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Studies on the Population Changes of Drepanosiphon platanoidis (Schrk) (Aphidoidea: Callaphididae)

By

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The examination of the insect population during a certain determined period can be considered a widespread research. Work has also been undertaken in the research of aphids. Primarily the population changes of aphids has been undertaken from the economical aspect. In Hungary, L. SZALAY—MARZSÓ (1954—56, 1958, 1960, 1961) has carried out pioneering research concerning the aphids of beet, pepper and potato leaves. Of foreign researchers, I mentioned CHU & CHANG (1954) who experimented on the aphid living on the cotton plant, *Aphis gossypii* GLOVER, BEJER-PETERSEN (1962) on *Neomyzaphis abietina* WALK, and the experiments of WEISMANN and HRNCIAR (1962) on the population changes of *Aphis fabae* SCOP. which feed on the *Evonymus* and beet.

My experiments involved the leaf aphid *Drepanosiphon platanoidis* (SCHRK). The experiments were designed to: *1.* Study the population changes of the species with the 100-leaf method. *2.* Collect information regarding its ethology and behaviour. *3.* Study its importance both from the point of view of forestry and apiary.

Ecology of the Species

According to BOERNER (1952) it is generally common and frequent in Central Europe. The species lives on maples trees: *Acer pseudoplatanus, A. platanoides* and *A. campestre*. In the apiary at Gödöllő which I selected as the area for my experiments, apart from the above maples, the *A. negundo* also grows. I merely found aphids in masses on the *A. pseudoplatanus,* seldom on the *A. platanoides* and never on the *A. campestre* and the *A. negundo*. I observed a similar picture in various hilly areas. Therefore its chief food supply in Hungary is the *A. pseudoplatanus*.

The young larva of the eggs which weather the winter appear before the buds open. They frequently suckle close together on the buds. Those having wings are seldom found next to one another, but are mostly dispersed (Table I.) Here, I mention DIXON (1963) and his findings in England, where he observed the position of 161 winged aphids. He found that they were never closer than 2.5 mm to one another and 60% of them were situated at a distance of 5 mm. So the species forms a colony. The developed virgo are always winged. Only the females fertilizing and laying winter eggs of both sexes and appearing in autumn are wingless as well as the larvae and nymphs. They suck on the under side of the leaves, sometimes on the leaf stems (Table I), and in spring

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on the inflorescence. Most frequently they suck along the leaves. I have never found them on young green growths. According to WEIS (1955), there can be as many as 10 generations yearly. The sexuparae appear mainly in October. The females lay their eggs on young branches, usually close to the buds. The species does not change hosts.

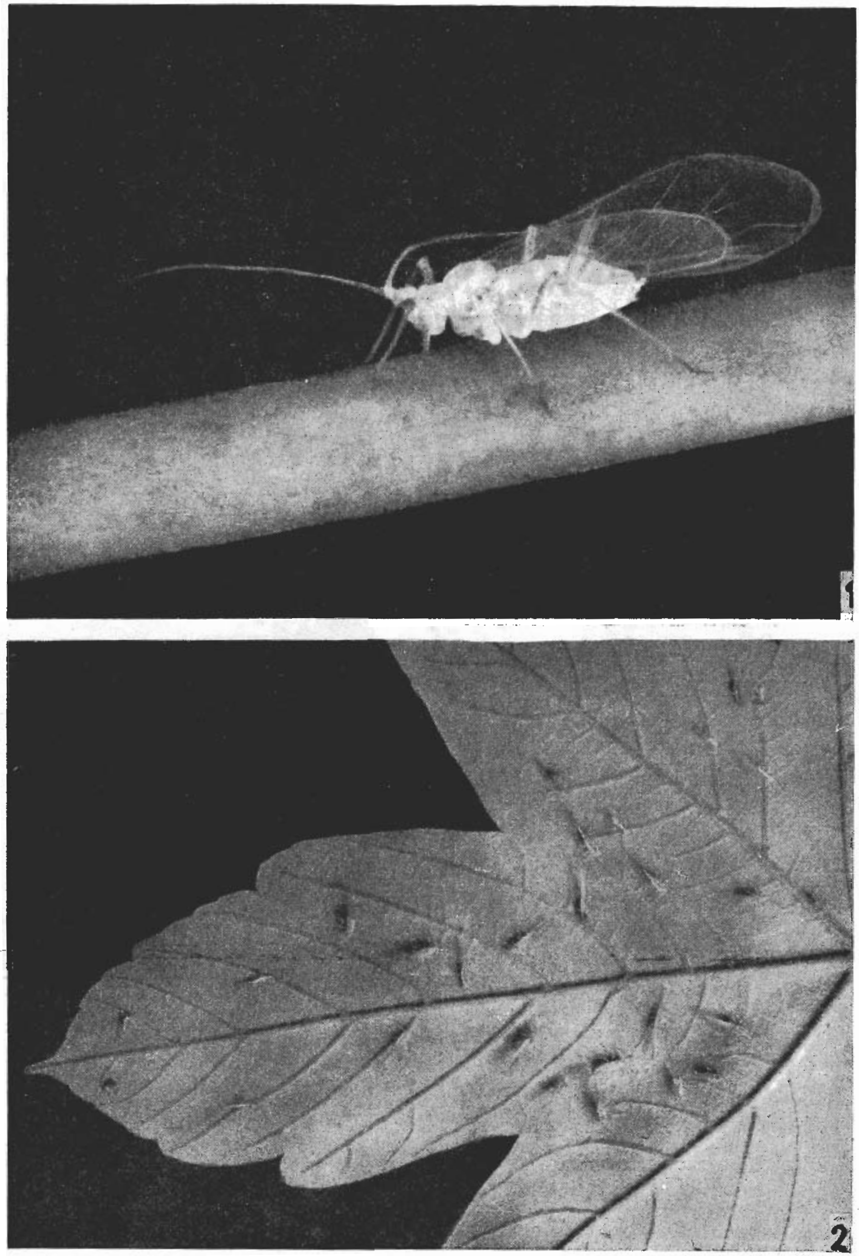
I wish to stress the great mobility of the individuals of the species. Particularly in warm weather, it is sufficient to approach the leaves with hands or move them, and the winged insects will immediately fly away; when, after removing their suctorial organs, with the aid of their long front legs they leave the leaves almost with a jump.

Methods of Experiments

My experiments for the population changes were performed on two *A. pseudoplatanus* trees, about 8 m high spreading and bushy crowned standing close together. The collection was started on 25 April 1962 and finished on 9 August of the same year. On April 25 we found only nymphs, no winged insects, and so the time seemed suitable to commence our experiments. Samples were collected once a week, generally on the same days. On both ocassions we collected 100 leaves each. We placed wide mouthed collecting bottles over the leaves and cut off the leaf stems. Each leaf was placed in a separate bottle. According to the general principle for testing quantity, 17 samples were collected from both the top and the bottom of the foliage and 16 samples from half way up the trees. The collected leaves when gathered were viewed from the top, and since *D. platanoidis* suck on the under part of the leaves, we could not ascertain whether the leaves had any aphids on them or not. We usually made our collections in the early hours of the morning, since the aphids are less mobile at that time. The collection of samples entailed very careful work.

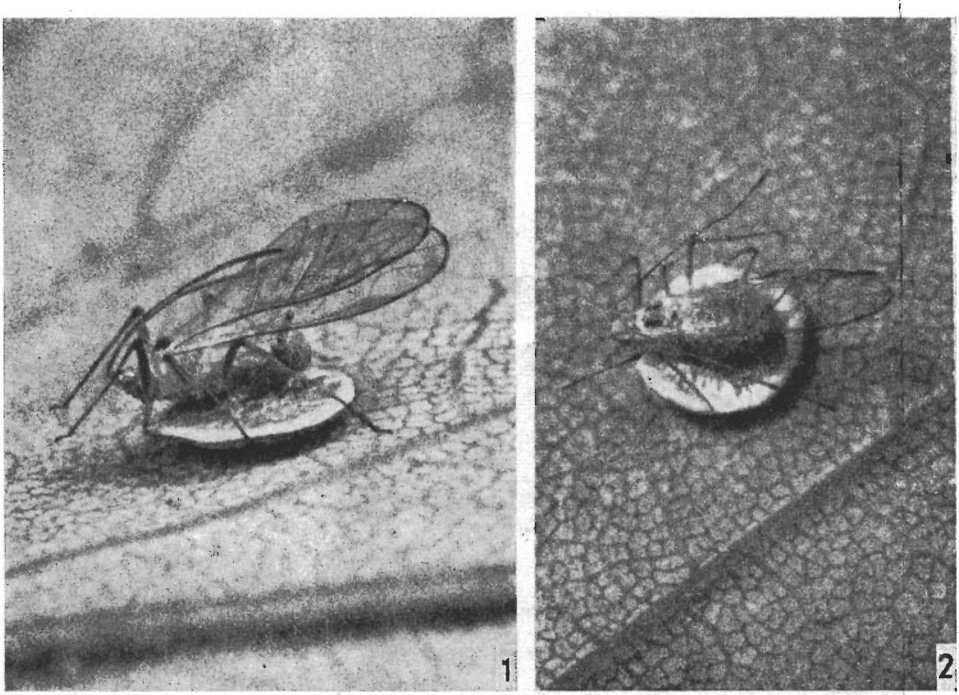
We poured 70% alcohol over the leaves in the laboratory. Every leaf was examined with binocular lupe, and the leaf aphids and other insects were carefully removed. The leaves were placed on even thicknesses of tracing paper and their outlines were drawn. Later, the sketched leaf shapes were cut out from the paper and weighed on analytical balances. The weight of the leaf surface was calculated in comparison with the known weight of the paper. The green leaves were placed in a heating cupboard at 105 C° for a few hours. The dry weight of the leaves was immediately taken in an dry condition. The carefully removed leaf aphids were sorted into groups of larva, nymphs and winged insects and the number of each was recorded. These were also placed in their groups (larva, nymphs and winged insects) from individual collections into the heating cupboard and then their dry weight was taken in an air dry condition. Other types of insects were also recorded. So, by this method we obtained the number and dry weight of the *D. platanoidis* larva, nymphs and winged insects found on 100 leaves, and the dry weight and surfaces of leaves. On the first three days of the experiment, I also collected 50 inflorescences. I ascertained their dry weight too, and the leaf aphids found on the leaves were analysed in the same way.

Table I



Drepanosiphon platanoidis SCHRK. *1*: Winged form, *2*: Winged forms on a leaf of *Acer pseudoplatanus*

Table II



Drepanosiphon platanoidis SCHRK. *1–2*: Parasited specimens

Results and Discussion

On the first occasion, on 25 April, I found 680 nymphs on the inflorescences i.e. 13.6% (at the same time the number of nymphs was 280, i.e. 2.8 for eacl leaf). So the dry weight of the nymphs was 2.42% of the dry weight of the tota collection of the inflorescence. Therefore, in spring, the individuals suck or the young, moisture rich inflorescence in considerable numbers. On the 2nc May I only found 2 winged insects, 12 nymphs and one larva on 11 inflorescences On the 9th May, I found aphids on 14 inflorescences, 24 winged insects, 10 larvae and not a single nymph. On 16 May, the inflorescence was practicall over and the aphids had moved down to the leaves.

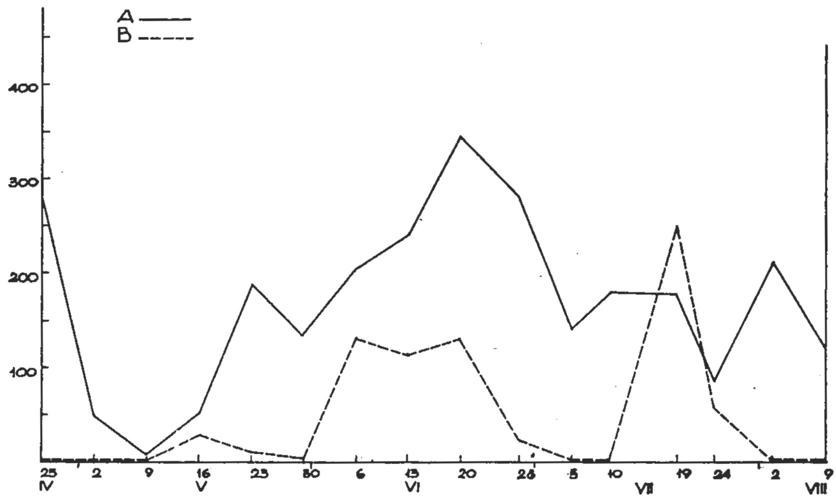


Fig. 1. *A*: Total number of nymphs and winged forms of *Drepanosiphon platanoidis*; *B*: Number of larvae of the same species

The analysed results of the *D. platanoidis* found on the leaves are shown in Figs 1—4. The values are always valid for 100 leaves.

Fig. 1/A shows the combined numerical changes of the nymphs and winged insects. On April 25, I found only nymphs in fairly large numbers. The combined number of nymphs and winged insects exceeded this value on June 20. On May 2 and particularly on May 9, a marked decrease in the population was noted. In my opinion this conspicuous decrease was due to the weather. As can be seen in Fig. 4, the temperature during the end of April and early May had considerably decreased. The daily minimum temperature on April 30 and May 2 was below 0 C°. The destruction may have been caused by frost. The increase in population after May 9 could be explained by the aphids moving to the leaves from the ageing inflorescences. The combined increase in numbers, though not a regular one, of both the nymphs and winged insects was observed until June 20. After this date, I observed a decrease. This might be explained by the decrease in reproductive activity of the species and by the increase of parasites and enemies. The decrease of the aphids noted on July 24, is most probably largely due to the heavy rain on that day.

The changes in the number of larvae are shown in Fig. 1/B. Here I wish to discuss the reproductive capacity of the *D. platanoidis*. DIXON (1963) cites MORDWILKO, who observed in Warsaw in 1896 that the winged aphids could be found in large numbers on the *A. pseudoplatanus* from about June or July until the end of July or August. At that time, MORDVILKO did not found any nymps. I have found the following quantities of nymphs from June 20; June 20: 113; June 28: 29; July 5: 7; July 10: Nil; July 19:63; July 24: 7; August 2: 6; and August 10: Nil. Thus there was a decrease in the number of nymphs, but nevertheless, they did not disappear entirely. According to DIXON (1963), in England, the leaf aphids did not increase after June 9. Some did, however, increase again in August. As shown

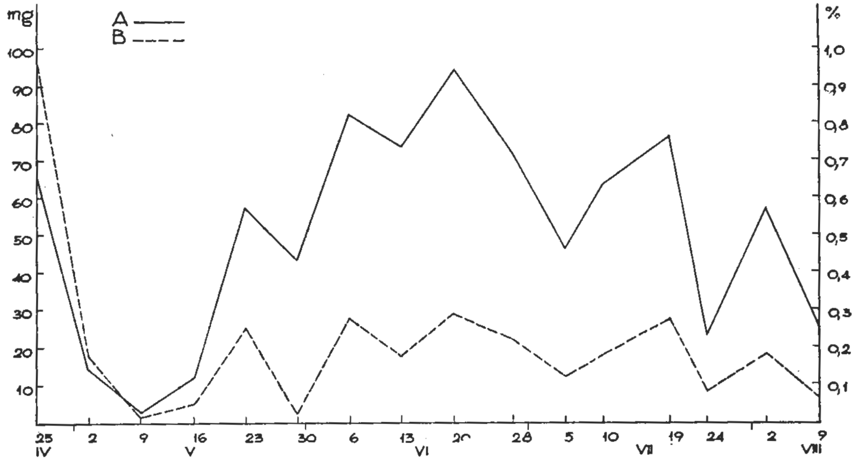


Fig. 2. *A*: Total dry weight of larvae, nymphs and winged specimens of *Drepanosiphon platanoidis*; *B*: Total dry weight of larvae, nymphs and winged types of the same species expressed in dry weight of leaves

in Fig. 1/B, there was a considerable variation in the number of larvae. No connection whatsoever is apparent between the numbers of winged insects and larvae. This indicates that not all virgo are capable of reproduction. They do not reproduce regularly and for some unexplained reason, intervals can be noticed. It was conspicuous that some of them reproduced greatly after July 10. On July 19, a decrease was again observed. This summer decrease in the reproduction activity of the *D. platanoidis* is explained by DIXON as due to the decrease of the soluble *N* content of the leaves. Additionally, he thinks the density of the population may also be a contributory factor. My experiments did not include a consideration of this matter.

Fig. 2/A shows the variations of dry weight of all the *D. platanoidis*; Fig. 2/B shows the same expressed as a percentage of the total dry weight of the leaves. The variation of the two curves is caused by the increase of leaves. Fig. 3/A shows the total numerical changes of nymphs and winged types on a 100 cm² leaf surface; Fig. 3/B shows the dry weight changes of all the *D. platanoidis* on a 100 cm² leaf surface. This figure shows clearly that the aphids reached maximum density on a surface unit in spring, and later it becomes at most half of this density. The method of WLADIMIRSKI (1925) and KALLINIKOVA (1927) both cited by BALOGH (1958) had been employed to determine the quantity, i.e. dry weight of the aphids, compared with the weight, i.e. surface of the leaves.

It should be emphasized that the examinations were performed in 1962. Varying weather conditions may modify the shape of the curves.

THEOBALD (1927), cited by WEIS (1955), enumerates the following insects as the natural enemies of *D. platanoidis*: *Aphidius constrictus, Megaspilus carpenterii, Asaphes aenea, Cyrtogaster vulgaris, Coryna davata, Encyrthus atheas,* also *Adalia bipunctata, Coccinella 7-punctata,* Syrphida larvae, Hemerobiidae and Crabronidae. I am unable to supply or complement any information about

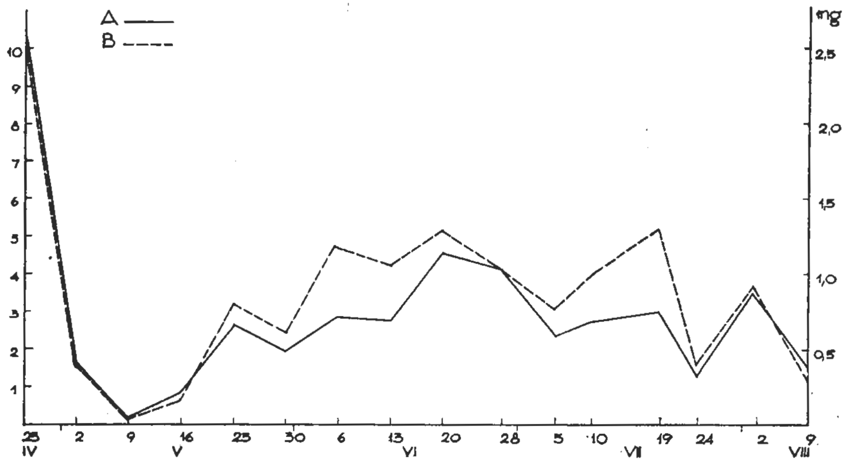


Fig. 3. *A*: Number of nymphs and winged forms of *Drepanosiphon platanoidis* on 100 cm surface of leaves; *B*: Total dry weight of larvae, nymphs and winged animals on the same surface

these species. I can supply some quantitative information and some as a hypothesis. I consider the greatest insect enemies of *D. platanoidis* to be the ichneumon fly. The parasited aphids become discoloured and deformed. Some of them are shown in photograph 7. I found the first few parasited aphids on June 20. On 100 leaves I found 21 parasited *D. platanoidis* on July 5; 32 on the 10 th; 82 on the 19th, and 70 on the 24th. The figures quoted are not entirely accurate, since on the freshly parasited aphids, marked changes cannot be noted with a cursory examination. The primary importance of the ichneumon wasps, among the other natural enemies, may be indicative of the mobility of *D. platanoidis.* The Syrphida larvae, the Coccinellida and *Chrysopa* larvae rather destroy the larvae of the aphids, to a slight extent the nymphs, and rarely the winged individuals. I observed the first Syrphida larva fairly late on June 13, and a few Coccinellida of various species; on June 20, I studied the first chrysopas.

GALECKA (1953) is of the following opinion arrived at by studying the *Aphis fabae* and *Capitophorus ribis* species. The biotic factors (enemies, parasites) mostly restrict mass increase; whilst climatic factors may cause a sudden cessation in increase and disturbing crises may be the result of normal development. I agree with these views and wish to add that the characteristic reproduction ability of the species and their individual numbers equally depend on the physiological condition of the host plant (combination of nourishment moisture), the weather, the parasites and enemies.

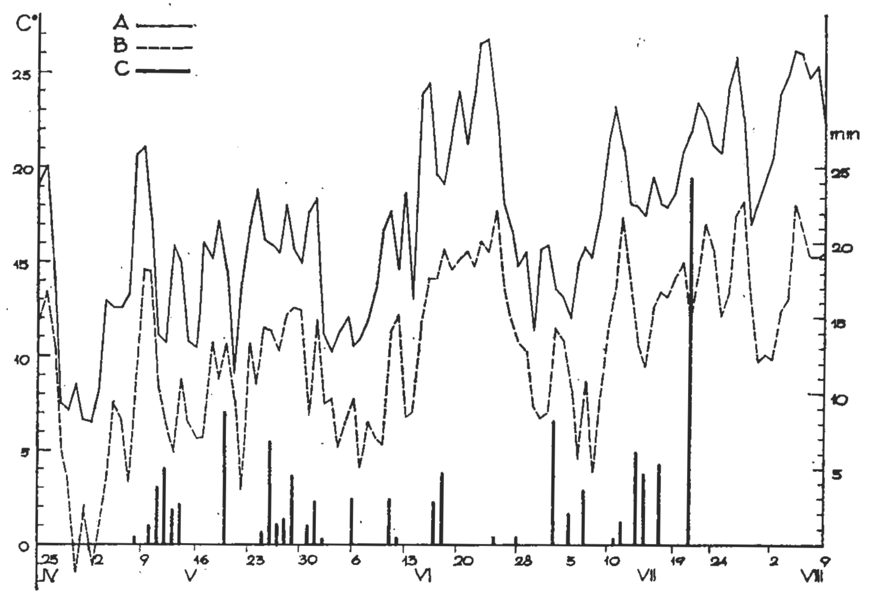


Fig. 4. Meteorological data during field work. *A*: Daily mean temperature; *B*: Daily minimal temperature; *C*: Precipitation

The average dry weight of the collected *D. platanoidis* was not part of the experiments, but was determined. Of the daily averages, the extreme values and total values were as follows:

	extreme values	total values
larva	15–74 gamma	60.3 gamma
nymphs	138–332 gamma	222.0 gamma
winged type	210–468 gamma	304.0 gamma

The period of the examinations was too short for drawing conclusions regarding any sort of connection concerning the weight of the winged types. However, it should be noted that I obtained the biggest average values on the 2nd and 3rd collection days (May 2: 411 gamma, May 9: 468 gamma). The values were considerably lower on the last three collection days (July 24: 252 gamma, August 2: 265 gamma and August 9: 210 gamma). This great discrepancy is probably explained by the combination of vegetation juices being less favourable for the growth of the aphids than it was in spring.

Economic Importance of the Species

The species is usually not mentioned in the forestry literature. Undoubtedly their importance is much less than that of other aphids of individual leafy trees. Nevertheless, they should not be entirely disregarded. The aphids by their sucking cause yellowing and decay of the young, tender leaves. I frequently noticed that young larvae invaded individual leaves, or those close together, whilst on other leaves there were none at all. The production of honey dew decreases the gas exchange of the leaves. During my observations I first noticed soot mould spots on June 20.

The information in the literature as regards their apiary importance varies. For apiary purposes aphids are important, if they produce ample honey dew, which the bees collect. BÖRNER (1931) mentions a strong honey dew formation. According to RIETSCHEL (1951), they are of little use. The reason for this it that owing to the great mobility of the species, the carbonhydrate contens of the honey dew is small, and the honey dew is thin, with little viscosity and dries quickly, so the bees can only collect it with difficulty. ZOEBELEIN (1956) maintains that if the weather is favourable, much honey dew is produced during June and July; yet of the insects visiting the honey dew, he does not mention the Apis mellifica. SCHMUTTERER (1958) does not mention the species in his summarizing work. HARAGSIM (1963) in Czechoslovakia includes it among the excellent producers of honey dew.

According to my observations, I can state the following. It profusely extracts honey dew by sucking on the young, growing florescence shoots and leaves during April and May, provided the weather is favourable. At times this is so plentiful that it not only covers the leaves of the tree, but makes the vegetation growing underneath the tree sticky. The bees are able to collect the honey dew and do so mainly in the early, humid hours of the morning. Later in the year, on the fully grown leaves, scattered aphids can be observed and also honey dew in scattered tiny spots, consequently the leaves dry quicker too. Although there is sometimes plenty of honey dew in June and July, this owing to the abowe reasons is not important for the bees. According to the experience gained during my examinations and previous observations made in other parts of the country, I consider the species, from the point of view of apiary, merely of occasional value. The honey dew of the maples cannot be entirely attributed to the product of this species, since other species also play a role.

Summary

The author examined the *Drepanosiphon platanoidis* SCHRK. aphid's population changes with the 100 leaf method on *Acer pseudoplatanus* trees between April 25 and August 9, 1962. His main conclusions are as follows:

1. In Hungary, the species mainly lives on *Acer pseudoplatanus*.

2. The larvae and nymphs densely suck on the buds and young leaves and later the winged types can be found scattered in the foliage.

3. The population of the species is reduced by frosts in spring and probably by heavy rainfull in summer.

4. The most important enemies seem to be ichneumon wasps.

5. The reproductive activity of the species decreases in summer, but not that of all individuals. In warm weather, reproduction is fairly uneven.

6. Regarding forestry and apiary, the importance of the species is moderate. It mainly causes damage in spring, i.e. can be a supplier of honey dew.

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