# Aphids damage in sunflower production from 1986 to 1993

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## Abstract

Changes in the individual density of two aphid species, Aphis fabae Scop. and Brachycaudus helichrysi Kalt which cause. damage to sunflower were studied between 1986 and 1993. In the years 1986, 1987, 1989 and 1991 the damage was quite high. The aphids colonized the sunflower stands between 13 and 25 May, depending on the given years. The insecticide treatments applied against the aphids did not destroy their populations, but killed their natural enemies, notably ladybirds. In the years when the aphids damaged 30-82 % of the sunflower plants, coccinellids also appeared in high numbers; in spite of the high densities of adults and larvae, the early mass multiplication of their prey could not be prevented.
The mass appearance of aphids at the end of the vegetation period was followed by a 10.7 % decrease in weight and 10.9 % decrease in the germinating capacity of seeds, as shown by studying samples of 1000 achenes. The aphids also contributed to the spread of Alternaria helianthi Hans., a pathogen of the sunflower.

## Introduction

In this paper aphid parasitoids were also considered: from Aphis fabae individuals the hymenopterous parasitoid Lysiphlebus fabarum Marsh. was reared. From among the homopteran pests of sunflower, members of the families Cicadellidae and Oliarus quinquecostatus Duf., Eliarus panzeri Low., Empoasca pteridis Dah. and Eupterix atropunctata Goeze, from aphids Aphis fabae Scop. and Brachycaudus helichrysi Kalt. are the most important (Camprag, 1987).
According to Sutic (1960) sunflower may be attacked by Aphis fabae, Brachycaudus helichrysi, Aphis evonymi Fabr. and Aphis gossypii Glow. Whereas these data referred to the former Yugoslavia, Scsegolev (1960) mentioned from the Soviet Union Aphis evonymi, Aphis fabae and Brachycaudus helichrysi.
Besides Aphis fabae and Brachycaudus helichrysi, sunflower may also be infested by the oleander aphid, Aphis nerii B.d.F. (Ranagarjan et al. 1977). This species has been found in South Hungary, where it occurred on the common weed Asclepias syriaca L. (Horváth and Szalay-Marzsó, 1984).
Manolache (1961) also mentioned in sunflower in Roumania the well known aphids Aphis fabae and Brachycaudus helichrysi; the same two species are listed as sunflower pests in Bulgaria (Grigorov, 1968).
According to earlier Hungarian data (Manninger, 1960, Huzián, 1968, Nagy, 1968, Szalay-Marzsó, 1969) Aphis fabae was most common on sunflower. High population densities and leaf deformations were reported by Bujáki (1980), caused on sunflower by Brachycaudus helichrysi.
According to Camprag (1987) Aphis fabae appears in sunflower stands in Yugoslavia by the end of the first period of May and its mass reproduction can be expected from the end of May; the individual density of aphids decreases during the summer (from early July) and the damage is most noticeable on the bordering plants.
Bujáki (1986) found in glasshouse experiments on young sunflower plants that Aphis fabae colonies occur mostly on the stalk, leaf petioles and along the midrib of leaves, mainly on the undersides. On budding sunflower plants the aphid colonies appear on the squamate leaves.
If Aphis fabae colonizes the sunflower head inside the bordering squamate leaves, it may cause partial sterility of the floretes (Horváth, 1984).
Brachycaudus helichrysi migrates from plum to sunflower and mass colonization can be expected by the end of May or early June. As a result of its feeding, the sunflower leaves become distorted and spoon-like (Camprag, 1987).
Bujáki (1984) found colonies of Brachycaudus helichrysi mostly on leaves in areas bordered by the collateral veins. The colonies spread mostly on the undersides, but at mass reproduction the upper surfaces of the leaves also become colonized.
The colonization process is easily followed by yellow pan traps. Most Aphis fabae or Brachycaudus helichrysi adults were caught in traps placed 2 meters inside the border; in traps placed 50 meters from the plot border the number of winged aphids was by 50 % lessand in traps 100 meters from the border the catch was insignificant. At the same time, the number of aphids that do not colonize sunflower hardly differed with the distance from

the plot borders. This can be explained by the host-finding process of aphids; those that did not find their host after probing continued their flight, whereas Brachycaudus helichrysi and Aphis fabae colonized their hosts after the first feeding (Bujáki, 1984).

The damage of aphids on sunflower can be traced according to the data of Bujáki (1984). In May 1978 mixed colonies of Aphis fabae and Brachycaudus helichrysi damaged Dabas. Strong, mosaic-like symptoms were found in the sunflower plots up to 50 meters from the edge. The symptoms extended to 72 % of plants and the in case of a bordering forest strip up to 85 %. Young sunflower pants (12-16 leaves) were sprayed with Pirimor 50 Dp; the aphids and the mosaic-like symptoms disappeared. The same two species caused damage in the Katymár area of Bácsalmás State Farm that necessitated chemical control in the same year.

In 1979 and 1980 the hot, dry weather prevented the mass reproduction of aphids; in late summer of 1980, however, a new type of damage appeared when in September the aphid colonies withdrew between the achenes and in the same year all attacked heads became victims of grey-mold rotting (Bujáki, 1984).

Leclant (1968) described the damage of Aphis fabae, Myzus persicae, Brachycaudus helichrysi, Myzus ornatus, Aulacorthum solani Kalt. and of Macrosiphum euphorbiae Thomas, but regarded Brachycaudus helichrysi as the most important of all aphids mentioned. Badenhausser at al. (1988) studied the colonization of Brachycaudus helichrysi in the sunflower stand in 1984 and 1985. In 1984 the species appeared when the plants were in the 10-leave stage, while in 1985 this happened much later, at the time of flowering. The authors established that when the aphids colonized the plants at a young stage before the blooming period, the number of Brachycaudus helichrysi individuals could reach up to 600 per plant, causing at least 16 % yield loss. As these authors carried out their experiment under isolators, aphid reproduction was not controlled by any aphid predators or parasitoids.

**Materials and Methods**

1. Surveys of individual plants

The changes in individual densities of sunflower pests were monitored continually from 1986. The amount of precipitation per month and the temperature data of the survey period were noted; the latter were received from the local meteorological station. On each occasion 50-50 plants were selected randomly, the numbers of aphids and natural enemies were counted and noted. The individual numbers were depicted on diagrams.

Main survey condition in 1986:
Place: Katymár
Plot size: 175 hectares
Hybrid: NSH-45
Sowing date: 10.4.1986
Insecticide treatments:
1./ 10.6.1986: DECIS 2,5 EC
2./ 28.6.1986: Bi 58 EC

Main survey conditions in 1987:
Place: Katymár
Plot size: 200 hectares
Hybrid: NSH-45
Sowing date: 13.4.1987
Insecticide treatments:
1./ 15.6.1987 /CHINETRIN 25 EC/
2./ 15.7.1987 /DECIS 2,5 EC/

Main survey conditions in 1988:
Place: Katymár
Plot size: 92 hectares
Hybrid: NSH-26
Sowing date: 10.4.1988
Insecticide treatment:
15.6.1988 /DECIS 2,5 EC/

Main survey conditions in 1989:
Place: Katymár
Plot size: 65 hectares
Hybrid: Barbara
Sowing date: 28.4.1989
Insecticide treatment:
21.6.1989 /Bi-58 EC/

Main survey conditions in 1990:
Place: Katymár
Plot size: 248 hectares
Hybrid: NSH-45
Sowing date: 6-9.4.1990
Insecticide treatment: none

Main survey conditions in 1991:
Place: Katymár
Plot size: 130 hectares
Hybrid: NSH-45
Sowing date: 9-10.4.1991
Insecticide treatment: none

Main survey conditions in 1992:
Place: Katymár
Plot size: 69 hectares
Hybrid: Iregi HNK-173
Sowing date: 6.5.1992
Insecticide treatment:
27.6.1992 /DANADIM 40 EC/

Main survey conditons in 1993:
Place: Katymár
Plot size: 216 hectares
Hybrid: NSH-45
Sowing date: 18-23.4.1992
Insecticide treatment: none

**Results and conclusions**

In our sunflower plots only the black bean aphid (Aphis fabae) and the yellow plum aphid (Brachycaudus helichrysi) damaged the plants. In our surveys from all the ladybirds, only Coccinella septempunctata L. was observed.
The changes in individual densities both of aphids and their coccinellid predators in the period 1986-1993 are shown in Figs. 1-6.
The proportional damage of the two aphid species was not separately studied, but as their damage is different, this will be established in future surveys.
1986 was very favourable for aphids, due to the ample precipitation (110 mm) in May-June, resulting in fast and high aphid reproduction. This was shown by the survey results: whereas only 4 % of plants were found infested, on 20 May, on 5 June this increased to 45 %. After the insecticide treatment (spraying with pyrethroid DECIS 2,5 EC) 30 % of plants were still found infested, but the ladybird predators had disappeared. By 25 June the aphid again infested 58 % of plants and the State farm decided to repeat the insecticide treatment. As a result of Bi-58 spraying, the percentage of infested plants decreased to 10 % and stayed at this level until the end of July. Due to the dry and hot weather in July and the high number of ladybirds (that had reappeared in the meantime) the aphids completely disappeared from the plot by early August (Fig.1).
During the vegetation period of 1987 the aphids appeared twice on the sunflower; their presence was first noted on 18 May and on 5 June 20 % of the plants were found infested.
The first insecticide treatment (CHINETRIN) decreased the infestation below 10 %, but the rainy June (60 mm precipitation) favoured aphid reproduction. On 15 July another spraying was carried out against the had aphids that infested by then 30 % of the sunflower. As a result of DECIS 2,5 EC the aphids disappeared from the plot. In August 63 mm rain fell and the hot, humid weather caused the aphids to reappear and mixed populations of Aphis fabae and Brachycaudus helichrysi invaded the plots. Whole plants were infested and the aphids hid even between the achenes (the experiments on achene damage was there and then initiated) (Fig.2).
The colonization of aphids into the sunflower plots was noted in 1988 on 25 May; during the vegetation period the percentage of infested plants did not exceed 20 %. The low aphid infestation also resulted in a low density of ladybirds. The state farm carried out an insecticide treatment (DECIS 2,5 EC) on 15 June and after this the number of aphids and bugs decreased practically to zero; a total collapse of the aphid population was noted by 25 July (Fig.3).
In May 1989 95 mm rain fell in the experimental area (Katymár) which favoured aphid reproduction; the first colonies were noted on 18 May and the highest percentage of infested plants (45 %) was observed on 15 June. On 21 June insecticide treatment was carried out (Bi 58). As a result, the infestation decreased to below10 %. No ladybirds were found following the spraying but their fast recovery from early July helped in the suppression of aphids (Fig 4.).
In 1990 the damage of aphids was noticeable until 5 June. Their individual number reached its peak on 25 June, resulting in a 22 % infestation.
1991 resembled somewhat 1987 by showing two peaks in aphid densities, the first on 25 June, the second on 4 August. The June peak exceeded 80 %, due to the 72 mm of rain that fell in May. So the humid microclimate presented within the plant stand favourable conditions for the aphids and the outbreak of aphids (80 % infestation) followed only in June. This value decreased to 4 % by 17 July, resulting both from the activity of coccinellids and the high temperatures (low humidity) of July.
In the last part of July, however, humid, rainy weather followed again with 108 mm precipitation, which brought about the second peak in July-August (Fig.5).
In 1992 aphids damaged a low percentage of sunflower plants and accordingly, coccinellids occurred only in very low densities.
The first aphid colonies were observed in 1993 on 13 May; during the whole vegetation period Aphis fabae caused damage, but the proportion, however, did not exceed 14 % (Fig.6).
By studying Figures 1-8 it may be established that in the period 1986-1993 aphids presented a real danger to sunflower only in 1986, 1987, 1989 and 1991. Their mass appearance at the end of vegetation was observed in

1987 and 1991. The first ladybirds were found on sunflower at varying dates between 6 and 19 June but they appeared 10-18 days after the colonization of aphids (Fig.6). The increase of coccinellid densities coincides consistently with the collapse of aphid outbreaks, demonstrating that their population dynamics follow those of their prey. Coccinellid larvae appeared in higher numbers in 1987, 1989 and 1991 when the aphids damaged 30-82 % of plants; in the other years the low aphid densities did not stimulate ladybirds to reproduce.
It was also established that insecticidal treatments failed in many cases to suppress aphids below the damage treshold values. However, they caused the annihilation of beneficial aphid predators.

Figure 1-6. Changes in the individual densities of aphids and ladybirds at Katymár from 1986 to 1993

**Figure 1.**

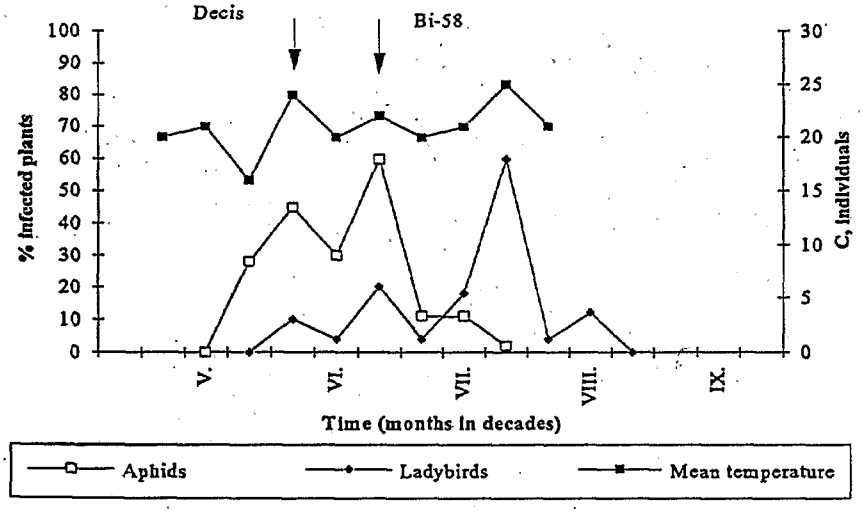



**Figure 2.**

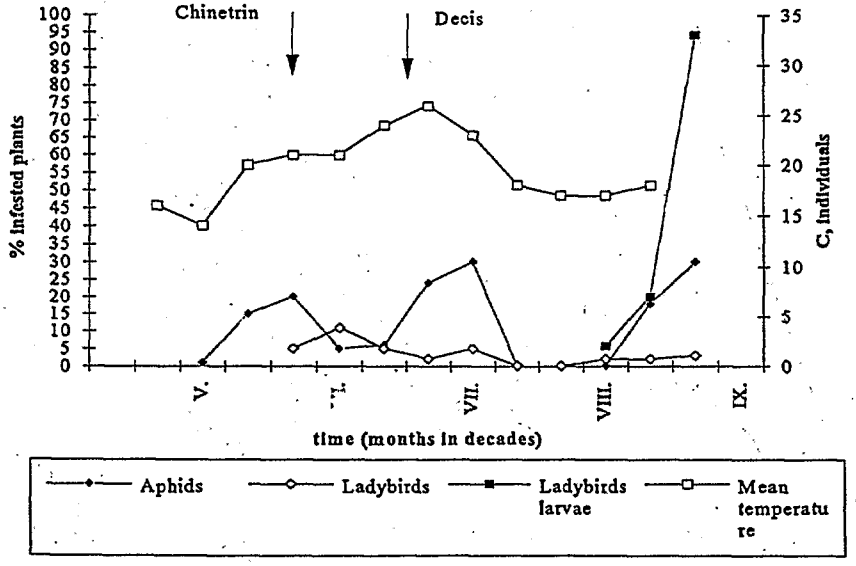


Figure 3.

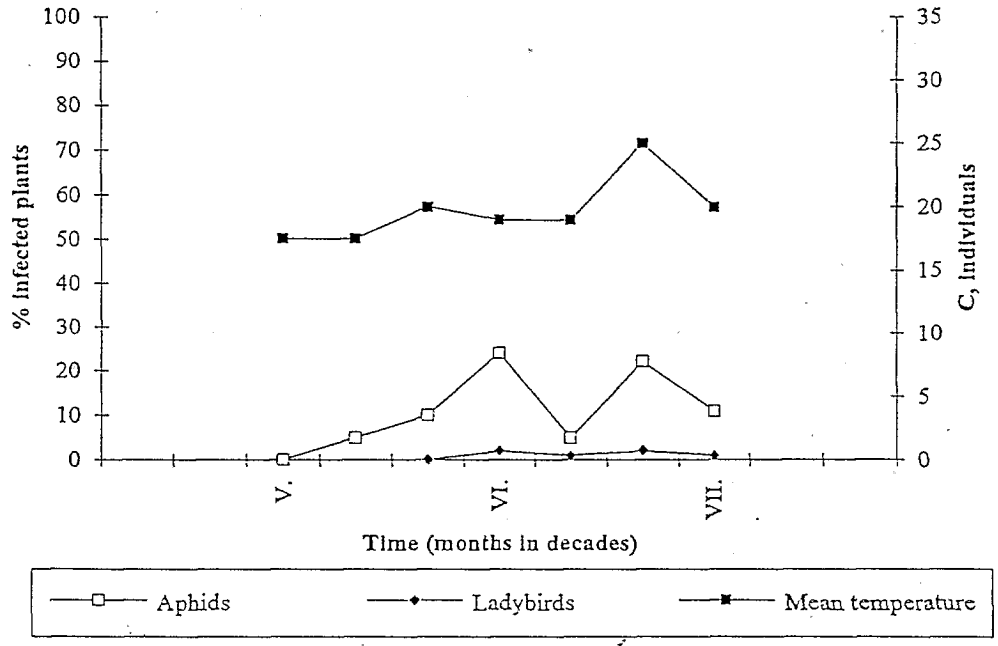



Figure 4.

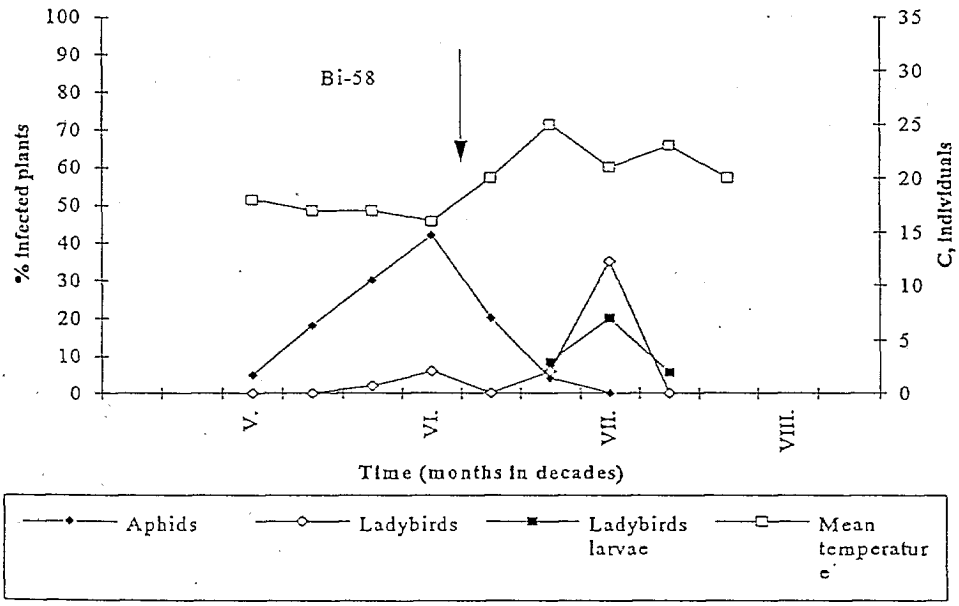


**Figure 5.**

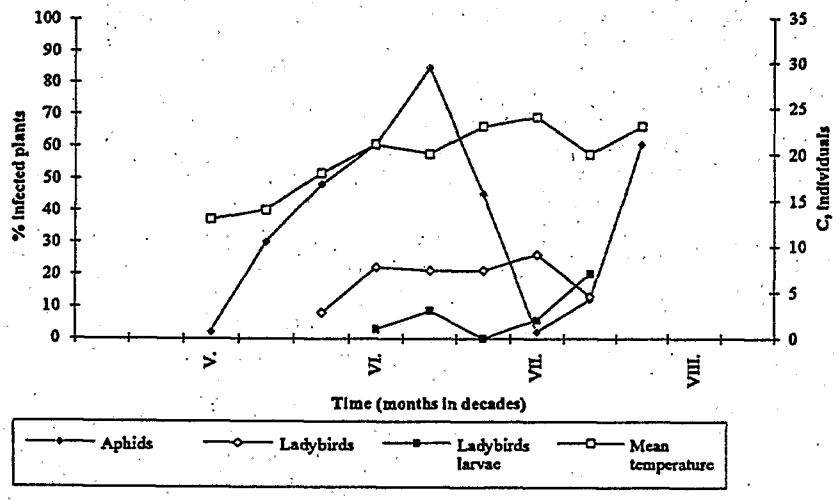
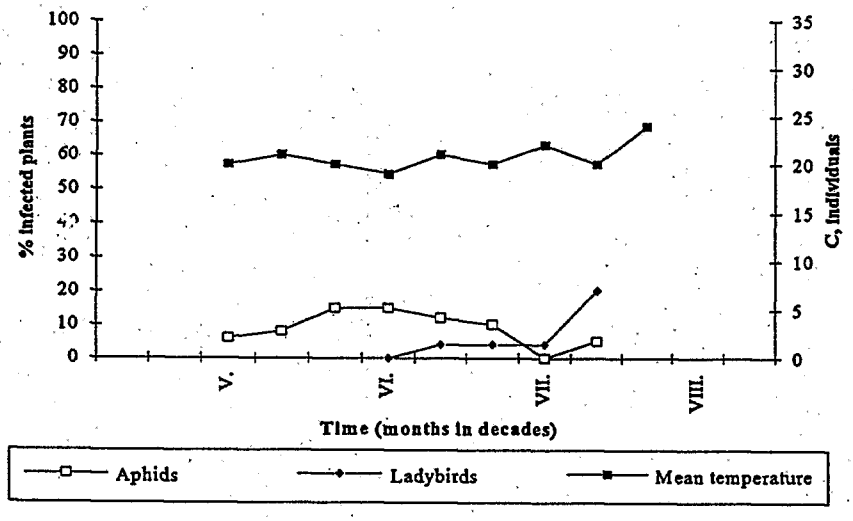



**Figure 6.**

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