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The natural control of the apple-grass aphid, Rhopalosiphum insertum, with remarks on the control of apple aphids in The Netherlands in general

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Abstract

In this paper the apple-grass aphid is stated to be the only aphid in the Netherlands that regularly hibernates in large quantities in commercial apple orchards. The possible reasons for this are discussed. Abiotic factors, especially rain, hail, wind and ice formation in early spring, are by far the most important in drastically reducing the numbers of fundatrices. Of the biotic factors, ladybird beetles in spring may be important. The apple-grass aphid parasite, *Monoctonus cerasi*, may reach high peaks of parasitism during some periods in the season; in comparison with abiotic factors, however, its effect does not seem to be very important. The life history of the parasite seems to be well adapted to that of its host. It is suggested that the winter wash against apple aphids might be omitted, with eventual application of a spring spray in certain circumstances. In most cases this spray will only be necessary if the rosy apple aphid is present.

Introduction

In The Netherlands the apple-grass aphid, *Rhopalosiphum insertum* (Wlk.), is a common aphid on apple; it occurs almost everywhere where apples are grown. Nevertheless, it often escapes the attention of the fruit-grower. This species is much less known than the green apple aphid, *Aphis pomi* Geer, and the rosy apple aphid, *Dysaphis plantaginea* (Pass.). The life history and control of the apple-grass aphid in Europe have been studied by Müller (1960) and Schneider et al. (1957).
The differences in field characters between the apple aphids have been given by Dicker (1954). I shall list only the characters by which the three main species may be easily distinguished.
Rhopalosiphum insertum: yellow-green with darker green stripes down the centre of the back and along each side. Short, pale honey tubes.
Dysaphis plantaginea: pink to slaty blue, lightly covered with a waxy secretion.
Aphis pomi: uniformly green, with black honey tubes and tail.
The three species may also be easily recognized by the kind of infestation they cause. The apple-grass aphid in spring usually infests the rosette leaves, which may become

slightly curled, and the blossom buds. The rosy apple aphid lives in about the same places, but as it remains longer on apple during the season, it may also seriously infest the shoots. The infested leaves become strongly curled, giving shelter to the aphids inside. The foliage, in particular the veins, may discolour yellow. The rosy apple aphid is by far the most injurious one on apple, since fruits from infested trusses, even if the aphid population does not seem to be very high, are small, distorted and unsaleable. The green apple aphid, on the other hand, infests only the tips of the young shoots.
There are some other aphid species which may infest apple incidentally and locally, viz. the rosy leaf-curling aphids, *Dysaphis* spp., the potato aphid, *Macrosiphum euphorbiae* (Thos.), the foxglove aphid, *Aulacorthum solani* (Kltb.), and the black bean aphid, *Aphis fabae* Scop. The most important are the rosy leaf-curling aphids, of which there are a number of species, difficult to distinguish. Like the rosy apple aphid they curl the leaves strongly; they may be distinguished from this species by the colour of the leaf curls, which is not yellow but bright red. The three other species are of no economic importance on apple.
In this paper it is mainly the apple-grass aphid that is discussed; the rosy apple aphid and the green apple aphid are considered only insofar as this is useful for comparison with the apple-grass aphid. As to the nomenclature of the morphs I follow Hille Ris Lambers (1966).

Life history of the apple-grass aphid

The apple-gras aphid hibernates in the egg stage on apple and also on some other Pomoideae, e.g. *Sorbus*, *Crataegus* and *Cotoneaster*. The eggs mostly start hatching in the second half of March; in some years we noticed the first young fundatrices only in the beginning of April. Hatching of the bulk of the eggs is usually complete by about mid-April; however, small numbers may go on hatching until May. In 1967 we noticed a few unhatched eggs and a few very young fundatrices on 8 May.
The first fundatrices are ordinarily full-grown in the second half of April and then start reproducing. Their progeny consists of only one generation of virginoparae on apple, which become full-grown, winged aphids from the beginning of May. These migrate to quite a number of grass species, where they produce exuls until the autumn, after which the gynoparae migrate back to apple. Here the oviparae complete their development on the undersides of the leaves. When they are full-grown they walk to the branches and the stem of the apple. Here copulation with the winged males, which immigrate from grasses at that time, generally takes place. Copulation may also be performed on the undersides of the leaves. After copulation a few winter eggs are laid in the spurs, on the older shoots and at the bases of the buds, mostly on places where the bark is more or less rough.
Some authors (Stroyan, 1952; Börner and Heinze, 1957; Schneider et al., 1957) state, or at least suggest, that there may be a very small second generation of virginoparae on apple; Massee (1956) even mentions a third in England in the spring of 1955. These authors come to this conclusion by observing unwinged adults late in spring. However, these adults may have been fundatrices from which, as I mentioned above, a very small number may hatch very late in the season. So the occurrence of more than two spring generations of *Rhopalosiphum insertum* on apple has not yet been proven.

In most cases migration to grasses has ceased by the end of May or in the first days of June. In 1962, however, March, April, and especially May, were very cold in The Netherlands and hatching of the winter eggs was later than normal. The first young aphids were observed on 8 April. The development of the aphids was also retarded, and apple-grass aphids were still seen on apple about the middle of June.
The species reproduces on grasses through several generations. Under experimental conditions, up to twelve succesive generations on *Poa annua* were bred by Mr. J. Noorlander, IPO, Wageningen. In these experiments the earliest winged specimens on apple were transferred to small *Poa annua* plants in pots under cages in the open. They were killed as soon as they had produced their first progeny. When this progeny was full-grown and had produced their first progeny, they in turn were killed and so on. The very last individuals were full-grown, and winged, on 18 October.

The population dynamics of the apple-grass aphid on apple

Fig. 1, 2 and 3 show the fluctuations in population density of the apple-grass aphid on apple during spring of the years 1965, 1966 and 1967, on the grounds of the Institute of Phytopathological Research at Wageningen. In 1965 a small apple orchard was used; here in most seasons there was a moderate infestation. Counts of the aphids were made about every week, at first on ten fruit buds and later in the season on ten rosettes, of each of ten apple trees. In 1966 and 1967 five isolated trees of 'Belle de Boskoop' in a grass plot were chosen. On these trees there was usually a severe infestation every

Fig. 1. Course of the population density of the apple-grass aphid (——) and of the percentage of parasitism caused by its main parasite (- - -) during 1965, with indications as to the date of appearance of some stages of both aphid and parasite.

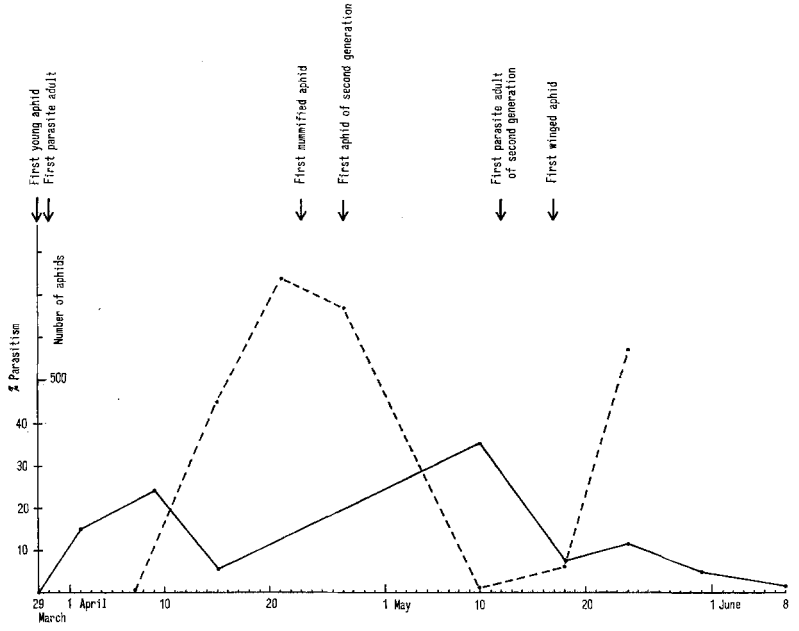

Fig. 1. Verloop van de populatiedichtheid van de appel-grasluis (——) en verloop van de parasitering door haar belangrijkste parasiet (- - -) gedurende 1965. Het optreden van de verschillende stadia van de bladluis en van de parasiet is door pijltjes aangegeven.

Fig. 2. Course of the population density of the apple-grass aphid (——) and of the percentage of parasitism caused by its main parasite (- - -) during 1966, with indications as to the date of appearance of some stages of both aphid and parasite.

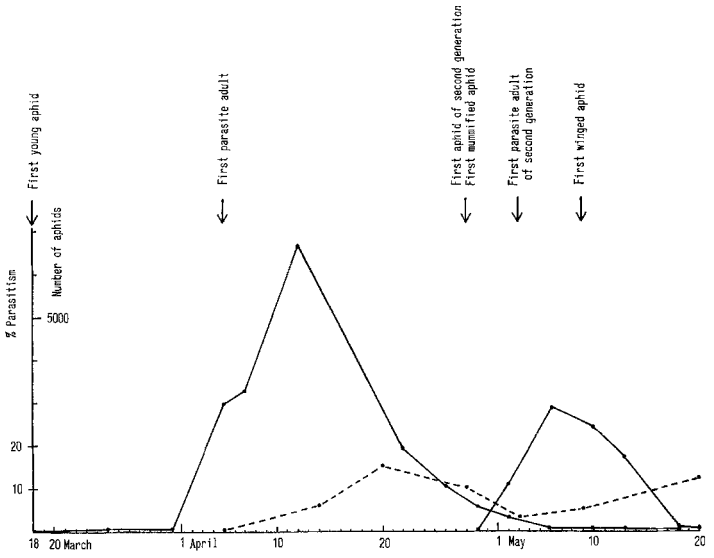

Fig. 2. Verloop van de populatiedichtheid van de appel-grasluis (——) en verloop van de parasitering door haar belangrijkste parasiet (- - -) gedurende 1966. Het optreden van de verschillende stadia van de bladluis en van de parasiet is door pijltjes aangegeven.

Fig. 3. Course of the population density of the apple-grass aphid (——) and of the percentage of parasitism caused by its main parasite (- - -) during 1967, with indications as to the date of appearance of some stages of both aphid and parasite.

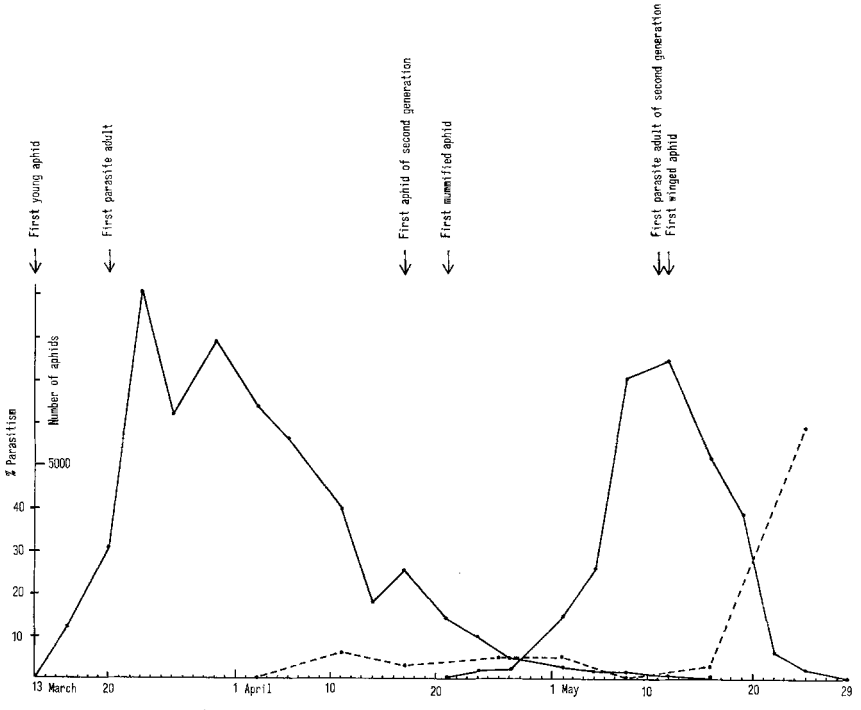

Fig. 3. Verloop van de populatiedichtheid van de appel-grasluis (——) en verloop van de parasitering door haar belangrijkste parasiet (- - -) gedurende 1967. Het optreden van de verschillende stadia van de bladluis en van de parasiet is door pijltjes aangegeven.

spring. The aphids on twenty buds, or later in the season on twenty rosettes, of each of five trees were counted. In 1965 individuals of both generations were counted indiscriminately; in 1966 and 1967 they were counted separately.
The dates of appearence of the first aphid of the first generation, of the first of the second generation and the first winged virginopara (emigrant) are also shown. The data on the main parasite and the parasitization are dealt with in a separate section. The first peak in all three graphs is the result of the continued hatching of the fundatrices from the winter eggs. After hatching has finished there is a rather steep decline of the population density. In 1965 no counts were made between 15 April and 10 May. However, a rise in the population density then could not be expected before the first aphids of the second generation had appeared on 27 April.

The influence of abiotic factors

Abiotic factors may play a very important role in the mortality in early spring. When the first winter eggs hatch most of the buds of many apple varieties, e.g. 'Belle de Boskoop', on which most observations were made, are still in the resting stage. The young aphids then find no green parts on which they can feed. Moreover, they find it difficult to hold on to the smooth twigs and buds and by far the greater part of the sometimes very dense populations may be removed by rain showers, hail and wind. This mortality is most important in early spring.
Some preliminary experiments were made on the effect of night frosts on mortality. In April 1966 young aphids on apple buds in Petri dishes were kept in a refrigerator at a constant temperature of 7.5 °C below zero for 24 h. Though this is a more extreme condition than would be ever met in the field, no aphids were killed. If, however, the aphids were moistened before hand, all were killed. Thus it is not low temperatures that are so harmful to the aphids in spring, but the combination with ice formation.

The influence of biotic factors

The predators

Biotic factors, also, may be of interest in many cases. In early spring, ladybird beetles (Coleoptera, Coccinellidae), which hibernate as adults, may destroy quite a number of aphids, especially when the buds are in the mouse-ear or later stage. Then the aphids may hide between the small leaves, where they are easily found and destroyed by the beetles.
We often noticed in spring the polyphagous species *Adalia bipunctata* (L.), *Coccinella decempunctata* L., *Harmonia conglobata* (L.), *Exochomus quadripustulatus* (L.), *Harmonia quatuordecimpunctata* (L.) and *Coccinella septempunctata* L. According to Iperti (1965, 1966) the first three species prefer aphids on trees; we think that we may add *Exochomus quadripustulatus* to this category. According to Iperti *Harmonia quatuordecimpunctata* prefers aphids on shrubs and *Coccinella septempunctata* prefers aphids on low plants. At least some of these species may lay their eggs on apple in spring and their larvae then destroy quite a number of aphids.
Anthocorus nemorum (L.) (Hemiptera, Anthocoridae), which also hibernates as an adult, was often observed feeding on apple-grass aphids. Lacewings (Neuroptera,

Chrysopidae and Hemerobiidae) do not seem to play an important role in the population dynamics of the apple-grass aphid in The Netherlands. In general, it is only the larvae that are important in reducing aphid populations and these appear too late in the season to have much influence on the apple-grass aphid.
Syrphid larvae (Diptera, Syrphidae) seem to be more important. *Syrphus ribesii* (L.), *S. vitripennis* Meig. and *Epistrophe balteata* (Geer) were commonly bred from apple-grass aphid colonies on apple. Moreover the larvae of *Lasiopticus pyrastri* (L.), *L. seleniticus* (Meig.), *Syrphus corollae* (F.) and *Platychirus scutatus* Meig. were sometimes found associated with the apple-grass aphid. It is difficult to appraise the real importance of syrphids in respect to the apple-grass aphid. We have the impression that they are not very important, as we found them in larger numbers only when the population density of the aphids was rather high.

The parasite complex of the apple-grass aphid

The apple-grass aphid has one main parasite, *Monoctonus cerasi* (Marshall). In some cases *Ephedrus persicae* Froggatt, the main parasite of the rosy apple aphid, may also parasitize this aphid (Evenhuis, 1964, 1965, 1966). *Monoctonus cerasi* obviously does not accept the other apple aphids as hosts. However, this species has been mentioned as a parasite of a number of other aphids. Mackauer (1962) records it as a parasite of aphids of the "*Brachycaudus–Myzus–Rhopalosiphum*" series. Starý (1966) mentions it as "a parasite of some leaf-curling species (*Myzodes* etc.)", in the "Habitat: Gardens, deciduous woods". He mentions especially *Myzodes ligustri* on *Ligustrum vulgare* as a host aphid in Czechoslovakia.
According to our observations *Monoctonus cerasi* hibernates as a full-grown larva in diapause within the dead, mummified aphid host, often in bark crevices, on apple. The adult parasite may appear very early in the season, sometimes even in the second half of March. In spring there are two generations of the parasite associated with the apple-grass aphid on apple; the first parasitizing the fundatrices, the second the next generation of virginogeniae.
During April and May of the last three years, one hundred wingless – not yet full-grown – aphids were sampled on apple every week: in 1965 10 from each of the 10 trees and in 1966 and in 1967 20 from each of the 5 trees. The aphids were dissected under a binocular microscope in the laboratory. The number of aphids with an egg or a larva of the parasite were counted. The newly laid eggs inside the aphids are very small and hence very difficult to discover; only the older eggs are larger and more easily seen. We are therefore aware that we may have missed a number of eggs, but as the egg stage is rather short, the error may not be so important.
Fig. 1, 2 and 3 show the course of the parasitism and some further data about the occurrence of the parasite in 1965, 1966 and 1967. In general, the percentages of parasitism were rather low. Only in 1965 was there a peak of 74% on 21 April, owing to the activity of adults of the first generation; at the same time the population density of the aphid was low. It must be remembered that in 1965 the trees sampled were different, with a much smaller aphid infestation, then those sampled in 1966 and 1967. In 1966 the peak in April was much less pronounced and in 1967 there was no pronounced peak at all. Observations in the same small orchard sampled in 1965 showed a peak of 16% on 1 May 1963 and of 7% on 21 April 1964.

The three graphs show very low percentages of parasitism somewhere in the first half of May, owing to the fact that the first generation of parasite adults had died and the second generation was not yet present, or had only been present for a very short period. This depression of parasitism had been observed in previous years: in 1963 it was on 16 May (1%) and in 1964 on 12 May (0%). After the depression the graphs show a rise in the percentage of parasitism, due to the activity of parasite adults of the second generation. The percentage of parasitism reached its maximum at the time that most aphids had migrated from apple. After the latest dates indicated on the graphs, the determinations of the percentages of parasitism were stopped because it was no longer possible to collect a sufficient number of aphids. In preceding years maximum percentages of parasitism had been observed of 24% on 7 June 1962, 90% on 28 May 1963 and 20% on 19 May 1964. Thus it may be concluded that in many years a high percentage of parasitism may be reached by the end of May or the beginning of June.

Besides the sample of 100 immature aphids taken on 26 May 1967, a sample of 100 winged, mature, aphids, collected from apple, were also taken and dissected under the binocular microscope. Only two of them appeared to contain a small parasite larva. It may even be that these aphids were parasitized just before they moulted to the adult stage. At any rate it may be concluded that the adult winged aphids will generally not be parasitized, or possibly not at all. It may also be conluded that aphids that are not yet full-grown, if parasitized, will only reach the winged stage as an exception. These conclusions may explain why parasitism is so high at the end of May or the beginning of June. They are important for they indicate that the parasite will not, to any great extent, migrate passively with its host to grasses.

On 26 May 1967, 83 parasitized but not yet mummified aphids were collected from apple trees on the ground of the Institute of Phytopathological Research at Wageningen. Parasitized but not yet mummified aphids containing a full-grown or almost a full-grown parasite larva are easily recognized by their rather yellow colour; also they are generally more shiny than unparasitized aphids. By 29 May the parasitized aphids were dead and mummified. On 21 June there had still been no emergence of adult parasites; 4 mummies were then dissected under the binocular microscope. Each contained a full-grown parasite larva, which had not yet defecated its dark gut contents. So it might be taken for granted that all parasite larvae were in a state of diapause. The mummies were inspected every week during the summer season. On 22 September still no adult parasites had emerged, but by 29 September 40 specimens had emerged. Two of them were cynipid hyperparasites, which will be dealt with in a later section of this paper. On 2 October, 10 specimens of the primary parasites emerged; on 6 October 2; on 13 October 2 and on 16 October 1. The remaining 24 mummies were dissected under the binocular microscope; 12 of them contained a full-grown larva in diapause and in 12 the contents were dead.

In the last days of September and at the beginning of October adult parasites were also observed on apple trees in the field, parasitizing the oviparae on the undersides of the leaves. It happened, however, that in 1967 very few oviparae were seen on the stems and branches; indeed very few winter eggs were laid on apple trees that had had abundant eggs in preceding years. This phenomenon was observed generally in 1967 in apple orchards near Wageningen and in the Betuwe district, but the reason for it is not known.

A sample of 100 full-grown oviparae was collected from the undersides of leaves from apple trees on the ground of the Institute of Phytopathological Research on 6 October and dissected under the binocular microscope; 23 contained eegs or young larvae of *M. cerasi*. From 50 winged aphids, collected from the same sites, only one contained a full-grown larva; this might even have belonged to another species. So the percentages of parasitism of oviparae and winged specimens were 23 and 2, respectively. Samples of 100 oviparae and 50 winged specimens were collected again on 11 October; these yielded parasitizing percentages of 25 and 4, respectively. These samples already contained a number of full-grown parasite larvae.
On 29 and 30 October 1967 an abundant population of the apple-grass aphid was observed on apple trees in a private garden at Nieuwe Pekela (Province of Groningen). Many winged aphids and oviparae were seen on the undersides of the leaves and on the stems and branches. A sample of 100 oviparae was collected from the woody parts and dissected under the binocular microscope at Wageningen; 64 contained a full-grown or nearly full-grown parasite larva. This was a very high parasite percentage. However, it must be remembered that this percentage was determined from oviparae that had already left the leaves; they were generally older and so might be expected to show a higher percentage of parasitism as a result of a longer period of exposure to the action of the parasite. A large number of leaves with oviparae was collected, but very few aphids mummified and during autumn all the remaining aphids died.

The influence of hyperparasites

Four hymenopterous hyperparasites may be bred regularly from mummified apple-grass aphids on apple, namely *Phaenoglyphis* (sensu Hellén, 1963) sp. (Cynipidae), *Lygocerus frontalis* (Thomson) (Ceraphronidae), *Pachyneuron aphidis* (Bouché) (Miscogasteridae) and *Asaphes vulgaris* Wlk. (Miscogasteridae). I have mentioned these hyperparasites in earlier papers, occasionally under somewhat different names (Evenhuis, 1964, 1965, 1966). I stated also that hyperparasites may markedly impede the effect of the primary parasite of *Aphis pomi*; and that later in the season they may eliminate this primary parasite almost completely (Evenhuis, 1964). Early in the season the hyperparasites apparently do not play an important role in the population dynamics of aphids.
As the apple-grass aphid has usually already disappeared from apple by early June, this is undoubtedly the main reason why the hyperparasites are generally not important then. Only in 1962, when the aphid, owing to the prevailing weather conditions, remained on the apple for a longer time than ordinarily, was a somewhat higher percentage of hyperparasites observed (Evenhuis, 1964).

Discussion

As already stated, in The Netherlands the apple-grass aphid is the most common and most numerous aphid on the apple in spring, especially in commercial orchards. In these orchards, aphid winter eggs often belong almost exclusively to this species. There may be a number of reasons for this.
The green apple aphid does not migrate to herbaceous plants, but remains on apple and other Pomoideae the whole year through. However, it can only maintain itself on

growing shoots. In commercial orchards all or almost all shoots have ordinarily stopped growth before September.
The aphid may survive in tree nurseries, where, owing to different cultural practices, growth is often prolonged until well into the autumn, and also on other Pomoideae elsewhere. On these plants winter eggs may be laid in large numbers along the young shoots. Reinfestation of commercial orchards may take place after winged virginoparae are produced; this occurs from about mid-May onwards through the whole season. These winged aphids, producing young aphids, may be observed in the field on the undersides of young apple leaves. However, only under very few exceptionally favourable circumstances may smaller or larger colonies persist on the tips of young shoots. For some reason by far the most of the invading winged virginogeniae and their progeny die.
The rosy apple aphid lays its eggs in roughly the same places on apple as does the apple-grass aphid. However, this species is restricted to the apple, *Malus pumila*, as a primary host. It migrates between apple and some *Plantago* species as summer host plants, viz. *P. lanceolata, P. major* and *P. media*. These plant species occur scattered in the field. Many grass species, on the other hand, ordinarily cover a far larger and more closed surface in and near apple orchards. As host plant finding by aphids is only by chance, it is evident that both emigrants and immigrants of the rosy apple aphid are in far less favourable circumstances for finding the right host plants than are those of the apple-grass aphid. Both aphids produce quite a number of generations on their summer host plants, consisting of both winged and unwinged exuls.
The winged exuls of the rosy apple aphid are again in less favourable circumstances as regards spreading from plantain to plantain than those of the apple-grass aphid from grass to grass. For the fruit-grower it is a fortunate fact that the very harmfull rosy apple aphid appears only occasionally in his orchard.
Mortality of the apple-grass aphid in spring is very high, mainly owing to adverse weather conditions. Predators generally are not so very important, except perhaps ladybird beetles in early spring.
The effect of the main parasite of the apple-grass aphid, *Monoctonus cerasi*, needs further consideration. This parasite may sometimes reach high percentages of parasitism and eliminate a very considerable number of aphids. The effect of this parasite, unlike that of many other aphid parasites, is not reduced by the action of hyperparasites. The parasite may have three generations a year, the first one parasitizing the fundatrices, the second one the fundatrigeneae, which, when not parasitized, will fly to grasses. The parasite does not follow its host aphid to grasses, but goes into a state of diapause on apple.
In autumn, at least according to my observations in 1967, most of the adult parasites emerge and this third generation parasitizes the oviparae, which have been produced on apple by the aphid immigrants from grasses. It is not yet clear what happens further. In spite of large numbers of oviparae, collected on apple at Nieuwe Pekela in autumn 1967, very few mummified. The reason may be that the oviparae are too small for the parasite larvae to complete their development. If this is true the role of the third generation of the parasite in relation to its own life history seems quite enigmatic. If this were to be a general phenomenon, the parasite would survive almost exclusively by the relatively small number of parasites that fails to emerge in autumn, but remains in diapause untill next spring. However, this does not

in any way reduce the effect of the third generation on the number of oviparae. It seems strange that *Monoctonus cerasi*, which has been recorded from quite a number of aphid hosts with different life cycles, is so specially adapted to the life cycle of the apple-grass aphid.
If we may generalize our findings of the past years we may conclude that there are two important peaks in the parasitizing of the apple-grass aphid by its parasite. The first peak is caused by the second generation of parasites, parasitizing the second generation of the aphid, the percentage being highest when the aphids are in an advanced stage of migration. This high percentage of parasitism is not very important in respect to the aphid infestation on apple. The percentage naturally rises as a consequence of unparasitized aphids leaving the apple; the harm done on apple by parasitized aphids will not differ materially from that done by unparasitized aphids. Furthermore the aphid passes through such a large number of generations on grasses, that the size of the initial population does not seem to matter very much. Little or nothing is yet known as to what happens with the populations on grasses.
The second peak, in September or October, seems more important; every ovipara killed means a proportionately smaller number of winter eggs. As the percentages of parasitism of the oviparae may be high, this may mean a substantial reduction in the number of fundatrices in spring. However, as shown above, aphid mortality in spring, especially as a result of weather conditions, may be so high that a reduction in the number of winter eggs of let us say 50 percent does not seem to be very important.

I should now like to mention a few facts which may be of importance for the fruit-grower in respect to control of apple aphids. As already mentioned, the only aphid that hibernates in the egg stage on apple in commercial orchards in The Netherlands is generally the apple-grass aphid. As this aphid is ordinarily not a very harmful species, for several reasons discussed above, it seems that a winter wash against aphids in commercial apple orchards does not make much sense. To-day many fruit-growers in The Netherlands no longer apply such a winter wash. I think the best for the grower to do would be to await hatching of the winter eggs and to consider then if it would be worth while to apply a spring wash.
It must be borne in mind that a fairly high initial apple-grass aphid population may be tolerated. If, however, only a few individuals of the rosy apple aphid are discovered, it will generally be necessary to control this aphid as soon as possible. Fortunately the presence of the rosy apple aphid can be rather easily discovered, as mentioned above. It must be emphasized that every spray that can be omitted not only gives a financial profit to the fruit-grower, it also reduces the harm done to the so-called "biocoenotical equilibrium". This is especially important to-day as we aim at attaining an integrated control of diseases and pests. It may be that this procedure still requires too much knowledge and responsibility on the part of the fruit-grower, but perhaps here lies a task for the Extension Service.

Samenvatting

De natuurlijke mortaliteitsfactoren van de appel-grasluis met enige opmerkingen over de bestrijding van appelbladluizen in het algemeen

In deze publikatie wordt er de nadruk op gelegd dat de appel-grasluis, *Rhopalosiphum insertum* (Wlk.), de enige bladluis is die in appelboomgaarden die in produktie zijn regelmatig in groot aantal als ei overwintert. Hiervoor wordt een aantal redenen opgegeven, die samenhangen met verschillen in de levenswijze ten opzichte van de beide andere belangrijke bladluizen van appel, nl. de roze appelluis, *Dysaphis plantaginea* (Pass.), en de groene appeltakluis, *Aphis pomi* Geer.
Uit Fig. 1, 2 en 3 blijkt, dat zowel de populatiedichtheid van de bladluis als de parasitering door de voornaamste parasiet, *Monoctonus cerasi*, in de loop van het seizoen vaak belangrijke schommelingen vertonen. De belangrijkste mortaliteitsoorzaken in het voorjaar zijn abiotische factoren zoals regen, wind, hagel en ijsvorming, die de bladluispopulaties in sterke mate kunnen decimeren.
Van de biotische zijn hoofdzakelijk enkele soorten lieveheersbeestjes (Coccinellidae) van belang. De parasiet veroorzaakt in sommige perioden van het jaar weliswaar hoge parasiteringstoppen, maar haar effect is, vergeleken bij de invloed van de genoemde weersomstandigheden, weinig belangrijk.
In verband met het besprokene lijkt een winterbespuiting tegen bladluizen op appel in het algemeen overbodig. Zo nodig kan in het voorjaar nog een bespuiting worden toegepast. Dit zal in het algemeen echter alleen noodzakelijk zijn als ook de roze appelluis optreedt, die door het vervormen van de vruchten veel schadelijker is dan de appel-grasluis.

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