

First records of *Forcipomyia paludis* (Diptera: Ceratopogonidae), an ectoparasite of dragonfly adults, in The Netherlands

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KEY WORDS

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On June 7th 2008, *Leucorrhinia pectoralis* individuals having the biting midge *Forcipomyia* (*Pterobosca*) *paludis* on their wings were photographed in National Park Weerribben-Wieden (The Netherlands). This ceratopogonid or biting midge is a temporary ectoparasite of dragonfly adults and the only ceratopogonid species known to specifically feed on this insect group in Europe. The photographs are the first evidence of the presence of *F. paludis* in The Netherlands, but reference material still has to be collected and stored. *Forcipomyia paludis* is already known from Ireland, England, France, Germany, Switzerland, Austria, Sweden, Poland, Italy and Croatia.

Introduction

Females of the ceratopogonid (biting midges) genus *Forcipomyia* Meigen (subgenus *Pterobosca* Macfie) have been reported to be attached to the wings or the thorax of many dragonfly species. In Europe there is only one species: *Forcipomyia* (*Pterobosca*) *paludis* (Macfie). This species is known to suck haemolymph from the veins of dragonfly wings (Wildermuth & Martens 2007, Martens et al. 2008). The life-cycle and the larval habitat are yet unknown. Currently, 61 species of Odonata are known as hosts in Europe (Martens 2012, Martens et al. 2008, Wildermuth 2012). This paper reports the first records of the species in The Netherlands.

Records

On June 7th 2008, several photographs of dragonflies were taken in National Park Weerribben-Wieden (52° 47' 22.40" N, 5° 55' 20.73" E). These include three photographs of *Leucorrhinia pectoralis* (Charpentier), which had ceratopogid midges attached to their wings. Weerribben-Wieden is a large peat reserve and the habitat of the infested *L. pectoralis* was a peathole of about 1.5 meters wide and included dense vegetation. The most obvious photograph was of a male *L. pectoralis* with *F. paludis* on the base of both hind wings (figure 1).

On the same day and same location, some photographs were made of a copula and another male *L. pectoralis*, also with biting midges on their wings. On July 5th 2008, a female *Crocothemis erythraea* (Brullé) with five *F. paludis* on the top of the wing bases were photographed in the same National Park (figure 2).

Discussion

To the best of our knowledge, *F. paludis* is the only specialized biting midge with females that suck haemolymph from the wing-veins of dragonflies in Europe. The midges are quite easily recognized from photographs as oval black dark dots on the odonate wings. The abdomen is brown and is covered by the two wings. When they are attached at the underside of the wings a brown, sometimes reddish brown stain is visible (Martens et al. 2012).

A microscopic study by Wildermuth & Martens (2007) showed *F. paludis* sucking haemolymph from the main veins in the wing base of dragonflies through their mouth parts (proboscis). In addition, they made rhythmic head movements. In *Calopteryx* species, the midges were likewise present on the wing tips. In a few cases midges were also found on the dragonflies' thorax and abdomen. In Anisoptera the biting midges were attached mainly to the upper side of their host's wings whereas in Zygoptera they colonized predominantly the underside.

Table 1. Dragonfly species with attached biting midges of cases. Data based on photographs in National Park Weerribben-Wieden in The Netherlands.

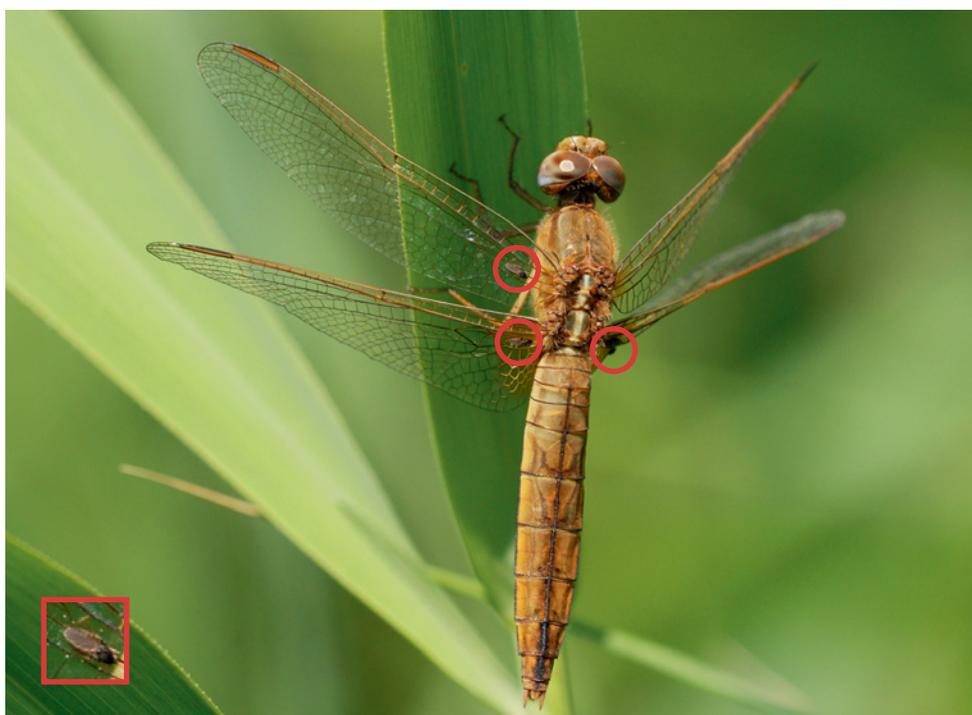
Tabel 1. Libellensoorten met vastzittende knutten (bijtmuggen). Data op basis van foto's die in Nationaal Park Weerribben-Wieden in Nederland zijn gemaakt.

host species	no. of infested imagines	no. of <i>F. paludis</i>	date
<i>Leucorrhinia pectoralis</i>	3 males, 1 female	5	7.vi.2008
<i>Crocothemis erythraea</i>	1 female	5	5.vii.2008



1. Biting midges on both hind-wings of a male *Leucorrhinia pectoralis*, 07.vi.2008, National Park Weerrribben-Wieden. Photo: R. Manger

1. Knutten (bijtmuggen) op beide achtervleugels van een mannetje gevlekte witsnuitlibel *Leucorrhinia pectoralis*, 07.vi.2008, Nationaal Park Weerrribben-Wieden.



2. Five biting midges on a female *Crocothemis erythraea*, 05.vii.2008, National Park Weerrribben-Wieden. Photo: R. Manger

2. Vijf knutten (bijtmuggen) op een vrouwtje vuurlibel *Crocothemis erythraea*, 05.vii.2008, Nationaal Park Weerrribben-Wieden.

Martens et al. (2008) assumed that the midges attack their hosts while the latter are perching and the differences in location per host species were caused by differences between species in the suborder-related posture of the wings while perching. Most resting and perching Zygoptera hold their wings more or less folded above their body, the upper side of the wings facing and often touching each other. All European Anisoptera rest and perch with their wings spread out, the under-sides in some cases facing towards substrates. Since ceratopogonids are chiefly active in muggy weather, they presumably attack their hosts during hot and damp weather conditions. Most notably, the body axis in most midges that are attached to the host's wings is directed to the wing base (Martens et al. 2008).

The distribution of *Forcipomyia paludis* is very patchy and the observations are often based on luck, just like these records from The Netherlands. From several European countries, records of *F. paludis* are known. The species is recorded in France, Germany, England, Italy, Austria, Sweden, Switzerland and

Croatia (Martens et al. 2008), as well as in Poland (Dominiak & Michalczuk 2009) and Ireland (Donnithorne 2010). In certain regions in southern France and northern Germany, more than 50 observations have been made (Martens et al. 2008). In Northwest Europe, the distribution map of *F. paludis* showed a fairly large gap between Northeast Germany and England. In Germany and Switzerland dozens of sites of *Forcipomyia paludis* are now known (Wildermuth 2012, Martens et al. 2012). In Germany, these sites are distributed over a large area in the northeast and the south of the country. As in Switzerland, these are mostly situated on the Swiss Plateau, in areas often originating from the ice age. Potential sites of *F. paludis* are areas with lakes, but also peat bogs (Martens et al. 2012). *Forcipomyia paludis* has been observed in Europe from early May until the end of August (Wildermuth 2012). We suspect that checking dragonfly photo archives will probably yield additional records of *F. paludis*. In the near future, we hope to sample midges from dragonflies to identify the species formally and to store specimens in a museum collection.

Acknowledgements

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Samenvatting

Erste waarnemingen van *Forcipomyia paludis* (Diptera: Ceratopogonidae), een ectoparasiet van libellenimago's, in Nederland

In het Nationaal Park Weerribben-Wieden werden op 7 juni 2008 foto's gemaakt van gevleete witsnuitlibellen (*Leucorrhinia pectoralis*) waarop vastzittende knutten (bijtmuggen) van de soort *Forcipomyia* (*Pterobosca*) *paludis* op de vleugels aanwezig waren. Deze tot de ceratopogonidae behorende knut parasiteert voornamelijk op de vleugels van libellenimago's. Voor zover bekend is *Forcipomyia paludis* de enige ceratopogonide die in Europa op libellen parasiteert. De knutten zuigen daarbij haemolymfe uit de vleugeladeren. De foto's zijn de eerste bewijzen van de aanwezigheid van de soort in Nederland, maar er zal nog referentiemateriaal moeten worden verzameld. *Forcipomyia paludis* is momenteel ook bekend uit Ierland, Engeland, Frankrijk, Duitsland, Zwitserland, Oostenrijk, Zweden, Polen, Italië en Kroatië.



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