

**FIRST RECORD OF COMMENSAL FLIES, *DESMOMETOPA* SP., ON A DRAGONFLY, *CORDULEGASTER BOLTONII* (DONOVAN) (DIPTERA: MILICHIIDAE; – ANISOPTERA: CORDULEGASTRIDAE)**

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**Abstract** – The flies were seen near the mouthparts of a perching and feeding ♂ *C. boltonii*. They sucked from the prey being consumed by the dragonfly and dabbed its mouthparts after its meal, possibly cleaning them. During the dragonfly's flight the flies probably rested on the lateral thorax. It seems likely, *Cordulegaster* was accompanied by *Desmometopa* at least for 20 min. – Commensalism of adult Diptera on large predaceous arthropods has been so far reported in spiders, bugs and robber flies only.

**Introduction and observations**

Commensalism in dragonflies is hitherto known from larvae only (e.g. DREYER, 1986; HAWKIN & WATSON, 1990) but not previously from adult dragonflies. On August 27, 1990, I observed

a male of *Cordulegaster boltonii* patrolling along a small ditch in the Kinzig-valley near Haslach (Baden-Württemberg, FRG). From time to time it rested on herbaceous vegetation at several localities along the ditch where it perched or fed on large prey. The ditch was accompanied by a small path close to the margin, so I could easily approach the resting dragonfly and observe it from a very close distance without disturbance. On one of these occasions I was very surprised to notice some minute flies sitting and running nimbly about the front parts of the head or sucking and probing the fluid-covered prey (Figs 1-2) which had already been chewed by the dragonfly and formed to an uniform mass. During the next 20 minutes I had several opportunities to watch closely this *Cordulegaster* individual (which



Figs 1-2. *Desmometopa* sp. (see arrows) are sucking the juices of the prey of *C. boltonii* male or sitting near their food source.

easily could be individually identified by certain wing damage) while feeding and perching on its sites. I always noticed some flies on its face or near its mouthparts. Due to their characteristic M-shaped mark between their eyes the flies easily could be identified as *Desmometopa* spp. (possibly *D. m-nigrum* Zetterstedt or *D. sordidum* Falén). In order to identify the flies more precisely I netted the dragonfly after 20 min, but unfortunately the meshes of my net were too wide and the flies escaped before they could be collected.

Adult milichiid flies especially of the genus *Desmometopa* are known to be commensalists on larger predaceous arthropods, such as spiders (e.g. BIRO, 1885, in HENNIG, 1937; BIRO, 1899; LUNDSTÖM, 1906; FROST, 1913; RICHARDS, 1953; McMILLIAN, 1965; ROBINSON & ROBINSON, 1977; SIVINSKI & STOWE, 1980; LANDAU & GAYLOR, 1987), reduviid bugs (Reduviidae, Hemiptera) (Biro, 1885, in HENNIG, 1937; Biro in KERTÉSZ, 1899; RICHARDS, 1953; ROBINSON & ROBINSON, 1977) and robber-flies (Asilidae, Diptera) (BIRO, 1897, 1899; PEYERIMHOFF, 1917). Flies associated with spiders and bugs are seen either coming to their host after prey has been caught (Biro, 1885, in HENNIG, 1937), or they remain in the vicinity (e.g. on non-sticky supportive lines of the spider web, or on the cephalothorax of a non-feeding spider itself), waiting for subsequent meals (ROBINSON & ROBINSON, 1977; SIVINSKI & STOWE, 1980). But *Desmometopa* flies, which accompany the very mobile asilids, were always found riding on the predator's back during its flight and obviously often seem to be associated with high fidelity with a certain individual host (*Ommatius minor* Dol.; see BIRO, 1897) at least for some time so that they are always present before the asilid preyed on an insect (BIRO 1897, 1899; PEYERIMHOFF, 1917).

The flies obviously locate their food by tracking volatile products of the external digestion or the haemolymph of the prey (SIVINSKY & STOWE, 1980) and BIRO (1899) stated that the *Desmometopa* flies were simply attracted by the scents of freshly killed insects. There is also some evidence that in the case observed here the milichiid flies were associated continuously with the dragonfly for some time and settle on the preda-

tor's face or, more probably, on its lateral thorax even while in flight: (1) The flies observed here doubtless were associated with the *Cordulegaster* male at least during the 20 min I observed the dragonfly and I suppose that they would have spent some more time on their host if they had not been expelled by me (see above). I always could recognize the flies immediately after the *Cordulegaster* perched in the immediate vicinity of my own watching point and flies never could be seen flying to the dragonfly after its landing. (2) The dragonfly was always accompanied by the flies even if it was only perching and not feeding. (3) The occurrence of the constant number of five flies during the 20 minutes I observed

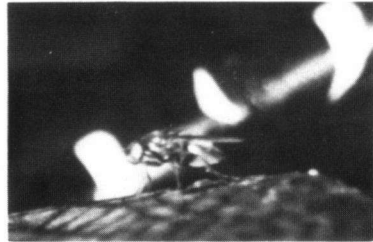


Fig. 3. For some moments one *Desmometopa* fly sat on one of the *Cordulegaster*'s wing where it fled to after it was expelled from the dragonfly's head while the *Cordulegaster* was cleaning its head with the fore-legs. From there (presumably) it returned to the head or thorax of the *Cordulegaster* during the takeoff phase of the latter.

the dragonfly does not seem to be accidental considering the fact that, if the dragonfly would be 'resettled' repeatedly by the flies, it would be very unlikely that the number of flies remained constant on every perch site even at different localities along the habitat. Five flies were seen also on the *Cordulegaster*'s head even after one fly sat on one of the dragonfly's wing (Fig. 3) to where it fled when the dragonfly vigorously cleaned its face with its forelegs brushing the fly off, and then the dragonfly started to fly. In this situation I expected that the fly on the wing would be lost after takeoff of the dragonfly, but surprisingly there were still five flies when the dragonfly perched again. Obviously the fly from the

wing was able to return to the dragonfly's body (head or thorax) during the takeoff phase of the dragonfly when the flight velocity of the latter was still low. This observation seems to prove the high fidelity of these fly specimens to the 'hospitable' predator as already stated by BIRO (1897). (4) With respect to the speed of the large flying *Cordulegaster* male, the flight velocity of the minute *Desmometopa* presumably is much lower, so it seems to be impossible for the flies to 'settle' onto the dragonfly during its flight.

With respect to the flight manoeuvres of the dragonfly, particularly when catching prey, it is very astonishing that the flies were able to settle on the dragonfly for such a long time, presumably the pubescent hairs of the *Cordulegaster*'s face and especially on its thorax may facilitate the phoretic habit of the flies or even make it possible. Immediately after the dragonfly has landed and for some seconds afterwards the *Desmometopa* flies were found more often on the lateral thorax or on the coxae than on the head before they changed to their food source at the dragonfly's mouth. If the dragonfly had caught a prey the flies probed the prey and after a prey had been consumed they dabbed the dragonfly's mouthparts probably cleaning them. But if the dragonfly was not feeding they rested on the lateral thorax, the coxae and legs. Thus, the thorax normally seems to be the place where they stay during the flight of the dragonfly. Because neither the dragonfly's legs nor the struggling movements of a larger restrained prey could reach the lateral thorax and brush off the flies, the thoracic pleurites may represent the safest place for the flies near their food source around the mouth of their host, while the dragonfly is flying and not feeding.

Corresponding to most other observations of commensal flies on predaceous arthropods (l.c.) all five flies observed on the dragonfly were females. While the dragonfly fed on the prey the flies sat on the labrum, labium, sometimes on the basal parts of the mandibles (see Figs 1-2) and even on the prey itself. The flies did not show any fear and seemed to have no respect for the jaws. The flies skilfully avoided being grasped by the heavy moving jaws of the predator or being stripped off by cleaning movements of its legs by running away quickly or - if disturbances

were too strong - by short flights, e.g. to the wings (Fig. 3), the thorax or the substrate on which the *Cordulegaster* was sitting. But there they remained only for some moments before they returned back to the dragonfly's face and/or its prey again. The dragonfly itself obviously did not take any notice from the sponging flies, and the brushing off of one fly mentioned above seemed to be accidental. After these observations I tried to find other dragonflies associated with commensal flies. But in the subsequent years (1990-1992) neither in the described habitat nor anywhere else I was able to discover another one. I also did not recognize any dragonflies associated with flies before and it has not been recorded previously.

#### Conclusions

The behaviour of the *Desmometopa* flies on the *Cordulegaster* is similar to Biro's observations on the asilid *Ommatius minor*, where the flies accompany an individual asilid with high fidelity and ride on its thorax during its flight. They rest on the asilid's thorax while their host is not feeding and only change to its head and mouthparts when the asilid is consuming an insect. This behaviour seems to be the only possibility for the little flies to participate in food from very mobile predaceous large insects, which external digestion products (or the haemolymph of its prey) may be necessary in some *Desmometopa* species for maturation (e.g. of the gonads) of the females. The occurrence of commensal flies on dragonflies (and also on other predaceous arthropods) seems to be very rare and the observation described here is unique yet within odonates. But probably this paper inspirit other odonatologists to search after phoretic flies on dragonflies.

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