T1988CROP56

STUDIES ON YIELD LOSSES CAUSED BY TWO SUCKING PESTS OF SUNFLOWER IN FRANCE: BRACHYCAUDUS HELICHRYSI (HOM. APHIDIDAE) and LYGUS spp (HET. MIRIDAE)

I. Badenhausser, J. Lerin, R. Bournoville
I.N.R.A Centre Poitou Charentes.
Laboratoire de zoologie
86600 LUSIGNAN. FRANCE

SUMMARY
Inventory studies of insect pests of sunflower, in Center West of France, led to study more precisely the impact of two pests: Mirid bugs : Lygus spp and an aphid : Brachycaudus helichrysi. In both cases, experiments have been carried out with controlled infestations under cages in the field. The action of the aphid is more damaging when infestation occurs before budding stage (100 aphids per plant). Late infestations do not have any effect on yield. Lygus spp affect the yield components till budding. The more precocious the infestation the more damaging are the bugs.

INTRODUCTION

Inventory surveys of insect pests have been conducted for 5 years in the center west of France. They prove the scarcity of soil pests, leaf eaters caterpillars and the sunflower moth. On the contrary, sucking insects are present during most of the cycle. The plum aphid, Brachycaudus helichrysi Kalt, colonizes fields in May. Generally, its populations increase till budding stage and are regulated by natural enemies. In 1985, a new increase occurred during maturation (Table 1). Mirid bugs (Lygus spp.) are never noticed before budding. The population maximum occurs between flowering and maturation, and reaches only a few individuals per plant (Table 1). Experiments have been conducted in semi-field conditions to assess the damaging action of these pests.

Table 1 : Evolution of the populations of Lygus spp and Brachycaudus helichrysi in the field (center West France).Number of insects per plant.

Stage	1983	1984		1985		1986		1987
	L	L	A	L	A	L	A	A
13-15 leaves	1.0	0.0	0	0.0	60	0.0	0.1	37
Budding	0.1	0.0	19	0.0	83	0.0	0.0	90
Bud>4cm	0.3	0.3	40	0.0	25	0.1	0.0	20
End flowering	2.7	1.1	70	2.8	20	0.2	0.0	0
Mid maturation	0.3	0.2	100	3.1	100	0.3	0.0	0

L= Lygus spp, A= Brachycaudus helichrysi

1-ACTION OF BRACHYCAUDUS HELICHRYSI ON SUNFLOWER PRODUCTION

1-1 STUDIES IN SEMI ARTIFICIAL CONDITIONS

Material and methods

Two experiments were realized under cages in a field to avoid natural enemies in 1985 and 1986. In this way, the populations are not regulated and can reach high levels. The cultivar used was Viky in 1985 and Mirasol in 1986. The number of cages, with 24 plants per cage, was 8 in 1985 and 10 in 1986. In each case half of the cages were uninfested controls and the other half were infested at the 10 leaves stage with 2 alates per plant in 1985, and at the 4-6 leaves stage with 5 aptera per plant in 1986. In both years, the number of aphids was periodically determined. We also measured:the stem diameter 5 cm above the ground,the plant height and the head diameter. At harvest, all yield components were determined on each plant.

Results

Figure 1 shows the population dynamic under cages for the two years. The same level (about 9000 aphids per plant) is reached during the maturation stage, but the dynamics are quite different between the two years: in 1986, there is almost no aphid until the beginning of maturation.

Table 2 displays the main results concerning production and significance levels of the analysis of variance (each row in the cage being considered as a replication). In both cases, there is no effect of the infestation on the oil content of seeds. These results show that late infestations have no effect on yield as indicated by the data of 1986. In 1985, a yield loss of about 10% is observed, on vigorous plants as the yield of a field composed of such plants would have been 5.6 metric tons per hectare (60000 plants per hectare). On the other hand, such a number of aphids would not have occurred in field conditions as populations are always regulated by natural enemies before flowering in France. These results indicate that early and heavy infestations are certainly more damaging than late infestations.

Table 2 : yield components per plant in experiments 1985-1986.

Year	Treatment	Number of seeds	100 seed-weight	Weight
1985	Control	1476	6.33	92.8
	Infested	1496	5.61	83.6
F treatment		0.20	17.40	7.34
1986	Control	750	5.00	37.7
	Infested	763	4.90	37.8
F treatment		0.08	0.54	0.00

F for 1/8 df

1-2 OPENFIELD EXPERIMENTS

Material and methods

In 1987, 210 plants regularly distributed in a field of Mirasol, were observed during the whole cycle. The same parameters as in the cage experiments were measured. In addition, we have established a visual notation from 1(intact leaves) to 4 of the leaf deformation caused by B. helichrysi. This curling of the leaves on sunflower, has been mentioned by Schmeltzer (1970) and Camprag (1976) as a reaction of the plant, specific to the presence of this aphid. The intensity of this reaction depends on agrometeorological conditions. The plants were classed according to the notation at the budding stage.

Results

Figure 2 (hollow bars) shows the relationship between plant production and the scale of deformation when the population maximum occurred: bud 2 cm diameter (E2), overall mean , 70 aphids per plant. There is also a close relationship between the note of deformation and the number of aphids at all observation dates before natural enemies began regulating populations.
Figure 2 (shaded bars) also presents the same relationship for groups of plants (3 subclasses) according to the number of leaves (L) they had at the beginning of the budding stage. It is obvious that for the same level of aphid population the yield losses are much lower on vigorous plants (5 %), than on weaker plants (26% , 58%).

CONCLUSIONS

From these 3 years of investigation , it is concluded that late infestations even as high as 9000 aphids per plant at maturation, do not have any effect on the yield (1986). Earlier infestations (1985, 1987) induce yield losses dependent on the interaction between plant vigour and number of aphids per plant. Further work is needed to see wether the notation of leaf deformation at the budding stage can replace aphid counts which are currently in use to determine if an insecticide control is necessary.In this case, an aphid specific insecticide should be used in order to avoid any deleterious effect on natural enemies which are quite effective in reducing populations.

2-ACTION OF MIRID BUGS ON SUNFLOWER PRODUCTION

Material and method

Three experiments have been carried out to assess the damaging effect of these bugs on different stages of sunflower. In all cases, plants were isolated under cages of different ground sizes containing from 1 to 10 plants each, to prevent them from other insect infestation. The conditions of the experiments are summarized in table 3. The most precocious action was studied in laboratory conditions (16 h photophasis, 20 °C),until the beginning of budding stage. Then , plants were transplanted outside . In the other experiments, plants grew in agronomical conditions from sowing. For the 3 experiments, cultivar Mirasol was used. Plants were homogenized by measuring the stem diameter 5 cm above the ground. At maturity, all plants were individually harvested and yield components were determined The infestations were realized with Lygus bugs (L. pratensis L. et L. rugulipennis Popp.)captured on sunflower or alfalfa.

Table 3 : Experimental conditions of the study of the action of Lygus bugs on sunflower

experiment	Phenology at infestation	Number of bugs per plant	Number of cages per modality (control or infested)	Number of plants per cage
1	2 leaves	3 adults until 8 leaves stage	3	6
2	14 leaves	10 adults	10	10
3	mid-budding	5 larvae renewed until maturation	12	1

Results

1- Precocious action of bugs on sunflower: The main action is noticed a few days after the infestation : plants wilt and produce 22 % of aborted heads. The main results of the non aborted plants are presented in table 4. It shows that the number of seeds per plant is affected (-30%) although the weight of seeds is not lessened.

Table 4: Action of Lygus bugs on plants at 2 leaves stage. Data per plant

Modality	Number of seeds	Weight of seeds (g)
Infested	343	15.8
Control	470	16.1
Test significance	HS	NS

2- Action of bugs at the beginning of the budding stage: The yield components, as shown by table 5 are affected as the height of the plants. The losses are about the level of 10%, excepted for the oil content of seeds (2%); Some analysis on the state of seeds prove an increase of shrivelled seeds percentage (11% for infested plants) and stained seeds percentage (9% for infested plants).

Table 5: Action of Lygus bugs on plants at the beginning of budding stage. Data per plant

Modality	Height(cm)	weight of seeds(g)	number of seeds	100 seed weight	oil content
Infested	170	47.1	1312	3.59	50.9
Control	150	42.2	1356	3.13	49.8
Test signif.	HS	S	NS	HS	S

3- Action of bugs at mid-budding stage:
In these conditions of long infestation at a level which is largely greater than observed in field of Center West of France, no action is noticed (table 6) on any yield component. The lack of significance analysis for the oil content, should be due to an insufficient number of repetitions.

Table 6: Action of Lygus bugs on sunflower production at mid-budding stage.Data per plant

Modality	Number of seeds	weight of seeds(g)	100 seed-weight	oil content
Infested	680	20.2	3.03	50.2
Control	643	19.8	3.02	51.2
Test significance	NS	NS	NS	NS

CONCLUSION

These results show that Lygus bugs can have a damaging action on early stages of sunflower plants at the level of 3 Lygus per plant. After this stage, losses in seed production are observed with a more important infestation from budding to maturation stages. After budding, no damaging effect is noticed.We have not considered at the later stages,the action of bugs on the quality of seeds which is reported by Shindrova (1979) and Camprag & al.(1986). Openfield observations in France point out that the risks are negligible except in the south-east of France.

ACKNOWLEDGMENTS
We thank CETIOM for financial support for these researches

BIBLIOGRAPHY

CAMPRAG D., 1976. Leaf aphids (Aphididae, Homoptera), an important problem in sunflower growing in north-east Yugoslavia. Proceedings of the VII th international sunflower Conference, Krasnodar, URSS, 260-265
CAMPRAG D. , SEKULIC R., KERESI T., ALMASI R., STOJANOVIC D., 1986. Several years studies of the occurrence of bugs of the Lygus (Heteroptera,Miridae) on sunflower in Vojvodina. Plant protection, Vol 37,101-110 .
SCHMELZER K. 1970.The cause of curly mosaic in sunflower. Pflanzenschutzdienst 24,1-5
SHINDROVA.P., 1979.Influence of injuries produced by some Pentatomid bugs on the seeding and biochemical characters of sunflower seeds. Plant science, Vol 16, 143-149

FIGURE 1:Evolution of the number of aphid/plant in cage experiments.

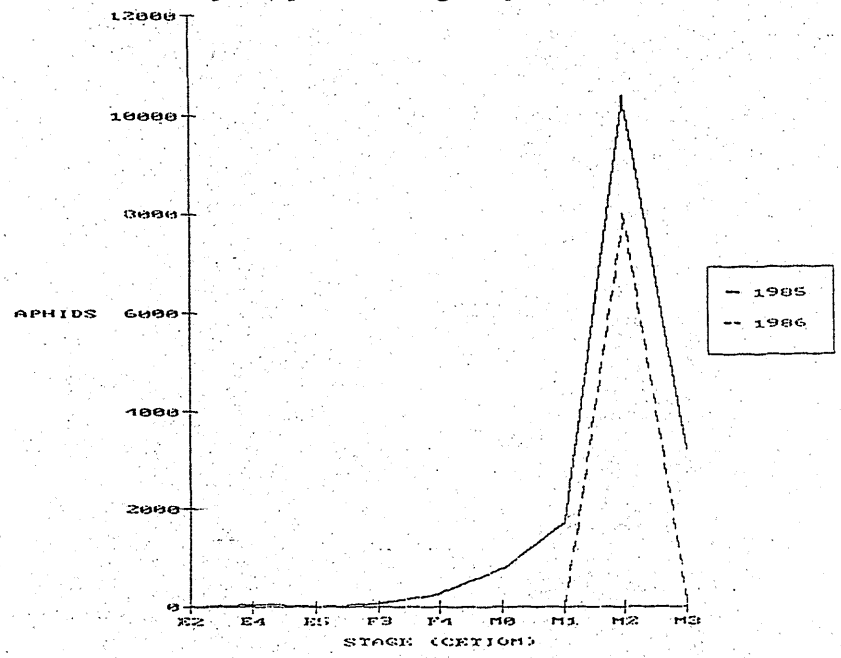

FIGURE 2: Relationship between yield and the note at stage E2.