Bagous rotundicollis, new for The Netherlands, feeding on water lily leaves (Coleoptera: Curculionidae)

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Abstract: *Bagous rotundicollis* Bohemann was discovered for the first time in The Netherlands. It was found on the undersides of floating leaves of *Nymphaea alba* L., where it feeds on the epidermis and the sponge parenchyma. Damage patterns are shown and described. Most new damage occurred from May till August on leaves which has been unfolded at the water surface less than two weeks before. Adaptations to maintain a plastron were demonstrated by means of scanning electron miscroscopy.

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Introduction

The development of floating leaves of *Nymphaea alba* L. and *Nuphar lutea* (L.) Sm. was followed in two separate m^2 plots in the Voorste Choorven (municipality of Oisterwijk, Province of Noord-Brabant) during 1988. Every newly developed and unfolded leaf at the water surface was marked and was followed weekly. The percentage of the surface area of each individual leaf damaged by a particular cause was estimated visually, so that the progress of the different types of damage could be followed for each leaf separately during the ageing of the leaf (see also Van der Velde et al., 1982).

A number of types of damage to the floating leaves could be recognized by their characteristic patterns, as these were already known from previous studies (e.g. Lammens & Van der Velde, 1978; Van der Velde, 1979; Brock & Van der Velde, 1983; Van der Velde & Hiddink, 1987; Van der Velde, 1988). However, one damage pattern which was found on the lower surface of the floating leaves of *Nymphaea alba*, was not familiar to us. Some adult weevils were found on such spots and could be identified as *Bagous rotundicollis* Bohemann (fig. 1), a species which had not been recorded from The Netherlands before (Brakman, 1966; Mol, 1984; Huijbregts & Krikken, 1985). Five specimens were observed of which two escaped by sinking. One was used for SEM studies, while two specimens were deposited in the collection of the Rijksmuseum van Natuurlijke Historie (RMNH) at Leiden.

As little is known of the ecology of *Bagous* species and of *B. rotundicollis* in particular, information on this species is presented here in some detail.

Distribution

Bagous rotundicollis was recorded from *Nymphaea* and *Nuphar* in East-Germany (DDR) (Mecklenburg, Brandenburg), Austria

Fig. 1. *Bagous rotundicollis* Bohemann from the Voorste Choorven (length 4-4.7 mm).

Fig. 2. Damage caused by adult *Bagous rotundicollis* Bohemann to the lower surface of a floating leaf of *Nymphaea alba* L.

(Niederösterreich), Poland (Schlesia), USSR (East Prussia: Kaliningrad (Königsberg)), Yugoslavia (Herzegowina) and Albania, according to Dieckmann (1964), Voss (1978) and Lohse (1983). Thus the nearest localities are situated in East Germany. Lohse (1983) considers the species to be rare.

Occurrence

In the Netherlands *B. rotundicollis* has so far only been found in the Voorste Choorven, and it may be questioned why it was not recorded before, in spite of many years of our thorough investigations on nymphaeid macrophytes in alkaline, eutropic oxbow lakes, break-through ponds and other ponds.

However, the water quality of the Voorste Choorven differs from the previously investigated waters, by a low pH (median 5.2, range 4.6-5.9), a low alkalinity, low concentrations of K, Na, Ca, Cl, and phosphate, and relatively high concentrations of ammonia and nitrate (see for more detailed data Kok et al., in press). Phytophagous insects in general are only bound to their host plant and do not seem to be influenced by water quality, though physical factors such as wind exposure might determine their occurrence. All other waters investigated were wind-exposed. The Voorste Choorven, however, is surrounded by trees which catch the wind, so that the floating leaves remain flat on the water surface.

Feeding

Although *Nuphar* and *Nymphaea* have both been described as food plants of *B. rotundicollis*, the beetle was only found in the *Nymphaea alba* plot. The damage pattern is highly characteristic. The beetle scrapes off spots with a diameter of c. one cm^2 from the underside of the floating leaf near its margin (fig. 2). Microphotographs of leaf parts with such spots demonstrated that the lower epidermis and the sponge parenchyma from such spots are consumed, while the palissade parenchyma and the upper epidermis remain intact.

Mean surface damage by *Bagous rotundicollis* to floating leaves was 0.28% with a maximum of 1%. The mean frequency of damage was 29% of the floating leaves over the period

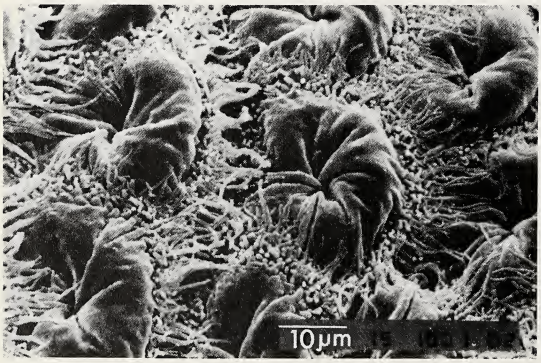

Fig. 3. Glandular pores and small scales on the body of an adult *Bagous rotundicollis* Bohemann (SEM photograph).

of presence of the damage, May 15-July 15.

Feeding spots coulds be found during a large part of the growth season of *Nymphaea* (fig. 4). The highest increase in damage occurred between the first and second week after unfolding (fig. 5). This means that, like other phytophagous insects living on floating leaves (Van der Velde & Van der Heijden, 1985), *B. rotundicollis* prefers young leaves.

Considering the damage to these leaves during the growth season, there are some indications of two generations during the season (fig. 6). As the development of leaves started on May 4th and reached its peak on 11 August, while the last leaf was observed on 27 October, it is clear that the occurrence of adult *B. rotundicollis* coincides with the development of floating leaves in the first half of the growing season.

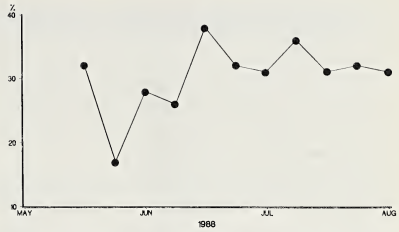

Fig. 4. Percentage of the floating leaves of *Nymphaea alba* L. showing damage caused by *Bagous rotundicollis* Bohemann during the growth season in a m^2 plot in the Voorste Choorven during 1988.

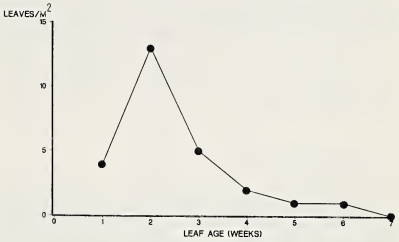

Fig. 5. Number of leaves of *Nymphaea alba* L. with new damage caused by *Bagous rotundicollis* Bohemann, in relation with their age after unfolding at the water surface in a m^2 plot in the Voorste Choorven.

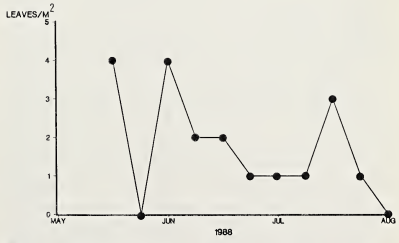

Fig. 6. Number of leaves of *Nymphaea alba* L. (one to two weeks after unfolding) with damage from adult *Bagous rotundicollis* Bohemann during the growth season.

Adaptations to aquatic life

Since *B. rotundicollis* lives under water on the undersides of floating leaves (although near the margins), adaptations to an aquatic life could be expected. Ruter (1937) demonstrated, that *B. subcarinatus* Gyllenhall, which lives on *Ceratophyllum submersum* L., maintains a sheath of air (plastron) around parts of its body, so that it can respire with its stigmata under water. At a magnification of 400 ×, he observed small linear scales (squamulae) originating from pores (the openings of glandular canals) on the hydrophobous parts of the body.

We made photographs of *B. rotundicollis* with the scanning electron microscope. The typical scales as described by Ruter (1937) for *B. subcarinatus* are also present in *B. rotundicollis* (fig. 3). They occur everywhere on the body surface with the exception of articulating body parts (the neck, between the segments), places where hair tufts occur, and under the elytrae.

Discussion

According to Gaevskaya (1969), who did not mention *B. rotundicollis* in her world lists of herbivores and macrophyte host plants, two other *Bagous* species have been recorded from water lilies, viz. *B. americanus* Le Conte and *B. longirostris* Tanner, both feeding on *Nymphaea odorata* Ait. and *N. tuberosa*

Paine in North America. These two *Bagous* species have a behaviour similar to that of *B. rotundicollis*. Both occur as mature adults under the floating leaves and can withstand wetting for a long time (even 14 days under water has been recorded). Clearly, the air sheath can act as a physical gill.

B. americanus oviposits on upper and lower surfaces of floating leaves, or in the tissue. Larvae mine the leaves, moving to the petioles, where they pupate in excavated pupal chambers, which may cause the petioles to become very fragile and to break off easily. *B. longirostris* oviposits on the stalks of *Nymphaea* and descends for that purpose to a depth of 2 m and more.

Similar information on the life cycle, oviposition sites and behaviour of *B. rotundicollis* is still lacking and can perhaps be collected during future studies.

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