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A new feeding site of Cecidomyia pini larvae on Pinus sylvestris (Dipt., Cecidomyiidae)

by

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ABSTRACT. — Larvae of *C. pini* (De Geer) were found in resin exudations between the scales of green cones of *P. sylvestris* L. In the laboratory, adults emerged in July and early August. It is suggested that the European pine resin midge has two generations per year in the Netherlands. The new feeding site offers good possibilities to elucidate the complete biology of this midge.

INTRODUCTION

Cecidomyia pini is the type species of the genus *Cecidomyia*; it was described in 1782 as *Tipula pini* by De Geer. Although much information on this midge has been published meanwhile, no detailed study on its complete biology is available; in particular knowledge of the biology of the egg and younger stages of the larvae is still lacking (Barnes, 1951; Escherich, 1942).

LITERATURE REVIEW

The larvae, which are reported to live in resin exudations on pine shoots as well as shoots of spruce and fir (Borries, 1891), form their cocoons on the needles (De Geer, 1782; Ratzeburg, 1841; Perris, 1870; Borries, 1891). According to Ratzeburg's description, the yolk-coloured larvae possess conspicuous bifurcated dorsal processes (tubercles) which differentiate them from most other cecidomyiids. De Geer (1782) had described these tubercles as "fleshy legs".

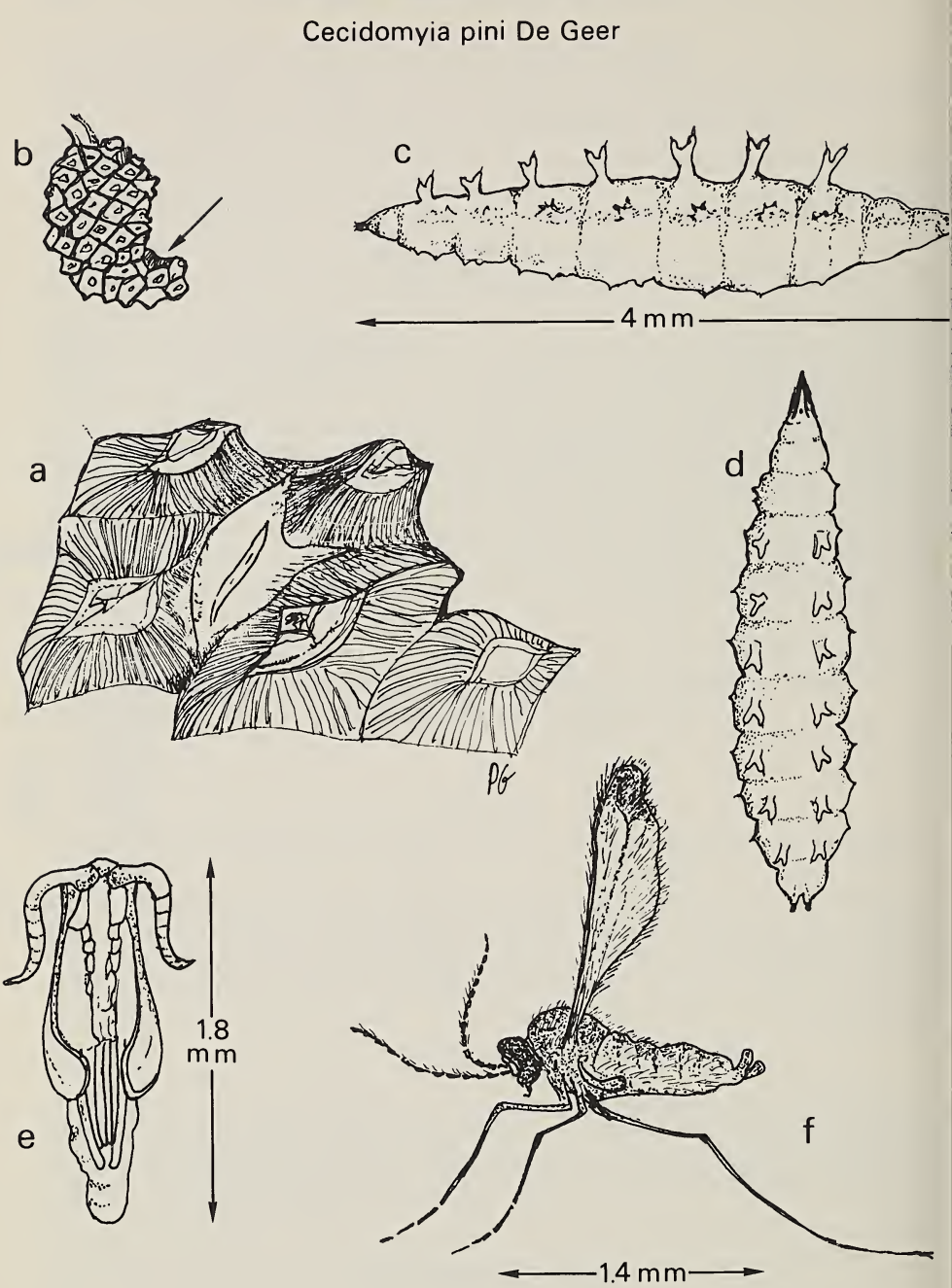

Fig. a-f. *Cecidomyia pini* (De Geer). a. Feeding site of larvae; b. Damaged cone with resin exudation in which three larvae were found; c. Lateral view of larva; d. Dorsal view of larva; e. Pupal case, extracted from cocoon; f. Adult female.

In view of these contradictory statements, Barnes (1951) stressed the need for a new detailed description of *C. pini*.

The larvae can almost crawl like caterpillars and are quite mobile. In view of this ability, Escherich supposed that they might wander to suitable feeding sites on the shoots; he concluded that the site where the cocoon is made is definitely not a feeding site. De Geer had suggested earlier that the larvae might feed on the needles.

Ratzeburg's as well as Perris' description suggest that only one generation occurs per year. The first author stated that overwintering larvae pupate in springtime, a few weeks before emergence in May. In France, Perris observed that mature larvae left the resin exudations in June and July to form their cocoons on the needles. Pupation within the cocoons started in the end of March.

According to Borries, *C. pini* occurs in Denmark on *Picea*, *Abies* and *Pinus* and has two generations per year. Adults of the first generation emerged in May; after mating females oviposited on the underside of fresh shoots. Young larvae made cavities in the young bark to feed on the exuded sap. Feeding sites of larvae of the first generation were found in resin lumps on the underside of fresh *Picea* shoots.

The larvae were also found in shoots with longitudinal injuries caused by caterpillars of *Zeiraphera ratzeburgiana* (Ratzeburg). Borries, who found the egg stage, indicated that these resinous injuries were selected by *C. pini* for oviposition. In early July, the larvae matured and formed cocoons on the needles. Adults of the second generation emerged from the middle of July until the beginning of August.

In September and October larvae of the second generation could be found in resin exudations near the newly formed terminal buds. They fed until the middle of October, after which cocoons, in which overwintering took place, were made on the needles.

In the literature, no record was found of *C. pini* larvae on cones. In the United States, however, Gagné (1978) recently described a new species, *Cecidomyia bisetosa*, which seriously damages conelets of *Pinus elliottii* var. *elliottii* Engelmann. Larvae of *C. bisetosa* feed in cavities between the scales during the first year of cone development, causing a hypertrophy of several scales. Often severe deformation results and many conelets die during the winter. In a seed orchard of *P. elliottii* var. *elliottii* in northeast Florida, conelet losses as high as 40 percent have been registered (Williams & Fatzinger, 1977).

MATERIALS AND METHODS

A survey of cone and seed insects on *P. sylvestris* L. was made in a seed orchard located at Grubbenvorst, Province of Limburg, the Netherlands. Some 10 to 15 green cones in the second year of development were collected on each of the following dates: June 24, July 2 and 17 and August 13, 1980. The cones were taken to the laboratory, stored in plastic containers and subsequentely studied under a dissecting microscope.

RESULTS AND DISCUSSION

Pissodes validirostris (Sahberg, C. R.) (Col., Curculionidae) and *Dioryctria abietella* (Denis & Schiffermüller) (Lep., Pyralidae) were found in the cones. The outer surface of the cones frequently contained cecidomyiid larvae moving freely in resin exudations in the depressions where the cone scales meet (fig. a). The larvae were identified as *Cecidomyia pini* (De Geer). Sometimes 2 or 3 larvae could be found together in locations where the cone had obviously been damaged by some other cause (fig. b). This observation is comparable to the observation made by Borries on oviposition of *C. pini* near injuries caused by *Zeiraphera ratzeburgiana*.

The number of larvae found on the cones varied between 0 and 6. Mature larvae were 3.5 to 4 mm long and possessed bifurcated dorsal tubercles (fig. c, d). The contents of the stomach of the larvae were green, indicating that they may feed on the green tissue of the cone scales. De

Geer, who did not know the feeding site of the larvae, had also noted the green contents of larvae extracted from cocoons and supposed that they might have fed on needles.

Resin exudations on the cones also contained smaller sized, transparant cecidomyiid larvae without prominent dorsal tubercles; these were probably younger stages of *C. pini*. Only mature, orange coloured larvae left their feeding sites on the cones. In a few cases did the larvae form their cocoon on the cone itself; most larvae however, dropped from the cone to the container bottom where they formed a cocoon. Although this behaviour may have been influenced by the artificial conditions under which the larvae were reared, the possibility should not be discarded that in nature mature larvae may also drop from the cones on the forest floor. In this survey only three cocoons were found on pine needles, a number which seems disproportionate to the number of larvae found on the cones.

From the larvae that formed a cocoon and pupated, male and female adults were obtained, on July 2, 11 and 17, and on August 4 (fig. e, f). This emergence period corresponds with the period observed by Borries in Denmark for the second generation. As no young overwintering larvae could be found on cones in the first year of development, it seems probable that *C. pini* in the Netherlands also has two generations per year. One of the cocoons found on the cones contained six hymenopterous parasites, which were identified as a *Platygaster* sp.

In contrast to *C. bisetosa* on *P. elliottii* var. *elliottii* conelets, *C. pini* did not induce hypertrophy of the scales on *P. sylvestris* cones in the second year of development. It is not yet known if seed production is affected by the feeding of the larvae or if the resin flow could hamper the release of seeds.

Since so many coniferous species have been recorded as hosts for *C. pini*, the question arises whether or not this insect is a general secondary pest, attracted to resinous injuries inflicted primarily by other insects or agents.

The finding of this new feeding site opens perspectives for the study of the complete life cycle of this gall midge, since cones are easier to handle and can be kept longer in a good condition than shoots. In addition, the larvae can be observed within the clear resin exudations, which they will not leave before maturity.

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