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ANALYSIS OF THE OCCURRENCE OF NEMATODES
IN ALFALFA CROPS
III. SOME OBSERVATIONS ON AGE STRUCTURE*

The age structure of nematodes occurring in two alfalfa plantations was determined on the basis of the relation in percentages between larvae and imagines. These relations were examined in the case of nematodes occurring in the upper parts and roots of alfalfa plants and in the soil, and also among ecological nematode groups, and additionally in populations of different species.

In the preceding two studies (Wasilewska 1967a, 1967b) the nematodes occurring in two alfalfa plantations were divided into ecological groups. The present study adds some observations on the age structure of species from different ecological groups of nematodes of the same plantations, referring to:

1. Quantitative proportions between the imaginal and larval forms of nematodes occurring in the upper parts and roots of alfalfa plants and in the soil.
2. Quantitative proportions between the larval and imaginal forms of species forming ecological groups.

I. STUDY AREA AND METHODS

A description of the two alfalfa plantations (stations *A* and *B*), from which plant and soil samples were taken over the course of two years (1960-1961

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and 1962–1963) for nematode contents, and also the sampling methods, were given in the first part of the whole study (Wasilewska 1967a). The present study is based on the same material. Age structure was examined only as the ratio of larval to imaginal individuals in defined habitats, ecological groups and populations of various nematode species. The percentage was therefore calculated of larvae and imagines, taking the sum total of both the former and latter as 100%. Individuals, in which the primary and secondary sex characters were fully marked, that is, females with open vulva and males with completely formed spiculae, were considered as imagines. The remaining individuals were treated as larvae. Quantitative proportions between larval and imaginal individuals in the upper parts and roots of the plants and in the soil were determined on the basis of material collected and treated jointly from the two study periods, i.e. 1960–1961 and 1962–1963. On station *A* these were observations of nematodes occurring in a one-year and three-year old plantation, and on station *B* a three-year and five-year old alfalfa plantation. The analysed species of nematodes were examined and allocated to ecological groups in accordance with Paramanov's classification (Paramanov 1952, 1962 and 1964). Proportions between larval and imaginal individuals in different ecological groups were determined on the basis of combined samples from the two-year period.

II. AGE STRUCTURE

In the alfalfa plantations examined the great majority of nematodes occurring were larval individuals (Figs. 1 and 2). Larvae formed 65–72% of all the nematodes occurring in the soil and roots of alfalfa plants during the study

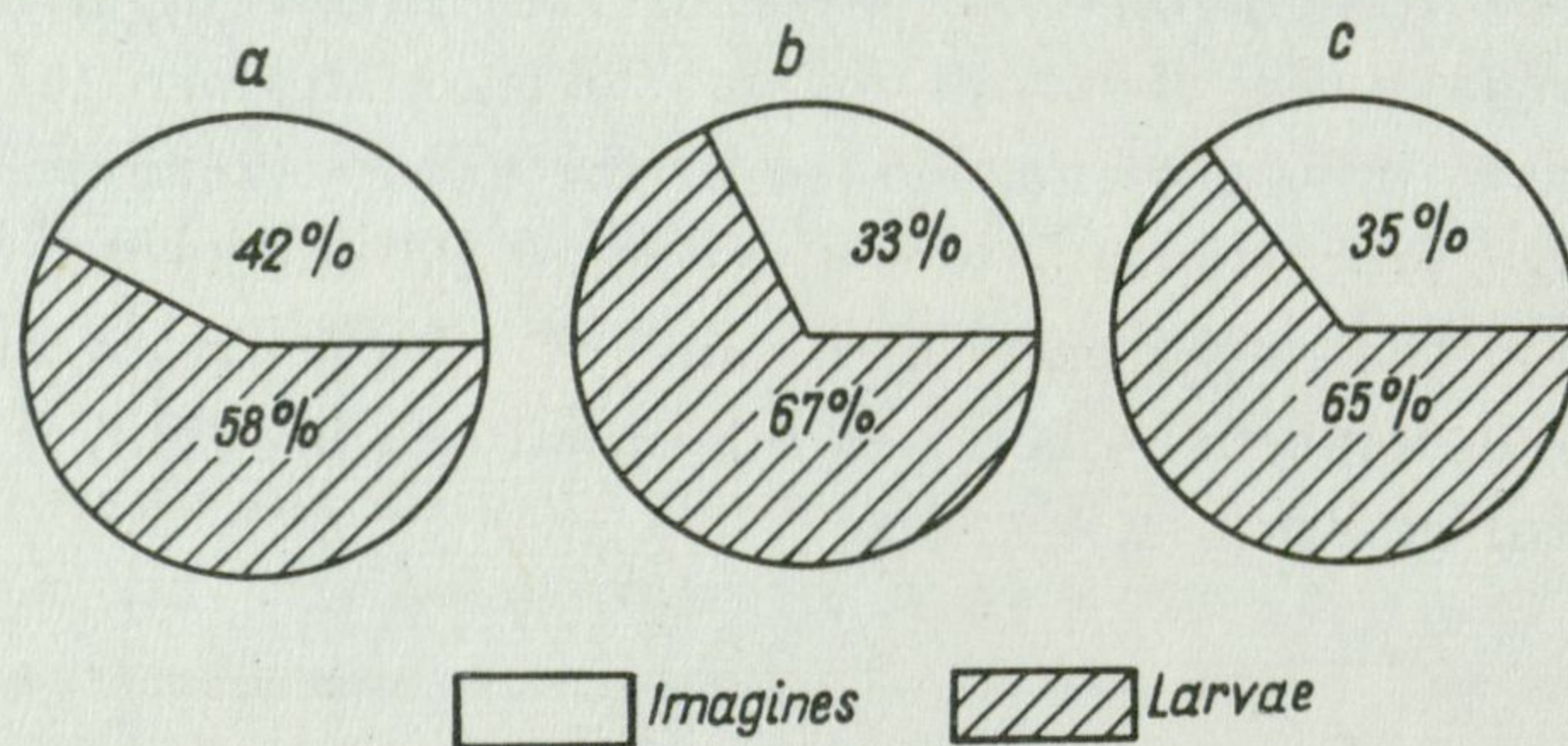


Fig. 1. Percentages of larval and imaginal forms of nematodes in the upper parts (a), roots (b) of alfalfa plants and in the soil (c) on station *A*

period. In the upper parts of the plants the percentage of larval individuals was smaller than in the soil and roots, while the percentage of imaginal in-

dividuals in the upper parts of plants, forming as much as 42% on station *A* and 43% on station *B*, was markedly higher in comparison with the percentage of imagines in soil and roots. The fact that the percentages of all larval and

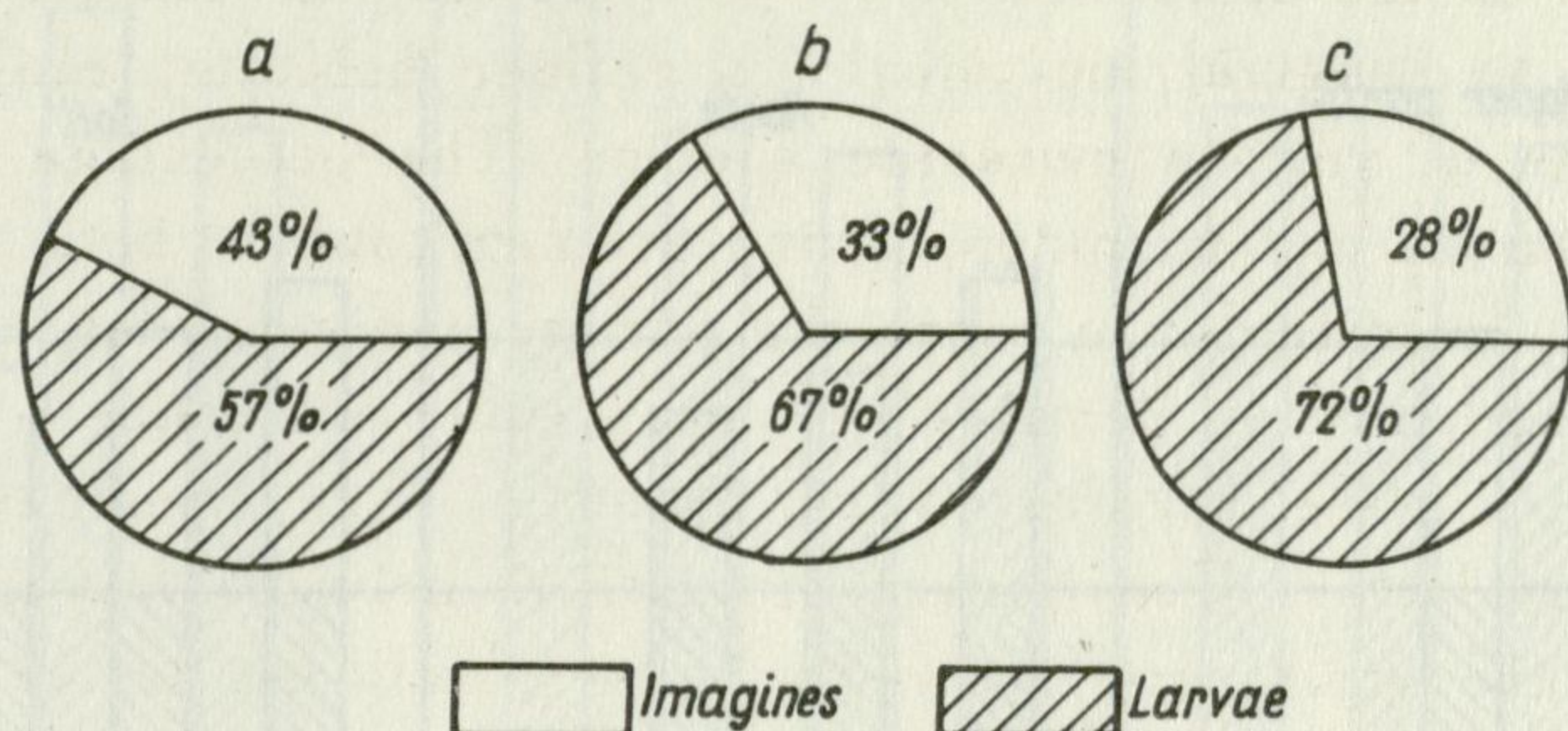


Fig. 2. Percentages of larval and imaginal forms of nematodes in the upper parts (a), roots (b) of alfalfa plants and in the soil (c) on station *B*

imaginal individuals in the upper parts and roots of plants were similar on both stations, which differed both as to situation, type of soil and age of the plantation, would appear to be characteristic (Figs. 1 and 2).

The ratio of larval to imaginal individuals was not uniform in the different ecological groups. The groups distinguished coincide to a great extent with taxonomic units; thus the eusaprobionts distinguished are simply *Rhabditidae* and *Diplogasteridae*, pararhizobionts are chiefly *Dorylaimida*, hemisaprobionts are *Cephalobidae* and *Panagrolaimidae* (apart from the genus *Plectus*) and plant parasites are *Tylenchida*.

The percentage of larval and imaginal individuals in the ecological groups of nematodes in the upper parts and roots of plants and in the soil for station *A* is shown in Figure 3, and for station *B* in Figure 4. The comparison is based jointly on over 16,000 individuals (Wasilewska 1967a).

Although larval individuals formed the majority of the sum total of nematodes in almost all ecological groups, differences could be found between them. It was possible to arrange ecological groups according to increasing percentages of larval individuals (or decreasing – imaginal). In the group of plant parasites the larval individuals formed 42.4% in the upper parts of plants on station *A* and 56.5% on station *B*; correspondingly for roots 59.5% and 55.0% and in the soil 59.5% and 69.5%. This group was therefore distinguished by the lowest percentage of larvae in comparison with the other groups (and the highest percentages of imagines) in the upper parts and roots of plants on both stations and in the soil on station *B*. In respect of the percentage of larval forms the group of hemisaprobionts came second (with the exception of the soil on station *B*, where the percentage of larvae was 3.4% lower than in the

group of plant parasites). The percentages of larval individuals in the group of hemisaprobionts were similar on both stations in the roots and soil: 71.5% in roots on station *A*, 72.4% on station *B*; correspondingly in the soil 66.0%

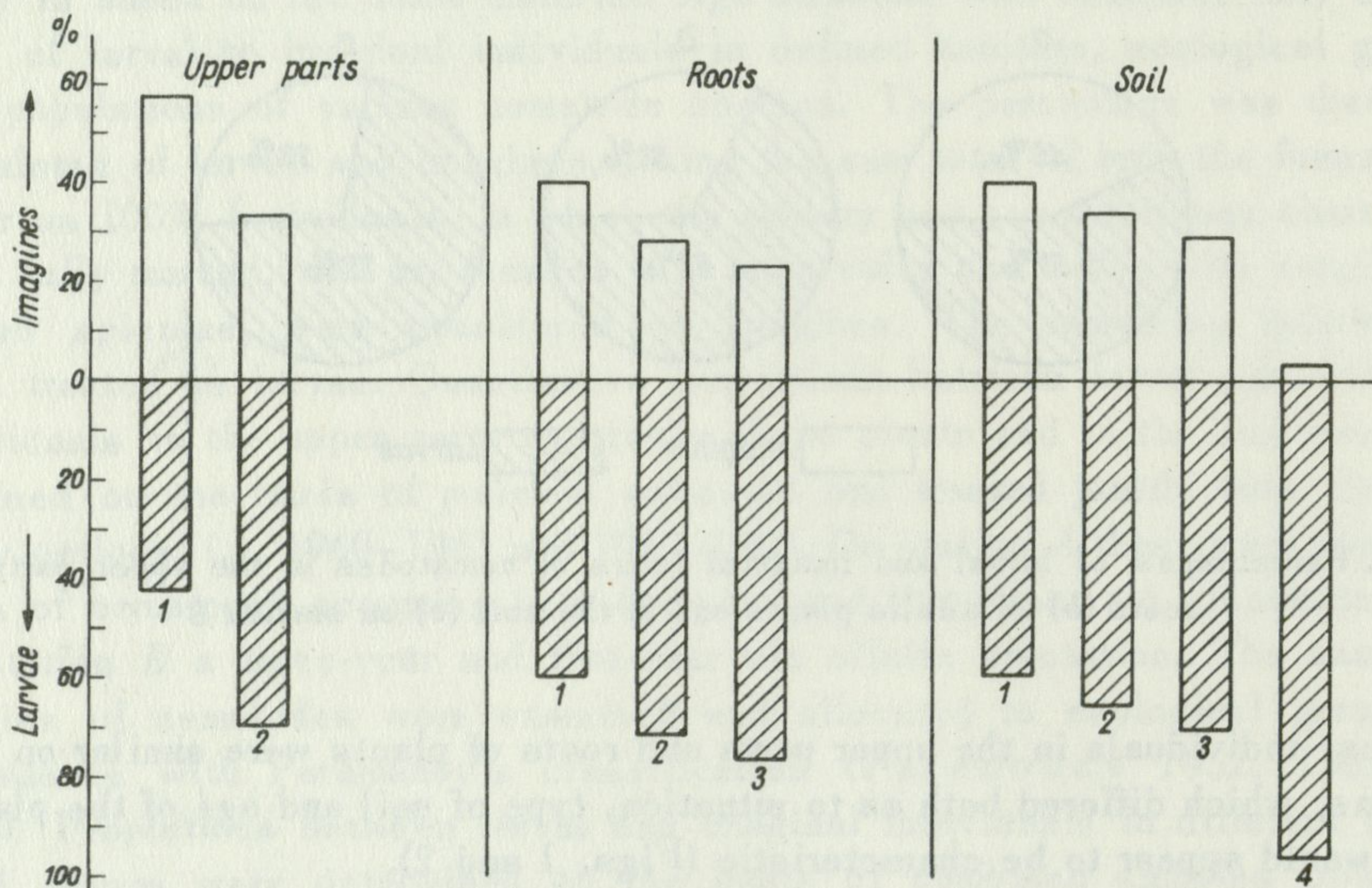


Fig. 3. Percentage of larvae and imagines in ecological groups in the alfalfa plantation on station *A*

1 — plant parasites, 2 — hemisaprobionts, 3 — pararhizobionts and 4 — eusaprobionts

and 66.1%. In the upper parts of plants they differed considerably, since on station *A* the figure was 66.9% and on station *B*, 57.3%. Even higher percentages of larvae were found in the group of pararhizobionts. On both stations in each of the habitats these percentages were higher than those in the above two groups, varying from 70.5% to 76.5%. The last ecological group, eusaprobionts, was characterised by the highest percentage of larval individuals (and thus the lowest percentage of imagines), being 96.8% in the soil on station *A* and 94.4% on station *B* and 90.0% in the roots on station *B*. Eusaprobionts did not form a numerous group in any of the other habitats, which made comparison impossible.

In order to illustrate the age structure of populations of different nematode species the percentages of larvae of the most numerous species of the pararhizobiont. group are given in Table I, hemisaprobionts in Table II and plant parasites in Table III.

The regular increase of larval individuals in the arrangement given of ecological groups, in the following sequence: plant parasites — hemisaprobionts — pararhizobionts — eusaprobionts, and almost in all cases the similar percentages

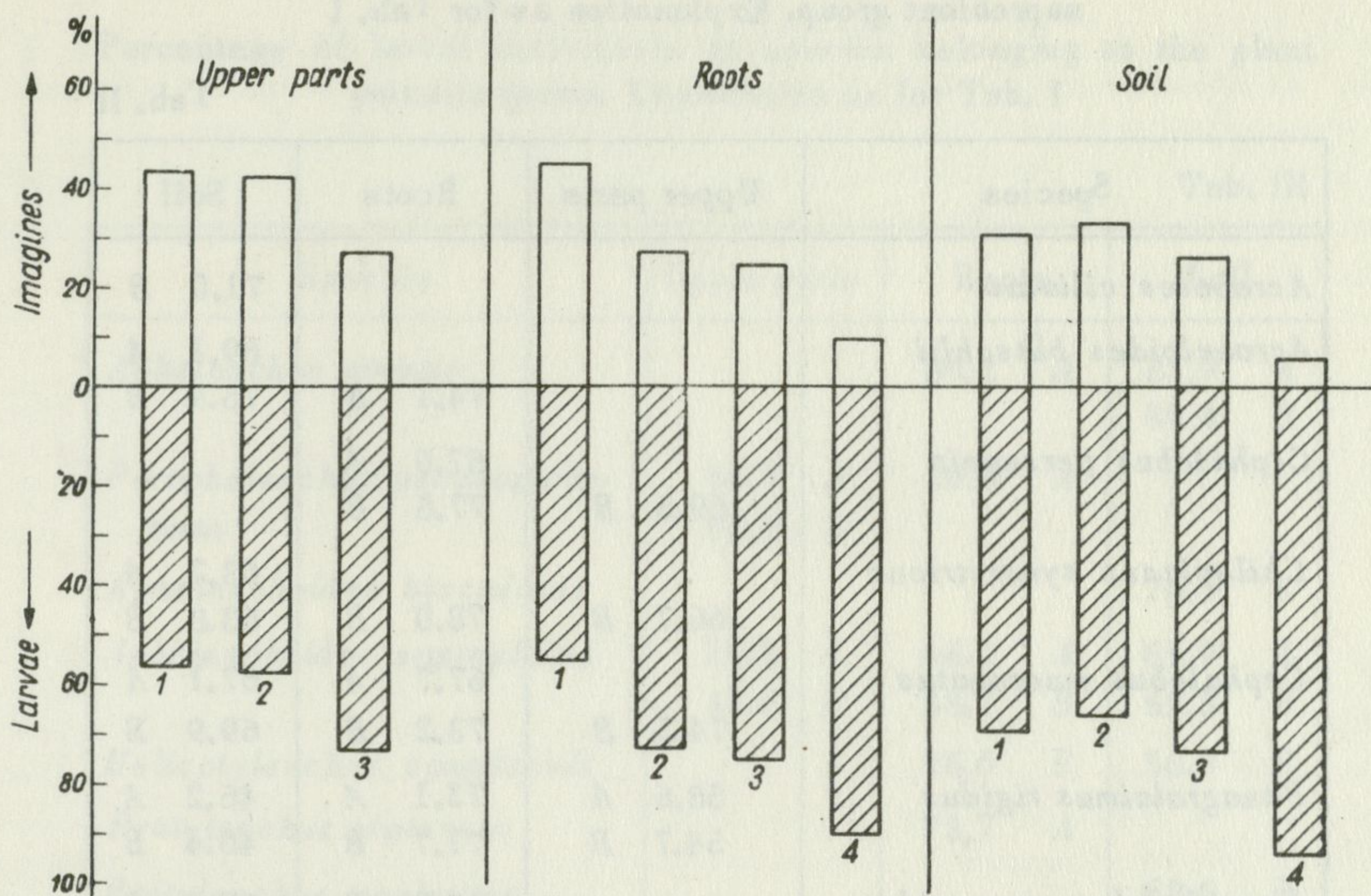


Fig. 4. Percentage of larvae and imagines in ecological groups in the alfalfa plantation on station B
Explanation as for Fig. 3

Percentage of larval individuals in species belonging to the pararhizobiont group. The sum total of larvae and imagines was taken as 100%. Letters A and B indicate stations

Tab. I

Species	Roots	Soil
<i>Eudorylaimus pratensis</i>		89.9 B
<i>Eudorylaimus monohystera</i>		82.2 A
<i>Diphtherophora communis</i>		78.5 A
<i>Diphtherophora brevicolle</i>		77.8 B
<i>Mesodorylaimus bastiani</i>	65.0 A 73.9 B	
<i>Dorylaimellus parvulus</i>		64.3 A

of larvae (or imagines) in analogical groups on two different stations of the same culture would seem to point to the existence of a connection between age structure and living conditions of the various ecological groups. Such considerable differences in age structure between nematodes of the eusaprobiont group and nematodes of the groups closely connected with plants (plant para-

Percentage of larval individuals in species belonging to the hemisaprobiont group. Explanation as for Tab. I

Tab. II

Species	Upper parts	Roots	Soil
<i>Acrobeles ciliatus</i>			71.0 B
<i>Acrobeloides bütschlii</i>			69.1 A
		74.1 B	75.9 B
<i>Cephalobus persegnis</i>		67.6 A	
	69.5 B	77.5 B	
<i>Chiloplacus symmetricus</i>			63.7 A
	66.7 B	78.0 B	63.8 B
<i>Cephalobus mucronatus</i>		67.7 A	67.1 A
	74.5 B	73.2 B	69.9 B
<i>Panagrolaimus rigidus</i>	58.6 A	73.1 A	46.2 A
	54.7 B	71.7 B	46.4 B
<i>Eucephalobus oxyuroides</i>		53.9 B	68.6 B
<i>Plectus granulosis</i>		57.6 A	
	70.4 B	67.6 B	
<i>Acrobeloides setosus</i>			57.7 B

sites, hemisaprobionts) are most probably the result of different mortality rates. The great rapidity of ontogenetic development, considerable fecundity and high mortality rate of eusaprobionts must be countered by the far slower development, lesser fecundity (apart from sedentary species such as, for instance, *Heteroderidae*), and therefore greater longevity of the remaining groups (Paramonov 1962).

III. CONCLUSIONS

With regard to the quantitative proportions of larval and imaginal forms of nematodes in the alfalfa plantations examined it may be said that:

1. Nematodes occurred in the great majority in larval form in both the upper parts and roots of plants and in the soil.

2. The percentage of larval individuals in ecological groups (which in fact correspond to definite taxonomic units) differed, and made it possible to arrange these groups according to increasing percentage of larval individuals (or decreasing percentage of imaginal forms). This arrangement was in the following order: plant parasites – hemisaprobionts – pararhizobionts – eusa-

Percentage of larval individuals in species belonging to the plant parasite group. Explanation as for Tab. I

Tab. III

Species	Upper parts	Roots	Soil
<i>Aphelenchus avenae</i>		89.2 A	81.9 A 89.4 B
<i>Paraphelenchus pseudoparietinus</i>	66.7 A 83.3 B	70.6 A	
<i>Aphelenchoides bicaudatus</i>			70.5 B
<i>Aphelenchoides saprophilus</i>	38.8 A 45.0 B	64.1 A 53.7 B	61.9 A 62.5 B
<i>Helicotylenchus canadensis</i>		76.6 B	56.0 B
<i>Pratylenchus pratensis</i>		73.7 A	
<i>Pratylenchus neglectus</i>			68.6 B
<i>Tylenchorhynchus dubius</i>	55.3 B	50.5 B	74.7 B
<i>Tylenchorhynchus brevidens</i>		45.7 B	66.5 B
<i>Ditylenchus medicaginis</i>		49.2 A 59.1 B	
<i>Ditylenchus intermedius</i>		48.0 B	
<i>Aglenchus costatus</i>		67.3 B	63.4 B
<i>Tylenchus vulgaris</i>		42.0 A	30.0 A
<i>Tylenchus minutus</i>			42.9 A
<i>Tylenchus ditissimus</i>			40.5 A
<i>Boleodorus thylactus</i>			48.4 A
<i>Paratylenchus microdorus</i>			53.8 A
<i>Paratylenchus aciculus</i>			42.7 A
<i>Paratylenchus nanus</i>			33.7 A

probiotics. It must therefore be assumed that there is a connection between age structure and the living conditions of the various ecological groups.

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ANALIZA ZASIEDLENIA NICIENI W UPRAWACH LUCERNY. III. KILKA OBSERWACJI NAD STRUKTURĄ WIEKOWĄ

Streszczenie

Zbadano stosunki ilościowe pomiędzy osobnikami larwalnymi i imaginalnymi nicieni zasiedlających dwie plantacje lucerny. Opis terenu badań, metodyka oraz podział nicieni na grupy ekologiczne przedstawiono w poprzednich pracach (Wasilewska 1967a, 1967b). Stosunki ilościowe określano na podstawie udziału procentowego larw i imagines (jako 100% przyjęto sumę larw i imagines) występujących w częściach nadziemnych i korzeniach lucerny oraz glebie (fig. 1 i 2), jak również wśród nicieni tworzących grupy ekologiczne w powyższych środowiskach (fig. 3 i 4), a ponadto w obrębie populacji poszczególnych gatunków (tab. I, II, III). Wysznięto następnące wnioski:

1. Nicienie występowały w przeważającej większości w postaci form larwalnych zarówno w częściach nadziemnych roślin, jak korzeniach i glebie.

2. Udział procentowy osobników larwalnych w grupach ekologicznych (odpowiadających zresztą określonym jednostkom taksonomicznym) był różny. Grupy te można uszeregować w następnący sposób według wzrastającego udziału ilościowego osobników larwalnych (lub malejącego — imaginalnych): pasożyty roślin — hemisaprobionty — parazytobionty — eusaprobionty. Przypuszczać zatem należy, że istnieje związek między strukturą wiekową a warunkami życia poszczególnych grup ekologicznych.

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