Helophorus croaticus and *H. pumilio* in The Netherlands, with description of their larvae (Coleoptera: Hydrophilidae)

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Abstract: The distribution of *Helophorus croaticus* Kuwert and *H. pumilio* Erichson is discussed together with habitat and life history. *H. croaticus* is new for the fauna of The Netherlands. *H. pumilio* is either brachypterous or has undeveloped flight muscles; *H. croaticus* is a ready flier. Descriptions of the third-instar larvae and the egg cocoons are made from reared material. The larval period of *H. pumilio* lasts about twice as long as in *H. croaticus*.

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Introduction

In August 1983 I collected a ♂ of a *Helophorus* species, unknown to me, in a ditch bordering a *Populus* plantation 1 km west of Druten (Province of Gelderland). Examination showed, that the specimen belonged to *Helophorus croaticus* Kuwert, which is a new species for The Netherlands. No single Dutch specimen of *H. croaticus* was found in collections. In the above mentioned *Populus* plantation I also found a population of *H. pumilio*, which is a rare species in The Netherlands. Extensive sampling (about 200 sites) in the river-clay area between the rivers Rhine and Meuse, showed that both species frequently occur here. Since the larvae of both species are undescribed, I took the opportunity to rear and describe them.

Identification

Identification of the adults of *Helophorus* species on external characters is not easy due to their variability. *H. croaticus* is a rather broad species with clearly mottled elytra and a short bronze-shining pronotum (fig. 1). The asymmetric last segment of the maxillary palp makes it easy to distinguish *H. croaticus* from the similar *H. brevipalpis* Bedel, which has a symmetric last segment (I very often found *brevipalpis* together with *croaticus*). *H. pumilio* is smaller and darker with almost uniformly brown elytra (fig. 2). The antennae are 9-segmented (the resembling *H. nanus* Sturm has 8-

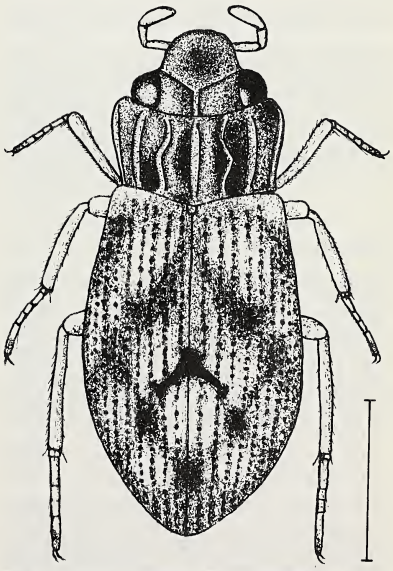


Fig. 1. *Helophorus croaticus* Kuwert. (Scale line 1 mm).

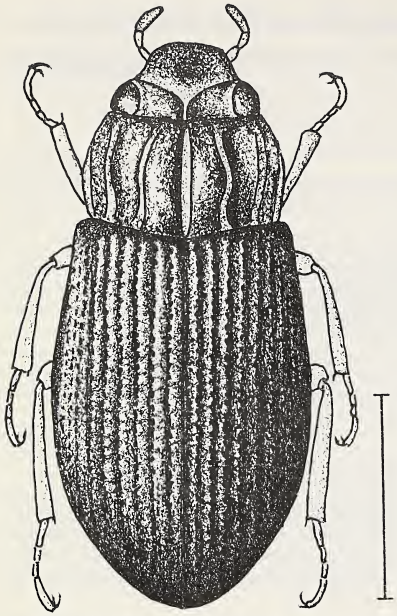


Fig. 2. *Helophorus pumilio* Erichson. Scale line 1 mm).

segmented antennae). The pronotum is widest in the middle, the pronotal grooves are narrow. The most reliable characters to identify the species are found in the male genitalia (fig. 3, 4). Both species are included in the keys of Hansen (1987) and Cuppen et al. (in press).

Material en methods

Distribution maps are based on material in the following collections: Rijksmuseum van Natuurlijke Historie, Leiden (J. Krikken), Instituut voor Taxonomische Zoölogie, Amsterdam (B. Brugge), and the private collections of J. G. M. Cuppen (Zetten), O. Vorst (Zeist) and the author.

From April 1986 to March 1988 the locality west of Druten, with the large population of *H. pumilio*, was sampled at two months intervals throughout the year. A second locality, "Boldershof" at Druten, where a large population of *H. croaticus* was found, was sampled in the same way from April 1987 to March 1988.

In order to obtain larvae, adults of *H. pumilio* and *H. croaticus* from the localities near Druten were placed in boxes, about 12 cm long, 8 cm wide and 7 cm high, with approximately 1 cm water at one side and an artificial bank of clay at the other. The boxes were closed with plastic foil, pierced by small ventilation holes. The beetles were kept at ambient temperature and were fed with filamentous algae. Both species placed their egg cocoons 1 to 2 mm deep in the mud of the banks. These silk cocoons, which were easily found by the projecting masts, were removed and placed on wet filter paper. The larvae, which are non-aquatic (Angus, 1973) were reared on wet filter paper in separate boxes and fed with *Tubifex*.

Distribution and ecology

Helophorus croaticus

In The Netherlands *H. croaticus* was collected from the localities Boven-Leeuwen, Druten, Ewijk, Hoek, Neerijnen, Waardenburg and Winssen, all situated along the river Waal in the province of Gelderland (fig. 14).

H. croaticus has a mainly eastern distribution from European Russia to Yakutsk in Siberia (Angus, 1974); it is widespread in central Europe. It has a disjunct north-western distribution in Western Germany, ranging from Hessen (Nassau) to Nordrhein-Westphalia (Hulser Bruch near Krefeld (Horion, 1949)). This enclave now extends into The Netherlands. Furthermore *croaticus* occurs in France; through the kindness of Dr. P. Leblanc I received a specimen collected in north-eastern France (Viélaines near Troyes, 6.vi.1984, Leblanc leg.). There is an isolated record from Belgium: a ♂ from Oostacker near Gent (d'Orchimont, 1924). According to Angus (1974) *H. croaticus* lives in pools along the banks of the river Lena. In eastern Bavaria the species inhabits muddy banks along backwaters near rivermouths and in flooded plains (Hebauer, 1980).

In The Netherlands *H. croaticus* was only collected in the river-clay area, where it occurs

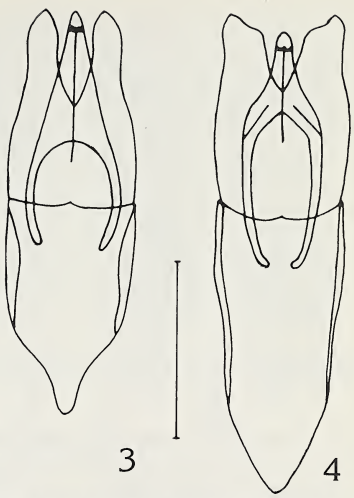
in river woods such as *Populus* plantations and willow-coppices, often with an undergrowth of *Crataegus* sp., *Ribes rubrum* L., *Fraxinus excelsior* L., *Rubus* sp. and *Urtica dioica* L. Most of these woods periodically have high groundwater levels. In spring the beetles are found along the water side of shaded ditches on clay bottoms covered with leaves and temporarily filled with water. These ditches have hardly any vegetation.

Most adults were collected in spring. In July, August and September they were collected in small numbers in the drying ditches. There is only one winter record during a period of very high water level: a few specimens in the middle of February at Druten. Teneral specimens were found in August and September.

Helophorus pumilio

In The Netherlands *H. pumilio* was observed in the following localities: province of Gelderland: Acquoy, Barchem, Boven-Leeuwen, Brakel, Buren, Doornenburg, Dreumel, Druten, Duiven, Ewijk, Hoek, Loenen (Valburg), de Regulieren (Geldermalsen), Varik, Vuren, Waardenburg, Wely, Winssen; province of Utrecht: Zeist; province of Noord-Holland: Heemstede; province of Zuid-Holland: Hoogblokland, Leiden, Rhoon, Vianen, Wassenaar; province of Noord-Brabant: Breda, Wijboschbroek; province of Limburg: Amby, Exaten, Spaubeek, St. Odiliënberg (fig. 15).

H. pumilio is distributed from central and eastern Europe to east Siberia; the western boundery runs from central France, Belgium and The Netherlands to Denmark (Hansen, 1987). Near Leningrad *H. pumilio* was very common in pools left by melting snow (Angus, 1974). In eastern Bavaria Hebauer (1980) collected *pumilio* in lowland *Carex* ditches and flooded meadows in early spring. As far as I can verify the situation in The Netherlands, *H. pumilio* has been collected twice in reedland ditches and once in a damp *Alnus*/*Fagus* wood. The main habitat in The Netherlands seems to be *Populus* plantations with periodically high groundwater levels. In the river-clay area many of these plantations are situated



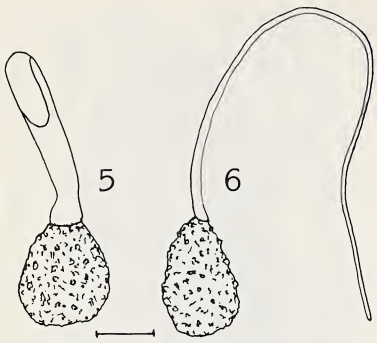
Figs. 3-4. Male genitalia. 3, *Helophorus croaticus*: 4, *H. pumilio*. (Scale line 0.2 mm).

behind the river dikes. The plantations are flooded by seepage through the dikes when the water levels in the rivers are very high. The soil of these plantations consists of (often sandy) clay. They have an undergrowth of *Crataegus* sp., *Salix* sp., *Ribes rubrum* L., *Alnus* sp. and a luxuriant vegetation of *Urtica dioica* L. and *Rubus* sp., indicating a very eutrophic situation. The shaded ditches have sparse or no vegetation, their bottoms are covered with leaves.

Only in spring the adults actively seek the water side. In summer, autumn and winter they were exclusively collected high up the shore in the woodland soil. In the *Populus* plantation west of Druten I observed the beetles in abundance along the water side in January, probably forced by the very high water level of that moment. In December 1987 this plantation was cut down, but it will be replanted.

Coexistence

In the river-clay area the habitats of *H. croaticus* and *H. pumilio* show an overlap. In 25



Figs. 5-6. Egg cocoon. 5, *Helophorus croaticus*: 6, *H. pumilio*. (Scale line 1 mm).

sites in total, both *croaticus* and *pumilio* occurred in 6 sites, *croaticus* only in 4 sites and *pumilio* only in 15 sites. However, *H. pumilio* was exclusively collected on sites with high groundwater levels, whereas *H. croaticus* seems to be indifferent to this factor. Contrary to *pumilio*, *croaticus* was never taken from unshaded places.

Many other water beetles frequently occur in the investigated river woods. Some of them are worth mentioning because they are mainly distributed in the river-clay area: *Hydrochus megaphallus* Van Berge Henegouwen (Van Berge Henegouwen, 1988) and *Cercyon sternalis* Sharp. Besides *H. pumilio* two other species unknown from the river-clay area were discovered in the river woods: *Hydraena britteni* Joy (Cuppen & Cuppen, 1982) and *Agabus chalconatus* (Panzer) (Dr. E. J. van Nieukerken, pers. comm.).

Flight capacity

Ten specimens of *H. croaticus* were tested for flight. When placed at room temperature in lamp-light, they flew away within a few minutes.

Three flight-tests were made for *H. pumilio*, with about 25 specimens altogether, but I never saw a specimen fly. Dissection of 57 specimens from the population west of Druten showed that 63% were brachypterous and the remaining macropterous specimens had undeveloped flight muscles.

Rearing

Females of *H. croaticus* collected in the middle of April deposited egg cocoons within two days. The cocoon has a short, wide hollow mast (fig. 5). The larvae hatched after one week and climbed out of the cocoon through the mast. The duration of each instar was about 4 days and after a fortnight the larvae were full-grown. The larvae always tended to crawl underneath the filter paper both at night and day (*H. pumilio* showed the same behaviour).

Eight ♀ of *H. pumilio*, collected in the beginning of January were dissected and showed their ovaries immature. In breeding experiments females from the same date started depositing egg cocoons after 7 weeks (end of February). The cocoon possesses a very long and thin mast (fig. 6). The larvae hatched after 11 to 13 days and left the cocoon after biting an aperture into the side or the bottom. A few larvae which were kept together with the adults, sometimes remained in holes in the earth. I observed one of these larvae eating a nematode. Rearing *pumilio* caused a lot of trouble due to high mortality, especially of the first instar larvae (about 90%). The first instar lasted about 12 days, the second and third instar varied from 8 to 13 days. The whole larval period took about a month.

Description of larvae

Of many *Helophorus* species only the third (last) instar larva can be identified. The third instar can be recognized by the longer and more slender urogomphi, of which segment 2 is 5 to 8 times as long as wide. The distal seta on segment 3 is much shorter than the three segments together (fig. 7).

The following diagnoses are based on reared larvae. For the characters mentioned reference should be made to the key by Angus (1973). With this key *H. pumilio* runs out to *H. granularis* (Linnaeus) or *H. brevipalpis* Bedel,

whilst *H. croaticus* runs out to *H. dorsalis* Marsham (dr. R. B. Angus, pers. comm.).

H. croaticus third instar larva

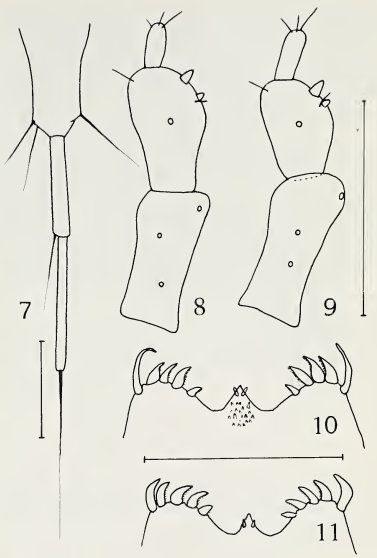
Length of fullgrown larva without urogomphi 4.8-5.0 mm, width of head 0.50-0.54 mm, distance between antennal insertions 0.33-0.35 mm. Area around eyespots darkened. Last antennal segment comparitively long (fig. 8). Nasale broad with many teeth on underside (fig. 10). Mandible (fig. 12) with row of weakly developed lacinial teeth. Tuft of hairs present on outer retinacular tooth and a tuft of long hairs present on basal section of mandible. Head dorsally with dark spot between eyes. Pronotal and abdominal sclerites dark, clearly visible. Asperities extending on to the 7th segment. Six reared larvae examined.

H. pumilio third instar larva

Length of fullgrown larva without urogomphi 4.8-5.2 mm, width of head 0.45-0.48 mm, distance between antennal insertions 0.26-0.30 mm. Area around eyespots darkened. Last antennal segment short (fig. 9). Nasale narrow, without fine teeth on the underside, only with two dorsal pegs (fig. 11). Mandible (fig. 13) with a row of large lacinial teeth, the 3 or 4 basalmost ones pointed-triangular, and recurved, so that the apices point basally (this character can be used for all instars). Outer retinacular tooth with tuft of hairs. Basal section of mandible with tuft of very short hairs. Head dorsally pale. Sclerites on pronotum and 9th abdominal segment slightly mottled, other sclerites pale. Dorsal abdominal asperities extending on to the 6th segment. Ten reared larvae were examined.

Discussion

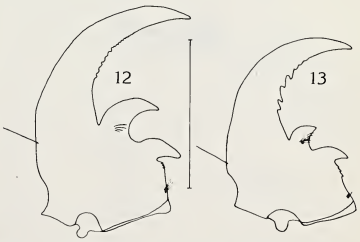
A recent extension of the distribution area of *H. croaticus* might be suggested, as there is no Dutch record prior to 1983. However, the possibility cannot be excluded that the species was overlooked in the past because of its local distribution and special habitat. Although



Figs. 7-11. Details of third instar larva. 7, *Helophorus croaticus*, urogomphus; 8-9: antenna. 8, *H. croaticus*: 9, *H. pumilio*: 10-11: underside of clypeus with nasale. 10, *H. croaticus*: 11, *H. pumilio*. (Scale lines 0.2 mm).

croaticus flies well it seems to be restricted to a few sites along the River Waal.

The beetles can only be collected easily in spring, when they congregate in the water along the banks of the ditches. In the remaining part of the year they live in the dried-up ditches or in the wood soil. Probably both species have univoltine life-cycles as was shown in many other *Helophorus* species (Fernando,



Figs. 12-13. Mandible of third instar larva. 12, *Helophorus croaticus*: 13, *H. pumilio*. (Scale line 0.2 mm).

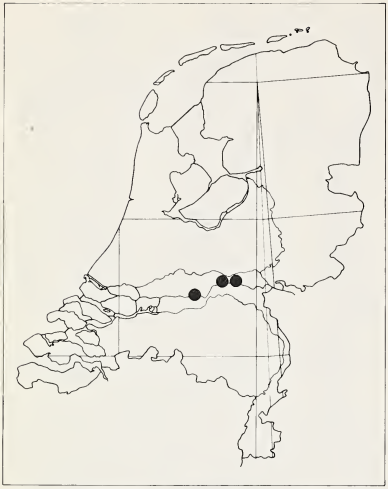


Fig. 14. Distribution of *Helophorus croaticus* in The Netherlands.

1958; Angus, 1973; Landin, 1980). I did not observe the non-aquatic larvae in the field, but it is likely they populate the drying ditches in spring and early summer.

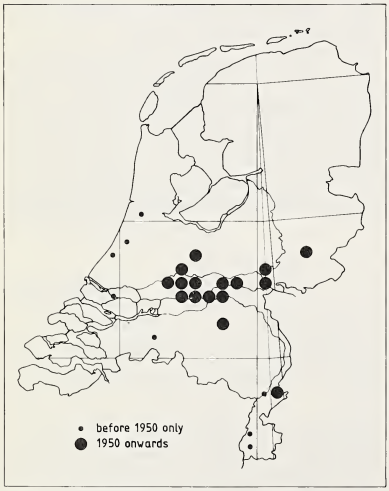


Fig. 15. Distribution of *Helophorus pumilio* in The Netherlands.

All investigated specimens of *H. pumilio* from the population west of Druten appeared to be flightless. In Denmark, however, *pumilio* was found in drift on the seashore (Hansen, 1987). As it is likely that these beetles had reached the shore by flight, I think a small part of a population can fly.

Flightless species are dependent on stable biotopes, such as streams, boggy moorlands or old lakes (Jackson, 1973). *Populus* plantations evidently offer the flightless *pumilio* adequately stable habitats, notwithstanding the dynamic character, caused by the strong fluctuations of the water level. Seepage possibly tempers the drying-out of the soil in dry periods.

In Western Germany *H. croaticus* has been listed as a strongly endangered species (Hebauer, 1984). In The Netherlands *croaticus* and in a less degree *pumilio* are local insects, and in spite of a few large populations (Druten, Wijboschbroek) they are regarded as endangered (Cuppen et al., in press). Dike strengthening, which is in progress along the rivers, will cause lowering of water levels in the adjacent river woods by decreased seepage and in this way leads to loss of habitat of both species.

Acknowledgement

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