THE DAMAGE OF LYGAEID BUGS CAUSED IN SUNFLOWER AND THEIR ROLE IN THE TRANSMISSION OF ITS SEED-BORNE DISEASES

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SUMMARY

The authors studied the damage of Lygus, Polymerus, Adelphocoris species in 25 m^2 sunflower plots, by applying the following treatments in four repetitions:

- single insecticide spraying at the begin of flowering;
- double insecticide spraying at the begin and end of flowering;
- isolation of individual flower heads with cheesecloth and at the begin of flowering;
- Colonization of Lygaeid adults on sunflower heads /10 on each/ and covering the heads with cheesecloths isolators.

The latter 10-10 Lygaeid adults caused a 31 % damage on the flowers while the natural Heteropteran population caused a 9.8 % damage.

In each treatment also the oil content and oleic acid number was assessed; due to the bug damage the oil content of seeds decreased by 8,1 % and the oleic acid number increased by 54 %.

The role of bugs in disease transmission was also studied. After harvest the seeds /achenes/ were exposed to wet-chamber conditions.

In the flower heads isolated with bugs the number of seeds infected by pathogens was twice as much as in the heads isolated from bug damage, and the number of seeds incapable of germination was high. 20 % of seeds did not germinate as compared to the check where 8 % of the seeds were unable to germinate. The pathogens isolated from the seeds were transferred to malt-agar and identified. In the isolates 8 fungus species occurred, the most common were Botrytis cinerea, Alternaria helianthi, Fusarium tricinctum and a Fusidium species.

INTRODUCTION

Besides pathogens also various pests participate in the yield decrease of sunflower in Hungary, both in a direct and indirect way. Many practical observations indicated that insects may play a significant role in the transmission of sunflower diseases.

According to the data of NÉMETH /1982, 1983/ the plant bugs had fed earlier on the leaves of sunflower, without causing, however, severe damage symptoms. ERDEI et al. /1983/ found considerable qualitative and quantitative damage caused by plant bug larvae in sunflower kernels. Az a result of larval brown spots had appeared on the kernels, accompanied by weight loss. NÉMETH and TAKÁCS/1974/ established decreased and irregular germination of kernels damaged by bugs. According to the studies of KOCZKA /1985/ in the damaged achenes 4-5 % weight decrease, on 40-50 % of the kernels brown discolouration and in the germinating capacity 25-50 % decrease was found.

KOZMA and TÓTH /1984/ mentioned that the Botrytis infection in sunflower achenes damaged by bugs was substantially higher than in undamaged ones. GANDET and SHULZ /1981/ proved that a Curculionid beetle, Apion occidentale transmitted the Phoma disease of sunflower. CAMPRAG et al. /1986/ found in Yugoslavia 12 % damage of achenes caused by bugs in the large-scale sunflower stands of the Department Voivodina. The bugs /Mostly Lygus rugulipennis/ decreased the yild by 80 kg per hectare.

MATERIALS AND METHODS

The experiments were carried out on 25 m^2 plots in four repetitions:

- only one spraying at the begin of flowering,
- two sprayings, one at the begin and one at the end of flowering,
- no spraying, isolation of the flower heads with cheesecloth at the begin of flowering,
- no spraying, colonization of 10-10 Lygus sp. bugs on the flower heads at the begin of flowering, the heads covered subsequently by a cheesecloth isolator,
- intreated check

The spraying was carried out with a motor-driven knapsack sprayer, by using the pyrethroid Decis 25 EC /0,5 l/ha/. After harvesting the heads the achenes were shelled and the percentage of damaged kernels was assessed by opening 5 times 1000 achenes per treatment.

The achenes originating from the different treatments were surface-sterilized by using Neomagnol and were then submitted to wet chamber germination tests /4 x 50 from each treatment/. The fungi from the dead or diseased kernels were then isolated and determined.

The pathogenicity of the identified pathogens was verified in subsequent tests. The oil content and acid number of the kernels collected per experiment was also determined.

RESULTS AND DISCUSSION

As a result of bug feeding a brown discolouration appeared on the kernels. In the treatment of isolated sunflower heads, where the bug feeding had been prevented, no brown necrotic spots appeared on the kernels. The single spraying at the begin of flowering has brought the same result in keeping off the bugs as no treatment at all /untreated check/. Thus a single insecticide application did not seem to prevent bug damage. In case of the double insecticidal treatment brown necrotic spots identifiable as bug damage were found on 155 kernels in the 5000 achenes opened. This latter number was by two-thirds less than in the untreated or once sprayed plot /Table 1/.

The best results in preventing bug damage were observed in heads isolated at the begin of flowering: 124 damaged kernels in 5000 achenes.

The highest damage was found in the sunflower heads where 10-10 bugs were colonized. Compared to the check /heads exposed to natural damage/ the number of injured kernels was three times higher /1231 from 5000 achenes/, that corresponded to 24.6 %.

When the percentages of injury in covered and artificially with bugs colonized heads were compared, in the latter case a damage of about 22 % was established. This is by all means significant as natural infestations as high as lo bugs per head are quite common.

From the achenes produced in different treatments 4 x 50 were studied in wet chamber experiments. Regarding their fungus infection three categories could be distinguished: a/ those that failed to germinate, b/ germinated, but were infected, c/ germinated and were healthy.

Most healthy achenes came from heads isolated at the begin of flowering /151 from 200/ and here was the lowest the number of kernels that failed to germinate /16 from 200/. Most achenes that were unable to germinate were found in the untreated /check/ plot and in heads colonized with 10-10 bugs. It may be concluded therefore that bug feeding contributed to a high extent to the decrease in germinating capacity.

The studies were completed by measuring the oil content and acid number of the kernels /Table 3/. It was remarkable that most possibly as a result of bug feeding the oil content had decreased by 8.1 % and the oil acid number had increased by 54 %.

The pathogens isolated from the infected achenes were inoculated onto malt agar nutrient and identified. In the isolates 8 fungus species were found. Most frequently the species Botrytis cinerea, Alternaria helianthi, Fusarium tricin-

tum and Fusidium sp. occurred. To a smaller extent Fusarium equseti, Trichotecium roseum, Cladosporium herbarum and Verticillium dahliae were identified.

It was remarkable that Fusarium tricinctum occurred only in achenes originating from flower heads infested with bugs, indicating some physiological conections between the fungus and the pests. This possible relationship merits to be further studied.

A new pathogen was found with the occurrence of Fusidium sp. that was isolated from sunflower the first time. The fungus was determined by Dr.J.Vörös /Plant Protection Institute of Hungarian Academy of Sciences, Budapest/.

The fungi isolated from the achenes were then submitted to further pathogenicity tests. Before sowing the soil was sterilized in an autoclave, then infected with the mycelia. The evaluation was made 10 days after the germination and the pathogenicity of the isolates was measured on the number of diseased seedlings. The pathogens were then re-isolated from the diseased plants, the results are shown is Table 4.

The comparative tests yielded in some cases surprises. From among the two Fusarium species F.equiseti did not cause actual damage to the seedlings, F.tricinctum, however, proved to be most pathogenic and killed more than 10 % of seedlings. Its pathogenicity was followed by Fusidium sp. that killed 6.5 % of the seedlings. Botrytis cinerea and Verticillium dahliae were less pathogenic /1.7 and 1.7 %/; it was remarkable that the two Alternaria species that were considered as serious pests of the well developed sunflower plants turned out to be not pathogenic in the seedling stage. Also in case of Trichotecium roseum no damage in seedlings was noticed.

Table 1

Influence of different treatments on the number of seeds damaged by bugs

Treatment	Number of healthy kernels	damaged	Percentage of damaged kernels
sprayed once	4561	439	7.78
sprayed twice	4845	155	3.10
covered heads	4876	124	2.48
heads colonized with 10-10 bugs	3769	1231	24.62
untreated /check/	4558	442	8.84

Table 2

Results of germination tests /4 x 50 achenes/

Treatment	healthy	Number of damaged	not germinated achenes
sprayed once	88	87	25
sprayed twice	105	81	14
covered heads	151	33	16
heads colonized	70	71	59
untreated /check/	89	71	40

Table 3

Oil content and acid number in kernels

Treatment	Oil content %	Acid number
sprayed once	45.8	0.80
sprayed twice	50.7	0.58
covered heads	49.2	0.67
heads colonized with bugs	42.5	1.36
untreated /check/	46.2	0.88

Table 4

Pathogenicity of fungi against seedlings

Pathogen isolated from achenes	% of damaged seedlings
Pusarium tricinctum	10.06
Fusidium sp.	6.46
Botrytis cinerea	1.73
Verticillium dahliae	1.73
Fusarium equiseti	0.0
Alternaria helianthi	0.0
Alternaria zinniae	0.0
Trichotecium roseum	0.0

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