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STUDY OF HARMFUL COLEOPTERA FAUNA ON SUNFLOWER DURING SPRING IN THE NORTH-EASTERN PART OF YUGOSLAVIA

Pests mostly damage sunflower during germination and emergence, when the attack of pests results in post-sowing and re-sowing on large areas. Much harm is very often caused by larvae Elateridae and a regular control of their population is therefore necessary by the method of soil tests before sunflower sowing. A considerable number of Coleoptera species which in the stage of imago are additionally fed in spring, can also badly attack sunflower during vegetation. In order to study the quality and quantity of their population, we have used the method of pitfalls of Barber's type. These investigations were carried out in Voevodina - the north-eastern part of Yugoslavia - on four chernozem plots (chernozem is the prevailing type of soil in Yugoslavia) and on one black hydromorphic plot. The pitfalls were set in early April 1973 and were inspected twice with an interval of three weeks. Accordingly, the length of the period in which the insects were collected was about a month and a half. On every plot 30 pitfalls were diagonally set - 10 at the edges and 10 in the middle, with spacing of 15 m between pots in every group.

The results obtained are presented in the tables using relative numbers to make the comparison easier.

On all five plots investigated we found 19,648 Coleoptera individuals. After inspection 19 families were identified 56.7% of which were Carabidae. The second and the third place were occupied by the families Tenebrionidae (18%) and

Curculionidae (11% of all individuals), which makes 29% of potential sunflower pests.

As regards the other phytophagous families, sunflower pests are Scarabaeidae, Elateridae and Alleculidae. However, their proportion among the collected material of insects was rather low: Scarabaeidae accounted for 1.7%, Elateridae 0.91% and Alleculidae for only 0.01% of all individuals. The reason for this should be searched in the fact that the exodus of the dominant species in the investigated soils occurs much later, while Alleculidae rarely occur in large numbers. Besides, they damage sunflower at the stage of larvae and the abundance of imago cannot serve as a reliable indicator in short-term forecasting.

To compare the plots we took the percentage of Carabidae, pest group (Tenebrionidae, Curculionidae, Scarabaeidae and Elateridae) and all other Coleoptera. Nearly on all plots, as can be seen from Table 1, Carabidae prevailed on black hydromorphic soil 65.48% and on chernozem (from 68.33 to 75.61%) on nearly all plots only one plot being an exception. Here Carabidae accounted for only 7.99% of collected individuals and representatives of the group of pests occupied the first place with nearly 70%.

As regards the important role played by Carabidae in regulating the population of harmful insects, this relation is an apparent example of disturbance in the natural biological balance. The proportion of all other representatives of Coleoptera ranged from 3.30 to 22.27%, depending on the plot.

The percentage of four families from the group of pests (Curculionidae, Tenebrionidae, Scarabaeidae and Elateridae) also changed depending to the plot (see Table 2).

It can be seen that Curculionidae prevailed on two chernozem, plots (82.86% and 85.96%), and Tenebrionidae were 78.89% on a chernozem plot and 93.49% and on a black hydromorphic plot. On one of the chernozem plots the propor-

Table 1

The Correlation of the Group of Pests,
Carabidae and Other Coleoptera (%)

Family group	Plot					Note
	1	2	3	4	5	
Pests	24.41	26.62	6.42	69.74	23.87	1-4 chernozem
Carabidae	68.33	70.08	75.61	7.99	65.48	5 black hydromorphic soil
Coleoptera	7.26	3.30	17.97	22.27	10.65	

Table 2

The Proportion of Four Families of the
Pests Group

Family	Plot				
	1	2	3	4	5
Curculionidae	82.86	85.96	26.72	15.33	1.66
Tenebrionidae	3.08	2.61	26.72	78.89	93.49
Scarabaeidae	8.61	7.07	13.79	5.22	1.38
Elateridae	5.44	4.35	32.76	0.56	3.46

tion of the two families was the same (26.72%). At the same time this plot was dominated by Elateridae (32.76%). Accordingly, the species from the families Curculionidae and Tenebrionidae, as the bulk of the Coleoptera fauna which affects sunflower in spring, undergo changes, i. e. their economic importance depends on the plot, however, it also happens that their proportion remains the same.

Considerable numbers of Elateridae on the chernozem plot No. 3 can be explained by the fact that the plot actually lies on a loess plateau mostly populated by the species *Agriotes sputator* which become adult early in spring. All other plots are on loess terraces, where the dominant species is *Agriotes ustulatus* in which the eclosion of the adult insects happens in early summer. Therefore, in our pitfalls there were no samples of this species.

The number of species in the group of pests ranges about 20. However, the great majority of individuals belong to a small number of species. We were only concerned with two or three main species in each family. Data on the proportion of individuals in the main and other species belonging to different families are given in Table 3.

On all four chernozem plots three species prevailed in the populations of Curculionidae: *Psalidium maxillosum*, *Otiorrhynchus ligustici* and *Tanymecus dilaticollis*, which are dangerous for sunflower at the stage of germination and emergence. The species *Tanymecus palliatus* which also damages the sunflower at the same time, was found on two chernozem plots. However, both *Tanymecus* species were present on black hydromorphic soil, while no samples of the two previous species were found there.

In the Tenebrionidae population only the species *Opatrum sabulosum* is harmful for sunflower. This species was the most numerous on all in-

Table 3

Percentual Relation of the Main and Other Species per Families from the Group of Pests

Species, order	Plot				
	1	2	3	4	5
Curculionidae:					
<i>Psalidium maxillosum</i>	42.02	41.01	38.71	17.70	0.00
<i>Otiorrhynchus ligustici</i>	36.32	25.44	32.26	34.70	0.00
<i>Tanymecus dilaticollis</i>	20.24	32.15	6.45	41.10	4.10
<i>T. palliatus</i>	0.00	0.00	12.90	5.10	4.10
<i>Sitona</i> spp.	0.44	0.51	6.45	0.00	12.50
<i>Ceuthorrhynchus</i> spp.	0.11	0.12	0.00	0.00	41.60
Other	0.87	0.88	3.23	1.20	37.50
Tenebrionidae:					
<i>Opatrum sabulosum</i>	52.94	54.53	77.42	99.76	99.60
<i>Blaps</i> spp.	47.06	45.47	22.58	0.19	0.00
Other	0.00	0.00	0.00	0.05	0.40

Table 3 (cont.)

Species, order	Plot				
	1	2	3	4	5
Scarabaeidae:					
<i>Tropinota hirta</i>	93.68	95.49	62.50	15.70	0.00
<i>Maladera holosericea</i>	0.00	0.00	0.00	0.00	5.00
<i>Rhizotrogus aequinoctialis</i>	2.10	0.00	0.00	0.70	0.00
<i>Anisoplia austriaca</i>	0.00	0.00	6.25	0.00	0.00
Other	4.21	4.51	31.25	83.57	95.00
Elateridae:					
<i>Agriotes</i> spp.	85.00	72.50	94.74	86.67	88.00
<i>Melanotus cinerascens</i>	3.33	27.50	0.00	0.00	0.00
<i>Adraustus</i> spp.	11.67	0.00	0.00	6.67	4.00
<i>Drasterius bimaculatus</i>	0.00	0.00	5.26	6.67	8.00

vestigated terrains and on some terrains it was the only one composing over 99% of the individuals of this family. This proportion was only registered on those plots where Tenebrionidae were absolutely predominant in the group of pests.

Tropinota hirta prevailed among the Scarabaeidae on three chernozem plots. Apart from flowers of different plants, this species also damaged sunflower leaves.

Maladera holosericea can be dangerous for sunflower when they appear on masse on sandy chernozem. On the investigated terrains it was found only on black hydromorphic soil and in small numbers.

Among the Elateridae family the dominant were species from the order Agriotes. They accounted to 72.50 to 94.74% on all investigated terrains and were the main pests in this group of insects.