

A STUDY OF THE OCCURRENCE AND HARMFULNESS OF BUGS (HETEROPTERA)  
ON SUNFLOWER

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SUMMARY

A long-term study conducted in northeastern Yugoslavia (Vojvodina Province), the main sunflower-growing region of the country, has indicated that the sunflower crop is attacked by ten bug species. According to the frequency and number, the most pronounced are the Lygus genus and the species L. rugulipennis Popp. The latter is counted among major pests of the sunflower in the examined region. The bugs damage about 10% of seeds reducing the yield by about 3% on average. The analysed hybrids differed considerably in the percent of damage. Attacks by bugs affect both, qualitative and quantitative indicators of sunflower seeds. Depending on the intensity of attack, seed mass is reduced by 6 - 37%, oil content by 5 - 17%, and germination by 10 - 60%. Conversely, the acid number increases 5 - 22 times. Extent of damage is increased by warm weather in the period June - August and the proximity of alfalfa to the sunflower plot.

INTRODUCTION

The sunflower is attacked by different species of phytophagous bugs which are counted among polyphagous pests; the following species have been registered in Yugoslavia: Adelphocoris lineolatus Goeze., Brachycoleus decolor Reut., Calocoris norvegicus Gmel., Coreus marginatus L., Corizus hyosciami L., Dolycoris baccarum L., Eurydema oleracea L., Holcostethus vernalis Wolff., Lygus gemellatus H.S., L. pratensis L., L. rugulipennis Popp., Palomena prasina L., Pyrrhocoris apterus L. (Batinica et al., 1974; Čamprag et al., 1979; Čamprag et al., 1986; Čamprag, 1988).

Taking into account the importance of this group of pests in some neighbouring countries too, we decided to investigate the occurrence and harmfulness of bugs in the main sunflower-growing region of Yugoslavia.

MATERIAL AND METHOD

A study on the occurrence of bugs, conducted in northeastern Yugoslavia (Vojvodina Province) in the period 1973 - 1987, included 753 sunflower plots in 150 locations. The harmfulness of the bugs (percentage of damaged seeds, intensity of attack, and effect on seed mass) was investigated for nine years. The materials for analyses were collected in 209 plots in 160 locations. Average samples were taken from each field before sunflower harvest, by going diagonally across the plots and sampling 100 plants (20 plants in five places). Each plot was represented in laboratory analyses by 300 seeds in five replications. The seeds were dehulled and the kernels were

classified in four categories (undamaged, small, medium, and large damage), counted and weighed by an analytical scale. The same samples were used to determine the effect of bug attack on the qualitative indicators of sunflower seeds. The investigations of the effect of bug attack on oil content lasted for four years, on the acid number and germination for two years. The analyses for oil content and acid number were made at the Oilcrops Department of Institute of Field and Vegetable Crops. The reaction to bug attack was examined on seven Novi Sad sunflower hybrids; the intensity of attack was determined by analysing 750 seeds of each hybrid.

## RESULTS

In northeastern Yugoslavia, sunflowers are attacked by 10 bug species. The dominant genus is *Lygus* which in some years comprises from 50 to 90% of the total population of phytophagous bugs. *L. rugulipennis* Popp. is invariably the most frequent and the most numerous species. It is a major sunflower pest in the examined region. The results recounted in this paper pertain mostly to that dominant bug species.

In the period of nine years, the bugs occurred in June and July at 90% and 100% of the analysed sunflower plots, respectively, on average. Bugs are observed on sunflowers throughout the vegetation period but they occur on a large scale at the time of flower and maturation of kernel (in July and August).

Of all plant parts, the bugs inflict the largest damage on sunflower seeds. The degree of damage ranged from 1 to 27%. The average percentage of damaged seeds varied annually from 4.8 to 18.5%, the average damage for the nine-year period being 10.3% (3.2% small damage, 3.7% medium damage, and 3.4% large damage). In the period of the commercial growing of sunflower varieties, the average damage had been 9.1%. In the period of the growing of hybrids, the average damage increased to 10.7% (the portions of medium and large damages were considerably increased in the latter period).

Temperature tended to affect the extent of damage (Table 1). For the five analysed years, the largest seed damage 13.2% on average were registered in 1975, 1981 - 1983, and 1986 when the mean air temperatures for June, July, and August were 20.5°C. In the remaining four years with less intensive attacks, the average seed damage was 6.7% and the mean temperatures were lower, 19.7°C. With the exception of 1987, when the weather was warm but abundant rainfall in late spring depressed the occurrence of the bugs, the remaining three years had the average seed damage of 7.3% at 19.3°C. It is thus evident that a high temperature brings an increase in the rate of seed damage.

The presence of alfalfa fields in the vicinity of sunflower plots, which are dwelling sites for various species of polyphagous bugs and from which the bugs migrate to sunflower

plots, also increases the intensity of attack. The percentage of damage was found to rise by 50% on average in relation to the sunflower plots which were not near to alfalfa fields.

Tab. 1 - Effect of *Lygus rugulipennis* attack on the degree of damage of sunflower seeds, with a review of mean air temperatures

Year	Bug attack (%)				Average seed damage in %	Mean monthly air temp. in °C (for June-Aug.)
	Plots		Plants			
	June	July	June	July		
1975	83	98	7	32	10.8	19.9
1976	100	100	9	21	7.4	19.1
1981	100	100	7	18	10.7	20.2
1982	95	100	27	62	14.5	20.7
1983	94	100	19	42	11.6	20.8
1984	50	100	1	22	6.5	19.0
1985	89	100	16	49	8.1	19.9
1986	100	100	30	64	18.5	20.8
1987	100	100	7	51	4.8	20.8
Average	90	100	14	40	10.3	20.1

Seven Novi Sad sunflower hybrids were tested for the reaction to the bug attack (Table 2). The least intensive attacks were registered for NS-H-15, NS-H-47, NS-H-33, and NS-H-45 (9.6 - 16.5% damaged seeds), the most intensive attacks for NS-H-26 and NS-H-44 (38.5% damaged seeds). The latter hybrids had predominantly medium and largely damaged seeds.

Tab. 2 - Effect of *Lygus rugulipennis* attack on seven Novi Sad sunflower hybrids in 1986 and 1987.

Hybrid	No. of test years	Average seed damage in %	Seed damage in %		
			Small	Medium	Large
NS-H-15	2	9.6	5.9	2.0	1.7
NS-H-26	2	36.7	16.1	10.4	10.2
NS-H-33	1	14.6	7.2	4.2	3.2
NS-H-43	2	21.8	9.1	6.2	6.5
NS-H-44	1	39.4	15.4	13.8	10.2
NS-H-45	2	16.5	8.3	5.3	2.9
NS-H-47	1	13.5	5.9	4.7	2.9
Average	-	21.7	9.7	6.6	5.4

The long-term investigation showed that the mass of kernel was reduced in consequence to the low, medium, and strong attacks by 6%, 12%, and 37%, respectively (Table 3). In northeastern

Yugoslavia, the bug attack causes an average loss of 80 kg of seed per hectare, i.e., the average yield is reduced by about 3%. The following reductions in oil content occurred in consequence to the small, medium, and large damages of seeds: 5%, 8%, and 17%, respectively (Table 3). Significant differences were established among the categories.

The acid number is an important indicator of oil quality. The bug attacks tended to increase the acid number, i.e., to lower the quality of oil. The following increases in the acid number took place in consequence to the small, medium, and large damages of seeds: 5, 8, and 22 times larger acid number than in healthy seeds, respectively (Table 3).

The damages inflicted by the bugs reduced also the seed quality. The germination in laboratory was reduced by 10%, 23%, and 60% in consequence to the low, medium, and strong attacks, respectively.

#### DISCUSSION

Lygus pratensis L. is the dominant species on sunflowers in Bosnia (Batinica et al., 1974), L. rugulipennis Popp. in Vojvodina Province. In Bulgaria, sunflowers are attacked by 20 bug species, Lygus rugulipennis Popp. being the most frequent and the most important, followed by Dolycoris baccarum L., Adelphocoris lineolatus Goeze., and Holcostethus vernalis Wolff. (Sindrova, 1980). In Hungary too, L. rugulipennis Popp. is the dominant species (Takács, 1985). The data on dominant bug species mentioned above are in full agreement with the results obtained for northeastern Yugoslavia.

The following species have been reported as major in the Soviet Union: Adelphocoris lineolatus Goeze., Carpocoris fuscispinus Boh., Dolycoris baccarum L., Graphosoma italicum Müll., Lygus pratensis L., Mesocerus marginatus L., Palomena prasina L., Poeciloscytus congnatus Fieb. (Piterska, 1962, 1965). It is evident that the fauna of major bugs of sunflowers in the Soviet Union differs from those in Yugoslavia and the two neighbouring countries.

In Hungary, a large-scale multiplication of bugs has been registered after the introduction of sunflower hybrids in the commercial production (Takács, 1985, 1986). In the Soviet Union, the increase in the numbers of the bugs occurred in the period when sunflower varieties were grown. In Yugoslavia, the extent of damage was increased after the introduction of hybrids.

Sunflower seeds are being damaged by bugs throughout the period of their maturation but the largest damage is inflicted on the 20th day after the peak of flowering (Piven, 1975). In Bulgaria, the bugs damage 10% of sunflower seeds (Sindrova, 1980), which is similar to our results. In the Soviet Union, however, the bugs damage 20% of seeds (Piterska, 1963) which is two times more compared with Bulgaria and Yugoslavia. Our results show that the extent of damage increases with increases in temperature. This

confirms the finding of Takács (1986) who studied the activity of bugs at various temperatures.

Tab. 3 - Effect of Lygus rugulipennis attack on quantitative and qualitative indicators of sunflower seeds

Degree of attack	Mass of 1 kernel		Oil content		Acid no.	
	In mg	Rel. value in %	In %	Rel. value in %	mg/KOH per 1g of oil	Rel. value in %
Undamaged	49	100.0	59.7	100.0	1.0	100
Small damage	46	93.9	56.6	94.8	5.7	570
Medium damage	43	87.8	55.1	92.3	9.2	920
Large damage	31	63.3	49.5	82.9	22.6	2.260

Bujáki (1986) observed differences in the intensity of bug attack on various sunflower varieties and hybrids. The largest damage was registered in NS-H-33 and then in NS-H-27, the smallest damage in Luciole and GK-70. Our results indicate also at significant differences in the intensity of attack on the tested hybrids.

The reductions in seed mass resulting from the weak, medium, and strong attacks in the Soviet Union and Bulgaria were 18 and 14%, 46 and 21%, and 68 and 52%, respectively (Piterska, 1962; Šindrova, 1980). The reductions in oil content following the weak, medium, and strong attacks in the Soviet Union and Bulgaria were 5 and 3%, 10 and 6%, and 25 and 16%, respectively (Piterska, 1963; Šindrova, 1980). Our results are closer to those obtained in Bulgaria.

In Bulgaria, the increases in the acid number ranged from 4 to 10 times, in dependence of the intensity of attack (Šindrova, 1980). In the Soviet Union, the increases ranged from 10 to 20 times (Piven, 1975). Our results are within the limits given by the above authors.

According to Bulgarian results, the bug attack reduces the laboratory germination of seeds from 12 to 38%, in dependence of the intensity of attack. Our results indicate the reductions from 10 to 60%. If damaged seeds are used for sowing, the yield decreases by 100 - 500 kg/ha (Piven, 1975). It is therefore of primary importance to control the bugs in seed plots.

#### CONCLUSION

In northeastern Yugoslavia, sunflowers are attacked by 10 bug species, among which Lygus rugulipennis Popp. is the most frequent and the most numerous. This species is a major sunflower

pest. In June, the bugs were found in 90% of the analysed plots, in July in all plots. They were most numerous at the time of flower and seed maturation. Their numbers were increased if alfalfa fields were close to sunflower plots.

The average degree of damage was 10%. In years with high temperatures in the period June - August (20.5°C) the damage rose to 13% and with lower temperatures (19.3°C) it fell to 7%. Significant or large differences were registered in the percentage of seed damage among the analysed Novi Sad hybrids, from 10 to 39%.

The bug attack reduced seed mass, oil content, and germination but increase the acid number. The reductions in the mass and oil content were 6 and 5%, 12 and 8%, and 37 and 17%, for the weak, medium and strong attacks, respectively.

The bug attack reduced the yield by 80 kg/ha or 3% on average. The laboratory germination was reduced by 10 - 60%. The acid number increased 5 to 22 times, depending of the intensity of attack. The results of our long-term investigation indicate that the bugs should be controlled primarily in seed plots.

#### LITERATURE

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