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ON THE INSECT FAUNA OF THE ALKALI FLAT AT KISKUNDOROZSMA

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Abstract

The monthly distribution of the dominant elements of the Arthropoda fauna in *Lepidio-Camphorosmetum* and *Lepidio-Puccinellietum limosae* associations on calcareous-sodic solonchak soils of a strongly alkali flat at Kiskundorozsma, near Szeged was investigated. Barber-traps were used for catching the arthropods totalling nearly 100 000 specimens.

The extensive alkali flats in the Danube—Tisza Mid-region have been greatly diminished and today, in its original state, only some small patches are extant in the environs of Szeged. These harbouring some endemic or rare species and associations were put under nature conservancy only recently (BODROGKÖZY, 1962, 1974). The alkali flat at Kiskundorozsma, near Szeged has a varied fauna of which SZILÁDY (1925) published a mere fraction discussing those of Chilopoda, Arachnoidea and some Acariformes, thus, the fauna of insects discounting some sporadic collectings, and the limnological investigations (FERENCZ, 1973; MEGYERI, 1972) is almost wholly unknown. This is the reason why we set as a target to elucidate the monthly distribution of at least the dominant species or groups of the arthropoda fauna of this region.

Investigated area

According to BODROGKÖZY (1962) South Kiskunság may be divided into the following zones: sand-dune, sand-bank, extreme saline zone (vakszik), halomorphic soil patch, inundation area, foreshore, sandy river-bank, bank zone with permanent water, deep-water zone. For our research we chose the extreme saline zone and the halomorphic soil patch at Kiskundorozsma as for the prevalence of extreme conditions.

This region belongs according to the classification of STEFANOVITS (1963) and ÁBRAHÁM—BOCSKAI (1971) to the calcareous—sodic solonchak soil type. The only prevailing association in this area is the *Lepidio—Camphorosmetum* standing well up to high concentration of Na_2CO_3, with only two species: *Lepidium crassifolium* and *Camphorosma annua*. The root system of these plants reach down into deep soil layers and is hemicryptophyte, appearing in the beginning of March in great masses, with a total coverage of less than 10—15%. In order to inprove the alkali soil *Puccinellia limosa* was introduced. Thus, in this way, partly in an artificial way the *Lepidio-Puccinellietum limosae* came about as secondary association being characteristic for the solonchak soil, that become dry at the end of spring. Dominant species are *Puccinellia limosa, Lepidium crassifolium* and *Plantago maritima* with a total coverage of 50%.

Methods

To draw reliable conclusions on the arthropod population of a region applying emergence traps at least 1—2 years of continuously functioning traps are necessary. This is especially applicable to the alkali soil whose vegetation is temporary, and occasionally rather poor. The emergence trap was introduced by SOUTHWOOD (1971) in "Central High Alps: Obergurgl-area, Tirol" and functioned by the Zoological Institute of the University of Innsbruck (JANETSCHEK and co-authors 1976). The basic area of the trap is 50×50 cm, height of iron framework 40 cm (Fig. 1—3), while the plastic collecting box fixed at the top is about 60 cm from ground level. The inner space is covered with a dark tulle material forcing the emerging animals to crawl upwards into the white plastic box. This latter contained 2—3% potassium bichromate solution in 1976, in 1977 50% ethylene-glycol solution. The thus enclosed 0.25 m² surface area was further supplied with a Barber-trap with ethylene-glycol in it (Fig. 3) in order to collect animals unable to fly. Both traps (upper and lower) have been evaluated separately, too.

Table 1. The average of those traps which captured more animals in the Barber-traps (lower trap) than in the upper ones, — variable position, c — constant position.

	lower trap		upper trap	place of traps	
				variable	constant
1976. VI	59.8	Hymenoptera	20.9	v	
	37.8	Collembola	2.6	v	
	18.0	Collembola	3.2		c
1976. VII	5	Araneidea	2.2		c
	9.8	Homoptera	6.2		c
	3.8	Collembola	1.6		c
	30	Hymenoptera	21.6	v	
	10	Araneidea	3.4	v	
	4.6	Homoptera	2	v	
1976. VIII	1.2	Orthoptera	0.4		c
	531	Collembola	293.8	v	
1976. IX	639.8	Collembola	156.8		c
	748.6	Collembola	64.4	v	
1977. V	3	Collembola	—		c
	30.4	Hymenoptera	27.8	v	
1977. VI	19.8	Araneidea	16.6		c
1977. VII	15	Hymenoptera	10.8	v	
1977. X	554.8	Collembola	94.6		c
	105	Collembola	75.6	v	

Fig. 1—3. The *Lepidio-Puccinellietum limosae* association at Kiskundorozsma, 1— surface area 5×5 m (at June 3, 1976), 2 — emergence traps of constant position and variable position (at June 29, 1976), 3 — Barber-trap overturned most likely by a *Spalax leucodon* specimen (at July 29, 1976) (Original).

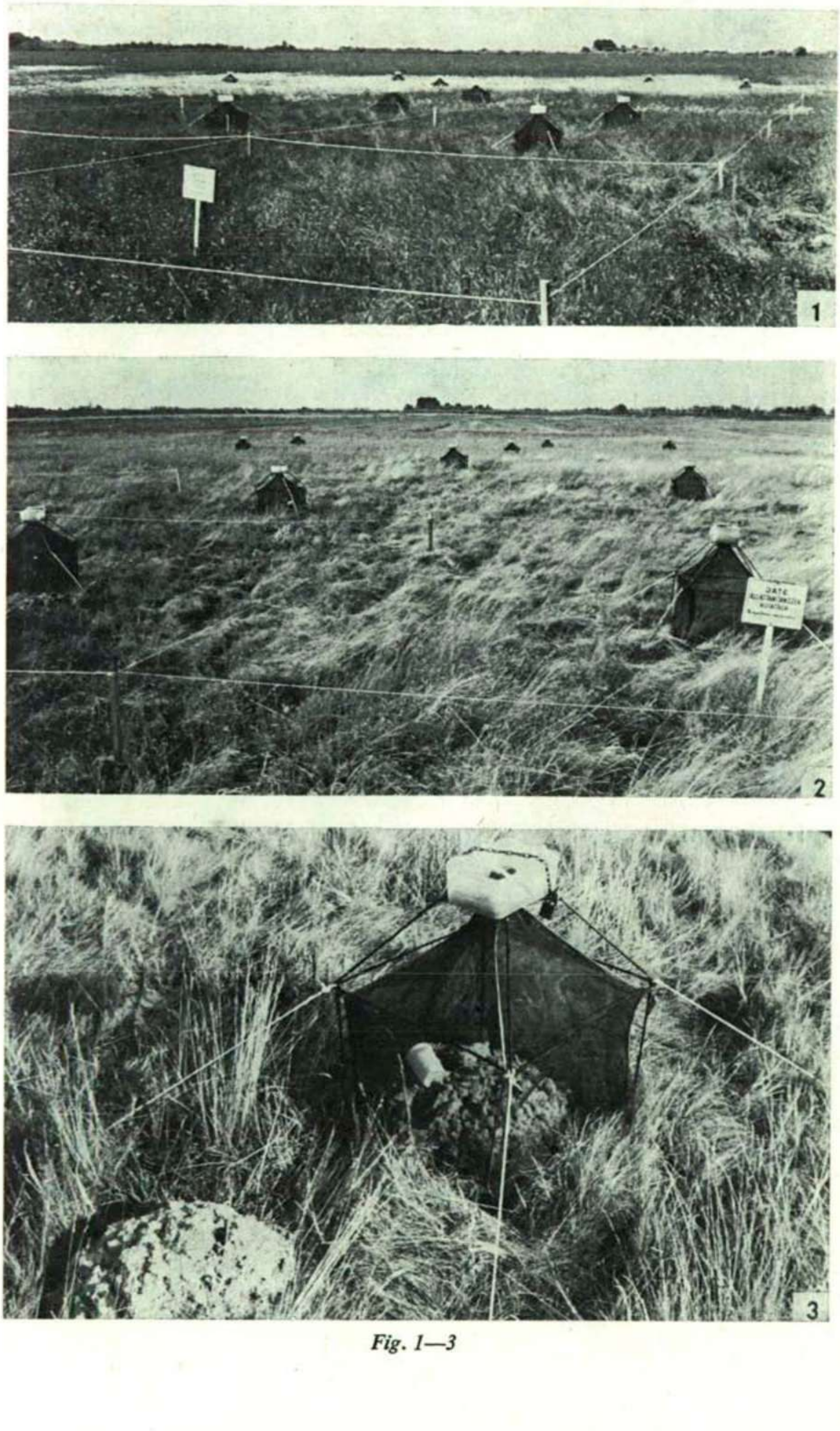


Fig. 1—3

The traps in 1976—1977 were placed out in areas some 800 m from one another in June (in May the areas were under water) and May until November, respectively, and were emptied once a month. Out of the 10 traps five remained in place over the entire vegetation period, while the position of the other five was changed monthly (Fig. 4—5).

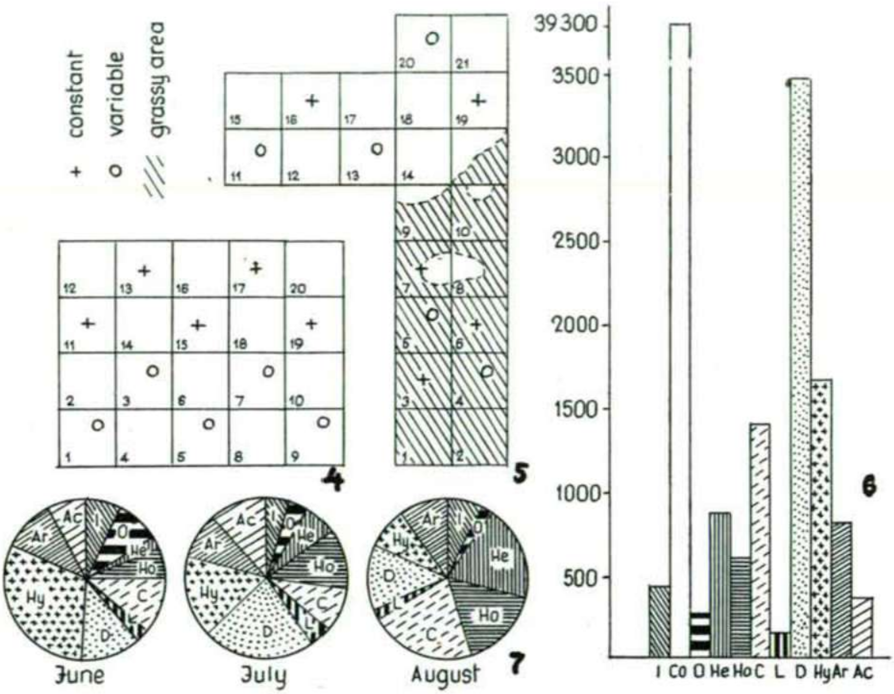


Fig. 4—5. Placing out emergence traps, 4 — in June 1976, 5 — in May 1977, o of changed (=variable) position, + constant position. — Fig. 6. Mean values of total number collected in 1976—1977. — Fig. 7. Summer changes in two-year averages of the ten most important orders.

The method of trapping allowed to draw the following conclusions. The 10 upper traps collected significantly greater number of specimens throughout the two-year period in each month than the 10 lower ones, the only exceptions in the two years are shown in Table 1. (In comparison the Isopoda were not considered.)

Owing to damage to the covering net, only insignificant number of animals reached the inner space, so this fact did not influence results, rather did though the number of animals that escaped through the slit, this was shown by a much lower number of animals caught.

The emerged and captured animals in both the five that remained in place and the other five that were constantly moved traps showed a perceptible fluctuation according to months: these were Orthoptera, Collembola and Hymenoptera. The fluctuation of the Isopoda population was obviously the result of the rather variable weather conditions (Table 2).

The data given in Table 1 and 2 also clearly indicate that no significant difference exists between the values of the two sets of traps. The climatological data used in our evaluation have been taken over from the Aerological Observatory at Szeged (Anonym, 1978) given in Tables 3.

Table 2. The variation of the average of specimen number in the different months (the four most important orders).

		1976					1977					
		VI	VII	VIII	IX	X	V	VI	VII	VIII	IX	X
Isopoda	c	16.6	5.6	2.4	2.8	5	1.6	8.6	9	8.8	10.6	22.8
	v	10.6	16.8	0.8	1.4	2.4	3	11.8	3	4.4	12.2	12.6
Collembola	c	21.2	5.4	664.6	796	3070	475	128	320	370	71	649
	v	40.4	3.8	824	813	1826	4704	477	186	122	23	181
Orthoptera	c	6.2	8.4	1.6	1.4	0.8	—	13	9	8.6	0.2	—
	v	5.2	18.8	1.4	0.6	0.4	—	12	10	6.8	—	—
Hymenoptera	c	58.2	68.4	13.8	10	0.8	35.2	48.6	28	12	2.8	4
	v	80.7	51.6	19.8	8.8	0.4	53.2	132	12	25.8	6.4	1.2

Table 3. Data of climatic conditions in the environs of Szeged in 1976 and in 1977.

Time (month)	Mean tempera-ture SZEGED (°C)	Absolute maximum of tempe-rature SZEGED, (°C)	Absolute minimum of tem-perature SZEGED, (°C)	Mean soil tempe-rature SZEGED, 13h			Relative humidity (%)	Duration of sun-shine (hour)	Total precipi-tation (mm)
				2	10	20			
				cm					
April	11.4	24.8 (IV. 4.)	0.6 (IV. 1.)	17.8	13.8	11.3	58	172	57
May	15.3	27.6 (V. 20.)	0.0 (V. 1.)	23.2	18.4	15.8	63	249	44
June	17.9	32.0 (VI. 21.)	6.0 (VI. 2.)	26.9	22.0	19.3	60	278	27
July	21.4	33.9 (VII. 21.)	9.2 (VII. 12.)	31.9	26.3	24.1	56	291	27
Aug.	17.9	28.1 (VIII. 29.)	8.2 (VIII. 7.)	26.1	21.6	20.2	65	218	31
Sept.	15.3	30.5 (IX. 14.)	6.0 (IX. 7.)	21.5	18.1	16.7	77	154	46
Oct.	11.9	27.7. (X. 3.)	2.8 (X. 23.)	17.6	14.4	13.2	80	139	29
Yearly total	10.0	—	—	15.6	12.4	11.2	71	1903	443
April	8.9	25.0 (IV. 30.)	—1.4 (IV. 12.)	15.1	10.9	9.6	73	177	49
May	15.9	29.2 (V. 20.)	4.8 (V. 27.)	23.2	19.2	17.3	70	245	39
June	19.5	32.7 (VI. 14.)	—2.9 (VI. 4.)	28.6	24.1	22.1	65	298	35
July	20.3	33.4 (VII. 31.)	10.4 (VII. 28.)	28.2	23.8	22.2	65	277	45
Aug.	20.1	31.7 (VIII. 10.)	8.0 (VIII. 26.)	28.1	23.3	21.6	70	233	36
Sept.	14.1	29.8 (IX. 5.)	−0.7 (IX. 29.)	22.9	18.4	17.5	70	209	46
Oct.	11.2	25.8 (X. 8.)	−0.1 (X. 18.)	18.4	13.2	12.2	75	171	7
Yearly total	10.7	—	—	16.4	13.0	11.9	76	2020	477

Table 4. Specimen number of large categories in monthly distribution. Abbreviations: G — Gastropoda, I — Isopoda, Di — Diplopoda, Chi — Chilopoda, Co — Collembola, O — Orthoptera, Th — Thysanoptera, He —Heteroptera, Ho — Homoptera, N — Neuropteroidea, C — Coleoptera, L — Lepidoptera, D — Diptera, Hy — Hymenoptera, Ar — Araneidea, Ac — Acariformes, Juv — juvenile.

Order / Month	G	I	Di	Chi	Co	O	Th	He	Ho	N	C	L	D	Hy	Ar	Ac	Juv
1976																	
June	16	136	2	—	308	57	—	30	161	—	275	3	2891	695	176	155	169
July	11	112	—	—	46	136	—	8	113	1	125	6	99	600	103	10	5
August	6	17	—	—	7 445	15	3	19	264	—	66	23	233	168	50	39	70
Sept.	20	21	—	—	8 048	10	—	187	241	—	187	28	118	94	31	—	9
Oct.	18	37	3	—	24 482	5	—	18	56	—	96	1	15	6	18	—	6
Yearly total	71	323	5	—	40 329	223	3	260	835	1	749	61	3356	1563	378	204	259
1977																	
May	1	23	—	2	25 554	—	1	933	26	1	517	9	1922	427	126	84	92
June	3	96	—	—	3 026	125	1	121	249	12	668	52	967	900	543	25	55
July	4	59.5	—	1	2 651	96.5	4	49	43	1	153.5	50	195	159	156.5	179.5	47
August	1	66.5	1	—	2 564	79.5	2	142	30	—	137.5	99	332	229	180.5	221.5	106
Sept.	2	114	1	1	467	1	—	160	8	—	224	14	92	46	146	—	13
Oct.	1	175	5	8	4 045	—	—	82	22	—	404	2	105	26	108	—	29
Yearly total	12	534	7	12	38 307	302	8	1487	378	14	2104	226	3613	1787	1260	510	342

Evaluation of material

Over the 11 months of collecting time 99 610 specimens of arthropod were collected. The members of the individual orders are shown in Table 4 broken down to months, while the average number for the two years is given in Fig. 6.

In the summer months the fluctuation of numbers in the most important 10 orders is given in Fig. 7 as the means of the two years. The members of the orders Orthoptera and Hymenoptera in summer play a less significant role, while those of Coleoptera, Heteroptera and Homoptera greatly increase in number. A comparative stability is seen in Isopoda and Araneidea. The emerging imagoes of Lepidoptera and Diptera reach the highest number in July. New individuals of Acariformes do not emerge at the end of summer. The Collembola populations owing to their great number are not included herein.

The mentioned systematic categories well indicate the percentual compositions however, the zoocenosis could only be ascertained if the entire material were broken down to specific level, thus the structural elements built up along the food-chain (Szelényi 1955) were grouped accordingly. However, our present aim was to survey the large categories persuing the same mode of life.

Scavenger elements

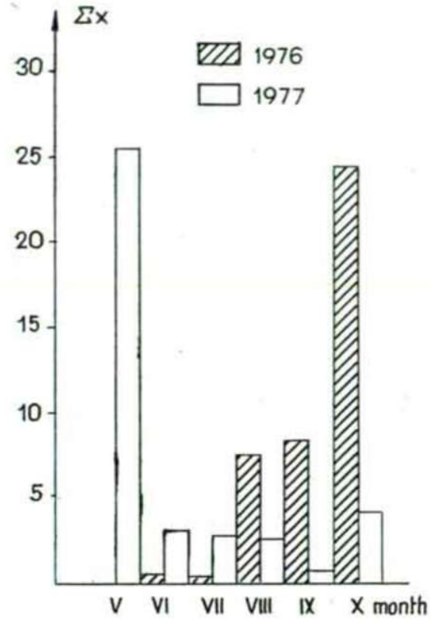
The consumers of dead plant and animal remains are primarily the Collembola (Fig. 8). Their number in October, 1976, following a small drop in number, sharply rose. The peak was reached in May, 1978 this was again followed by a decrease, however, once more in October a slight increase was observed. Life-conditions in May and in October are most favourable for Collembola: relative humidity (Tables 3, temperature of the soil surface as well as in the air is not too low, nor is it too high. In the two peak periods of increase the vegetable production reaches its maximum, while in the intermediate period the temperature sharply rises and the precipitation drops. Consequently, the best periods for food-intake are in spring and at the end of summer. The contradictory maximum also recorded over the two-year period may be due to the inadequately known life-cycle of Collembola (special attention should be paid to their development during the winter months), or very likely also to the extreme conditions of the two sites being some 800 m apart. In 1976 the research area was mowed and humans as well as animals freely moved about it. On the other hand, in 1977 the area was protected from such influences.

The following species of Collembola were collected in 1976 at Kiskundorozsma (identified by I. LOKSA):

Xenylla maritima TULLB.
Entomobrya marginata TULLB.
Bourletiella viridescens STOCK, s. GIS.
Orchesella cincta (L.)
Lepidocyrtus cyaneus TULLB.
Lepidocyrtus paradoxus UZEL
Isotoma viridis BOURL.
Seira pallidipes REUT.
Podura aquatica (L.)

The terricolous *Xenylla maritima* was represented in a strikingly high number. For example, in August, 1976 1588 adult and 428 juvenile specimens were captured in the upper collecting box of trap No. 19. At the same time the soil trap of this very apparatus only 68 adults and 40 juveniles were collected. On the other hand, in trap No. 15 the upper and lower traps showed the following values: 1094+244 and 106+86. The number of specimens in the other traps was greatly varying, or rather low. The number of the other species compared to *Xenylla,* similarly to results obtained in Bugac, is insignificantly small.

Among the other scavengers from the adult and juvenile forms of Isopoda the species *Armadillidium vulgare* LATR. was the most frequent (Table 4; Fig. 9). The graph showing the quantity of Isopoda in both years is very similar (Fig. 10) though one month difference exists between the two. Since in 1977 already in June there was a maximum value, that was smaller than the respective value for 1976. From thereon the number of Isopoda in the traps gradually decreases but in August it rises again. The one month delay in 1976 was caused by varying weather conditions. Since *Armadillidium vulgare* favours the dry, warm condition, consequently, the sunny weather with less precipitation at the end of summer of 1977 was promoting a good



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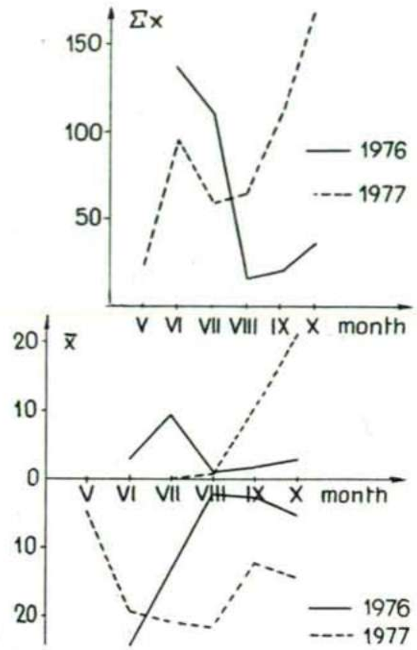

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Fig. 8. The quantity of the most important scavenger element: Collembola. — Fig. 9. The total of Isopoda in 1976—1977. — Fig. 10. The average of specimen number of Isopoda in the upper and lower traps.

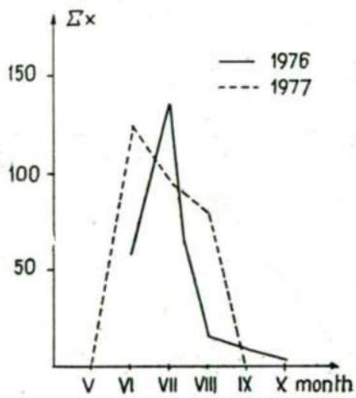
proliferation (Fig. 9). There is a difference between the catches of the upper and the lower traps (Fig. 10). Obviously the soil-traps catch a better number of specimens unable to fly than the upper traps. On the other hand, interestingly enough the number of captured specimens from August in 1976 is the same for the upper as well as for the lower trap. In 1977 the soil-traps showed an early maximum that was quite prolonged.

Only a very small number of Diplopods were collected over the two-year period, a total of 12 specimens. The very common *Polydesmus complanatus* POLAT was also captured here. In both years the best month was October (Table 4), very likely it was due to the cooler and more humid climate.

A part of Coleoptera occurred as the members of Staphylinoidea, but some obstant elements were also among them. Quantitatively they were insignificant.

Corrumpent elements

Most important representatives are the members of the suborder Acridoidea in Orthoptera. A rather less number of Tettigonoidea was observed, while no specimens of Grylloidea were present. As primary consumers a large number of juvenile specimens was captured especially in May and June. As they progressed in development the imagoes became dominant in summer months. The change in the total number of specimens over the two years is shown in Fig. 11, while the mean values of the soiltraps are given in Fig. 12. Among the yearly totals the one in 1976 was the highest, but after adjustment of the average values (Fig. 12) the one for 1977 came out better. The peak values both for the upper and lower traps in both years were more or less the same. The peak of proliferation in 1977 was somewhat prolonged. This might have been influenced by the higher vegetal production of 1977. The average values show identical courses, the maxima in both years well correspond. The height of graphs (Fig. 12) according to the movement of Orthoptera is different in the upper and in the lower traps. The zero-values indicate the spring and late autumn months, when the animals were either in eggs or in very young larval stadia. This especially emphasizes the basic principle of emergence traps, i.e. by using it we collect specimens emerging from the soil, or those living in that particular covered surface area.



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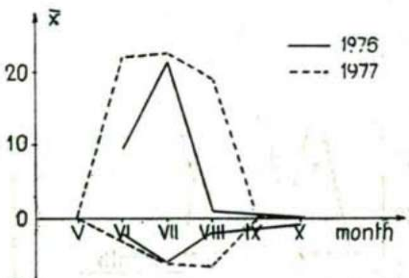

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Fig. 11. The total of the most important corrumpent element: Orthoptera, for the two years. — Fig. 12. The average of specimen number of Orthoptera in the upper and lower traps.

The populations of Homoptera yielded a higher number of individuals than those of the previous group (Table 4, Fig. 13), but owing to their minute size, obviously their significance is only secondary. The traps mainly collected the members of the following superfamilies: Auchenorrhyncha, Psyllina and Aphidina. The populations of these superfamilies proliferated in different times (Fig. 13). In 1976 the members of Auchenorrhyncha were common in the second half of summer, well illustrated by the graph representing the upper trap. In 1977 the number of Psyllina and Aphidina was higher and the peak occurred already in June, compared to July—August in the previous year. The collectings of the upper and lowers traps were proportional in 1977. While the same cannot be said for 1976, since for the upper trap maximum the soil-traps showed a July maximum. This is justified by the juvenile proliferation to be caught in the soil-traps, while in August the adult specimens easily reached the upper traps owing to their ability to fly.

From among Heteroptera (Fig. 14) primarily the phytophagous species have been captured. The May maximum in 1977 coincided with the best production of plants. On the other hand, their number is strikingly low in 1976, and the catches in September—October comprised mainly juvenile specimens.

The members of Lepidoptera (Fig. 15) are rather insignificant, only the Microlepidoptera were in measurable number.

Owing to their larval food Hymenoptera may be ranked among the corrumpent elements, too including the gall-making Cynipoidea populations. In 1976 their number was small, on the other hand, strikingly large number (179 specimens) emerged in 1977 (Table 5).

Rarely some species of Thysanoptera were also captured.

Among the larvae the members of the following orders have been recorded: Lepidoptera, Coleoptera, Heteroptera and Diptera.

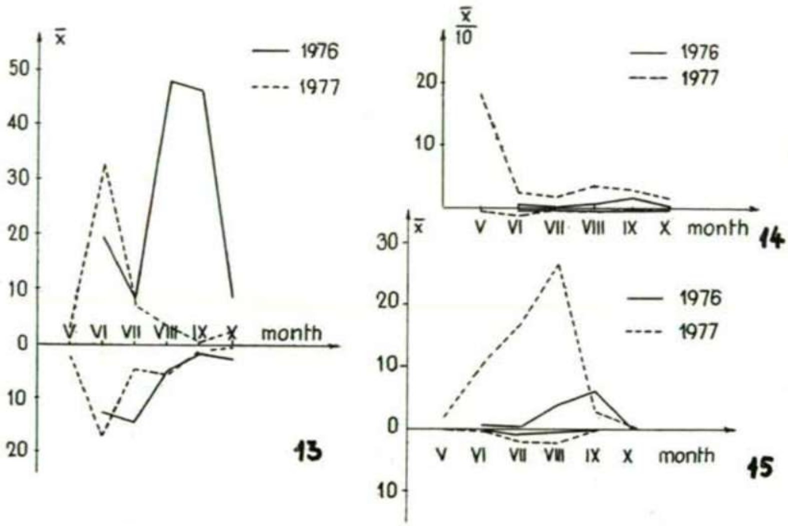


Fig. 13. The average of specimen number of Homoptera in the upper and lower traps. — Fig. 14. The average of specimen number of Heteroptera in the upper and lower traps. — Fig. 15. The average of specimen number of Lepidoptera in the upper and lower traps.

Obstant elements

These are the secondary consumers, obstracting over-proliferation, primarily the populations of Araneidea (Table 4). In both years their populations were the highest in both sets of traps in June (Fig. 16).

Among the insects the great majority of Hymenoptera belong to the obstant elements mainly due to the larval development (Tables 4 and 5): Inchneumonoidea, Chalcidoidea, Proctotrupoidea, Bethyloidea, Scolioidea and Sphecoidea, while Formicoidea belongs here also on imago basis too. Hymenoptera are most numerous, as it has been proved by the two-year research, in June (Fig. 17). The distribution of superfamilies are given in Table 5. Owing to the fact, that when selecting a site for the erection of a trap we avoided the proximity of ant-nests, their number is below to their supposed significance in that area.

The two-year total of Diptera (Table 4), as their number broken down to months, always surpasses the same of Hymenoptera. Their significance is nevertheless comes after Hymenoptera, since Tachinidae were represented by a small number of individuals only. The graph (Fig. (18) shows the changes of Diptera totals without regard to obstant or sustinent elements. The early spring increase reaches its peak in May—June. In July scarcely any new emergence takes place. While in August emergence again in on the increase, but after that their number gradually decreases.

The number of emerged Neuropteroidea is comparatively small. The maximum for the fully developed imagoes is in June (Table 4).

The graph of Coleoptera (Fig. 19), similarly to Diptera, comprising the total of specimens, shows the fluctuation in monthly units. The number of Coleoptera in 1977 was better than in 1976, since the June maximum was followed by a secondary peak in September. Due to their agility a greater number of beetles was captured in the upper than in the lower traps. It should be noted that Coleoptera, both as larvae and adults, and also to the rather heterogenous mode of life of the various groups, may only be partly ranked as obstant elements (e.g. Carabidae, Coccinellidae, Cicindelidae).

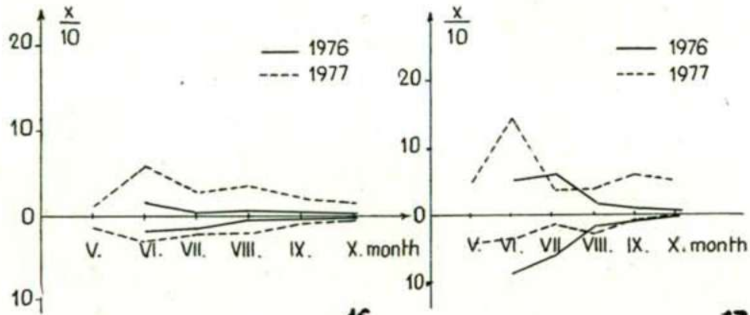
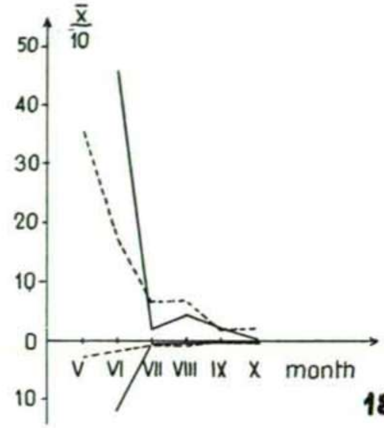


Fig. 16. Among the obstant elements the number of Araneidea is significant. — Fig. 17. The average specimen number of Hymenoptera.

Sustinent elements

The rest of the insects, like Apoidea, some Diptera (e.g. Syrphidae), many groups of Coleoptera help fertilization of plants. The data of Fig. 17—19 would yield only after a detailed study of the species composition the monthly changes of sustinent elements. It is most likely that the water covering the area in 1976 entirely abolished the Apoidea population, since no specimen emerged. Their number in 1977 was very small because they build nests in loose, sandy soils, rather than in hard, alkali soils.

In summary we may establish that the emergence traps placed out at Kiskundorozsma captured in the period of 1976—1977 an outstandingly great proportion of scavenger elements (80 174) as shown in Fig. 20, while the obstant elements (7466),



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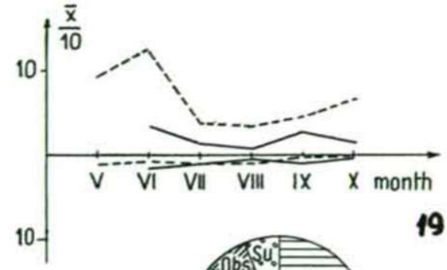

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Fig. 18. The average specimen number of Diptera. — Fig. 19. The sustinent element: Coleoptera. — Fig. 20. The distribution of animals captured in emergence traps according to mode of life.

Table 5. The monthly distribution of Hymenoptera broken down to superfamilies with regard to obstant, sustinent and corrumpent elements.

	Obstant										Sustinent	Corrumpent
	Inchneumonoidea		Chalcid.	Proctotrup.	Bethyl.	Scoli.	Formic.	Pompil.	Sphec.	Obstant total		
	Ichn.	Brac.-dae									Apoid.	Cynip.
1976												
VI. 4— VII. 9.	35	48	97	324	—	—	176	6	—	686	—	10
VII. 9.— VIII. 7.	14	4	31	53	—	—	523	11	—	636	—	6
VIII. 7— IX. 3.	8	3	17	18	4	—	94	5	3	152	—	8
IX. 3— X. 4.	16	3	5	8	3	1	40	8	1	85	—	1
X. 4— XI. 8.	2	—	1	—	—	—	3	—	—	6	—	—
VI.— XI.	75	58	151	403	7	1	836	30	4	1565	—	25
1977												
V.6— VI. 6.	20	2	73	103	4	—	—	16	—	218	—	179
VI. 6— VII. 9.	68	—	410	131	1	—	10	13	18	651	—	71
VII. 9 — IX. 6.	32	3	210	75	—	—	15	22	6	363	1	38
IX. 6— X. 7.	13	—	5	14	—	—	5	2	—	39	2	—
X. 7— XI. 4.	6	2	5	1	—	—	2	—	—	16	—	—
1977. V.—XI.	139	7	703	324	5	—	32	53	24	1287	3	288
1976+1977	214	65	854	727	12	1	868	83	28	2852	3	313

the corrumpent elements (5572) and the quantity of sustinent elements (5445) was significantly less. The individual elements may be compared with reservations when considering species representation, magnitude and efficiency, for more detailed study is needed, consequently, this present study should only be taken as tentative and orientative in nature.

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