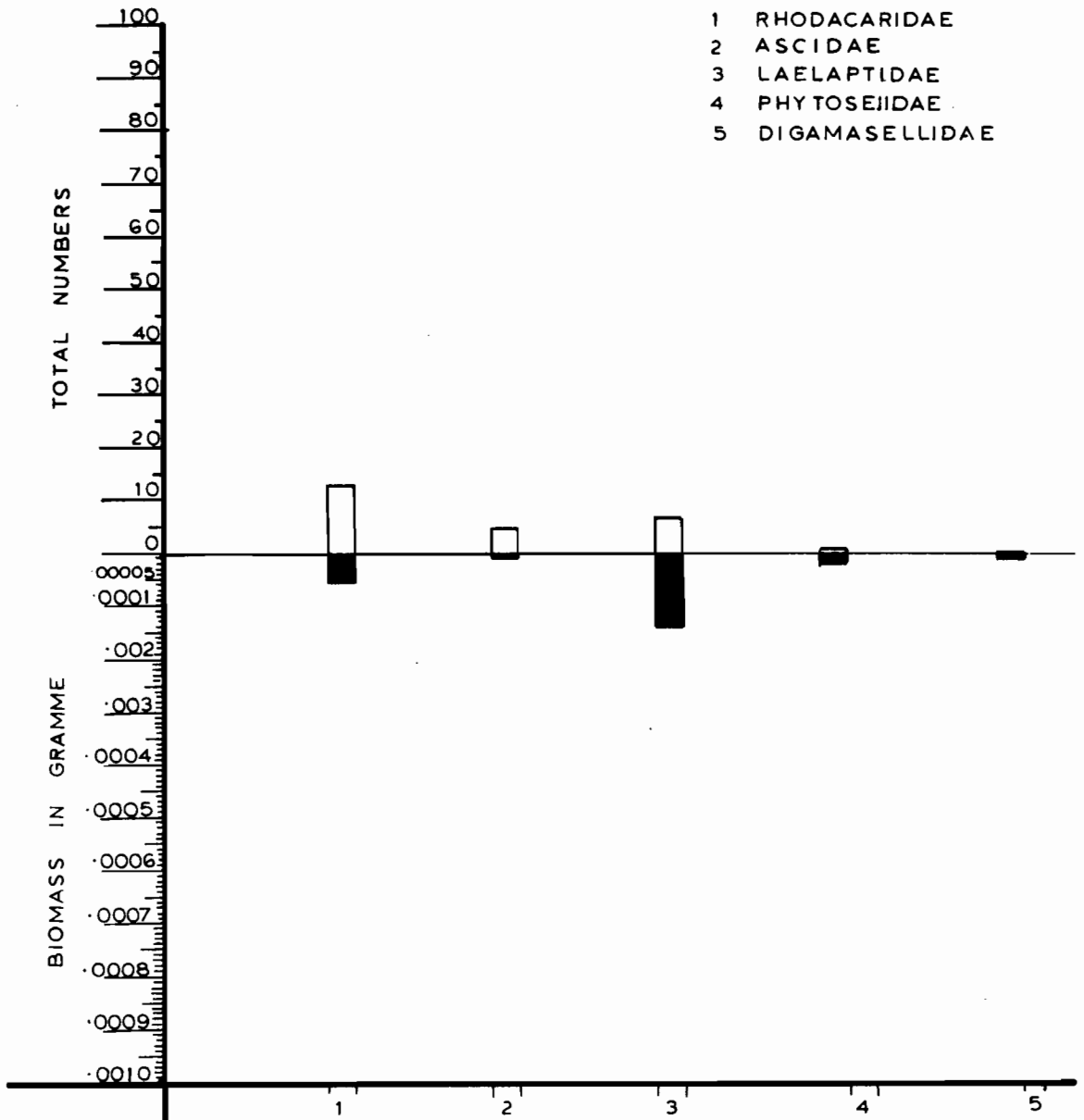


Fig. 78 Numbers and biomass of the families of Mesostigmata, plot A.

# FAMILIES OF MESOSTIGMATA

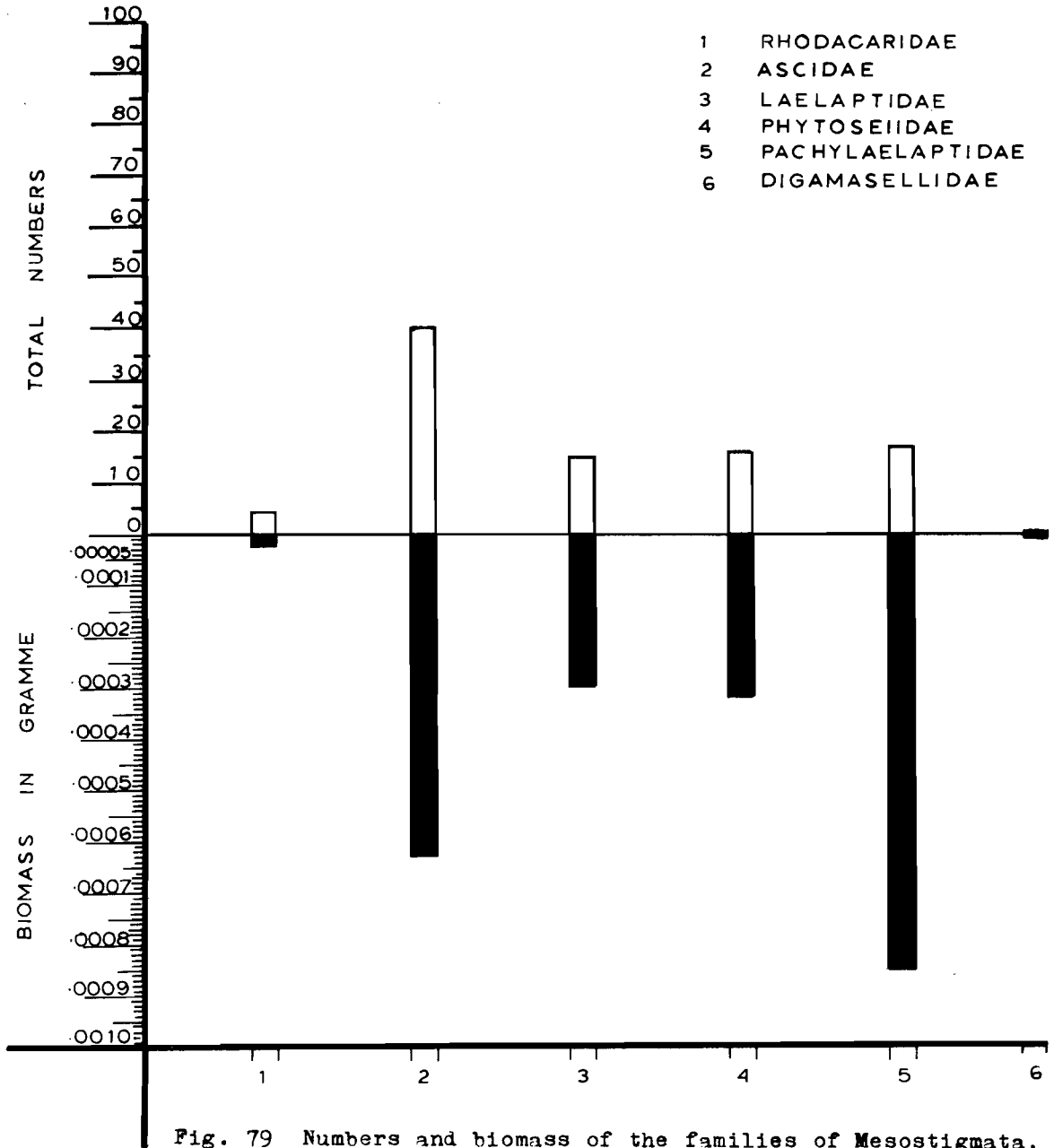


Fig. 79 Numbers and biomass of the families of Mesostigmata, plot B.

FAMILIES OF MESOSTIGMATA

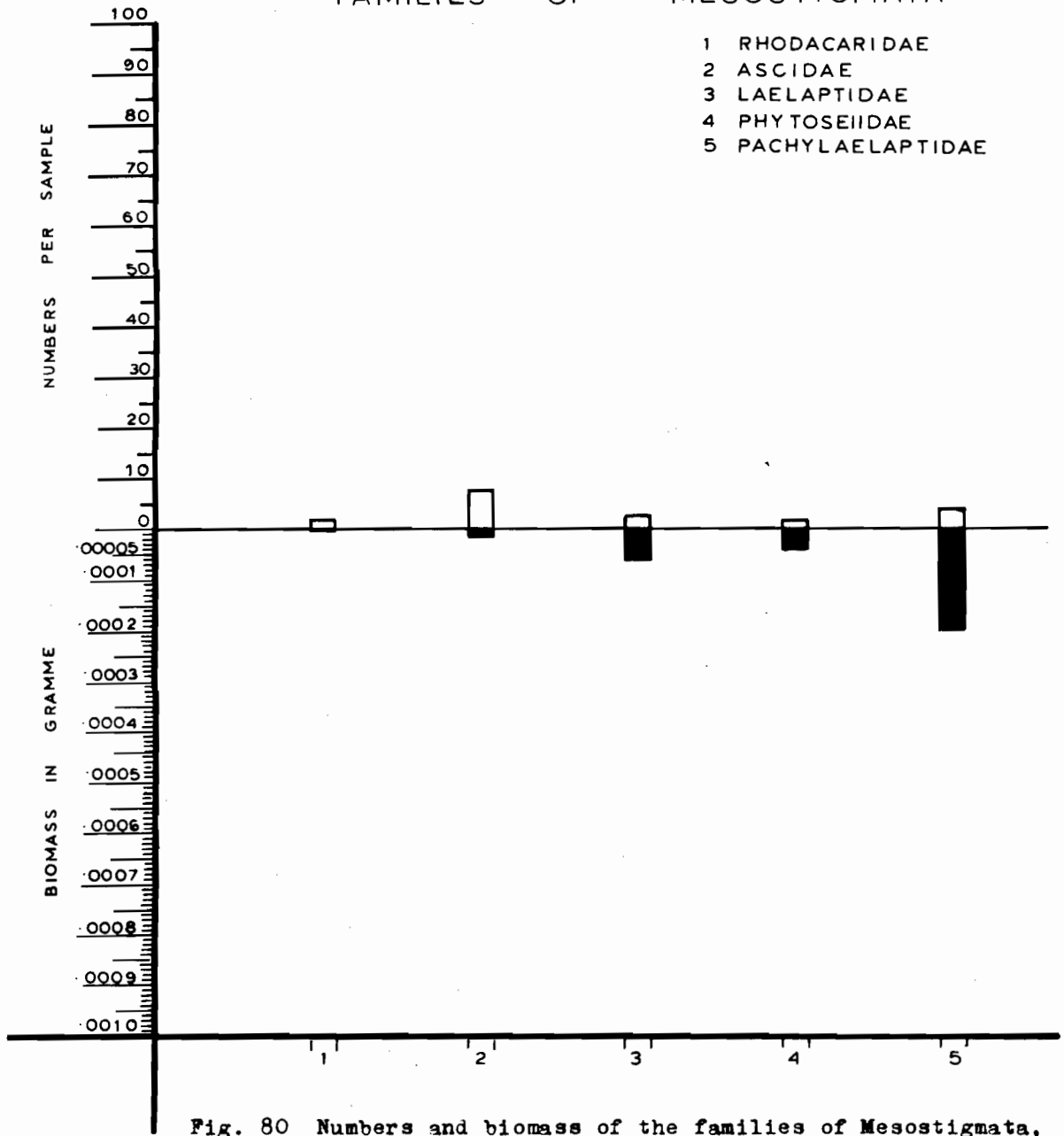


Fig. 80 Numbers and biomass of the families of Mesostigmata, plot C.

# FAMILIES OF MESOSTIGMATA

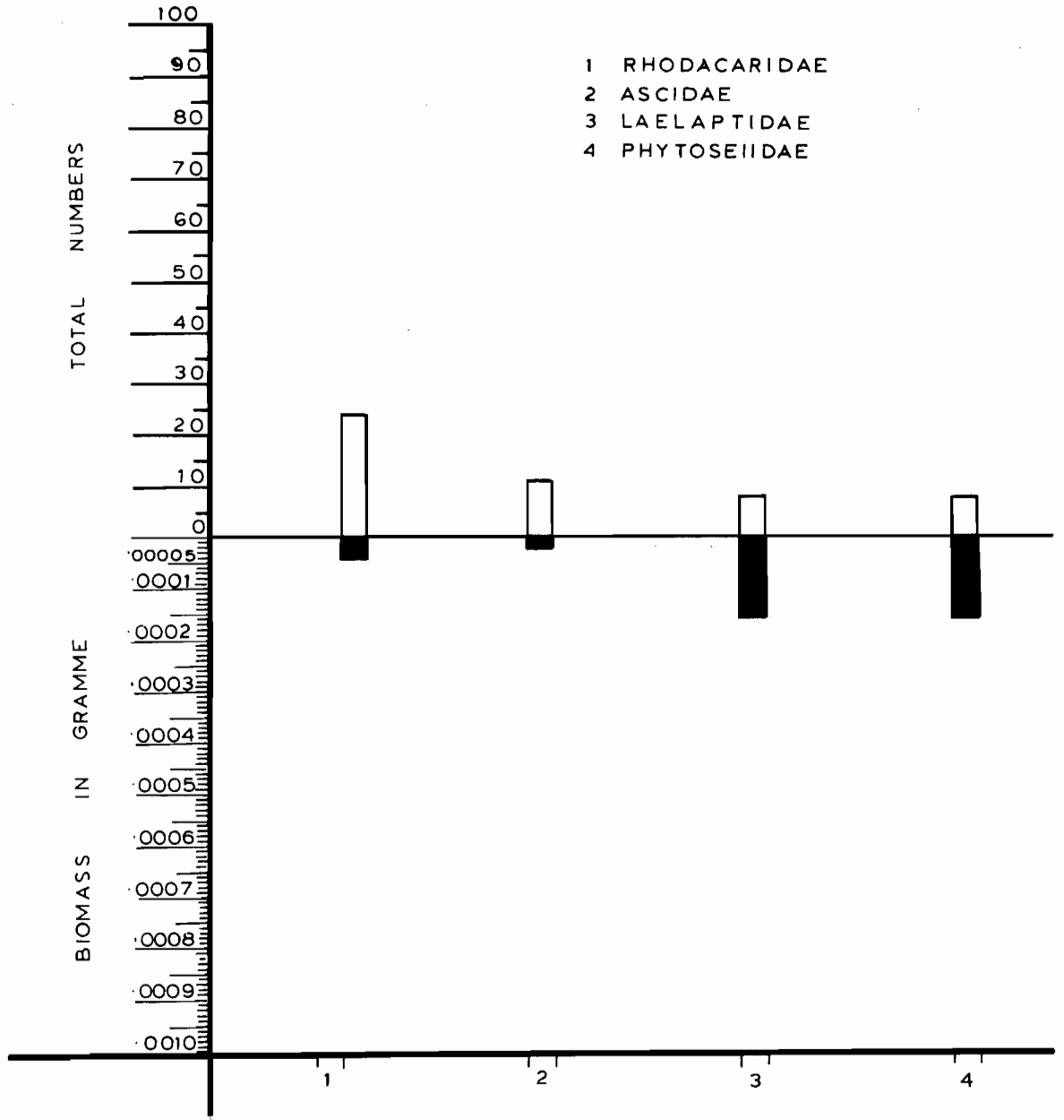


Fig. 81 Numbers and biomass of the families of Mesostigmata, plot D.

# FAMILIES OF MESOSTIGMATA

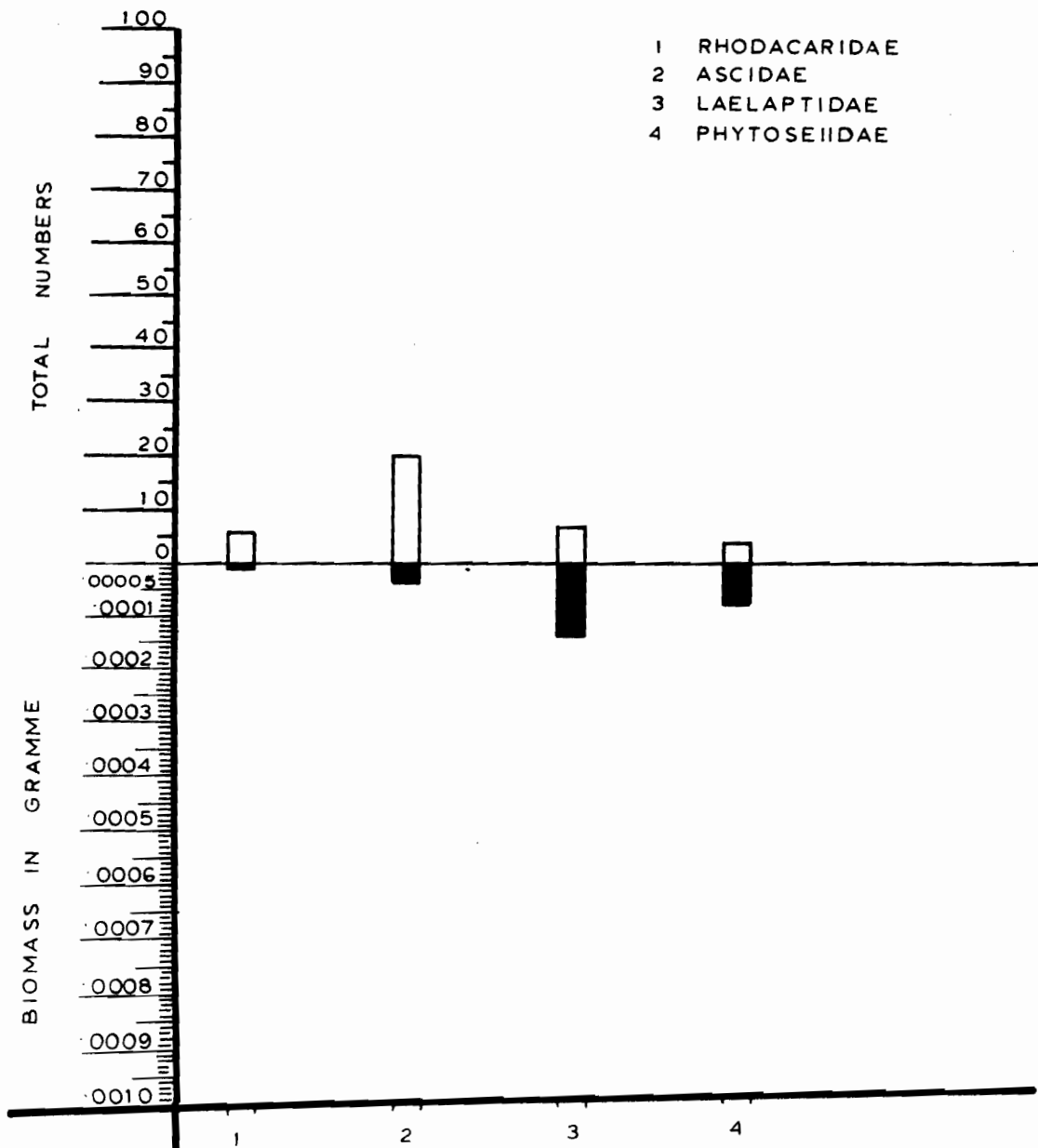


Fig. 82 Numbers and biomass of the families of Mesostigmata, plot E.

## RHODACARIDAE (fig. 83)

Rhodacarus sublapideus (Ryke) occurred in all four citrus plots as well as in the control plot. Slightly higher concentrations occurred in the control plot and biological control plot, but no definite results which would indicate population reduction or growth as a result of parathion application could be observed. The yearly mean numbers per  $m^2$  for the different plots were:

Plot A - 591/ $m^2$	Plot D - 354/ $m^2$
Plot B - 44/ $m^2$	Plot E - 88/ $m^2$
Plot C - 29/ $m^2$	

## ASCIDAE (figs. 84 &amp; 85, table 21)

The routine citrus plots had the highest population numbers of Ascidae. The yearly mean per  $m^2$  for the different plots was:

Plot A - 107/ $m^2$	Plot D - 177/ $m^2$
Plot B - 591/ $m^2$	Plot E - 295/ $m^2$
Plot C - 118/ $m^2$	

The Protogamasellus species was regularly present in all the plots, but Lasioseius sp., the biggest contributor to the numbers and biomass of Ascidae in plot B, made its late appearance in January and April 1966.

## DIGAMASELLIDAE (table 21)

Only two specimens of Digamasellus sp. were extracted

# RHODACARIDAE

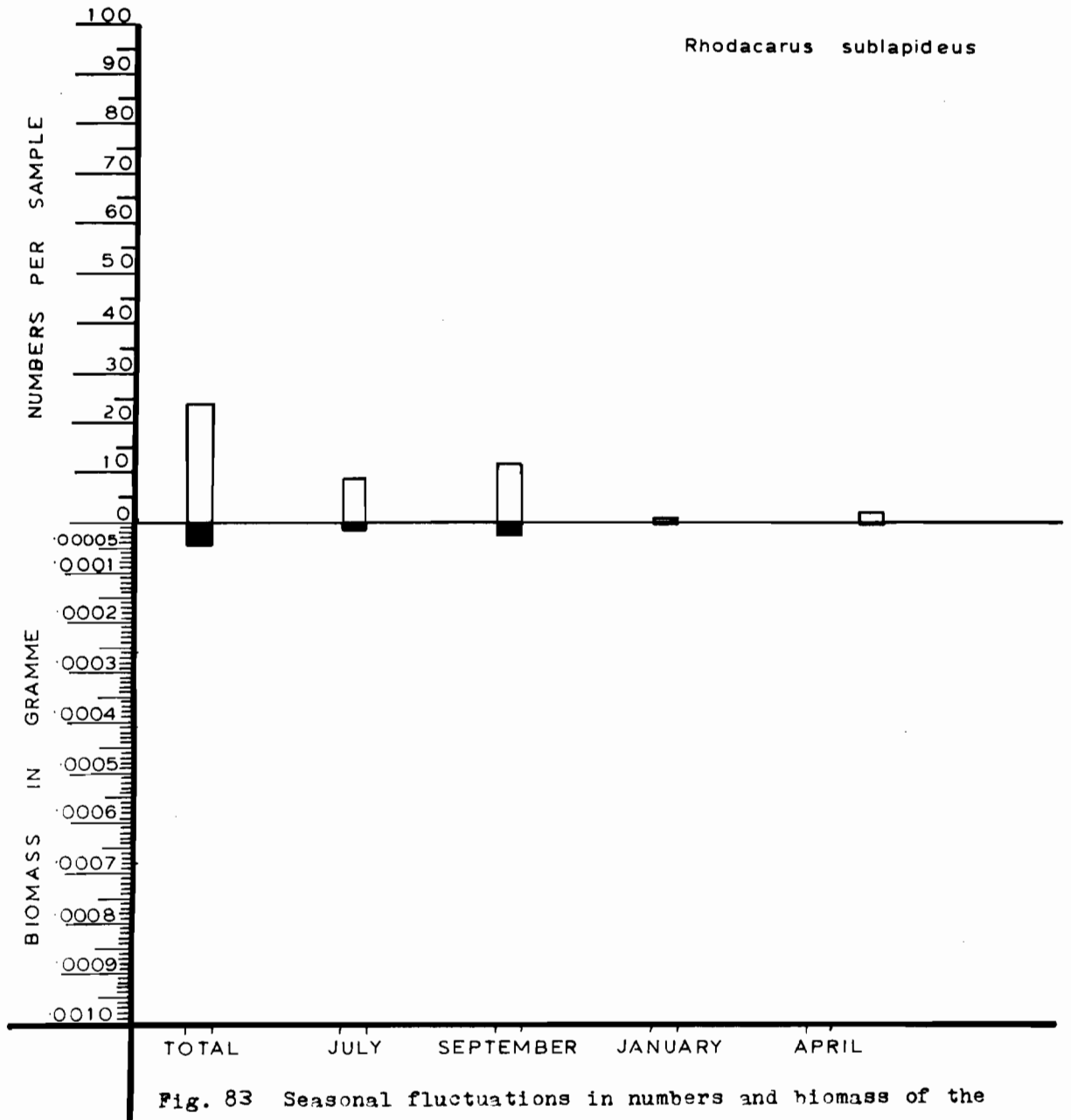


Fig. 83 Seasonal fluctuations in numbers and biomass of the family Rhodacaridae, plot E.

# ASCIDAE

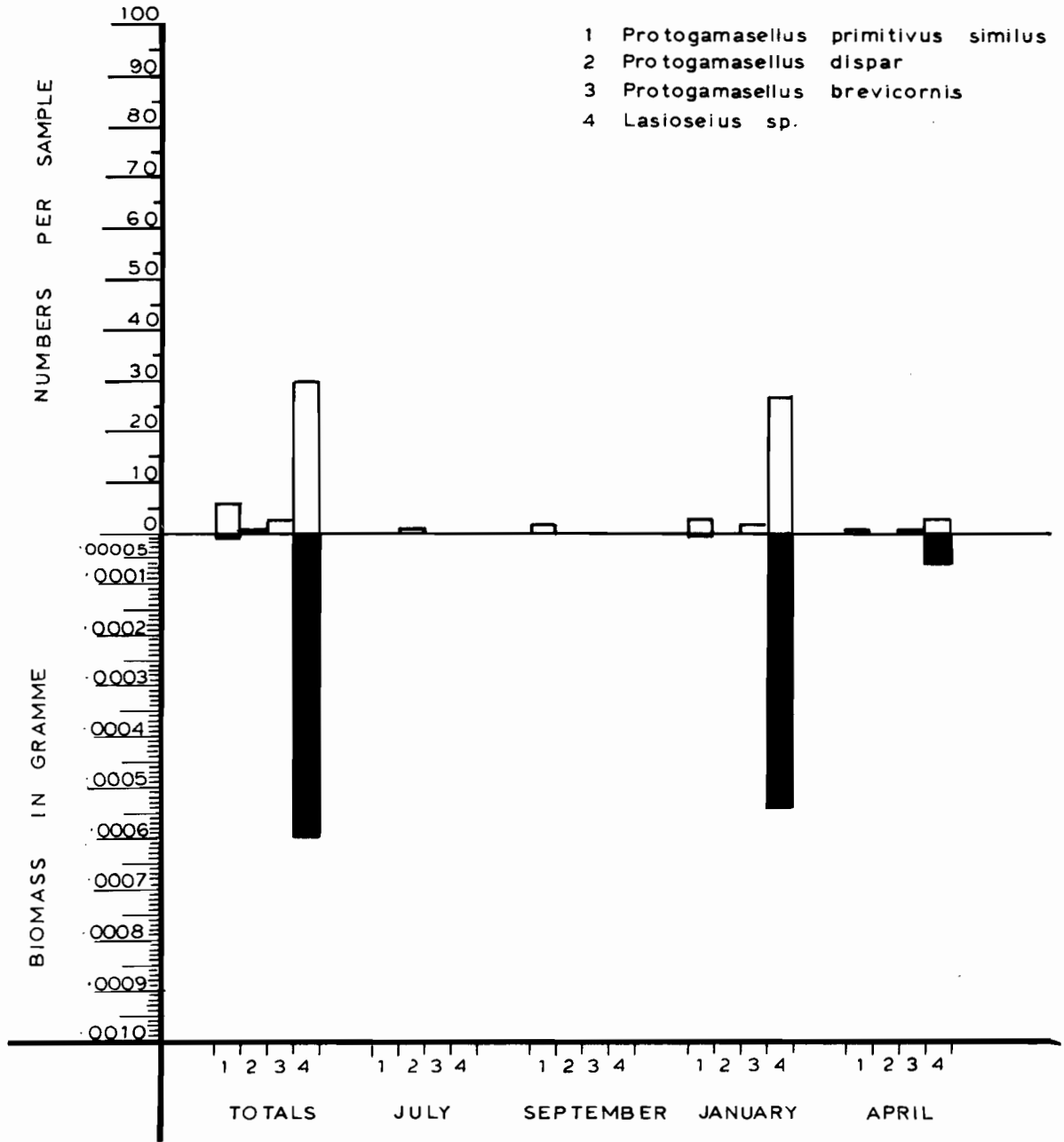


Fig. 84 Seasonal fluctuations in numbers and biomass of the family Ascidae, plot B.

# ASCIDAE

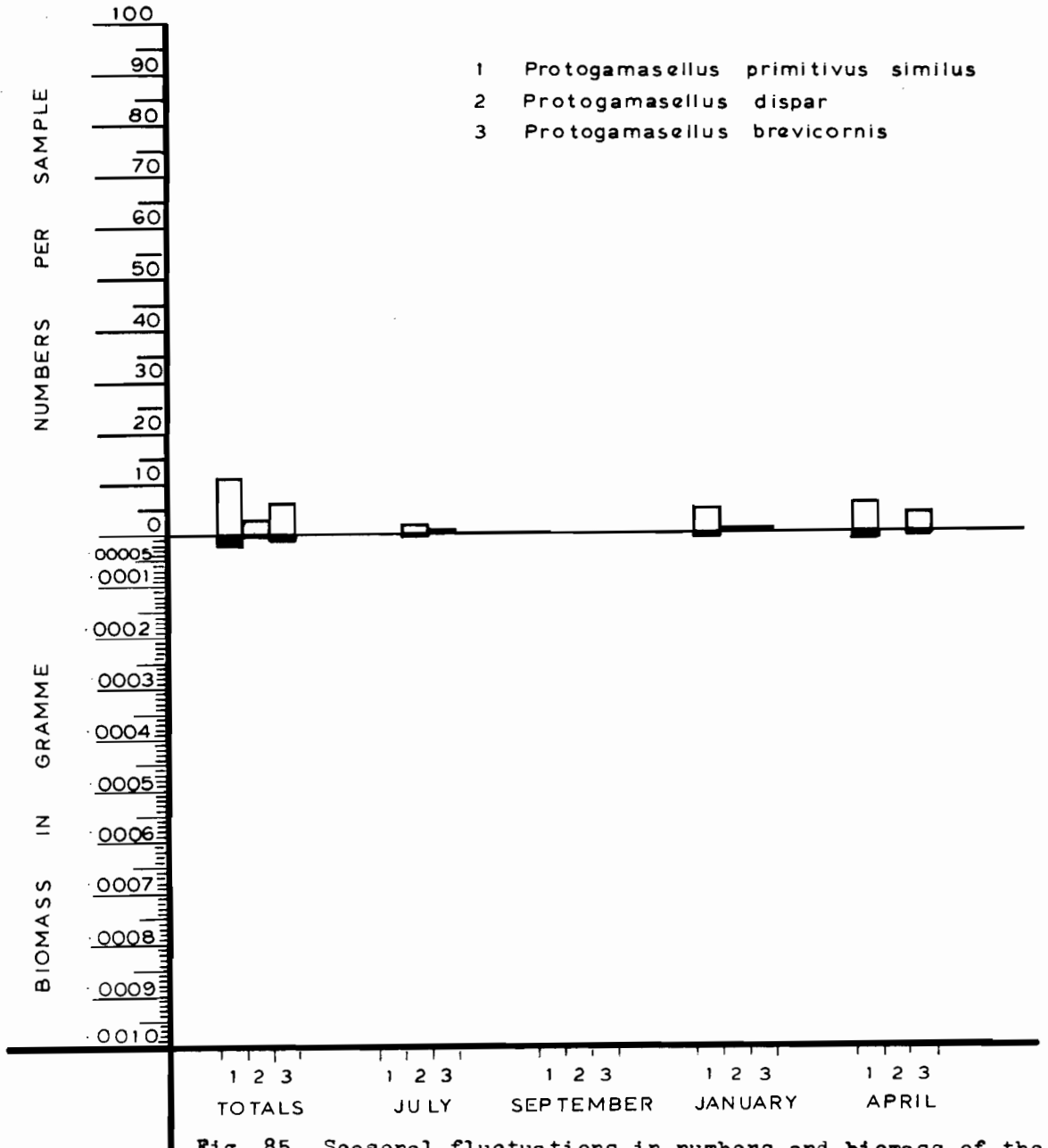


Fig. 85 Seasonal fluctuations in numbers and biomass of the family Ascidae, plot E.

during the sampling year. Plots A and B had a yearly mean  $29/m^2$  and  $14/m^2$  respectively. This species is often found in natural pasture soil.

#### LAELAPTIDAE (table 21)

The two species Hypoaspis quinquelongisetosa (Ryke) and Geolaelaps queenslandicus (Wom.) were extracted from all five plots. The recorded numbers were, however, very small. The yearly mean per  $m^2$  for the different plots was:

Plot A -	$88/m^2$	Plot D -	$118/m^2$
Plot B -	$236/m^2$	Plot E -	$88/m^2$
Plot C -	$59/m^2$		

#### PHYTOSEIIDAE (table 21)

Representatives of Amblyseius usitatus (Van der Merwe) were found in all the plots investigated. The biggest population concentrations, however, occurred in the citrus plots. No definite seasonal variation pattern could be observed, but the highest concentrations in plots B, C and D occurred in the summer sample. Plot B registered 945 specimens per  $m^2$  during January 1966. The occurrence of higher population numbers during January could possibly be connected with the Collembola population, which also had its climax in January. The yearly mean numbers per  $m^2$  for the different plots were:

Plot A -	$14/m^2$	Plot D -	$118/m^2$
Plot B -	$236/m^2$	Plot E -	$59/m^2$
Plot C -	$29/m^2$		

## PACHYLAELAPTIDAE (table 21)

A new species of Pachylaelaps was extracted on the citrus plots B and C. This species suddenly made its appearance in the last sampling season of plot B at a concentration of 1,004 specimens per  $m^2$ . It is, however, believed that they were already present during the preceding sampling seasons as the adjacent plot C recorded a concentration of  $177/m^2$  in September 1965 and  $59/m^2$  in January 1966. The occurrence of a population density of  $1,004/m^2$  in the April sample of plot B, is a definite indication that favourable conditions existed during that month.

## 7.113 Oribatei (figs. 86 to 90)

In all the citrus plots, as well as in the control plot the Oribatei constituted the sub-dominant order of the Acari. The different citrus plot had the following yearly mean numbers per  $m^2$  for Oribatei:

Plot B - $6,443/m^2$	Plot D - $3,133/m^2$
Plot C - $2,305/m^2$	Plot E - $2,305/m^2$

The control plot recorded a mean of  $3,606/m^2$  for the Oribatei. The normal yearly mean numbers per  $m^2$  for the Oribatei on Zebediela would be between 2,000 and 3,000 per  $m^2$ , though exceptions such as the concentration of  $6,443/m^2$  on plot B may occur. No uniform seasonal variation pattern has been observed for Oribatei on the different plots.

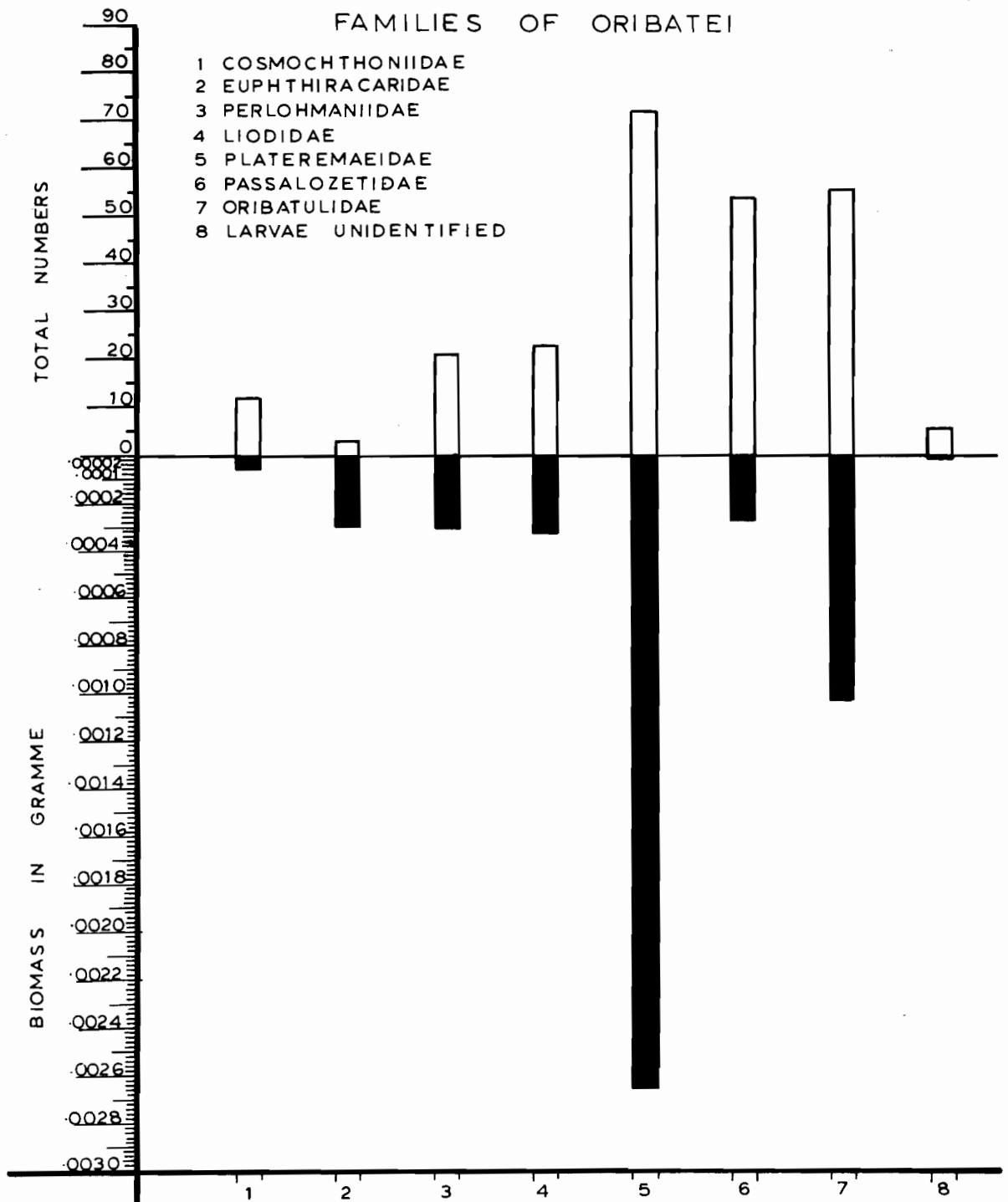


Fig. 86 Numbers and biomass of the families of Oribatei, plot A.

# FAMILIES OF ORIBATEI

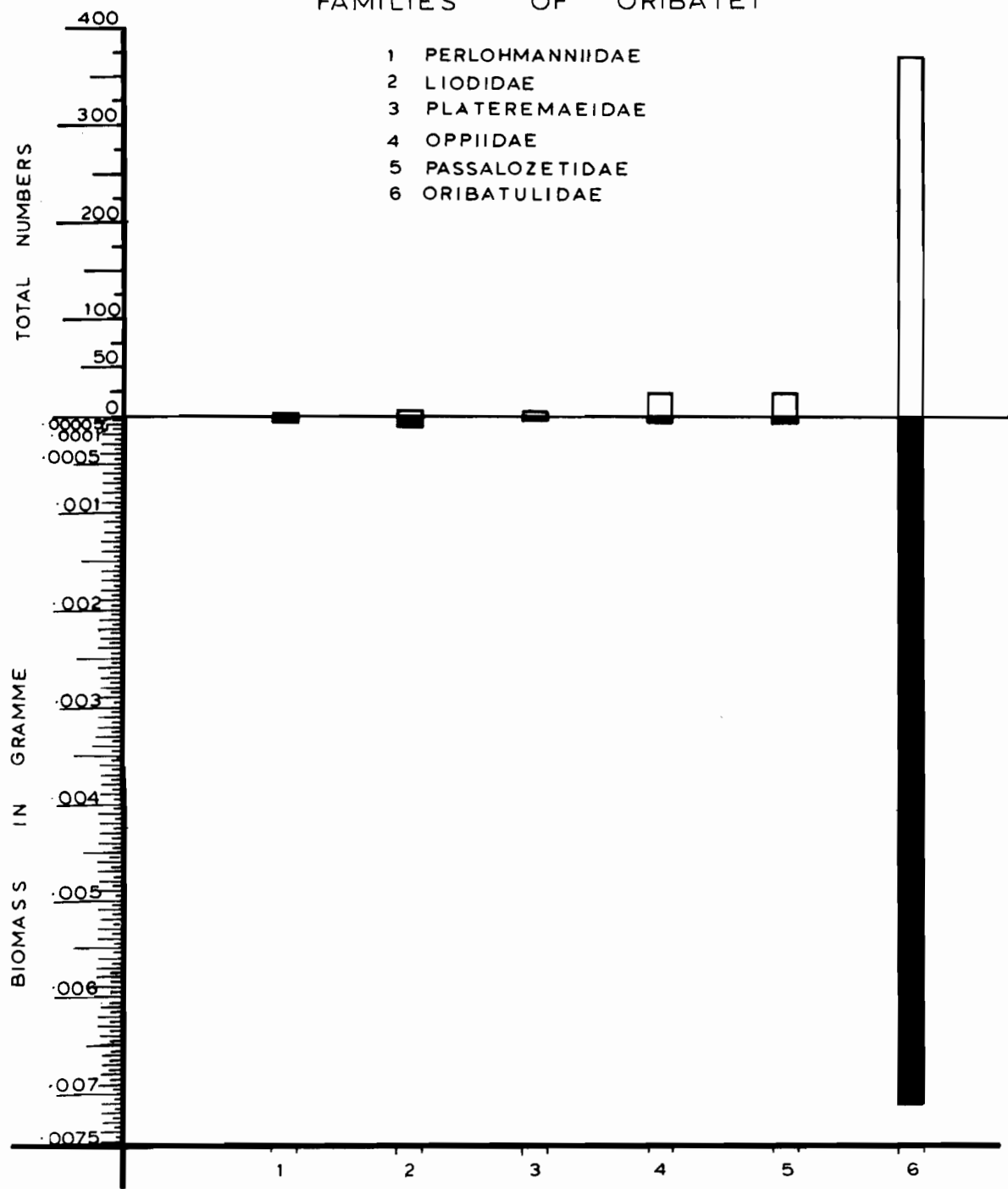


Fig. 87 Numbers and biomass of the families of Oribatei, plot B.

# FAMILIES OF ORIBATEI

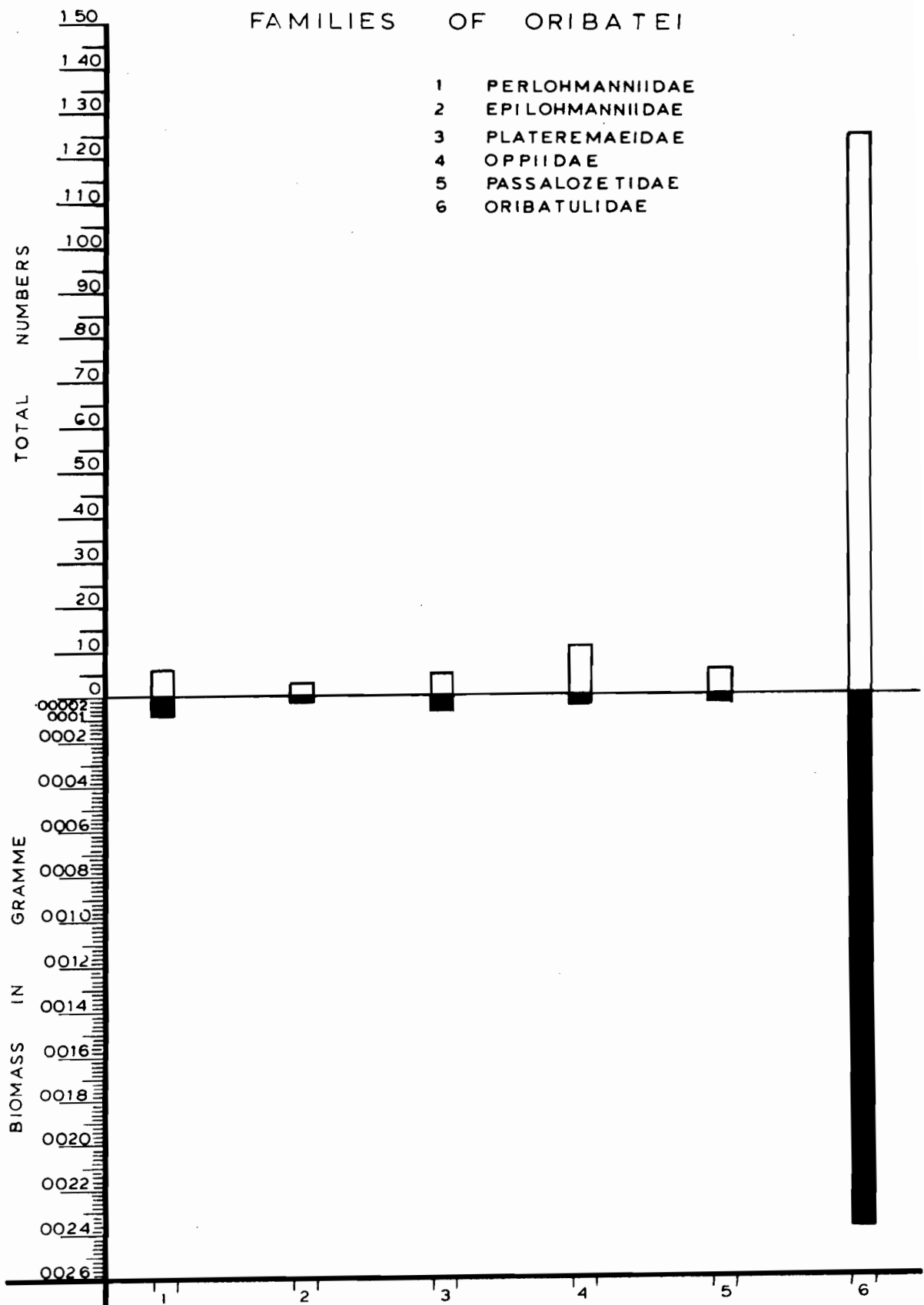


Fig. 88 Numbers and biomass of the families of Oribatei, plot C.

# FAMILIES OF ORIBATEI

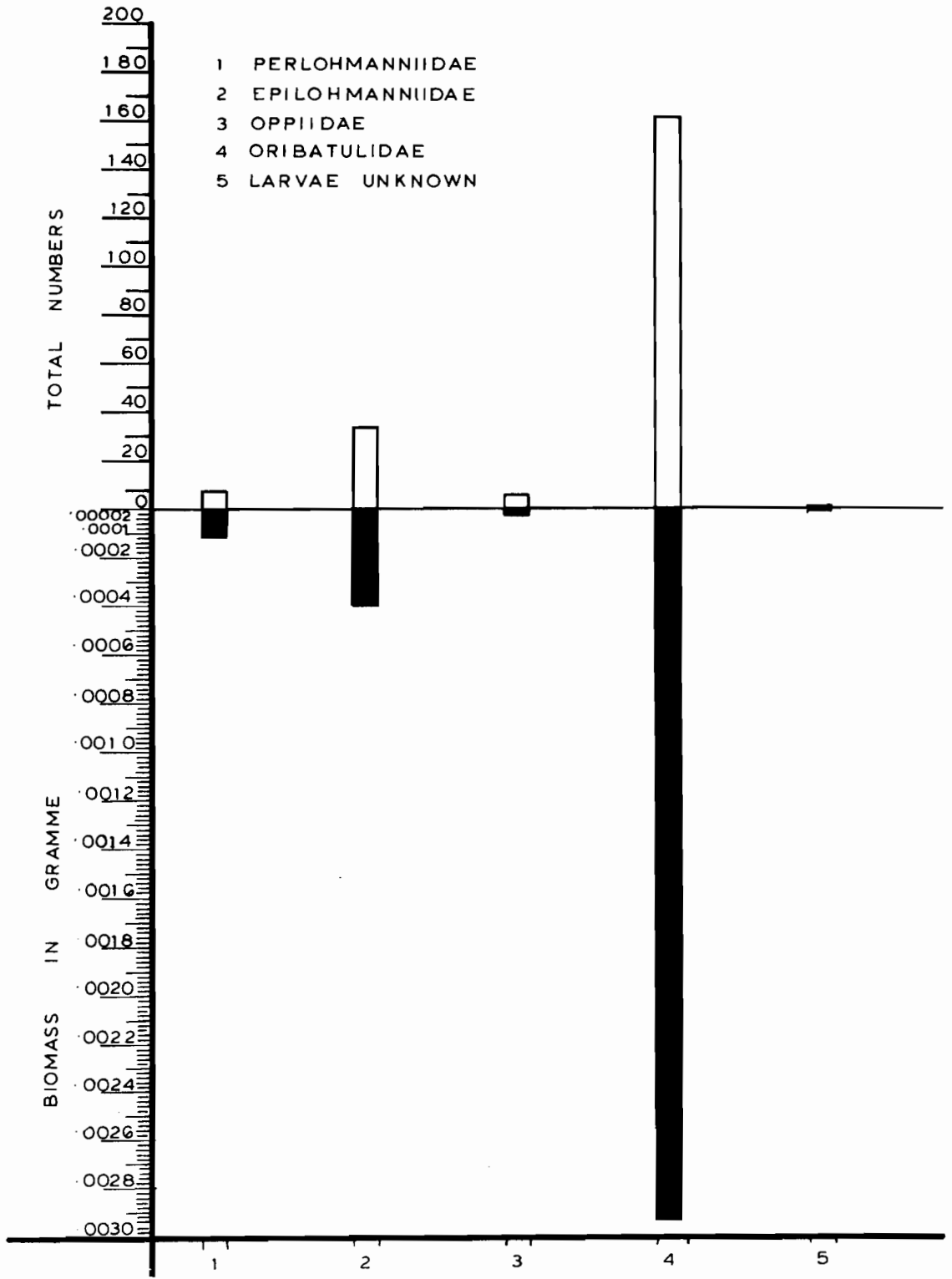


Fig. 89 Numbers and biomass of the families of Oribatei, plot D.

# FAMILIES OF ORIBATEI

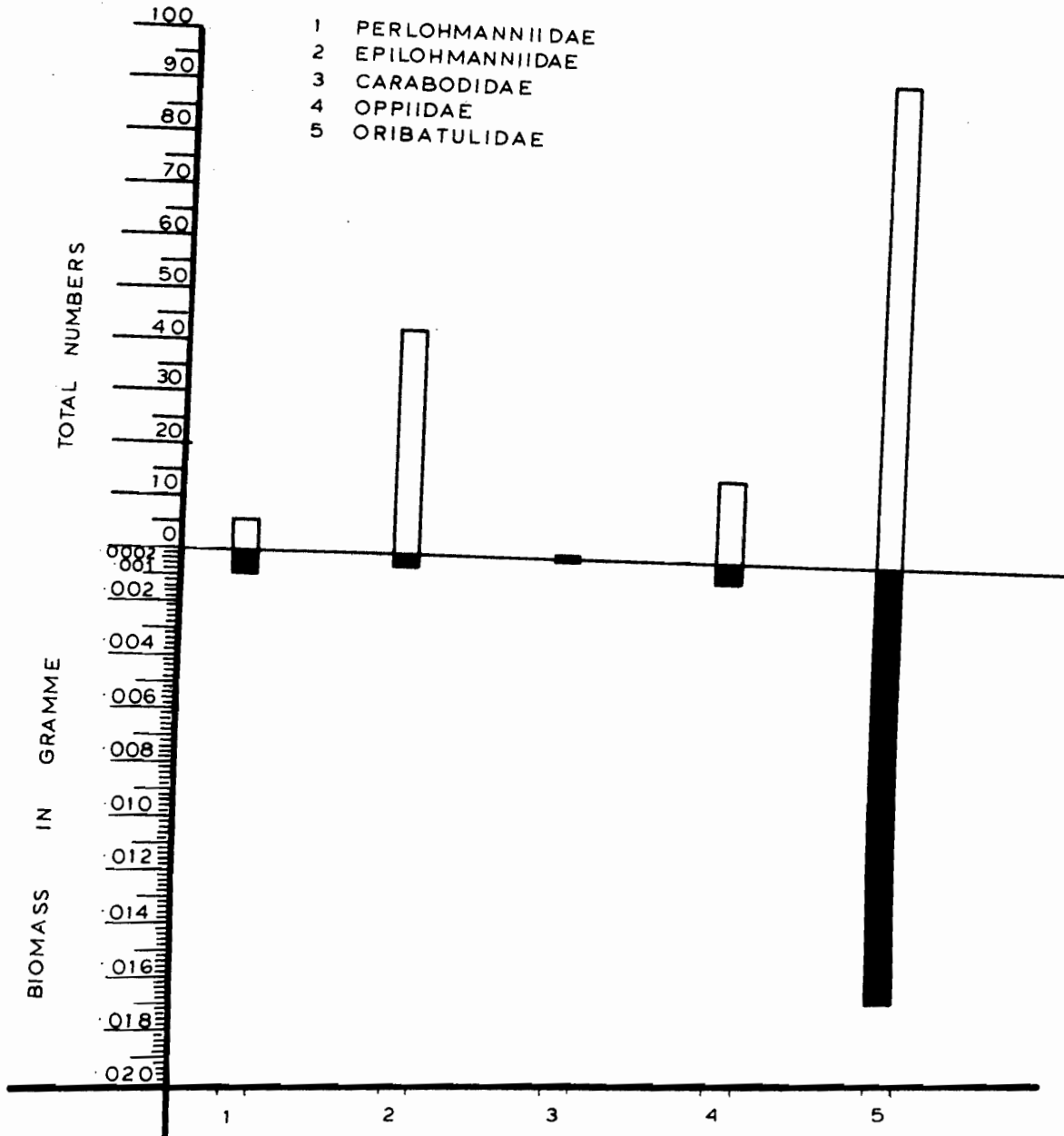


Fig. 90 Numbers and biomass of the families of Oribatei, plot E.

As the Oribatei and Collembola are both saprophagous thought has been given to possible population correlations with respect to food competition. It has been observed that the Oribatei attained their highest numbers in citrus plot B, which had the smallest Collembola numbers of all four citrus plots. But nevertheless, a great variety of physical factors usually also extend their influence in population dynamics. It is for instance well known that the Oribatei in general tend to resist and even breed in drought conditions where Collembola are suppressed. Examples in this connection could be found in the July 1965 sampling season of the plots investigated:

Plot A : Oribatei -  $5,911/m^2$   
 Collembola -  $354/m^2$

Plot B : Oribatei -  $1,537/m^2$   
 Collembola -  $1,300/m^2$

Plot C : Oribatei -  $2,541/m^2$   
 Collembola -  $118/m^2$

Plot D : Oribatei -  $3,014/m^2$   
 Collembola -  $1,064/m^2$

Plot E : Oribatei -  $1,477/m^2$   
 Collembola -  $1,716/m^2$

As Karg (1967) and other authors discovered, chemical poisons do not destroy soil populations totally, but tend to

work selectively. Various predators, especially the bigger surface dwelling trombidiform species were removed from the routine citrus plots while others such as the Oribatei Scheloribates sp. and Oppia nova (Oudem.) as well as some of the Collembola, such as members of Isotomidae and Onychiuridae, seem not only to resist extermination, but even increase in numbers. Examples in this connection could be found in the September seasonal sampling of the citrus plots.

Ten families were recorded, of which five were found in the plots of Section 3 B only.

#### ORIBATULIDAE (figs. 91 to 95, table 22)

Oribatulidae was the dominant oribatid family on all the plots investigated both in relation to number and biomass. The highest numbers were recorded on the citrus plots. The following yearly mean numbers per  $m^2$  were calculated for Scheloribates sp.:

Plot A -	827/ $m^2$	Plot D -	2,364/ $m^2$
Plot B -	5,497/ $m^2$	Plot E -	1,359/ $m^2$
Plot C -	1,832/ $m^2$		

Scheloribates spp. increased their numbers from July to September in all plots except plot E. As the control plot indicates, the increase of Scheloribates sp. numbers from July to September was a general seasonal phenomenon. Nevertheless, the fact that their numbers were much larger in the citrus soil, and their considerable increase after chemical applica-

# ORIBATULIDAE

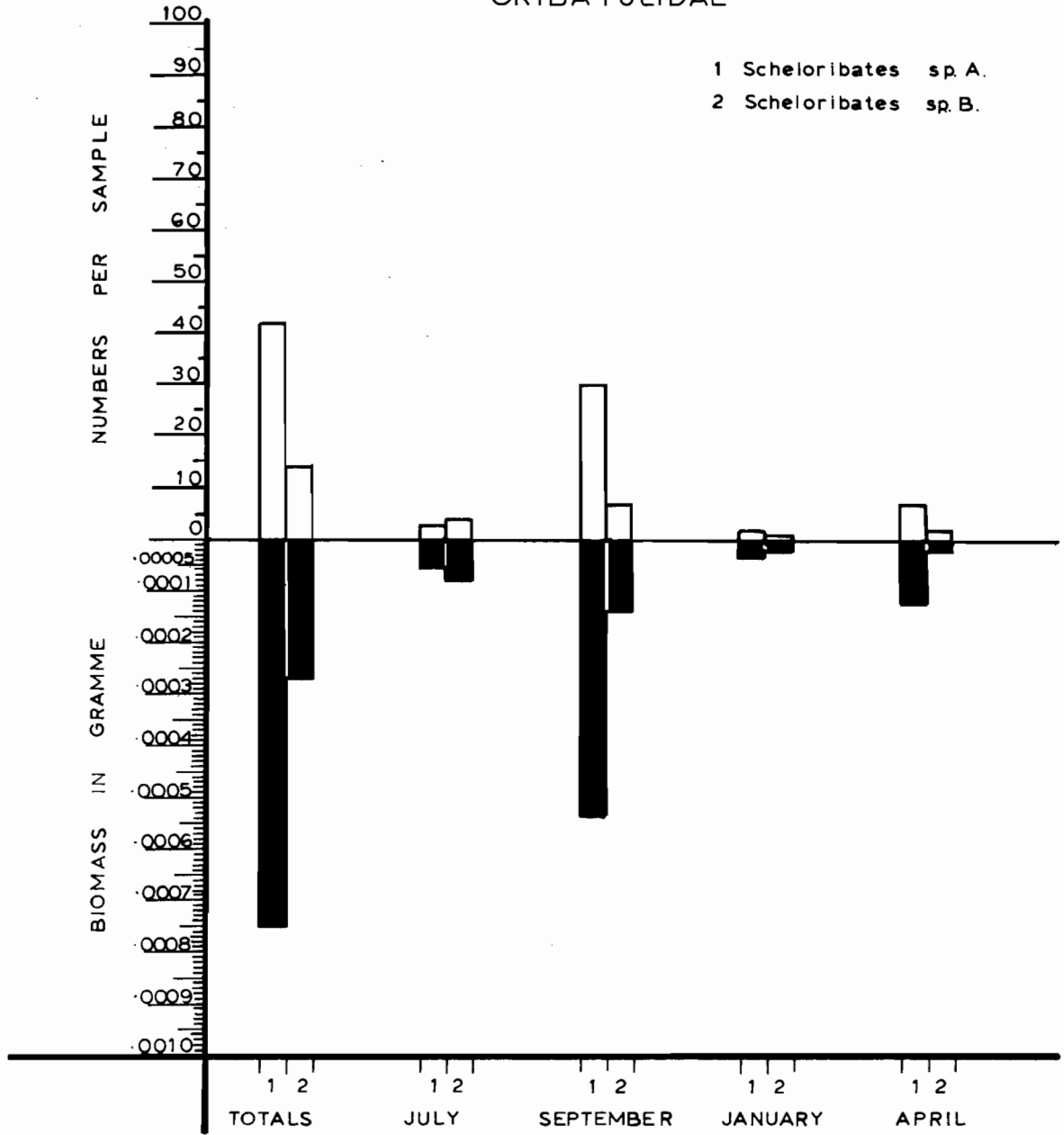


Fig. 91 Seasonal fluctuations in numbers and biomass of the family Oribatulidae, plot A.

# ORIBATULIDAE

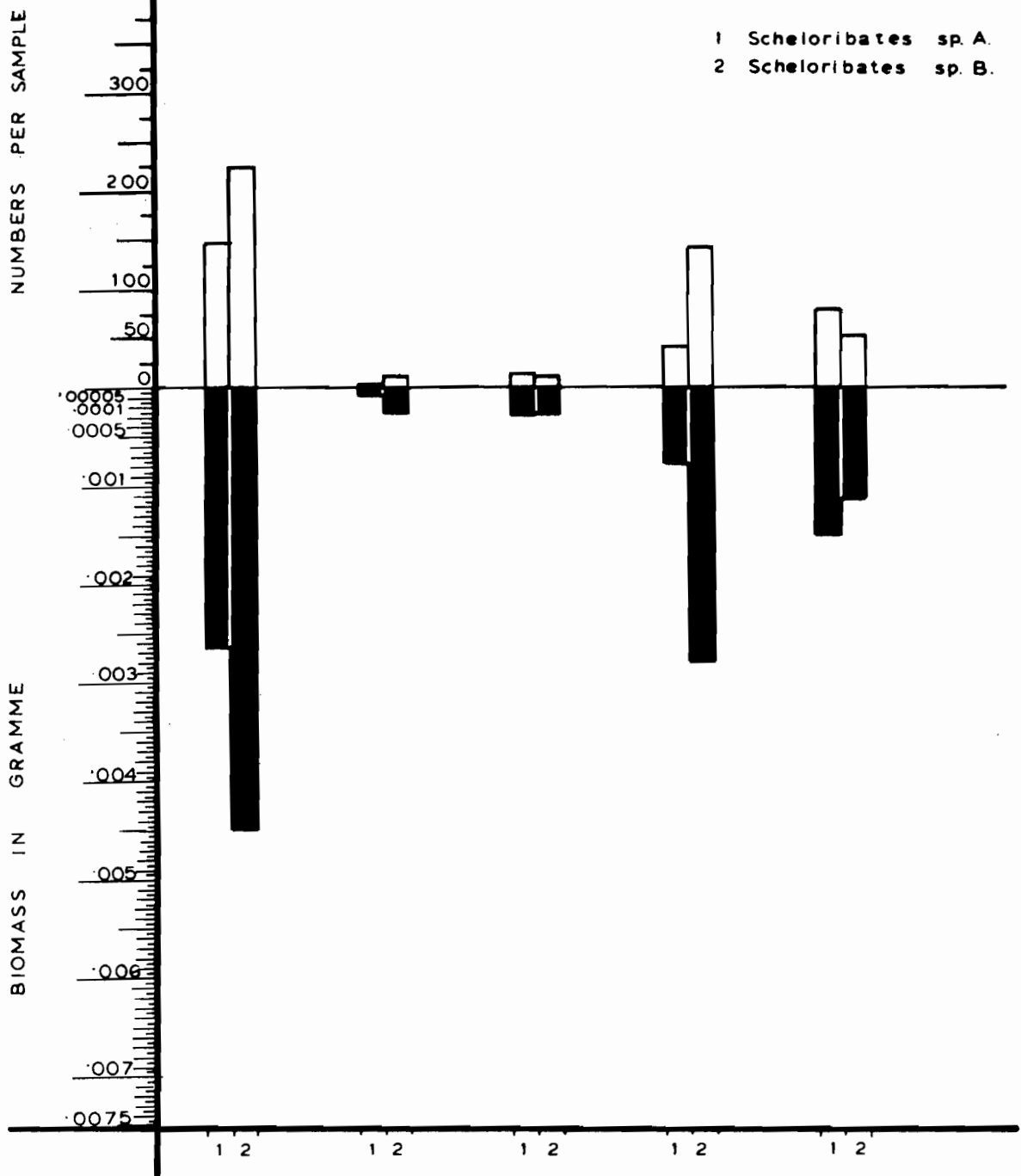


Fig. 92 Seasonal fluctuations in numbers and biomass of the family Oribatulidae, plot B.

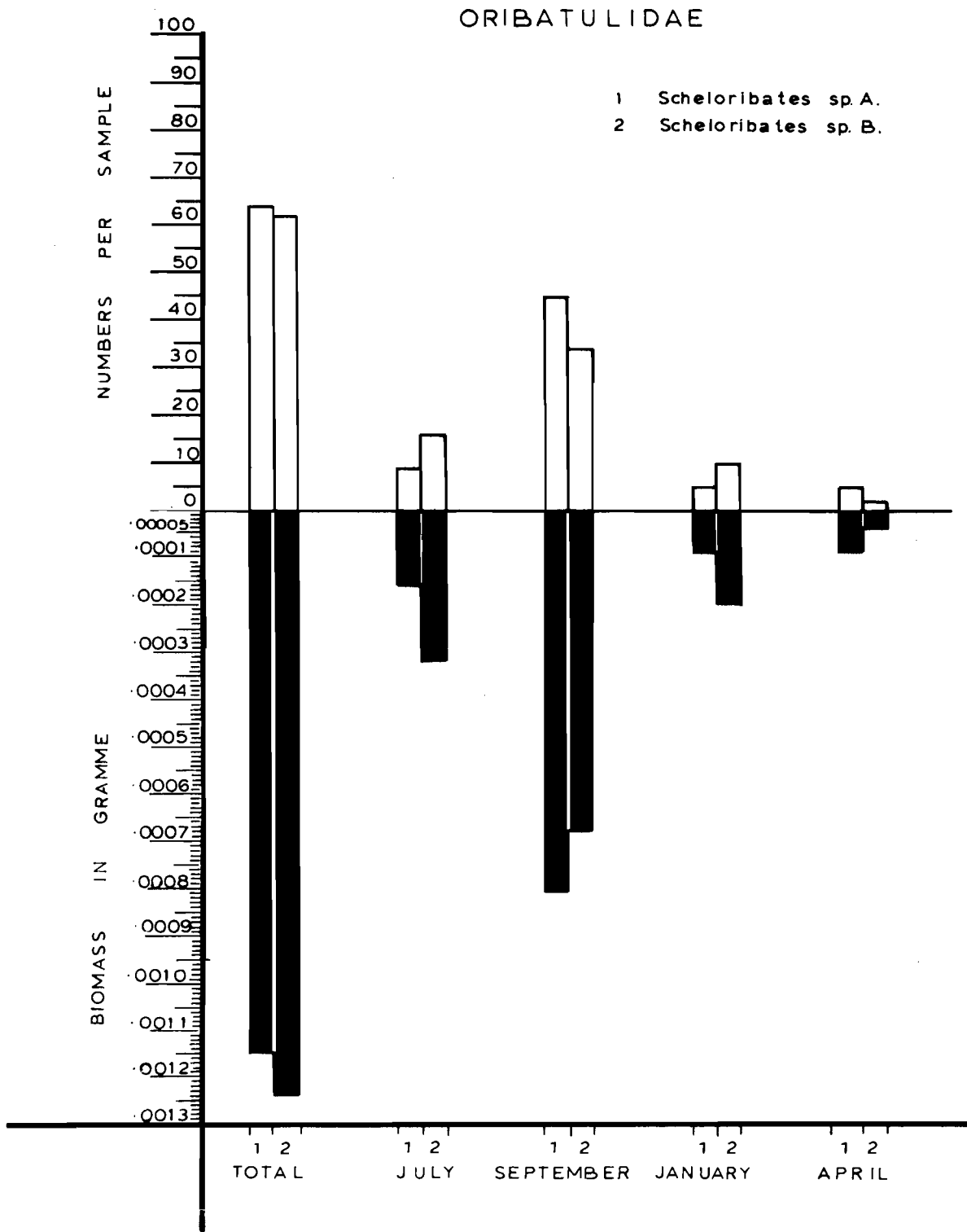


Fig. 93 Seasonal fluctuations in numbers and biomass of the family Oribatulidae, plot C

# ORIBATULIDAE

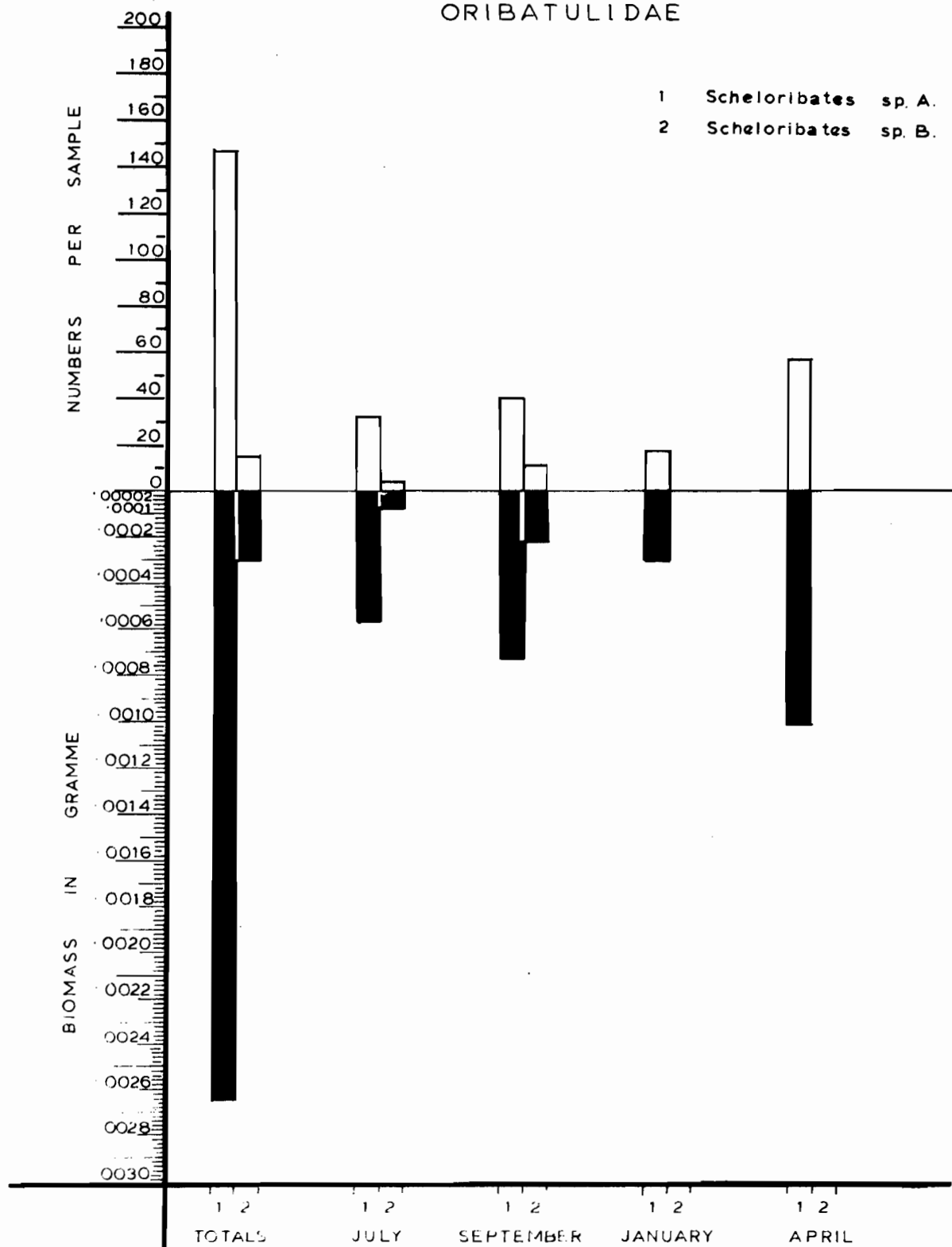


Fig. 34 Seasonal fluctuations in numbers and biomass of the family Oribatulidae, plot D.

# ORIBATULIDAE

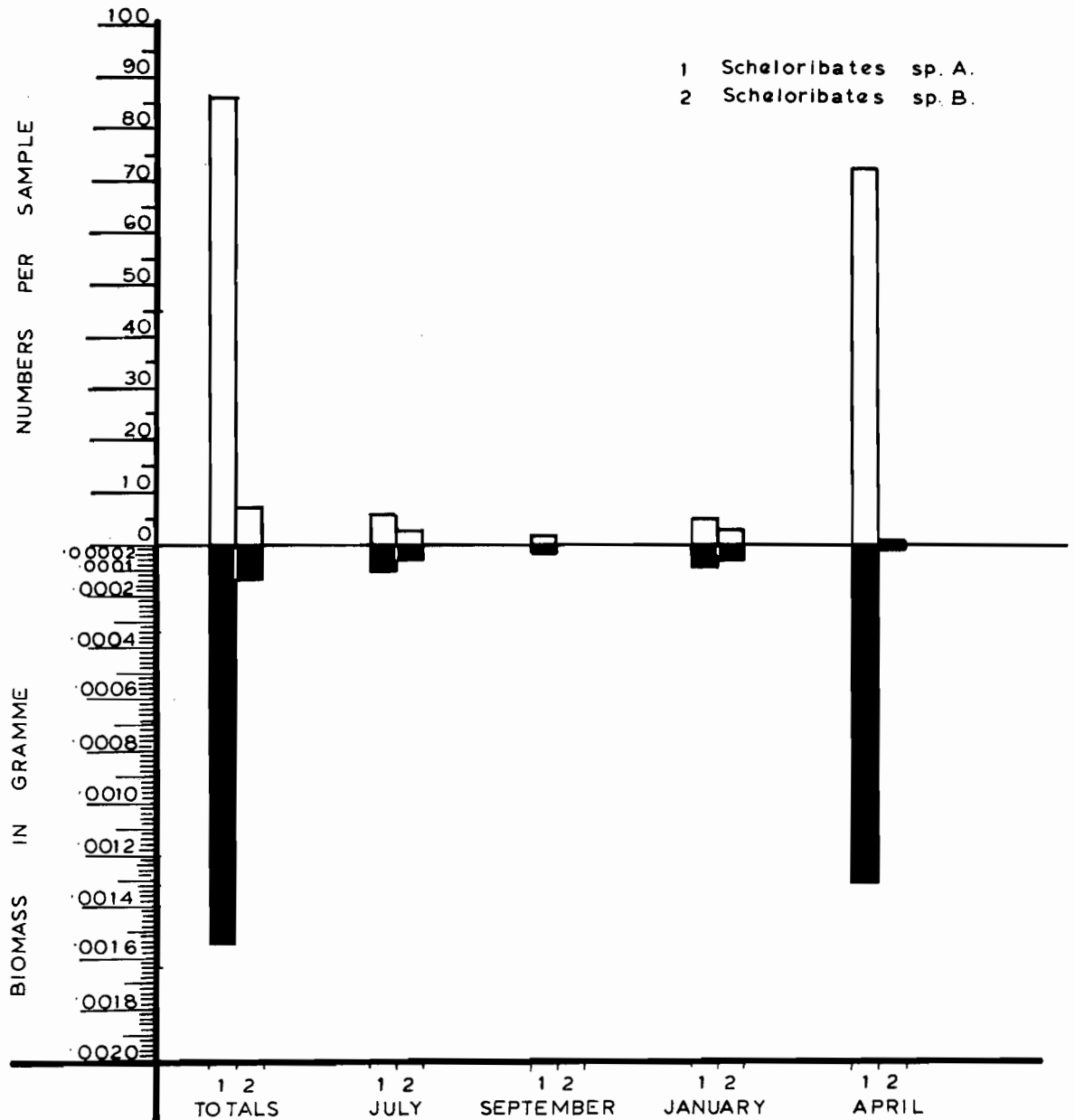


Fig. 95 Seasonal fluctuations in numbers and biomass of the family Oribatulidae, plot E.

tion, reveals their resistance. The initially low numbers recorded for plot E in the first three sampling seasons probably occurred as a result of unknown retarding factors.

The marked increase of Scheloribates sp. after chemical application was in correspondance with results obtained by Karg (1967). This author noticed the high insecticide resistance of Scheloribates sp., after application of various HCH preparations, which are in general use as insecticides, and DNOC, an active ingredient of herbicides and Trichlorophon, which is also an insecticide. The population reductions which occurred during January and April might be attributed to food competition with the Collembola. The mentioned reductions of Scheloribates sp. occurred in those plots which attained the highest Collembola numbers. On the other hand, these mites gained their highest numbers in plot B; the citrus plot with the smallest Collembola numbers. Scheloribates sp. recorded 10,877 and 8,276 per m<sup>2</sup> respectively for the January and April samples at the last mentioned plot.

#### COSMOCHTHONIIDAE (table 22)

Representative species of Cosmochthonius sp. occurred on the control plot only. The population density for both the July and September samples was 59 per m<sup>2</sup>. During January their numbers increased to 591 per m<sup>2</sup>, but they disappeared altogether in April. Cosmochthonius sp. also occurred in natural pasture soil investigations in the Potchefstroom district. The absence of this species in agricultural soils

reveals their attachment to natural soil conditions.

#### EUPHTHIRACARIDAE (table 22)

Rhyzotritia sp. were found at the control plot only and seemed also, to be attached to natural vegetation conditions as the previously described species was. A concentration of 59 per m<sup>2</sup> was recorded in September and 118 per m<sup>2</sup> in April 1966.

#### LIODIDAE (fig. 96, table 22)

Representatives of the family Liodidae were extracted from samples of plots B and A only. Both species A. and B. of the genus Liodes were found at the control plot, but only representatives of Liodes sp. B. were recorded on the old citrus plot. Liodes sp. A. had a yearly mean of 236 per m<sup>2</sup>, while sp. B. recorded 118 per m<sup>2</sup> for both plots.

#### PLATEREMAEIDAE (fig. 97, table 22)

This family occurred in the plots of Section 3 B only. Two genera and species were found. Plateremaeus sp. occurred at the control plot only and had a yearly mean of 664 per m<sup>2</sup>. It was, however, extracted only in the September, January and April samples. This big mite lives in the undisturbed, loose soil litter which is rich in coarse organic material. They probably do not survive in citrus soils, as a result of different habitat conditions and agricultural practices.

# LIODIDAE

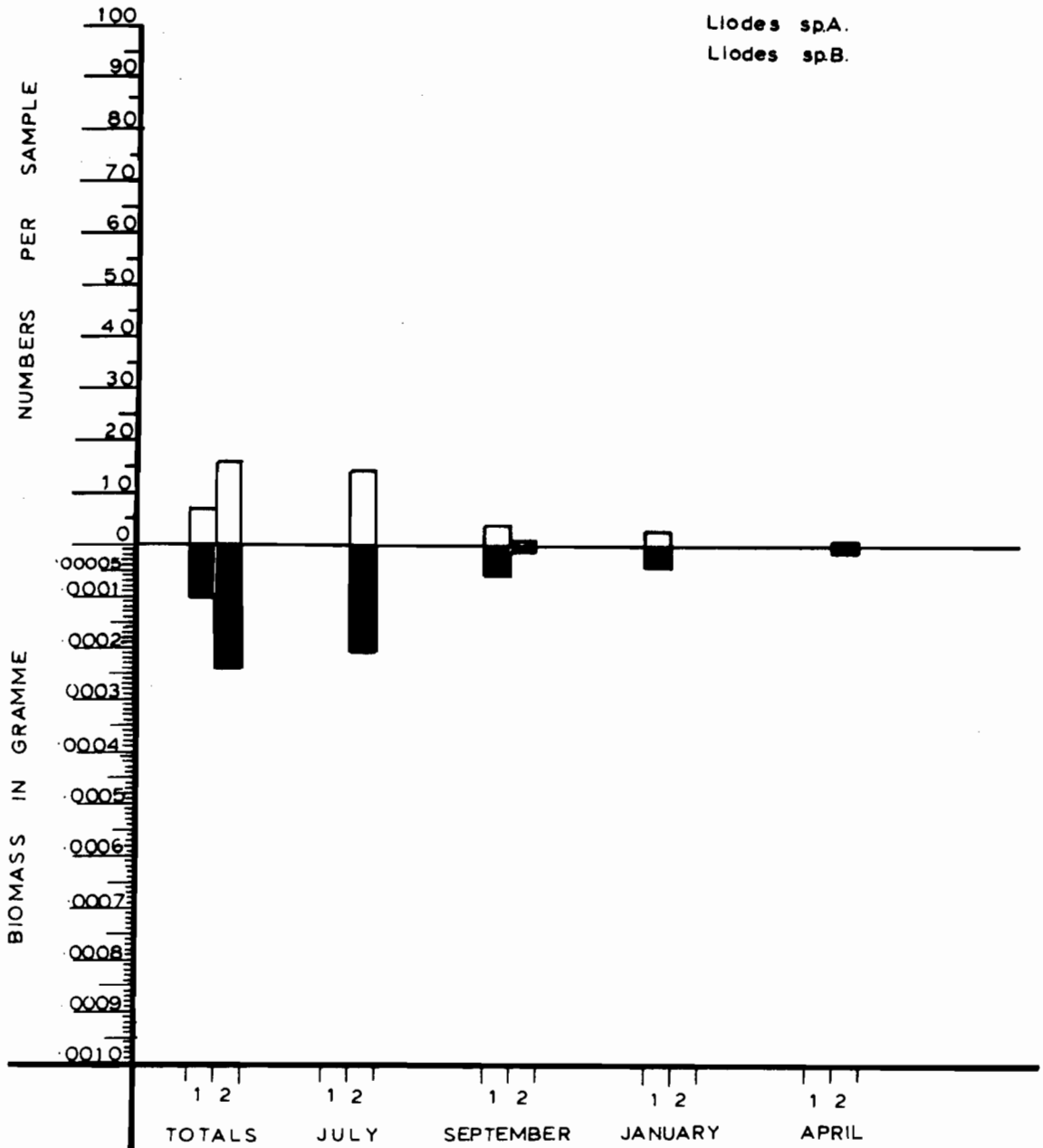


Fig. 96 Seasonal fluctuations in numbers and biomass of the family Liodidae, plot A.

PLATEREMAEIDAE

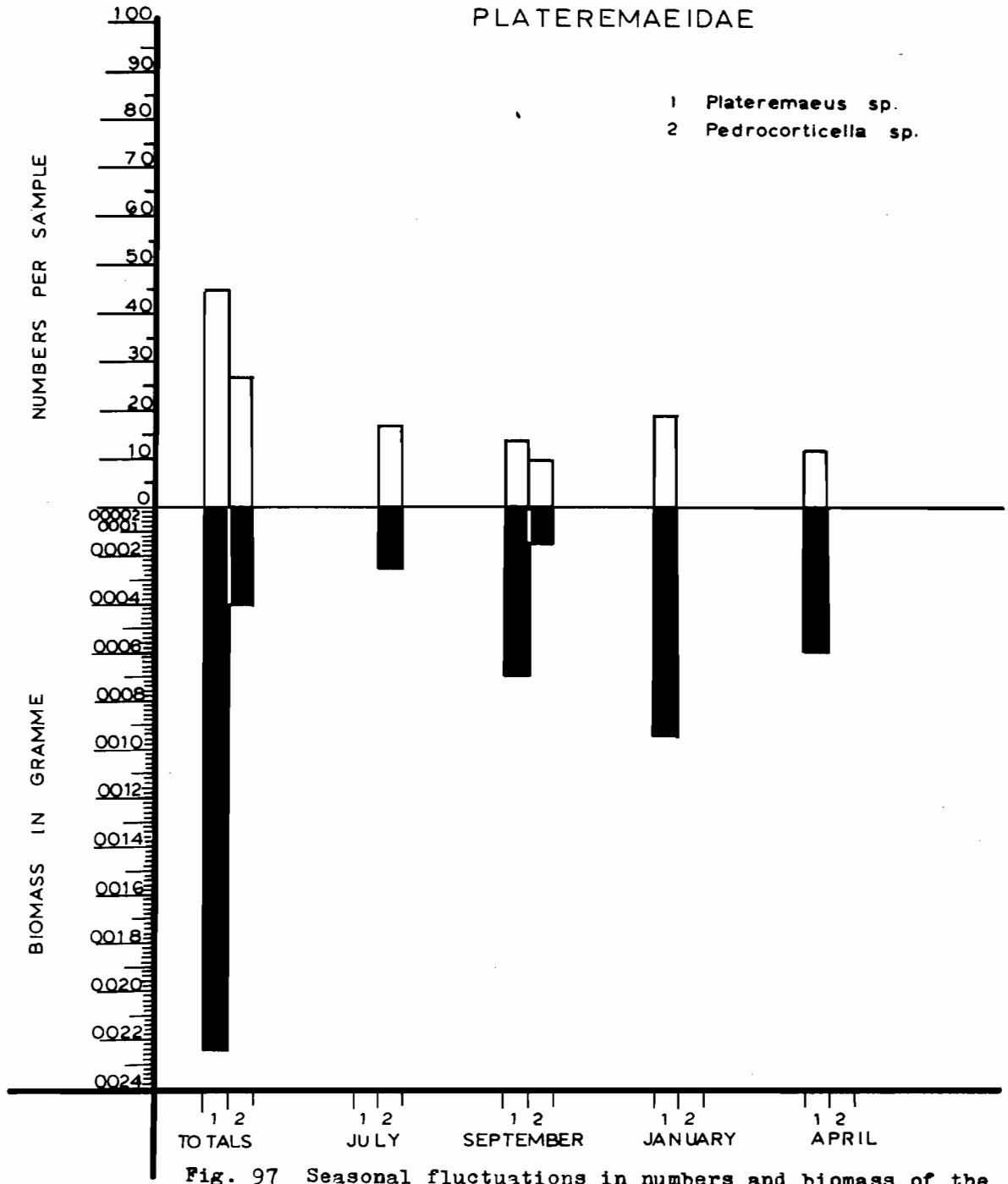


Fig. 97 Seasonal fluctuations in numbers and biomass of the family Plateremaeidae, plot A.

Pedrocorticella sp. is a small oribatid mite with nearly the same form and proportions as Oppia nova (Oudem.). A yearly mean of 88/m<sup>2</sup> and 73/m<sup>2</sup> were recorded for Pedrocorticella sp. on citrus plots B and C respectively. The natural habitat of this species is the natural soil of the control plot and a yearly mean of 398 per m<sup>2</sup> was registered.

#### CARABIDIDAE

Only one representative specimen was extracted on plot E during January 1966. The genus and species is unknown.

#### OPPIIDAE (fig. 98, table 22)

Oppia nova (Oudem.) was the sole representative of this family. This minute species occurred in all the citrus plots, but was not recorded on the control plot, though it could be expected to occur in the natural soils too. No definite seasonal variation pattern could be observed in the amount of specimens collected. The yearly mean numbers per m<sup>2</sup> for the different plots were:

Plot B - 354/m <sup>2</sup>	Plot D - 103/m <sup>2</sup>
Plot C - 162/m <sup>2</sup>	Plot E - 236/m <sup>2</sup>

Karg (1967) mentioned the resistance of this species to different insecticides and herbicides.

#### PASSALAZETIDAE (fig. 99, table 22)

Representatives of Passalozetes sp. were extracted from

# OPPIIDAE

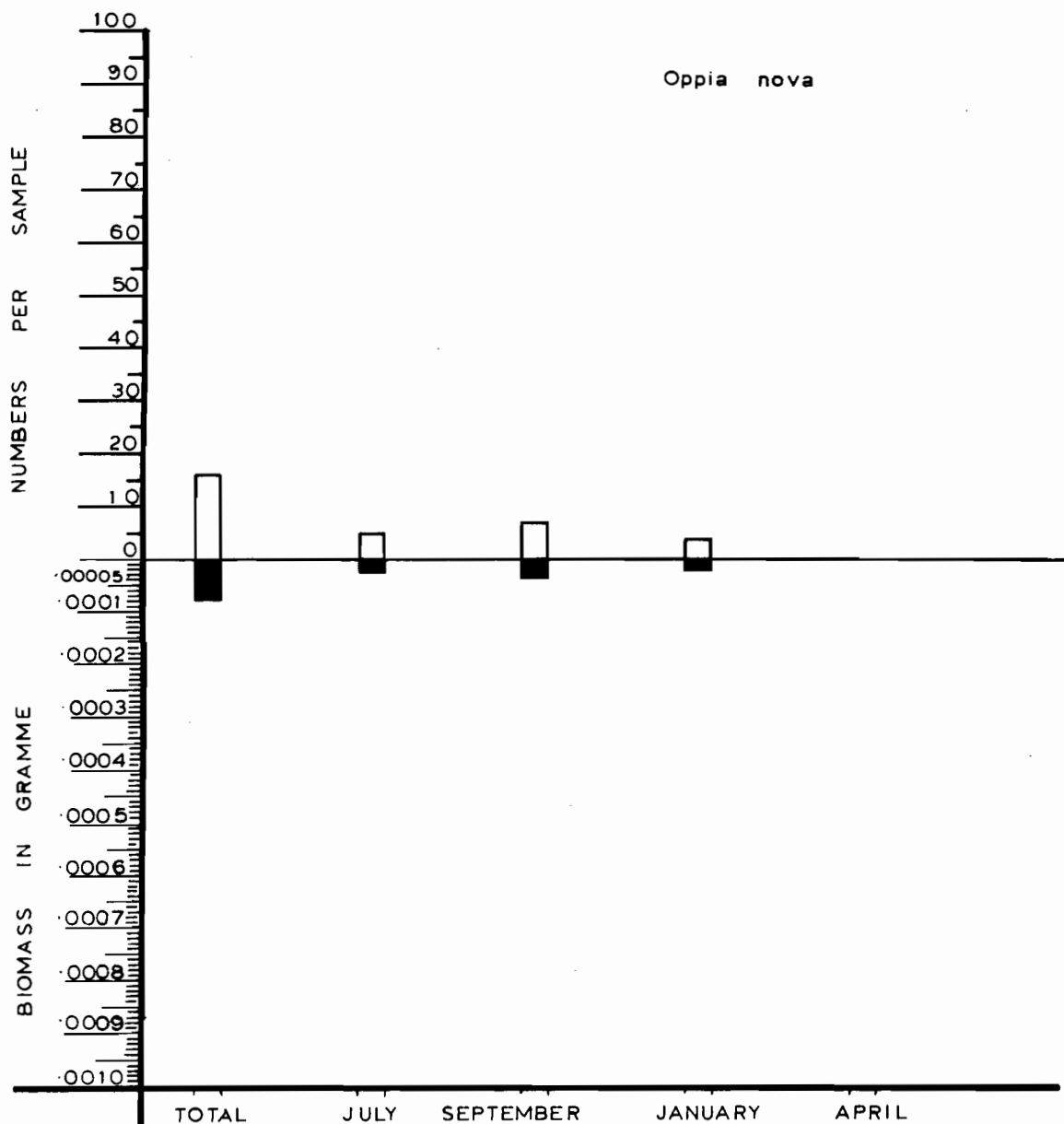


Fig. 98 Seasonal fluctuations in numbers and biomass of the family Oppiidae, plot E.

# PASSALOZETIDAE

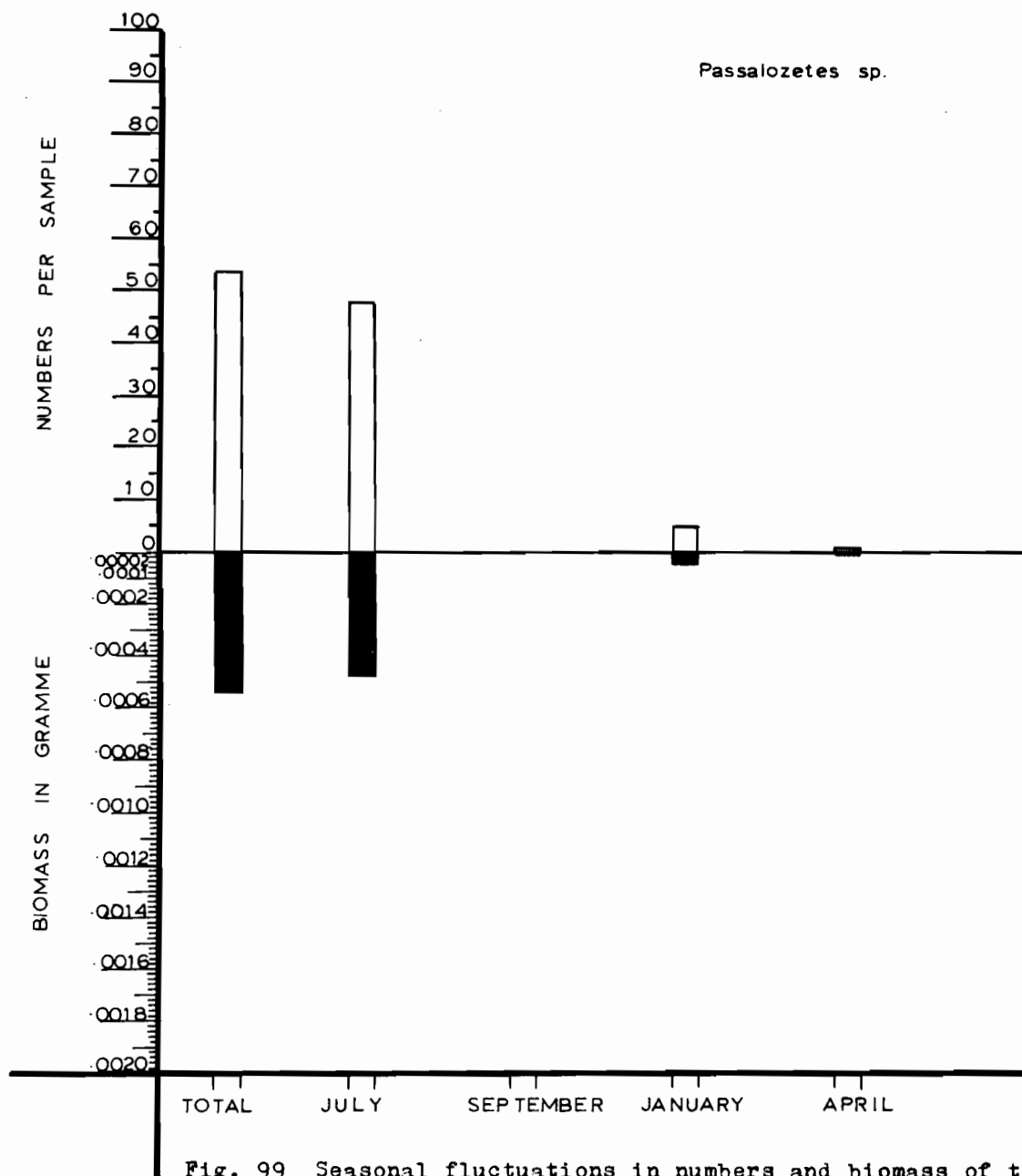


Fig. 99 Seasonal fluctuations in numbers and biomass of the family Passalozetidae, plot A.

the three plots of Section 3 B only. This species possibly prefers the natural soil conditions. A yearly mean of 797 per m<sup>2</sup> was calculated for this mite on the control plot, while plots B and C had yearly means of 354 and 88 per m<sup>2</sup> respectively.

#### PERLOHMANNIIDAE (table 22)

The largest population numbers of Perlohmanniidae sp. occurred in the control plot, but representative specimens were also found in all the citrus plots. No definite seasonal variation pattern could be observed from the number of specimens collected. The yearly mean numbers per m<sup>2</sup> were:

Plot A - 309/m <sup>2</sup>	Plot D - 118/m <sup>2</sup>
Plot B - 73/m <sup>2</sup>	Plot E - 88/m <sup>2</sup>
Plot C - 88/m <sup>2</sup>	

#### EPILOHMANNIIDAE (figs. 100 & 101, table 22)

Epilohmanniidae sp. had their biggest population numbers on plots D and E of Section 2, but a few specimens were also recorded on plot C.

This mite is an eu-edaphic organism of medium size and appears to thrive in the sandy citrus soils of Section 2. No representative specimens were extracted on plots A and B. A yearly mean of 501 and 635 per m<sup>2</sup> was calculated for plots D and E respectively. A comparison of the numbers of specimens extracted on plot E with those recovered from the biolo-

# EPILOHMANNIIDAE

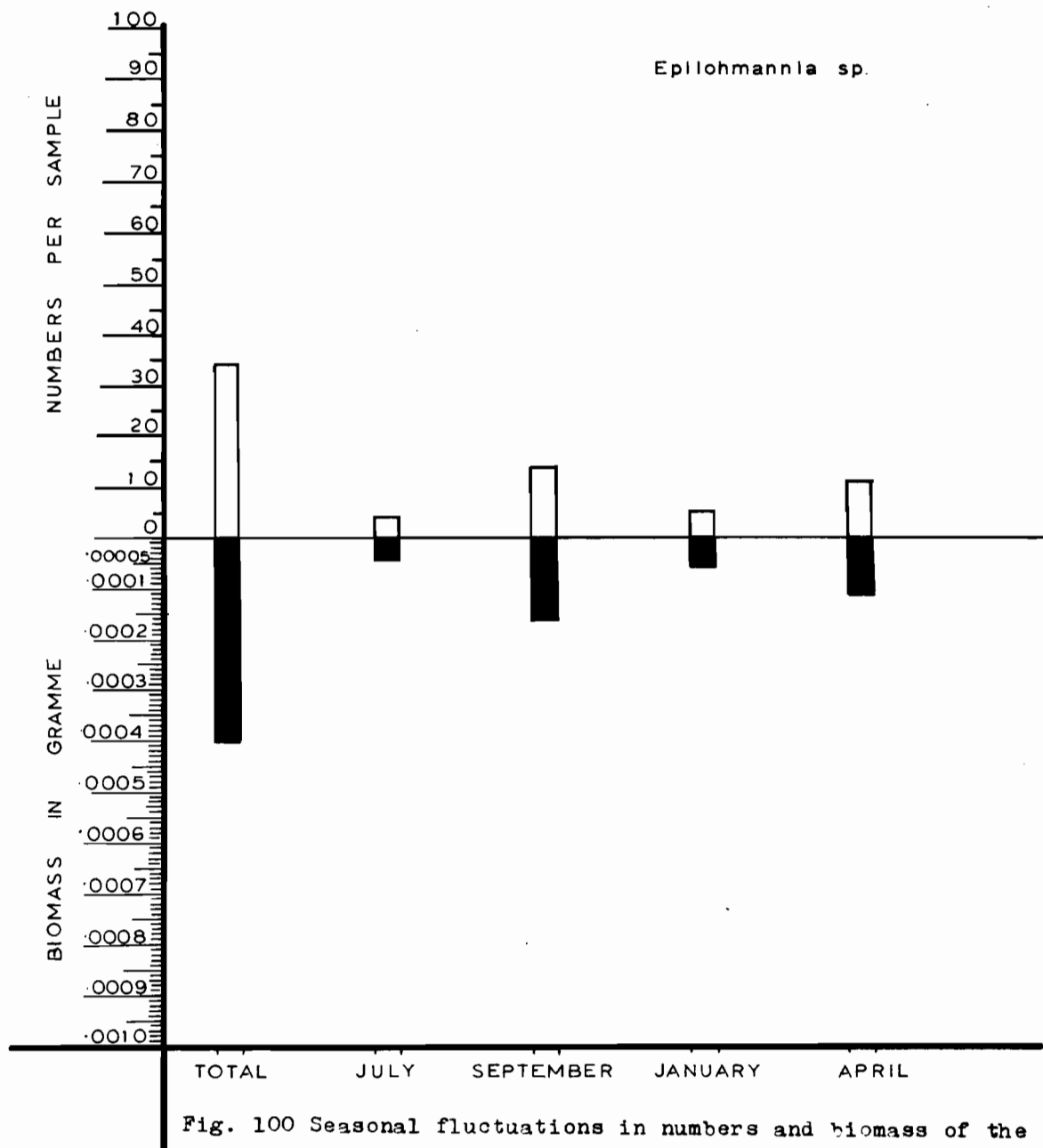


Fig. 100 Seasonal fluctuations in numbers and biomass of the family Epilohmanniidae, plot D.

# EPILOHMANNIIDAE

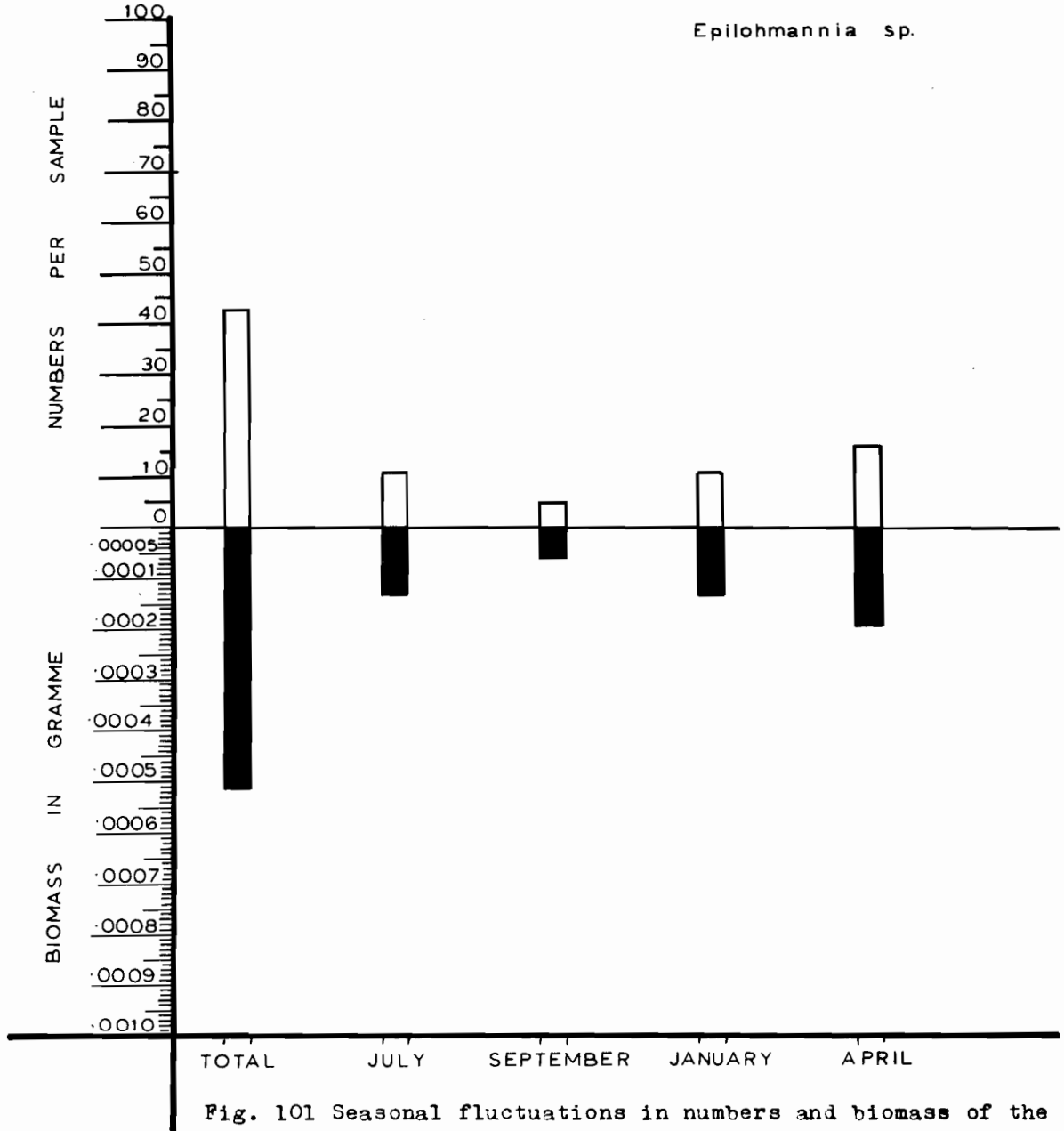


Fig. 101 Seasonal fluctuations in numbers and biomass of the family Epilohmanniidae, plot E.

gical control plot gave an indication of the organism's chemical resistance. Though their numbers per  $m^2$  reduced from 650 to 295 per  $m^2$  after parathion application, they quickly regained their numbers and continued to increase to 946 specimens per  $m^2$  in April 1966.

#### 7.114 Acaridiae

##### ACARIDAE (fig. 102, table 23)

Representatives of Tyrophagus sp. were collected on all plots except plot E. The biological control plot, however, had the highest numbers. A yearly mean of 354 specimens per  $m^2$  was recorded at the last mentioned plot. The other plots had yearly means that varied between 44 and 118 specimens per  $m^2$ . No seasonal variation pattern could be observed.

#### 7.115 "Other Arthropoda"

From the "Other Arthropoda" section, sixteen orders and twenty-five families were recorded. The largest part of the total biomass values of all the plots was recorded in this division. This part of the mesofauna also held the highest mesofaunal numbers for plots C, D and E as a result of high Collembola numbers.

##### THE COLLEMBOLA (fig. 108)

Representatives from five collembolan families were ex-

# ACARIDAE

*Tyrophagus* sp.

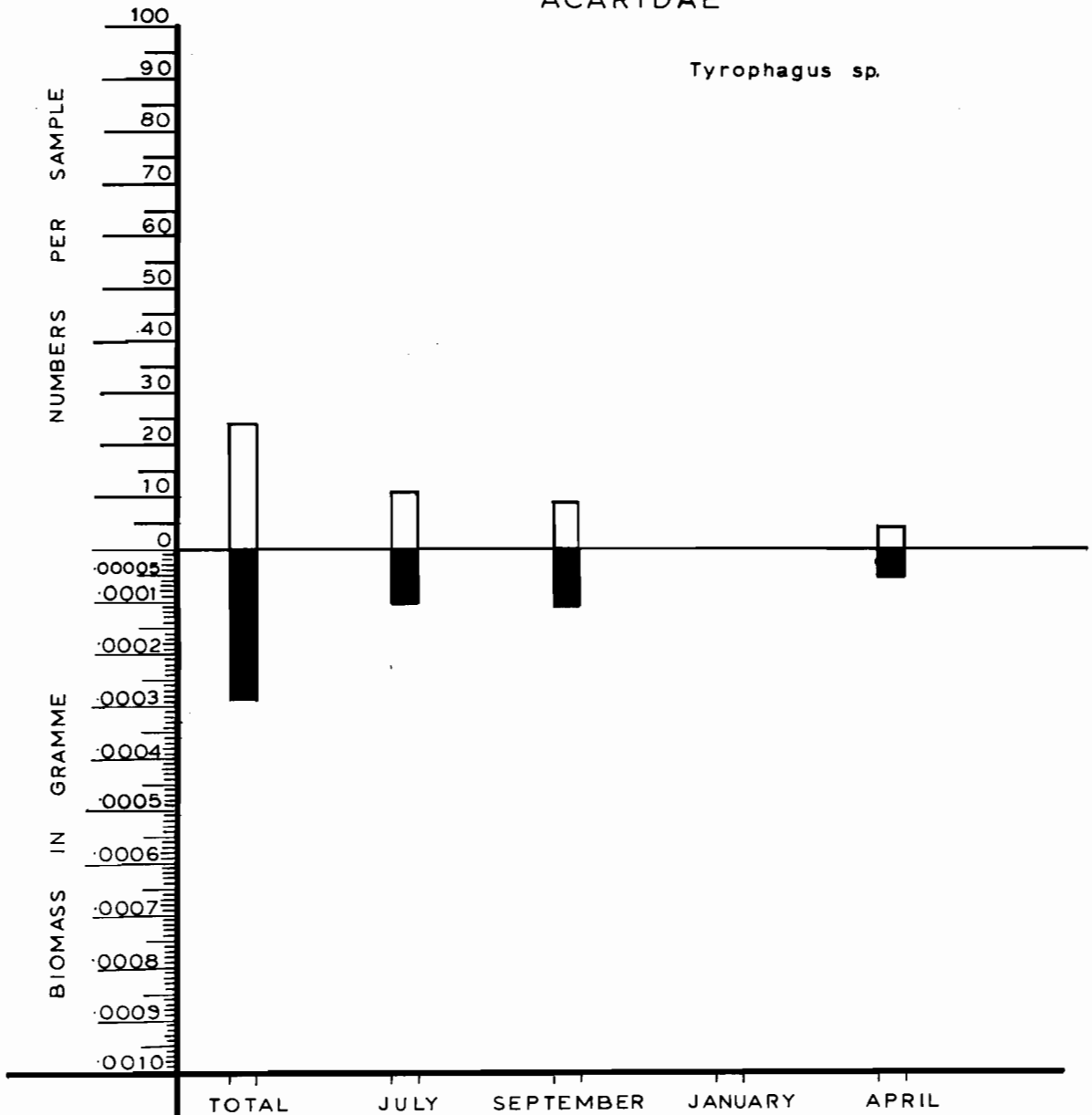


Fig. 102 Seasonal fluctuations in numbers and biomass of the family Acaridae, plot D.

## FAMILIES OF "OTHER ARTHROPODA"

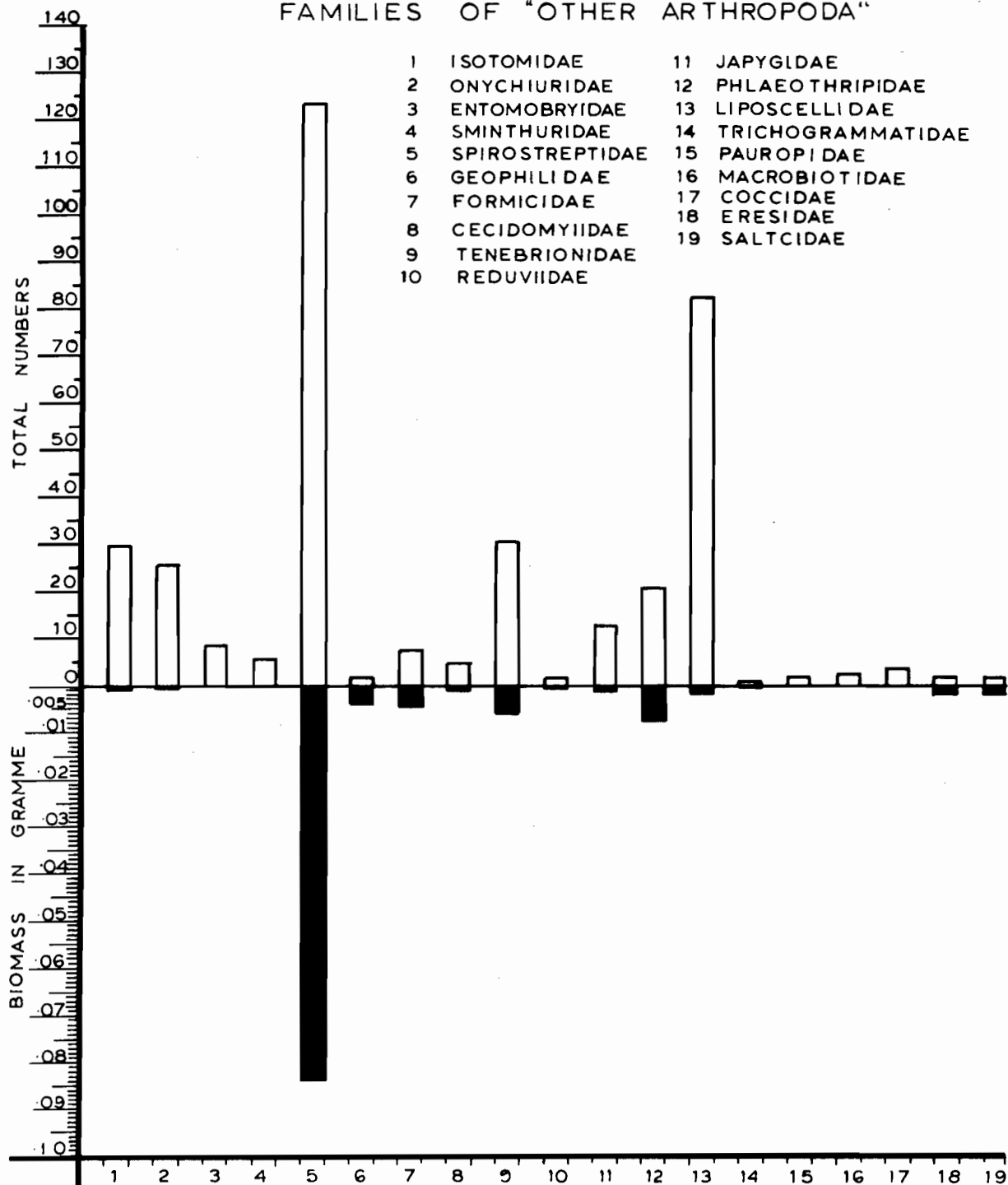


Fig. 103 Numbers and biomass of the families of 'Other Arthropoda', plot A.

## FAMILIES OF "OTHER ARTHROPODA"

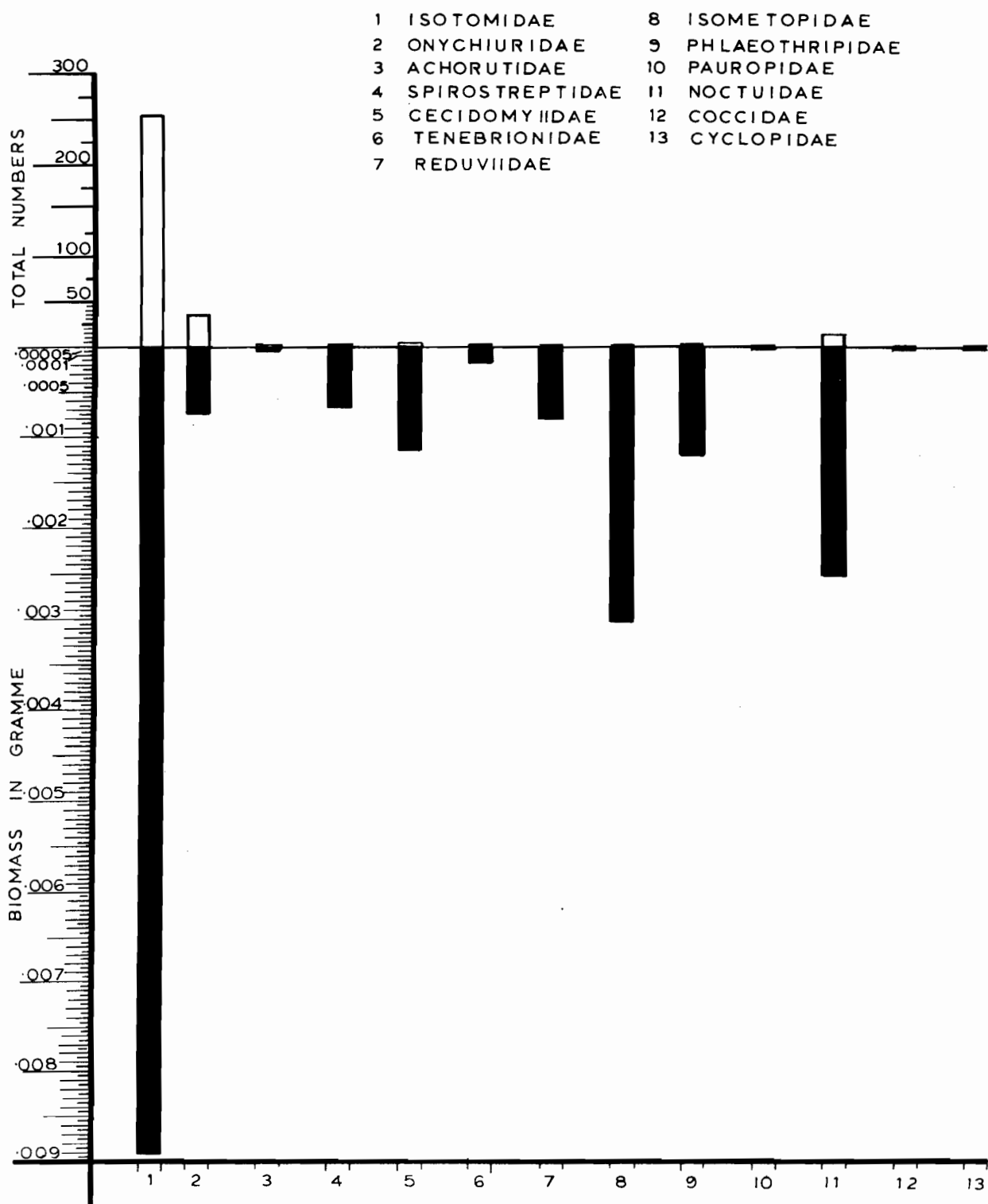


Fig. 104 Numbers and biomass of the families of 'Other Arthropoda', plot B.

# FAMILIES OF "OTHER ARTHROPODA"

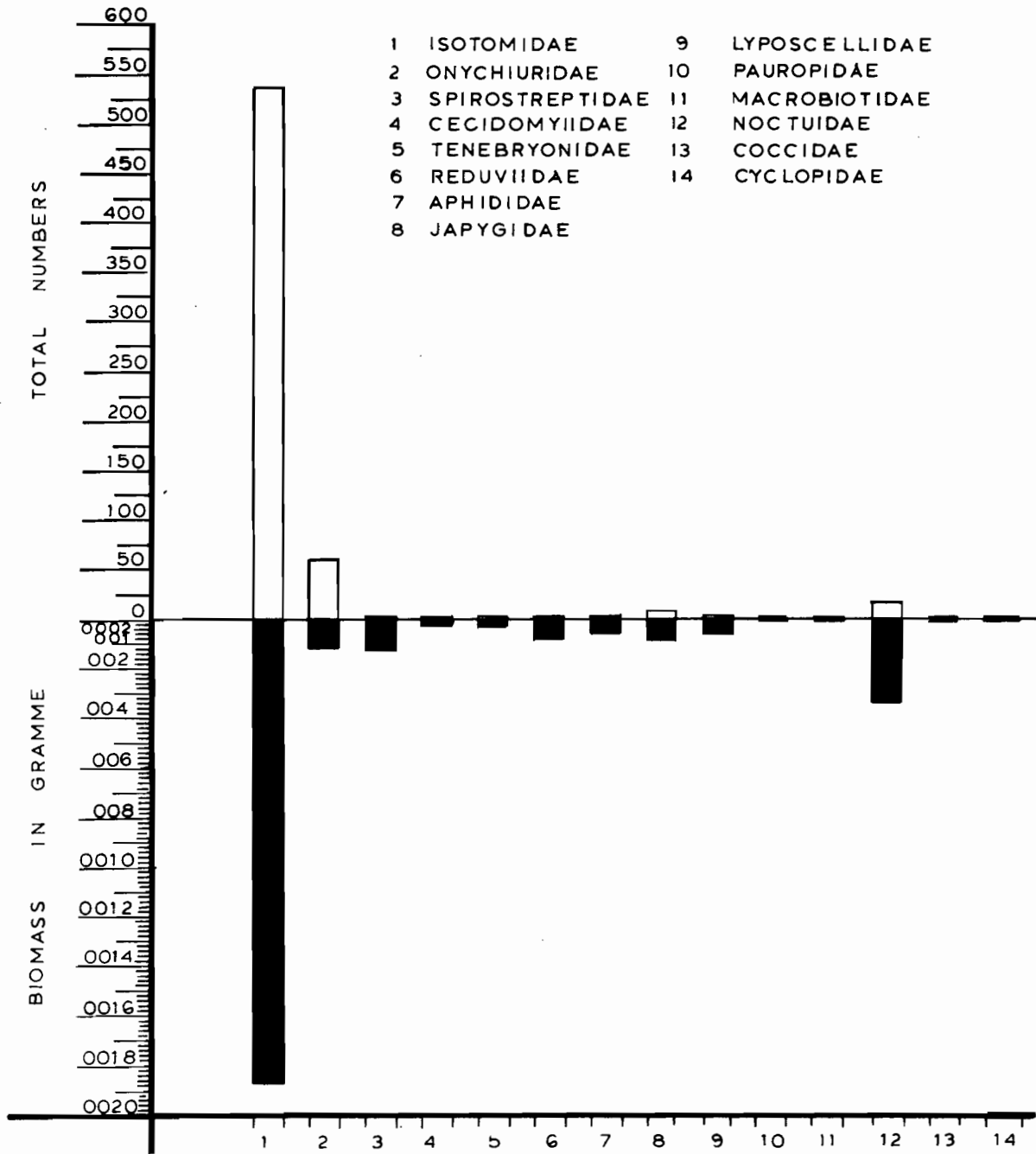


Fig. 105 Numbers and biomass of the families of 'Other Arthropoda', plot C.

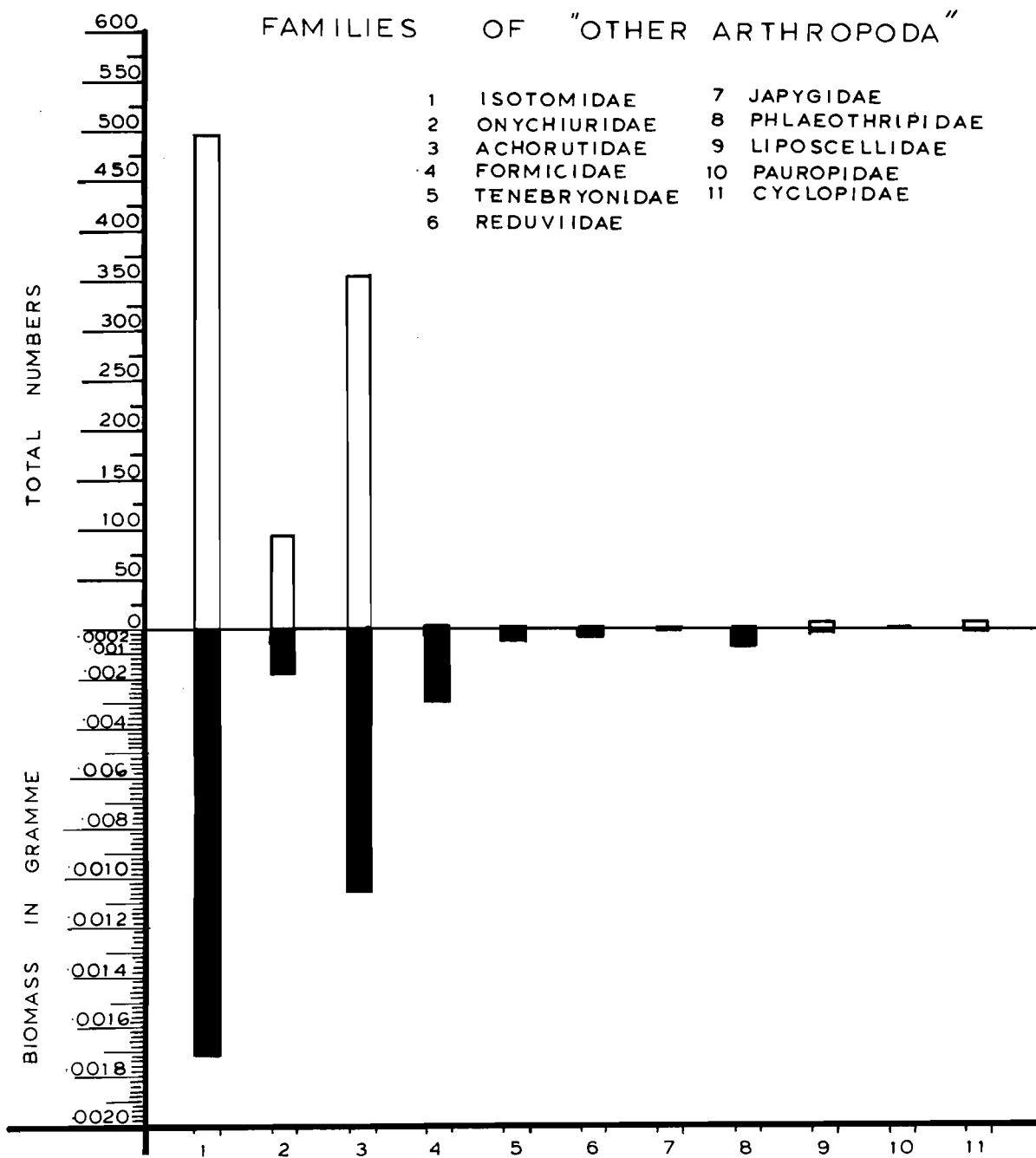


Fig. 106 Numbers and biomass of the families of 'Other Arthropoda', plot D.

# FAMILIES OF "OTHER ARTHROPODA"

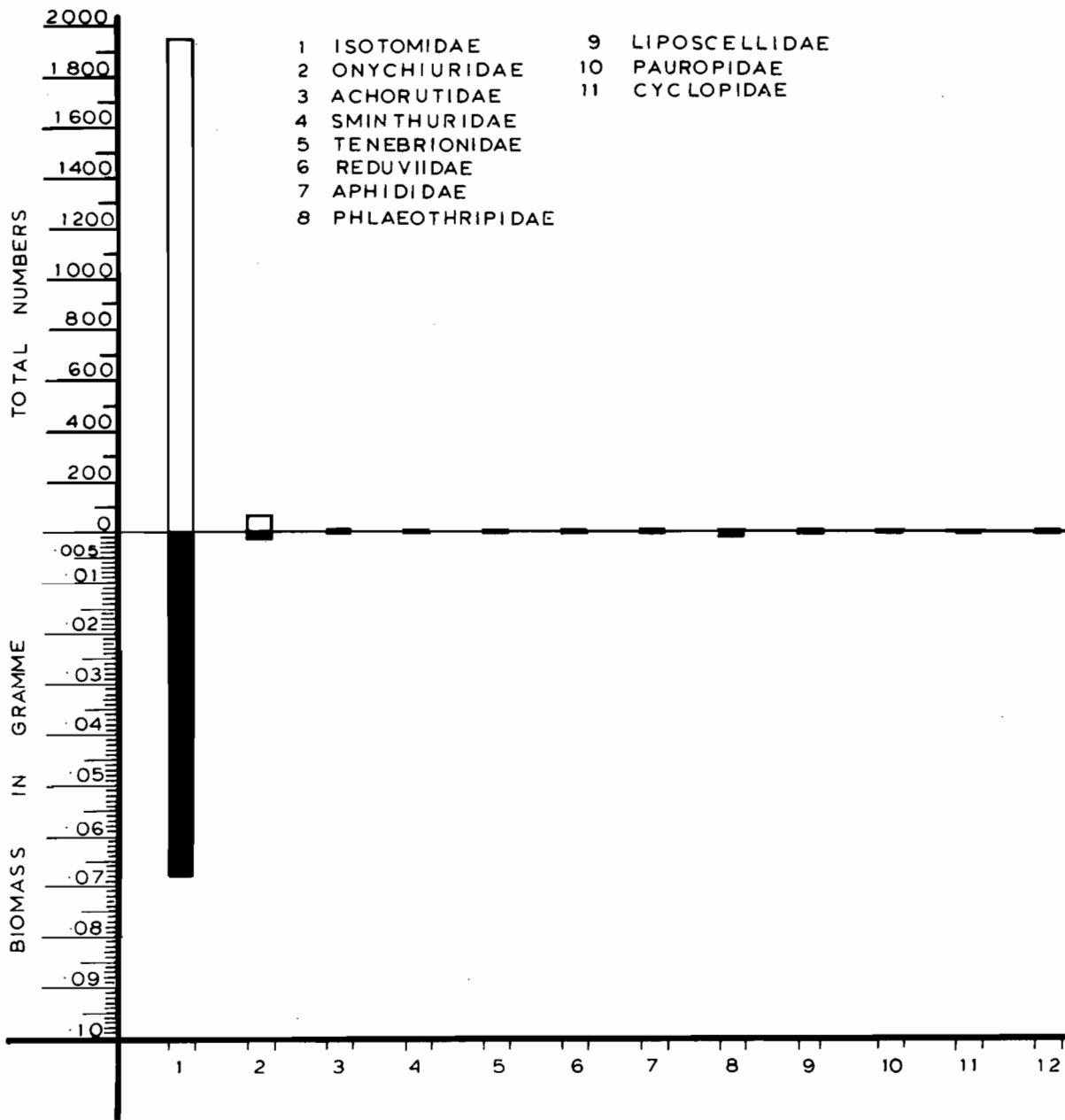


Fig. 107 Numbers and biomass of the families of 'Other Arthropoda', plot E.

# FAMILIES OF COLLEMBOLA

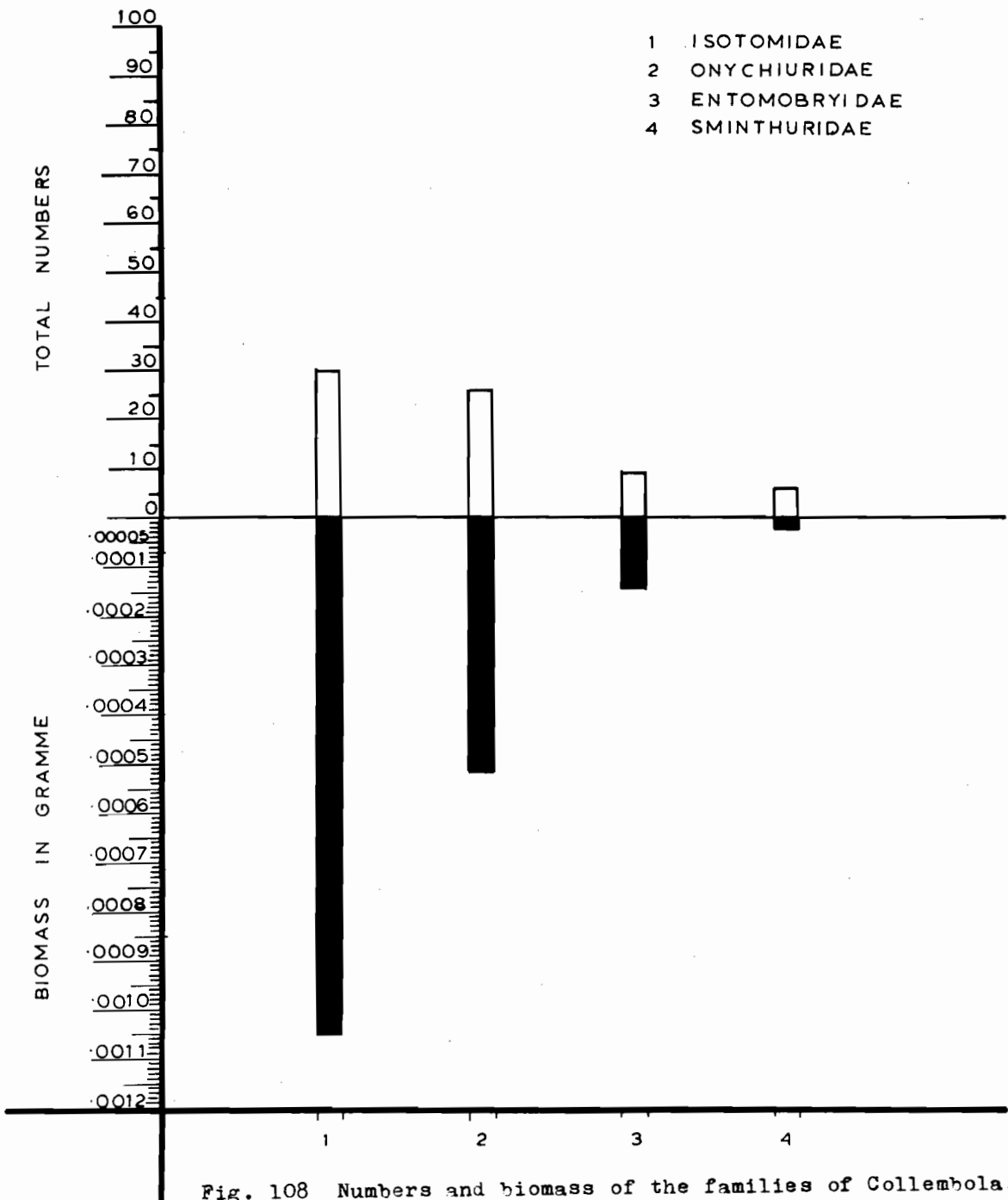


Fig. 108 Numbers and biomass of the families of Collembola, plot A.

tracted, but only three, namely Isotomidae, Onychiuridae and Achorutidae made significant contributions. Isotomina termophila (Axelson) was without doubt the dominant species, not only for this section but also for the mesofauna of all the citrus plots investigated. At the control plot, however, this order was, in relation to numbers and biomass, and inferior group, but was of interest for comparison with the Collembola of the citrus plots.

A definite seasonal variation pattern was observed for the Collembola. During the first two samplings, the numbers were negligibly small, but suddenly reached enormous numbers during the January sampling. In April, all the plots again recorded a decline.

#### ISOTOMIDAE (figs. 109 to 113, table 24)

This family was represented by one species only, but nevertheless had the biggest population concentration in three of the citrus plots. It was only in plot B that the trombidiform Pyemotidae outnumbered the Isotomidae. The mentioned trombidiform family had a yearly mean of 6,266 per m<sup>2</sup> in that particular plot. The following yearly means were calculated for Isotomina termophila (Axelson) on the different plots:

Plot A - 457/m <sup>2</sup>	Plot D - 7,325/m <sup>2</sup>
Plot B - 3,768/m <sup>2</sup>	Plot E - 28,774/m <sup>2</sup>
Plot C - 7,935/m <sup>2</sup>	

# ISOTOMIDAE

*Isotomina termophila*

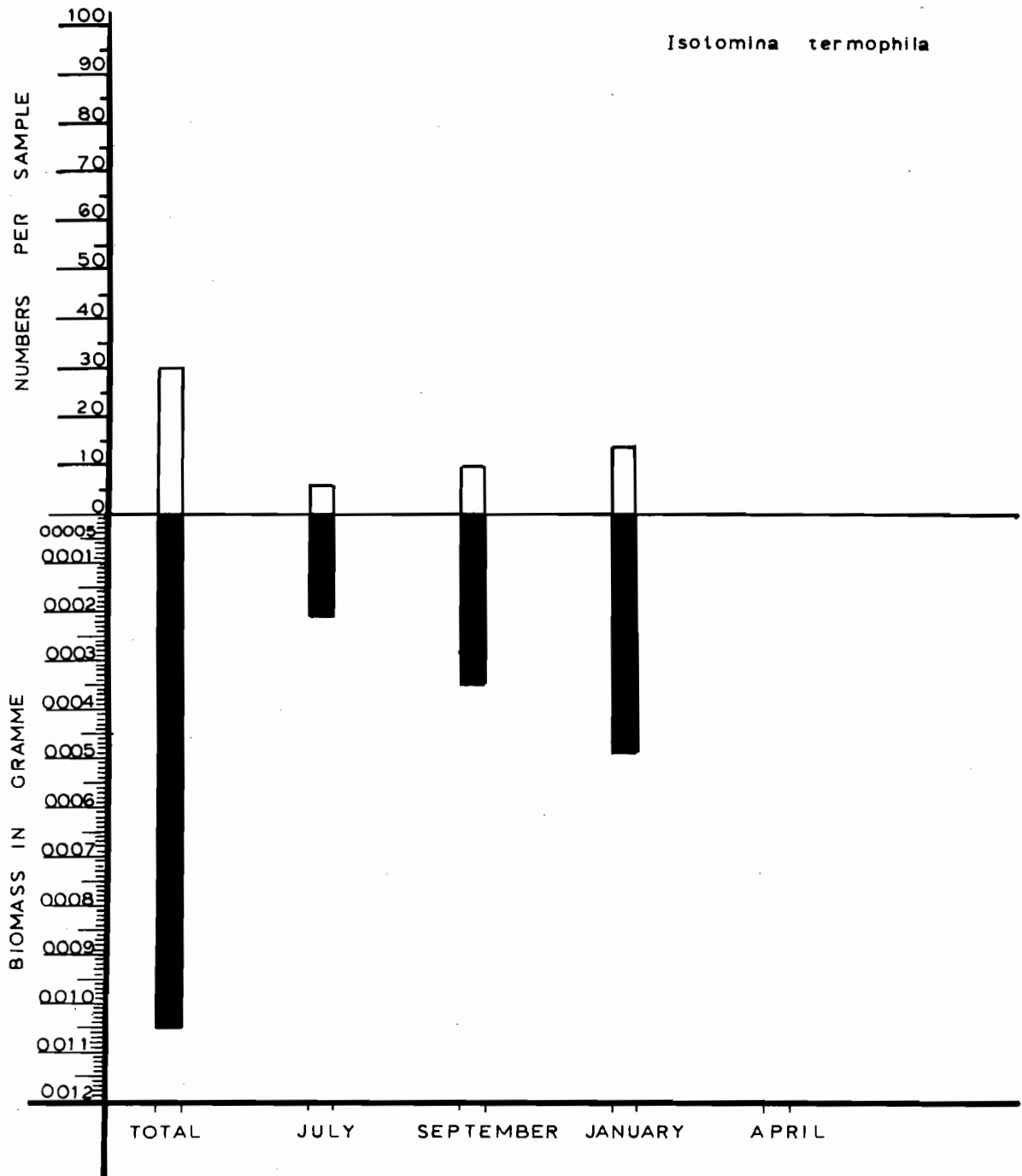


Fig. 109 Seasonal fluctuations in numbers and biomass of the family Isotomidae, plot A.

# ISOTOMIDAE

*Isotomina termophila*

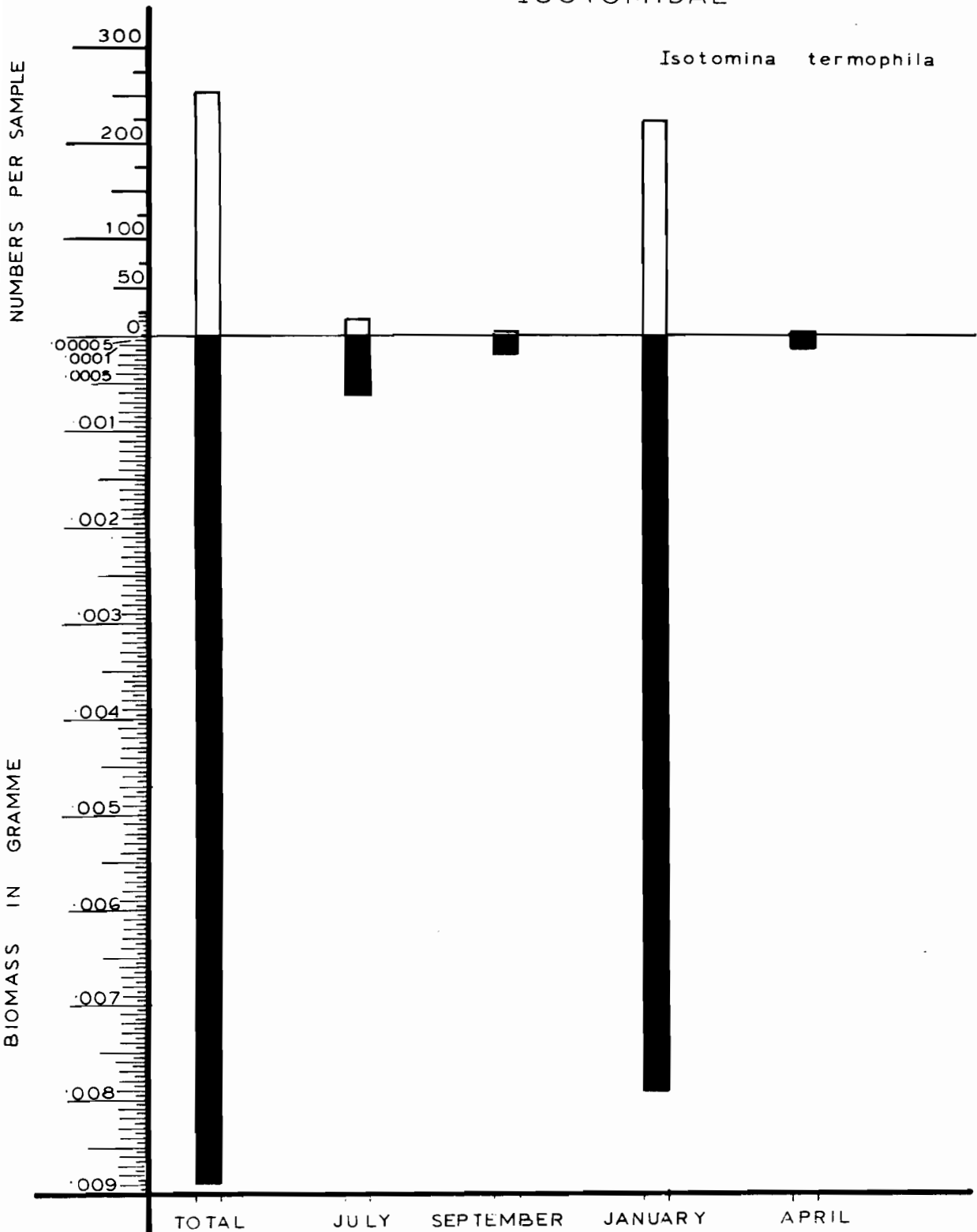


Fig. 110 Seasonal fluctuations in numbers and biomass of the family Isotomidae, plot B.

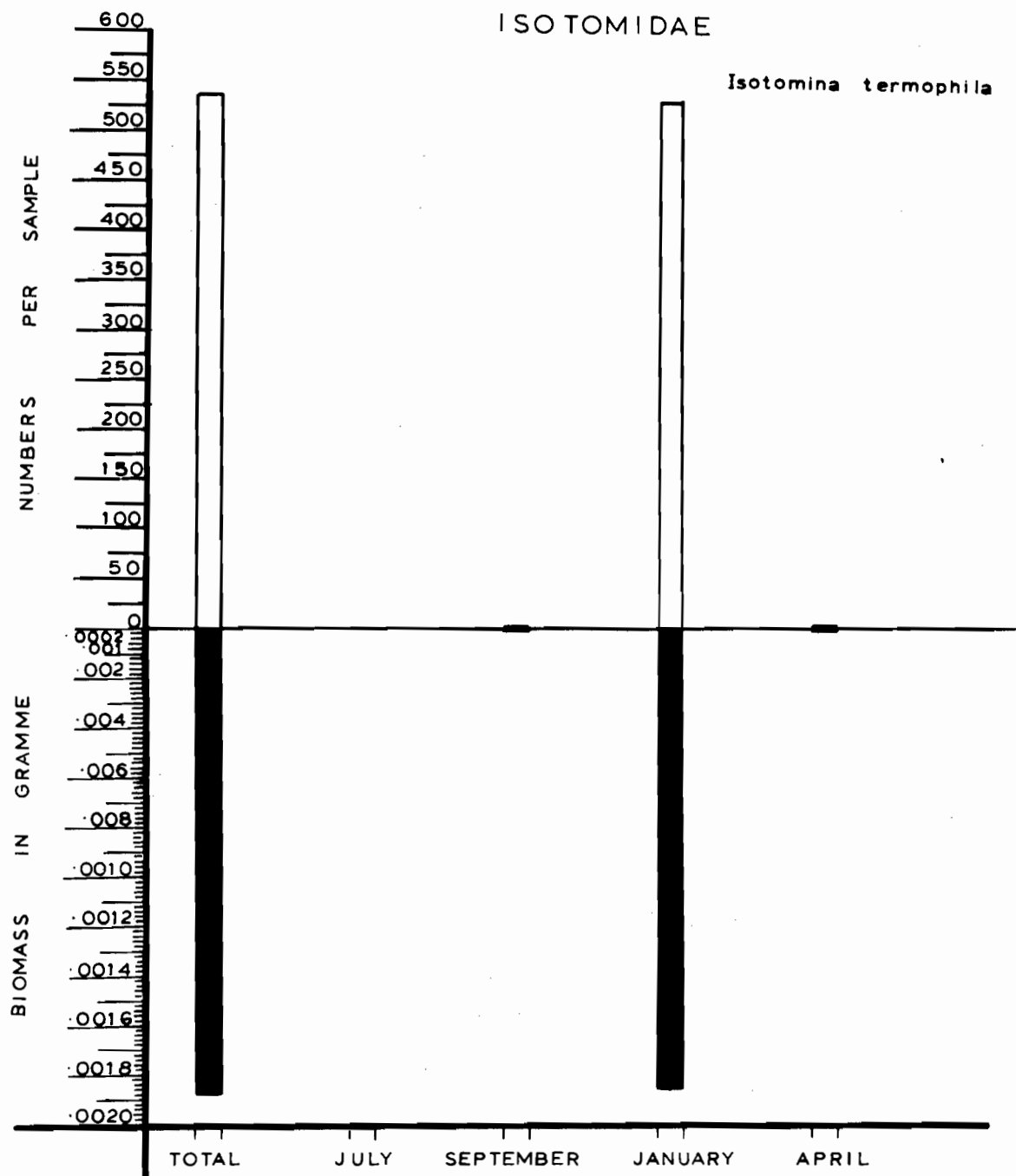


Fig. 111 Seasonal fluctuations in numbers and biomass of the family Isotomidae, plot C.

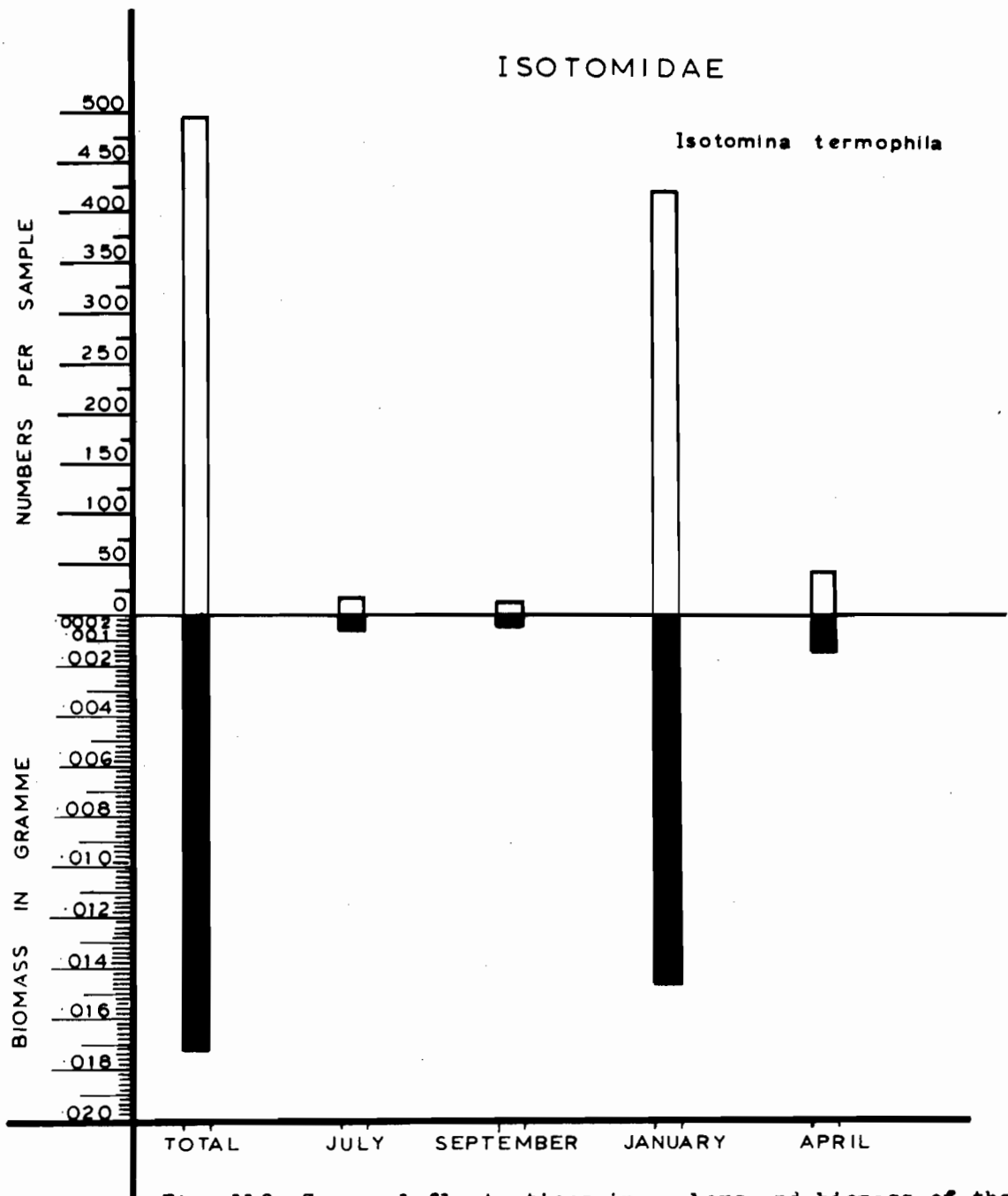


Fig. 112 Seasonal fluctuations in numbers and biomass of the family Isotomidae, plot D.

# ISOTOMIDAE

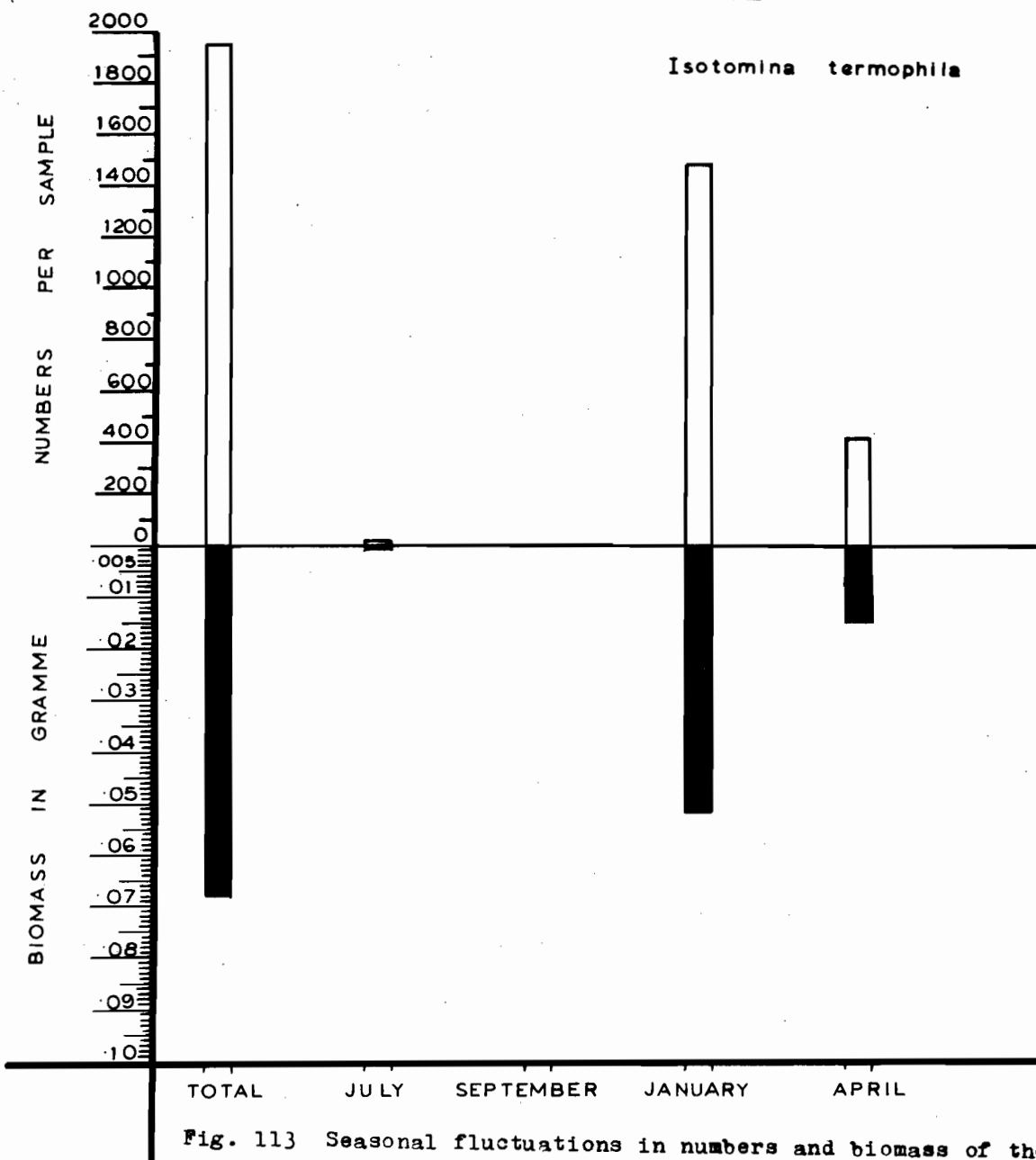


Fig. 113 Seasonal fluctuations in numbers and biomass of the family Isotomidae, plot E.

During July 1965, all the citrus plots, except plot C, recorded a population density of Isotomina termophila (Axelson) which varied between 1,064 and 1,537 specimens per m<sup>2</sup>. The September 1965 sampling, however, revealed a reduction of this species in all the citrus plots to a population density which varied between 177 and 786 specimens per m<sup>2</sup>. Though unfavourable climatic conditions and other factors such as the paration spraying reduced the populations of Isotomina termophila (Axelson) considerably, their density in all the citrus plots was still high enough to produce large numbers during the coming summer season under favourable conditions.

The January 1966 sample revealed astronomical figures as high as 88,000 per m<sup>2</sup> for this insect species. The January recording of Isotomina termophila (Axelson) on the different citrus plots was:

Plot B - 13,419/m <sup>2</sup>	Plot D - 24,887/m <sup>2</sup>
Plot C - 31,390/m <sup>2</sup>	Plot E - 88,141/m <sup>2</sup>

Karg (1967) demonstrated the resistance of certain Collem-bola including a specimen of the Isotomidae, Isotomodes productus (Axelson), to poison application. In the course of Karg's investigation, the last mentioned insect was subjected to various HCH preparations, which are in general use as insecticides, and DNOC, an active ingredient of herbicides. The Isotomina termohila (Axelson) populations of the present investigation proved to have attained a resistance similar to that of the tested species of their family kind to poison application. Baudissen (1952) who treated loamy field

plots with B.H.C. dust, also observed reduced populations of Collembola which, however, recovered after five to eight weeks. Similarly, Grigor'eva (1952) recorded a marked increase in Collembola numbers after treatment of field plots with B.H.C. dust at the rate of 5 kg/ha, but concentrations of 15 and 30 kg/ha reduced the populations. Hoffman, 1949, sprayed forest areas from the air with D.D.T. and an oil solution at an concentration of 4 lbs. of D.D.T. per acre. Collembola were extracted from soil samples before and after spraying took place and were found to have increased more in the sprayed area than in the control plot, three months after the treatment. The Collembola on the trees also increased greatly after spraying.

It is, however, believed that their chemical resistance alone could not be credited for the very high collembolan population density, but the absence of most of their predators which were affected by the poison, and the presence of different favourable conditions such as moisture, temperature, aeration and food, also played a major role. Berim (1964) mentioned that: "The mass increase of phytophagous arthropods following the use of pesticides can be explained mainly by the destruction of entomophages and acarophages whose resistance to insecticides and acaricides may be less than that of the phytophages. At the same time, the mass increase of phytophagous arthropods may have other causes, in addition to destruction of entomophages. These causes may include direct stimulation of breeding, and increased fertility as a consequence of improved nutrition resulting from the stimula-

ting effect of pesticides on plants...". In connection with the food matter it is speculated that extensive fungal growth must have occurred, as a result of a stimulating effect by chemicals or other influencing factors, to provide abundant food for the very active Collembola masses. This hypothesis is of special interest when considering the fact that a collembolan density varying between 47,000 to 89,000 per m<sup>2</sup> occurred during January 1966 in the soils of Section 2, which had only an organic material content of between 2 and 3% at the sampling site. Feeding studies done by Mr. J.L. Aucamp (personal communication) on saprophagous Acaridiae proved that productive phytophagous organisms could reach enormous numbers in a short time on fungal growth if climatic conditions were favourable.

The mesofaunal results of the control plot provided additional facts for this speculation. On plot A, a big population of trombidiform predators occurred, but small Collembola numbers. In January 1966, 951 specimens of Isotomina termophila (Axelson) were recorded at the control plot while trombidiform predators such as Cunaxa sp., Bdella sp., Acheles aethiopica (Meyer & Ryke) and Smaris biscutatus (Meyer & Ryke) had 5,143, 2,364, 2,069 and 1,418 specimens per m<sup>2</sup> respectively during the same sampling period. It may also be possible that the lack of irrigation on the control plot had a suppressing effect on the populations of the Collembola themselves and on the fungal growth, but the mean moisture percentage of 4% was the same as that recorded on the citrus plots during the time of the January sampling.

The April survey revealed a general faunal reduction in all plots. It was found that the citrus plots of Section 3 B experienced the greatest decline while those in Section 2 still supported big populations. The numbers per m<sup>2</sup> recorded for Isotomina termophila (Axelson) during April 1966 were:

Plot B - 236/m <sup>2</sup>	Plot D - 2,541/m <sup>2</sup>
Plot C - 177/m <sup>2</sup>	Plot E - 25,124/m <sup>2</sup>

The control plot had no recordings of Isotomina termophila (Axelson) during April 1966. As mentioned before, no definite explanation could be supplied for the April decline, as climatic conditions such as soil moisture, relative humidity and temperature were apparently favourable. In connection with the soil moisture, it has been observed that plots B and C registered soil moisture percentages of 16.7 and 13.4% respectively while plots D and E had 5.4 and 6.2% respectively for the same April sampling. These differences could be explained as being due to differences in soil properties. The four plots received irrigation at nearly the same time, a week prior to sampling. The sandy soils of Section 2 let the water drain away more quickly than the loamy soils of Section 3B, which are more compact and tend to hold soil moisture longer.

ONYCHIURIDAE (figs. 114 to 118, table 24)

Just as in the case of Isotomina termophila (Axelson), Onychiurus camerunensis (Schött) recorded its largest population numbers on the citrus plots. Also, as in the former,

# ONYCHIURIDAE

*Onychiurus camerunensis*

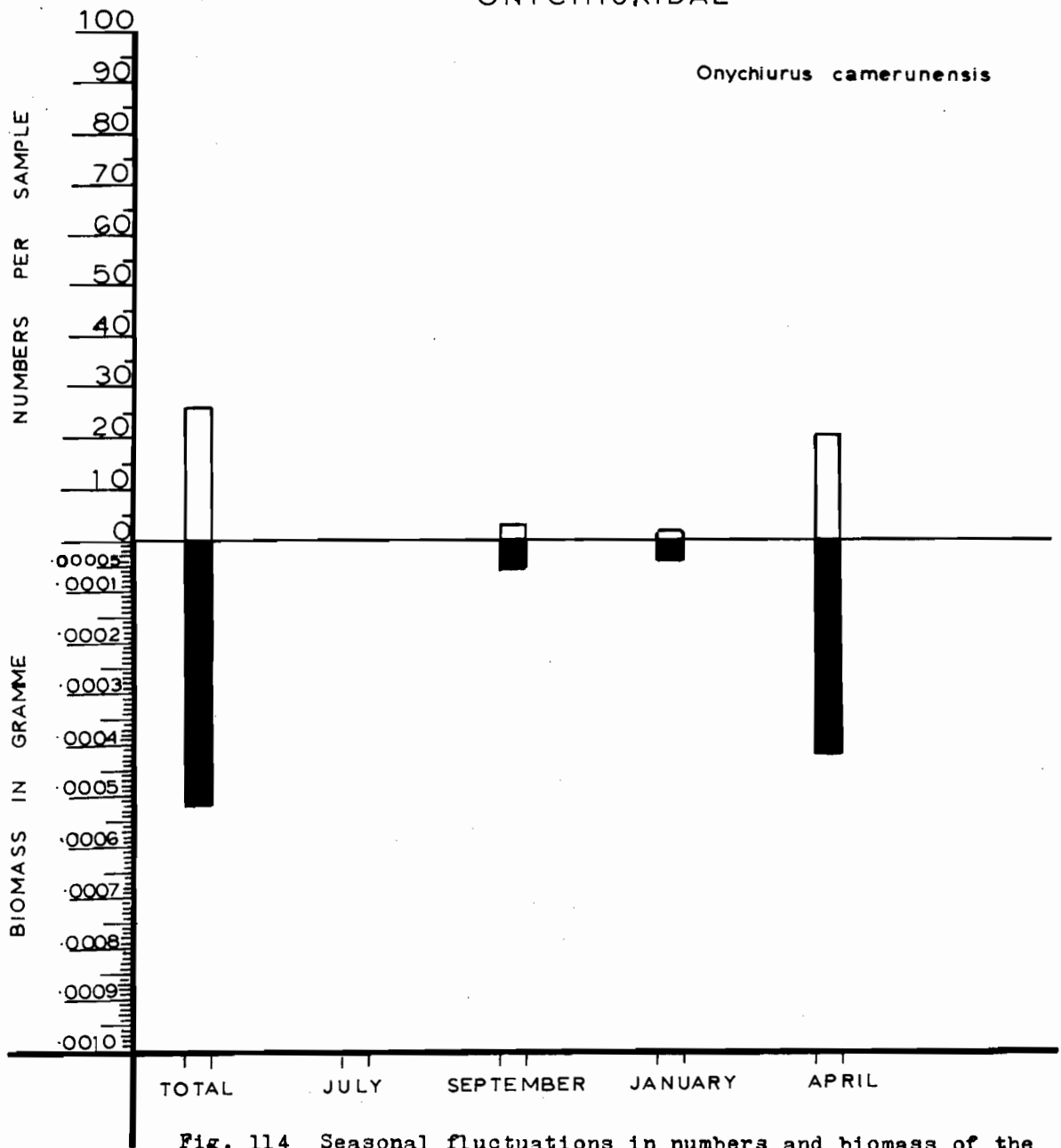


Fig. 114 Seasonal fluctuations in numbers and biomass of the family Onychiuridae, plot A.

# ONYCHIURIDAE

*Onychlurus camerunensis*

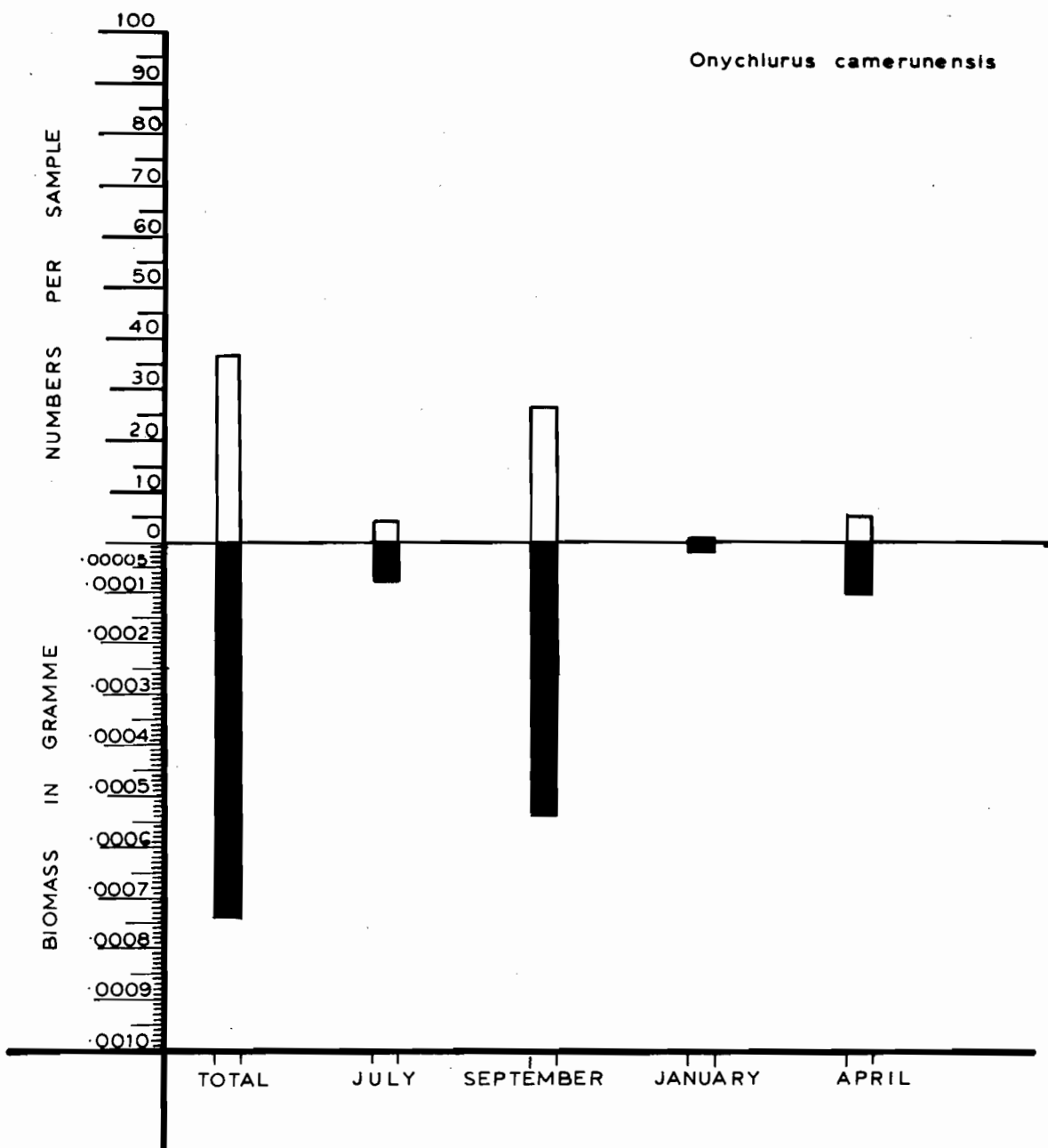


Fig. 115 Seasonal fluctuations in numbers and biomass of the family Onychiuridae, plot B.

# ONYCHIURIDAE

*Onychiurus camerunensis*

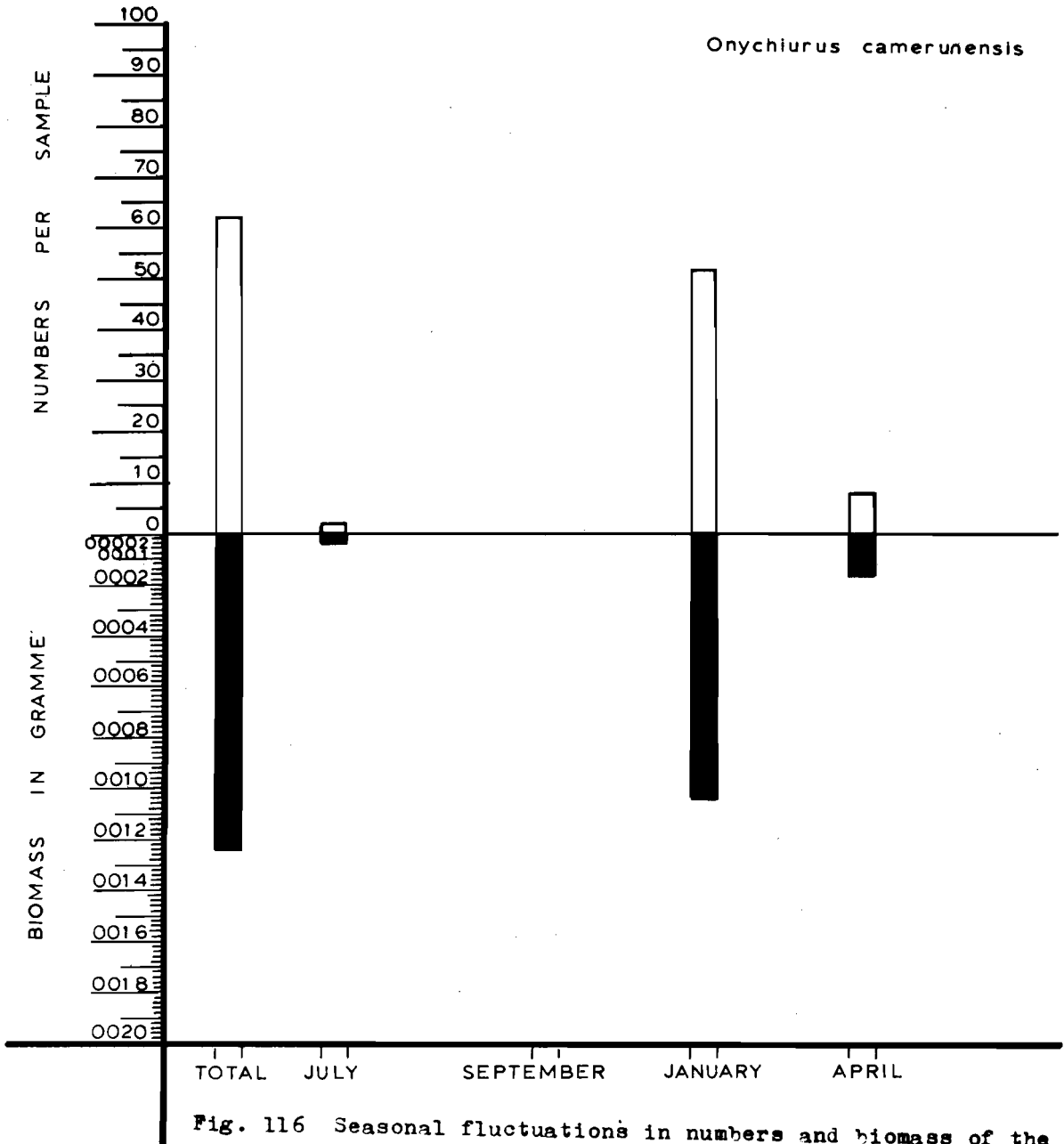


Fig. 116 Seasonal fluctuations in numbers and biomass of the family Onychiuridae, plot C.

# ONYCHIURIDAE

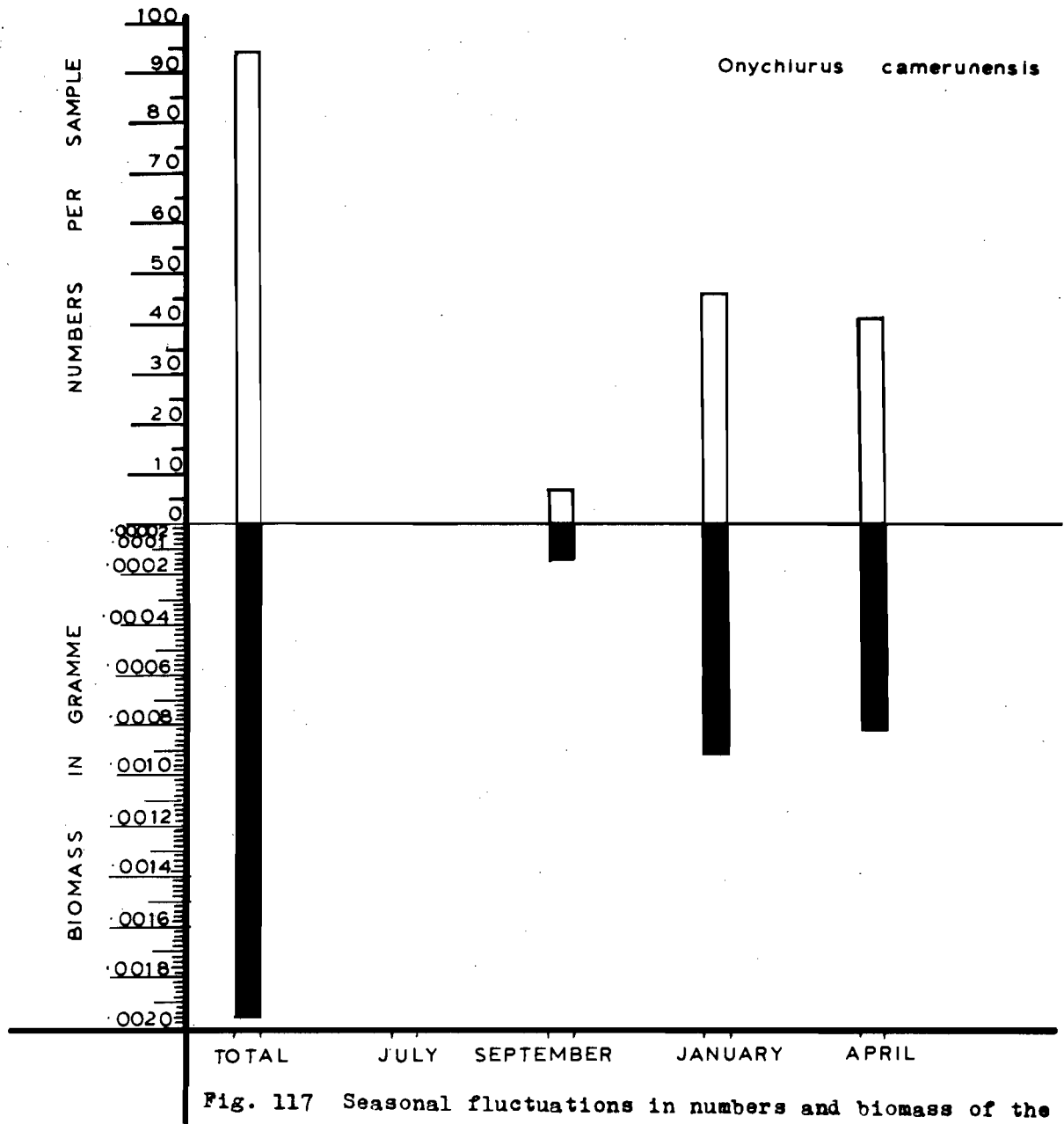


Fig. 117 Seasonal fluctuations in numbers and biomass of the family Onychiuridae, plot D.

# ONYCHIURIDAE

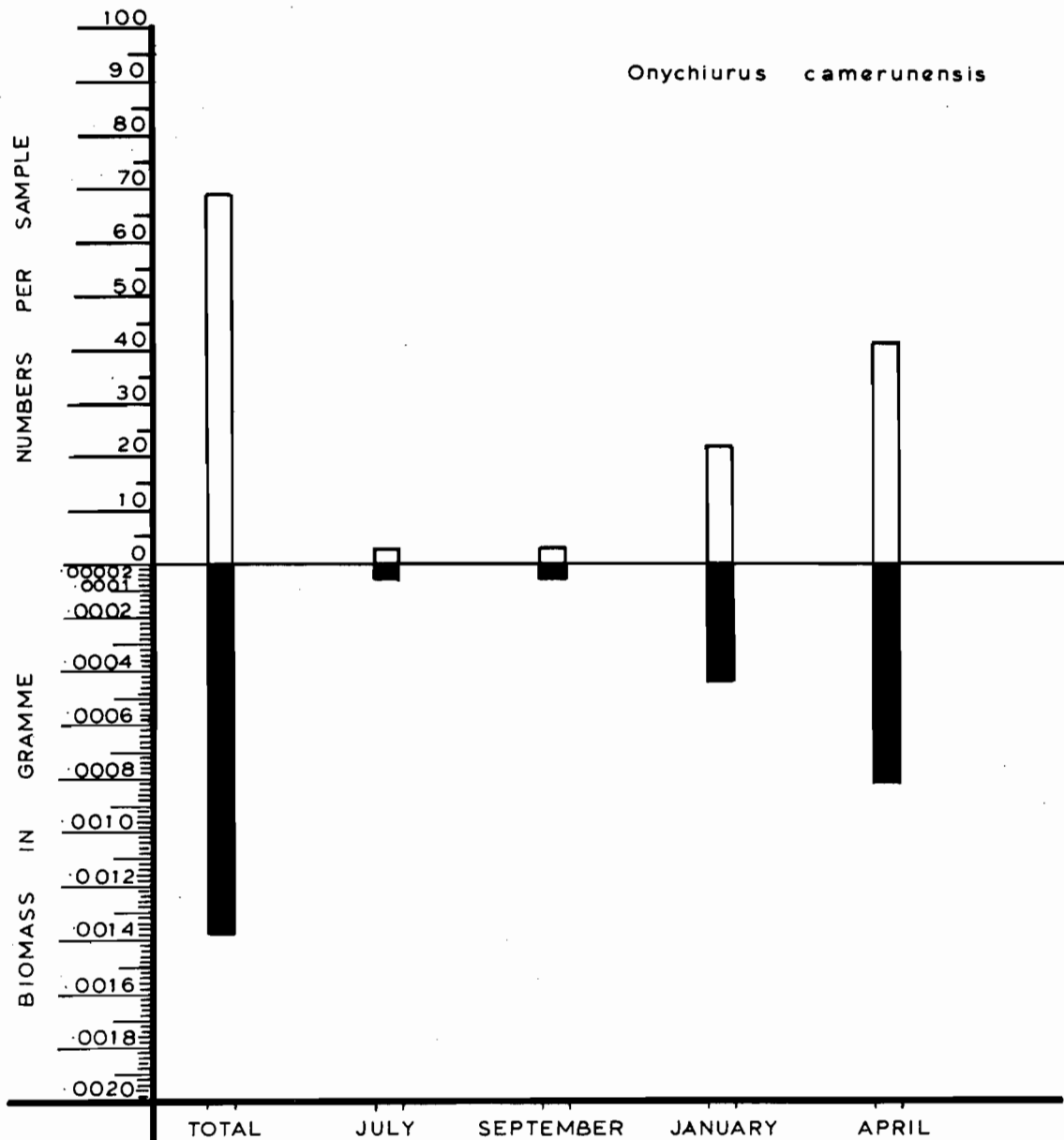


Fig. 118 Seasonal fluctuations in numbers and biomass of the family Onychiuridae, plot E.

the largest population densities were found in the plots of Section 2. The numbers were, however, by far, smaller than those of the dominant species. The yearly means of Onychiu-  
rus camerunensis (Schött) at the different plots were:

Plot A - 383/m <sup>2</sup>	Plot D - 1,388/m <sup>2</sup>
Plot B - 546/m <sup>2</sup>	Plot E - 1,018/m <sup>2</sup>
Plot C - 915/m <sup>2</sup>	

The seasonal variation pattern was almost the same as that for Isotomina termophila (Axelson) though the peak numbers in the different plots varied. This may possibly be as a result of intraspecific and interspecific competition.

#### ACHORUTIDAE (fig. 119, table 24)

It was not until January 1966, that the first specimens of Brachystomella parvula (Schaeffer) were extracted. It is nevertheless believed that they were present in the plots previously, but were not sampled because of their small numbers. They suddenly made their appearance on the biological control plot at a concentration of 19,685 per m<sup>2</sup>.

It is also possible that the numbers of Isotomina termophila (Axelson) recorded on the biological control plot could have been bigger were it not for the direct competition of Brachystomella parvula (Schaeffer) for factors such as food and living space. In accordance with the general season variation pattern, their numbers again declined during April, but a fair population of 1,241 per m<sup>2</sup> was still recorded.

# ACHORUTIDAE

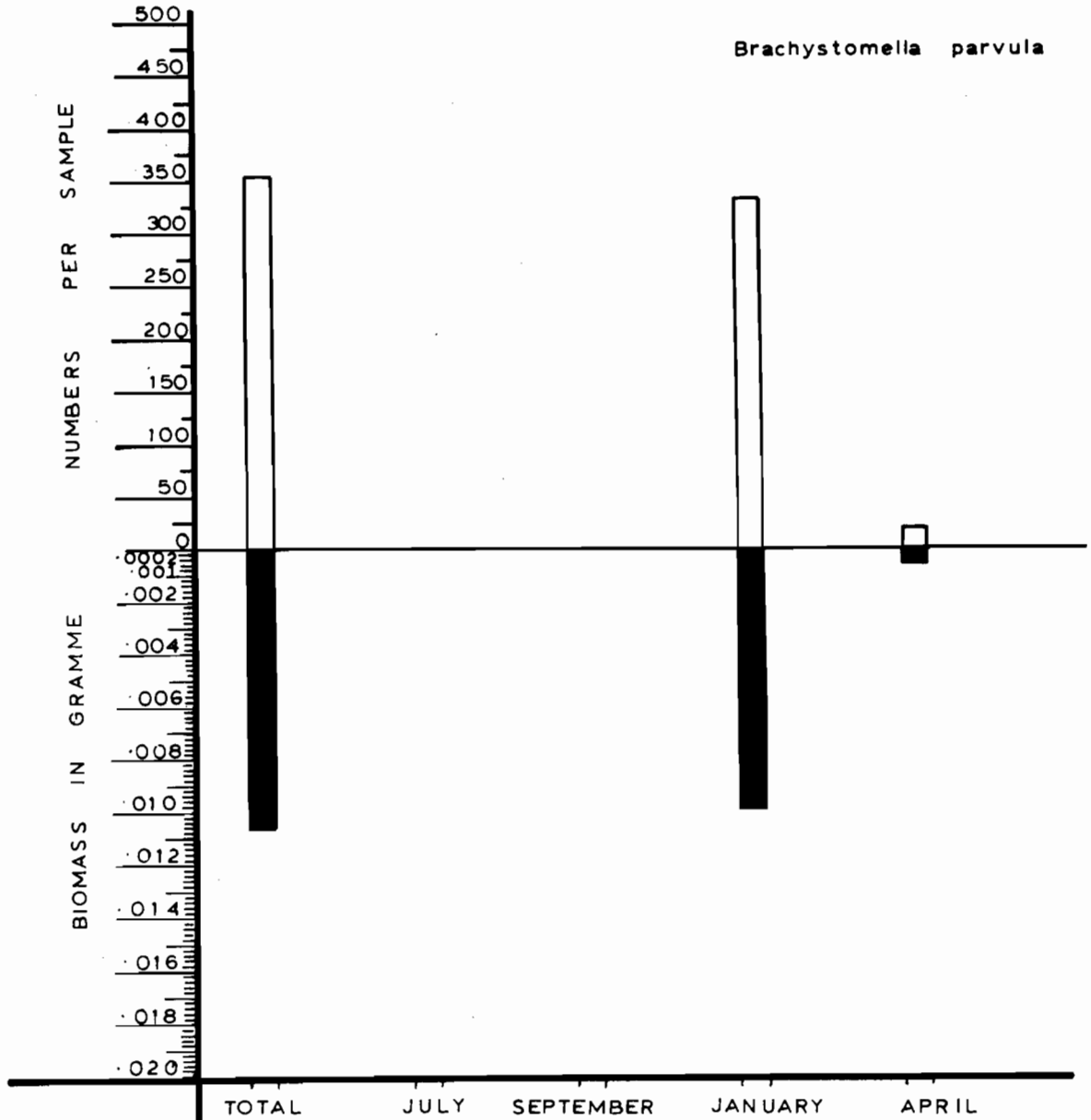


Fig. 119 Seasonal fluctuations in numbers and biomass of the family Achorutidae, plot D.

This species was also present in the April sample of plot E, where it reached a density of 472 specimens per  $m^2$  and in the January sample of plot B, which had a concentration of 118 per  $m^2$ .

Only a few representative specimens of Entomobrya sp. and Seira squamoornata (Schtscherbakow) were extracted from the control plot. No recordings of these collembolans were made on the citrus plots. Sphaeridia pumilis (Krausbauer) were extracted on the control plot and routine plot E. The last mentioned collembolan species was found only in the April survey of the control plot where it reached a concentration of  $354/m^2$  while a population density of 59 per  $m^2$  was recorded for the September sample of plot E.

DIPLURA : JAPYGIDAE (table 24)

The largest population density of Japyx sp. occurred at the control plot which had a summer peak of 591 specimens per  $m^2$ . At the citrus plots yearly means of 132 and 14 per  $m^2$  were recorded for plots C and D respectively.

CORRODENTIA : LIPOSCCELLIDAE (table 24)

Liposcellidae sp. were predominant on the control plot but representative specimens were also found in all citrus plots except plot B. The yearly mean number per  $m^2$  for the different plots was:

Plot A - 1,226/m <sup>2</sup>	Plot D - 132/m <sup>2</sup>
Plot B -	Plot E - 59/m <sup>2</sup>
Plot C - 44/m <sup>2</sup>	

A definite seasonal variation pattern could be observed. On the control plot, this species recorded 354 specimens per m<sup>2</sup> during the July sample. In September the population density increased to 532 per m<sup>2</sup> and ultimately reached its climax with 3,783 specimens per m<sup>2</sup> in January 1966. In April 1966, their numbers again decreased to 236 specimens per m<sup>2</sup>. This species probably preferred the natural vegetation of the control plot for its food availability and habitat conditions. More topsoil litter and seeds were to be found in the natural vegetation of the control plot than in the citrus plots. They were also probably sensitive to the chemicals.

No seasonal variation pattern could be observed for the Hemiptera and Homoptera as only a few specimens were collected. Specimens occurred in both the natural soil and citrus plots.

THYSANOPTERA : PHLAEOTHIPIIDAE (fig. 124, table 24)

The thrips that were found in the citrus soils were few and revealed no seasonal variation pattern and had a yearly mean number which varied between 14 and 44 per m<sup>2</sup> on plots B, D and E. On the control plot on the other hand the numbers were more numerous and followed the general seasonal variation pattern. During July 1965, a density of 295 per m<sup>2</sup> was recorded. The September collection of thrips was smaller,

# PHLAEOTHIRIPIDAE

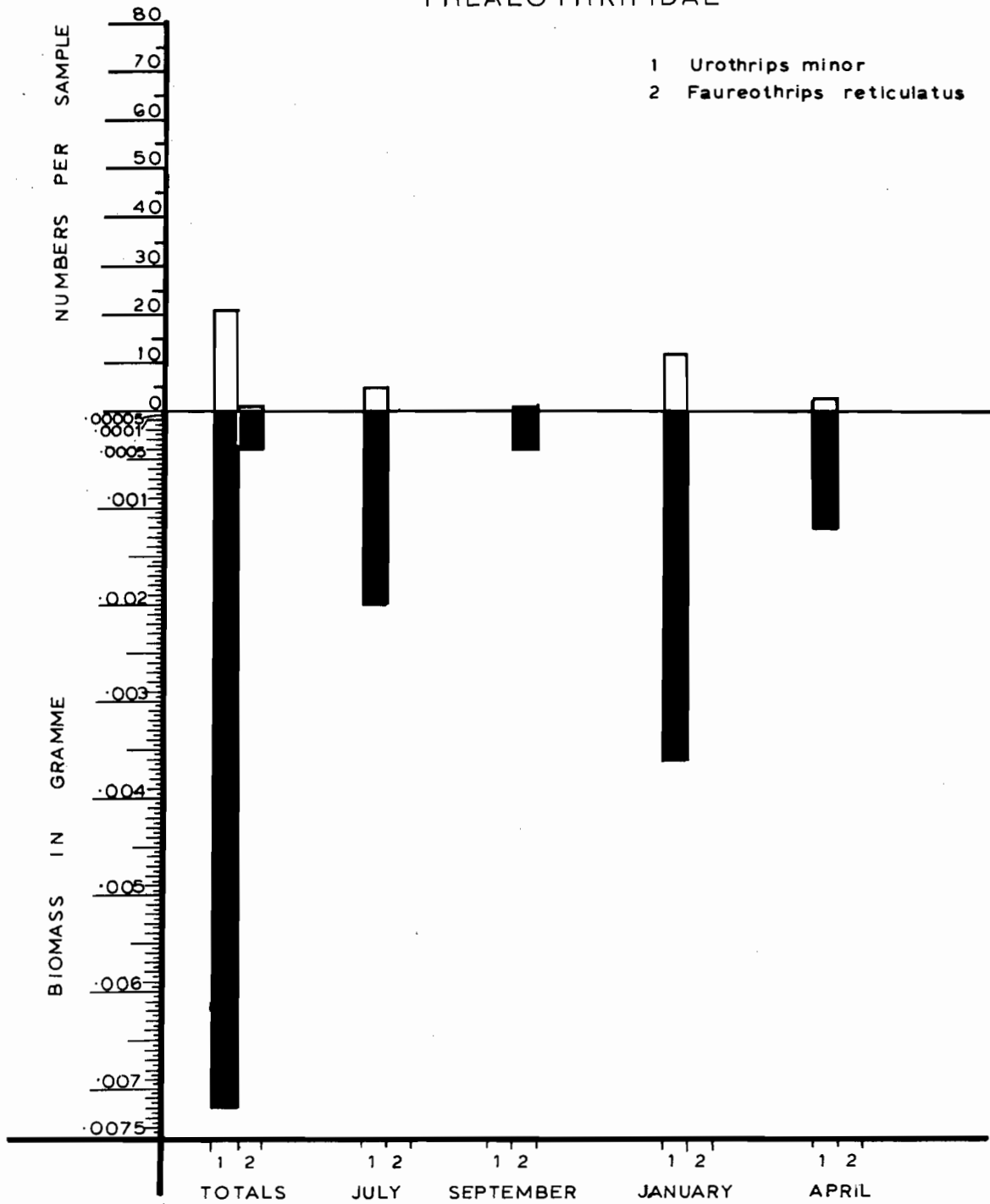


Fig. 120 Seasonal fluctuations in numbers and biomass of the family Phlaeothripidae, plot A.

its seasonal density being 59 per m<sup>2</sup>, but the following summer season the extractions revealed an increased density of 709 per m<sup>2</sup>. In April 1966 the numbers again decreased to 177 per m<sup>2</sup>. The yearly mean for the control plot was calculated at 236 specimens per m<sup>2</sup>.

The majority of the specimens belonged to Urothrips minor (Faure). Only two specimens of Faureothrips reticulatus (Tribom) were extracted during the whole investigation. The thrips species recorded from the soil community was found to be totally different from those found on the citrus trees by den Heyer and indicates the difference between the arthropod tree and soil communities.

LEPIDOPTERA : NOCTUIDAE (table 24)

No significance could be attached to the occurrence of Lapygma exempta (Walk.) on plots B and C during the January sample. They were just "visiting" larvae and were all collected from the surface subsamples, which indicates that they did not penetrate the soil. Their numbers were fairly high though. Plots B and C recorded 1,123 and 823 specimens per m<sup>2</sup> respectively.

DIPTERA : CECIDOMYIIDAE (table 24)

The representatives of Cecidomyiidae sp. were all extracted from the plots on Section 3 B and all the specimens were recovered from September and January samples. The numbers

recorded on all plots were small. The yearly means for plots B, C and A were 73, 14 and 73 specimens per  $m^2$  respectively. Kevan (1962) mentioned that representatives of Cecidomyiidae are inactive in the soil most of the time but that some do feed on mycelia, etc.

COLEOPTERA : TENEBRIONIDAE (table 24)

The tenebrionid soil beetles were found to be predominant in the natural soil of the control plot. A yearly mean of 457 specimens per  $m^2$  was extracted on the last mentioned plot as against 14 to 44 per  $m^2$  recorded on the citrus plots. The occurrence was not in line with the general seasonal density pattern. During July 1965, a density of 591 per  $m^2$  was recorded on the control plot, followed by 472 per  $m^2$  in September 1965, 118 per  $m^2$  in January 1966 and 650 per  $m^2$  in April 1966. As a result of cultivation practices such as poison application, weed extermination and removing of the litter layer, the citrus soils were less densely populated by the soil tenebrionids, than natural soils.

DIPLOPODA : SPIROSTREPTIDAE (table 24)

The diplopods were collected on the three plots of Section 3 B only, but carcasses of these arthropods have been observed on the plots of Section 2. Spirostreptidae sp. were found to be far more numerous in the natural soil of the control plot. The yearly means for the three plots were:

Plot A - 1,832/m<sup>2</sup>

Plot B - 14/m<sup>2</sup>

Plot C - 29/m<sup>2</sup>

A definite summer peak was recorded for the diplopods on the control plot. During July 1965, a density of 118 per m<sup>2</sup> was recorded at the last mentioned plot, followed by 1,832 per m<sup>2</sup> for the September survey and ultimately 4,019 per m<sup>2</sup> for the summer peak in January 1966. In April 1966, the population numbers again decreased, but the density of 1,359 per m<sup>2</sup> was still high.

These animals are pre-eminently dwellers in natural soil conditions with rich litter layers and debris vegetation, as it was found on the control plot. To say that the citrus habitat offers very little opportunity for these soil arthropods, is an understatement.

Though only the smaller diplopods were extracted, their weight was in comparison with the other micro-arthropods, enormously large. As could be expected, they were the dominant biomass contributors on the control plot. It would be interesting to know what the effect of animal behaviour would be on the population density of this species. Do these small diplopods hibernate during the winter and thus constitute a smaller number per m<sup>2</sup>, or not?

HYMENOPTERA : TRICHOGRAMMATIDAE (table 24)

In contrast to the big population densities which oc-

cur in citrus tree populations, only one adult Trichogramma sp. was extracted. This species was found on the control plot.

#### HYMENOPTERA : FORMICIDAE (table 24)

Ants were recorded on the control plot and the biological control plot only and a yearly mean of 118 and 73 per m<sup>2</sup> was recorded for the plots respectively. As a result of an ant extermination programme, they were absent in routine plot samples. No definite seasonal variation pattern could be observed for Pheidole megacephala (Fabr.)

#### ARANEIDA (table 24)

The five spiders collected belonged to three different families. A yearly mean population density of 29 specimens per m<sup>2</sup> was recorded for both Eresidae and Salticidae on the control plot, while Linyphiidae registered 14 specimens per m<sup>2</sup> on plot E.

#### PAUROPODIDAE : PAUROPIDAE (table 24)

Representatives of Pauropus sp. were recovered from all plots. No definite seasonal variation pattern could be observed for this eu-edaphic arthropod as very small numbers were recorded. Nevertheless, they obviously live equally well in the citrus habitat.

## TARDIGRADA : MACROBIOTIDAE (table 24)

From the Tardigrada, a few specimens of Macrobiotidae sp. were extracted on plots A and C. During January 1966 a population density of 177 per m<sup>2</sup> was registered on the control plot while 59 specimens per m<sup>2</sup> were recorded during July 1965 on plot C. These arthropods were also extracted from natural pasture soil in the Potchefstroom district.

## CRUSTACEA

## COPEPODA : CYCLOPIDAE (table 24)

Mesocyclops sp. is no true soil dweller, but some of this species reached and penetrated the citrus soil by means of irrigation from nearby dams. No specimens were extracted from the control plot which received no irrigation. The calculated yearly mean for the different citrus plots was:

Plot B - 29/m <sup>2</sup>	Plot D - 59/m <sup>2</sup>
Plot C - 14/m <sup>2</sup>	Plot E - 103/m <sup>2</sup>

The mesofaunal soil populations of Zebediela's natural and agricultural plots, were in correspondance with soils under the same conditions elsewhere, which included both natural soils and agricultural soils. The various investigations made at Potchefstroom were most suitable for comparison.

The general occurrence of population peaks in the summer and winter seasons seemed to be the fixed population

pattern for, at least, the Transvaal Highveld grasslands or pastures. Similar trends, other than those found in this investigation were also noted by Olivier & Ryke (1965), Loots & Ryke (1965), Erasmus & Ryke (1965), den Heyer & Ryke (1965) and Van Jaarsveld & Ryke (1965). The investigations of the mentioned authors ranged from pasture soil to arable soil investigations, and were all done in the Potchefstroom district. The Potchefstroom district is a true summer rainfall area, which receives the same amount rainfall as the Zebediela surroundings. During the year October 1962 to September 1963, 653.1 mm rain was recorded at the Potchefstroom Agricultural College. The total average yearly rainfall at Zebediela for the period 1911 to 1963 was 650.7 mm (Bester, 1965).

Loots & Ryke (1965) recorded a summer peak of 63,027 arthropods per  $m^2$  on Potchefstroom veld during February 1963. During the summer sampling, a peak of 53,030 arthropods was recorded at the control plot at Zebediela, during the present study. The Kikuyu grass investigation (Olivier & Ryke, 1965) equally revealed a summer peak of 54,400 arthropods per  $m^2$  in January 1963, while den Heyer (1965) recorded a peak of 55,599/ $m^2$  in an Acacia biotope during February 1963.

Winter population peaks were registered by all the authors already mentioned. A winter population peak of 34/ $m^2$  was registered by Loots & Ryke (1966) on the 22nd of July 1963. Den Heyer & Ryke (1965) and Olivier & Ryke (1965) had extremely high winter populations that year, due to an

extraordinarily wet winter, and other factors, such as soil surface covering. The winter population numbers were 117,095/m<sup>2</sup> on the 10th of June 1963 for den Heyer's investigation and 69,846/m<sup>2</sup> on the 16th for Olivier's project. The control plot registered a winter peak population of 26,190/m<sup>2</sup> on the 14th of July 1966 during this investigation, which most probably could have reached higher numbers if more rain had fallen in late summer.

It has been observed that natural, undisturbed soil has a greater and much more diversified number of families and species than the agricultural soil with intensive cultivation. The mesofaunal arthropods of agricultural soils, however, smaller in faunal variety, produced some species with formidable growth potentials, and capable of high population numbers within one season. In this respect R.F. Lawrence (1952, p. 42) states:

"Although the populations of fertile agricultural soils agree with those of the forest in being composed predominantly by arthropods, they usually differ in another respect; there is a far greater tendency among them for certain groups of arthropods, usually the Collembola and Acarina, to bear the main weight of population numbers between them; a large segment of the population may even be composed of only a few species of Collembola, which are present in truly enormous numbers. In this connection Salt, Hollick, Raw and Brain (1948) mention the figure of 169 million Collembola per acre divided among 5 species; Glasgow (1939) 117 million per

acre attributed to only four species."

The Collembola : Acari ratios calculated from the total mesofaunal numbers of each plot were:

	<u>Collembola</u>	<u>Acari</u>
Plot A	1	26.9
Plot B	1	5.3
Plot C	1.2	1
Plot D	1.1	1
Plot E	4.1	1

These ratios reveal the very low collembolan numbers on the control plot. On the other hand the biological control plot had very high collembolan numbers, but due to considerable Acari recordings the ratio of Collembola to Acari was more or less equal, in comparison with the 4:1 ratio of plot E. The given ratios gave only a general impression as to the overall Collembola : Acari composition of the different plots. During the summer season, however, the Collembola : Acari ratio on plot E reached 17:1. The general Collembola : Acari ratios recorded during investigations by Olivier & Ryke (1965) was 1:5 in kikuyu grass; 1:5.2 and 1:7 in pasture soils by Loots (1966), and 1:15 in an Acacia biotope investigated by den Heyer & Ryke (1965). No other South African investigation has ever recorded Acari : Collembola ratios of 1:1 proportions, as has been found in the present investigation.

In the present study it was found that the mesofaunal population fell to a minimum during September (spring) period.

Similar mesofaunal trends were also recognised by Loots & Ryke (1966), Den Heyer & Ryke (1966), Erasmus & Ryke (in press) and Olivier & Ryke (1965). This was followed by an increase in population density which resulted in the January (summer) peak. Summer population peaks also occurred during investigations of the abovementioned authors. The population numbers again decreased during spring.

The dominant Collembola and the majority of the Acari and "Other Arthropoda" exhibited a summer peak population, with reductions in spring and autumn. However, some arthropods, such as representatives of the trombidiform family, Tydeidae, revealed peak populations in July (winter) and a second but lower prominency in summer.

The seasonal variation in temperature and soil moisture content were probably the most important factors which determined population size. The interaction of these mentioned factors, and various others, such as chemical application, with the intrinsic control of the life cycle of the different species, may be expected to account for the development of peak populations.