SYRRHIZUS DELUSORIUS AND SCAMBUS POMORUM, TWO PARASITOIDS OF THE APPLE BLOSSOM WEEVIL

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SUMMARY

Little is known about the parasitoids of the apple blossom weevil. The ichneumonid Scambus pomorum parasitizes the Anthonomus larvae in capped blossoms. Possibly there is a second generation of Scambus on alternative hosts, like the strawberry blossom weevil. The braconid wasp Syrrhizus delusorius attacks the adult beetle and has two generations.

INTRODUCTION

Integrated Pest Management (IPM) is applied in 40 percent of Dutch apple orchards. In this system, natural enemies and selective pesticides are used to control pests, e.g. phytophagous mites are regulated by the predatory mite Typhlodromus pyri (Scheuten). Still, non-selective insecticides, that might reduce the impact of beneficial insects, have to be applied against certain occasional pests. Therefore a project has been started at "De Schuilenburg" to explore the possibility of promoting parasitoids to control these pests.

The apple blossom weevil Anthonomus pomorum L. (Curculionidae) is one of these pests. This species is distributed all over the Palaearctic area, except northern Scandinavia, and was also transferred to N. America (Freude et al., 1983). It is a pest on apple and, to a lesser extent, on pear.

Before World War II the apple blossom weevil was a common pest in apple orchards. That is probably the reason why most publications about A. pomorum are more than 50 years old (Miles, 1923; Speyer, 1939; Huysmans, 1944). In the following period the weevil was hardly seen in commercial orchards, because broad spectrum pesticides kept it at low levels. Nowadays, in IPM-orchards, more selective insecticides are applied, with less effect on non-target organisms, and occasionally the apple blossom weevil may cause damage again. The pesticides carbaryl and fosalone are normally used to control it.

All species of the genus Anthonomus develop in buds (Scherf, 1964). The apple blossom weevil attacks blossom buds. Normally, small numbers of weevils can be tolerated as a way of natural flower thinning (Huysmans, 1944). More than 10 %
infested apple flowers results in reduced yield at harvest on spindle bush apple trees, according to Reijbroek (1983).

The first example of biological control of the apple blossom weevil was described by Decaux (1899), at the time that collecting and burning of infested blossoms was a common practice. Decaux (1899) found a way to separate weevils and parasitic wasps emerging from these blossoms, and released the wasps to achieve better biological control of apple blossom weevil in the field.

Natural enemies of the apple blossom weevil are birds, fungi and insects. Predation of A. pomorum by birds is known from literature (Maarschalk, 1918; Miles 1923). In spring 1991 we observed that a considerable part of the capped blossoms was pecked open by birds in some orchards. The fungus Metarrhizium anisopliae (Metch.) Sorokin appears to infect apple blossom weevils, but in the field, control is not evident (I. Nikusch, G. Zimmerman, pers. comm.). Insects, attacking A. pomorum include a species of Thyssanoptera, Haplothrips tritici (Kurd.), a predator of the larvae (Miles, 1923), and various hymenopterous parasitoids (e.g. Speyer, 1939; Lagowska & Winiarska, 1982). According to our observations so far, three parasitoids can be numerous in the Netherlands: Pteromalus (Habrocytus) grandis Walker (Pteromalidae), Scambus (Pimpla) pomorum (Ratzeburg) (Ichneumonidae) and Syrphus delusorius Förster (Braconidae). A summary follows of what is reported about the last two species in literature, and of our first results. Observations were made in the experimental orchard, unless stated otherwise.

THE APPLE BLOSSOM WEEVIL

A. pomorum is a univoltine species. Depending on temperature, the first adult weevils leave their winter quarters between the end of February and the beginning of April. After some initial feeding on apple buds, mating takes place. The female starts ovipositing into developing flower buds during bud burst. The egg is deposited in the anther lobes (Miles, 1923). The larva feeds on the interior of the bud. As a result, the blossoms do not open. These brown “capped blossoms” (Alford, 1984) are easily recognized in the field. The larva moults two times (Huysmans, 1944). The full grown larva, which measures about 6 mm, remains quiescent for 4 to 5 days before pupation takes place. After the pupal stage, which takes another 10 days, the adult emerges, gnaws an aperture in the cap and leaves the blossom. There is much activity in the following period. The weevils fly around and feed on leaves and blossom (Huysmans, 1944). After a month or so, the adults move to hiding places, rough places on the ground and under the bark of trees. Here they stay at rest till next spring, although high temperatures may occasionally stimulate some weevils to move around.

Capped blossoms were collected and put singly into small glass tubes stoppered with cotton wool, and kept in an outdoor insectary in order to establish the emergence of adult weevils. Daily observations showed that adult weevils emerged from 31st May until 1st July 1991 in samples from various apple orchards in The Netherlands. Fifty percent had emerged on 11th June. Two species of parasitic wasps appeared as well, identified as Scambus pomorum, and, in smaller numbers, Pteromalus grandis.
SCAMBUS POMORUM

Detailed studies of the biology of *S. pomorum* have been made by Imms (1918) and Speyer (1926). The adult female pierces the capped blossom with her ovipositor, stings the *Anthonomus* larva and injects a paralysing poison. Then, she deposits a transparent elongate egg onto the larva. Grown larvae are selected mainly for oviposition, rarely pupae. When the attacked larva is about to start pupation, it will finish transformation, despite of the sting (Speyer, 1926). A single egg is deposited on an individual host. Rarely we found two eggs per host larva, probably the result of oviposition by different females.

The egg hatches within three days at 15°C. The young larva is usually found on the dorsal side of the host larva, with the mouth parts immersed within the tissue of the latter (Imms, 1918). The fully grown larvae are elongate fusiform in shape, narrowing towards the two extremities, and more so at the anal than at the cephalic end (Imms, 1918). There are four larval stages (Speyer, 1926). Eight to ten days after hatching (at 15°C) the full grown larva leaves the remains of the host to spin a thin silken cocoon within the cavity of the capped blossom. Four to five days later, pupation has been completed. In the following days the colour of the pupa turns from whitish pale to black and after about 11 days the adult wasp emerges.

In 1990 we reared 353 *A. pomorum*, 17 *S. pomorum* and 16 *P. grandis* from capped blossoms. In an outdoor insectary, the parasitoids emerged between 17th May and 30th June and between 6th and 29th June, respectively. In 1991 we reared 154 adult weevils, 10 *S. pomorum* and 3 *P. grandis*. The parasitoids emerged between 21th June and 3rd July and on 4th and 5th July, respectively. On the average *S. pomorum* emerged about 2 weeks later than *A. pomorum*, the males appearing earlier than the females (also: Speyer, 1926). In some other orchards we visited in 1991, up to 20 percent parasitism was assessed (maximum 21.8 %).

SYRRIHIZUS DELUSORIUS

Little is known about the parasitoid *S. delusorius*. Speyer (1939) established that this braconid wasp parasitizes the adult apple blossom weevil. Van Oosten (1966) and Van Steekelenburg (1967) found that *S. delusorius* has, in contrast to its host, two generations per year.

The parasitoid overwinters as a small (about 1.2 mm long) larva in the abdomen of the adult weevil. In spring, teratocytes are formed in the haemocoeel, serving as food for the larva. In early May, the full grown larva (about 3.0 mm long) leaves the host through a hole made between the last tergite and the epiproct (Van Oosten, 1966). The emerging larva is very mobile and spins a white cocoon within 24 hours. In this elongate cocoon, pupation takes place. When moistened soil is provided, the emerging larva digs into it before pupating. Thereafter it takes 3 to 3.5 weeks at 15°C till the adult wasp emerges. During this period, *A. pomorum* passes through the larval and pupal stage. In June, the parasitic wasp appears in the field, when the new generation of adult weevils is emerging too. In the insectary, *S. delusorius*, reared from weevils that were collected during the winter, emerged between 7th and 11th June 1991, while 50% of adult weevils had emerged on 8th June.
S. delusorius has a partial second generation. Full grown larvae leave the host in the first half of July in order to pupate, and the adult wasps appear and reproduce in August (Van Oosten, 1966; Van Steekelenburg, 1967). In tapping samples, up to 14 % of the weevils was parasitized by the end of winter 1990-91.

In the laboratory, S. delusorius females show little reluctance to oviposit on A. pomorum (Van Steekelenburg, 1967; Blommers, pers. obs.). When a female meets a host, she climbs on its back, and almost immediately stings into the abdomen, under the elytra. The whole act takes usually a few seconds, and at most half a minute. Several weevils are accepted this way, one after the other. One female accepted 49 weevils in a run, of which at least 25 appeared parasitized afterwards. Female wasps become also excited when offered a capped blossom, even when empty. This might indicate the way she finds her host.

DISCUSSION

Because small numbers of A. pomorum can be tolerated economically, the impact of parasitoids might be of relevance for the control of this pest.

We found 20 percent parasitism by S. pomorum in some orchards; not unlike the rates observed in Central Europe (Speyer, 1926). In fact, it appears to be rather difficult to assess these rates, as there is little time, if any, between the end of the oviposition period of S. pomorum and the emergence of the first weevils, when empty capped blossoms start to drop.

The fate of S. pomorum after its emergence from the capped blossoms is not clear. According to Fitton et al. (1988), adult wasps are on the wing till September, and overwinter too. Wasps from our rearings could not be kept alive for more than a few weeks. Therefore we are tempted to suggest that a second generation of S. pomorum might exist on an, as yet unknown, other host. Apart from apple blossom weevil, S. pomorum is known to parasitize A. piri Kollar, but this occurs also in spring (Speyer, 1926). The strawberry blossom weevil A. rubi (Herbst), the only Anthonomus-species with larval development in summer (Scherf, 1964), should be a suitable candidate. But so far, we have reared only some apparently different Scambus sp. - only males - from A. rubi larvae.

The abundance of S. delusorius is highly variable over the years. Speyer (1939) found 25 % parasitism and Van Steekelenburg reported up to 50 % in 1967, but Reijbroek (1979) found only one parasitized beetle among several thousands in spring. The reasons for this variation are not known. Acceptance and handling of the host is apparently not a restriction. Finding the host may be a problem for second generation wasps, for, when these appear in August, the weevils are at rest and hidden.

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REFERENCES


50