

NOTES ON A PECULIAR REPRODUCTIVE BEHAVIOUR AND ON HABITAT RECOGNITION IN *SYMPETRUM INTERNUM* MONTGOMERY (ANISOPTERA: LIBELLULIDAE)

E. SCHMIDT

Seminar für Biologie und ihre Didaktik, Pädagogische Fakultät, Rheinische Friedrich-Wilhelms-Universität, Römerstrasse 164, D-5300 Bonn-1, Federal Republic of Germany

Abstract — A peculiar clustering of mating and ovipositing pairs in sprinkled park lawn and in grass-like reed vegetation in the surroundings of Calgary, Alberta, Canada, is described and discussed in terms of habitat adaptation and avoidance of interference by conspecific males.

Introduction

S. internum is a common species in northern America, but the information on its reproductive behaviour is scarce (cf. CANNINGS & STUART, 1977; ROBERT, 1963; WALKER & CORBET, 1978). The eco-ethological peculiarities described here were confined to a short period of the day and a special vegetation belt. The phenomenon was rather inconspicuous; since it would suffer from net swinging it could easily be overlooked. More intensive observations may be stimulated by these short notes, gathered during some field trips made in the framework of the S.I.O. Symposium in Calgary, 1983.

Methods

Observations were made on the S.I.O. symposium field trips (CANNINGS & CANNINGS, 1983) and on additional field trips in the surroundings of Calgary (Spy Hill Pond, 13-VIII-1983), near Red Deer City (Blind Man Creek/Red Deer River, 23-VIII-1983), at Bragg Creek (mill pond, 24-VIII-1983) and to Kananaskis Provincial Park (Pocaterra marsh, 12 and 22-VIII-1983); furthermore, the species could be studied on the Calgary University

Campus away from breeding habitats. This peculiar reproductive behaviour was recorded at Spy Hill, at Blind Man Creek, and, on 15 and 19-VIII-1983, on the University Campus.

Field work was based on sight, supported by field glasses 10x25, and close-up photography (Nikon 200 macro lens; high speed film at available light, medium speed film with flash light). Care was taken to avoid disturbing the dragonflies. Confirmation of species determination was based on photographic documentation. — Marking experiments could not be carried out in the very limited time available.

Natural habitats

Oviposition of *Sympetrum internum* was confined to a belt with grass-like reed vegetation (wetland grass species, *Eleocharis*, *Carex* etc.) that was about 0.5 m above the August water table, but still moist at the ground even at high noon (Fig. 1).

Dragonflies spent most of the day in the surrounding grasslands. In contrast to other *Sympetrum* species, e.g. *S. costiferum* (Hag.), *S. danae* (Sulz.), the males of *S. internum* only exceptionally came to the open water, and usually undertook no patrol flights over the oviposition site or at the water.

Grasping of females for copulation mainly took place in these surroundings at high noon of hot sunny days, when dew had dried up completely. At Bragg Creek sunshine was interrupted by some rain at noon (11.30-14.00 h); oviposition in *S. costiferum* and *S. danae* continued



Fig. 1. *Sympetrum internum*: clustered oviposition at Blind Man Creek, Alberta, Canada (August 23, 1983), in a narrow grassy-reed belt above the actual water table. In the foreground about 15 pairs on a patch of 0.1 m², in the background two smaller groups, which had separated from the main one in front after the approach.

afterwards, in *S. internum* no sexual behaviour was noticed until 16.00 h, when the observations were terminated.

In tandem and wheel position the abdomen of the male was curved like an interrogation mark, not straight as in other species of the genus, thus touching the head of the mate down to frons (tandem) or to clypeus (wheel). The female usually held the male's abdomen at about segment 6 with her midlegs, in tandem as well as in the wheel position and in flight. This was sometimes supported by the hind legs (at about segment 4), whilst the forelegs usually were bent behind the head in resting position. Tandem flight was supported by the female mainly with the hind wings, less with the forewings (Fig. 2).

When a pair (tandem or wheel) settled on the ground or in low vegetation, the male gave a "starting signal" by bending the wings backwards and touching the sides of the mate shortly, just before taking off for a new flight (Fig. 3).

The tandems at first made long flights, which ended at the oviposition site. In this phase they

usually settled for a short time only, and they flew distances of 2-3 m and more in spite of cautious approach. Sometimes during these flights the "mating wheel" was also formed, and again settling was only short and shy.

These long-distance flights usually ended near to another pair or pairs at the oviposition site. The arriving pair stayed hovering there or sat down near to or even on top of a still settling pair. There was a steady change of settling, hovering and short flights, but all usually within a small patch of the oviposition site, and all pairs would remain quite below the tips of the reed vegetation. By the continuous arrival of new pairs, a cluster formed of up to 15 pairs on a patch of 0.2 m² (Spy Hill), or of 25 pairs on 0.5 m² (Blind Man Creek). These clusters usually were well hidden in the vegetation, and therefore hard to see. They seemed to be established only for some minutes, and spread away at disturbance by uncautious movements of the observer. Then a new cluster formed at another place, likewise accidentally chosen, at some distance (10 m at Spy Hill) but within the oviposi-

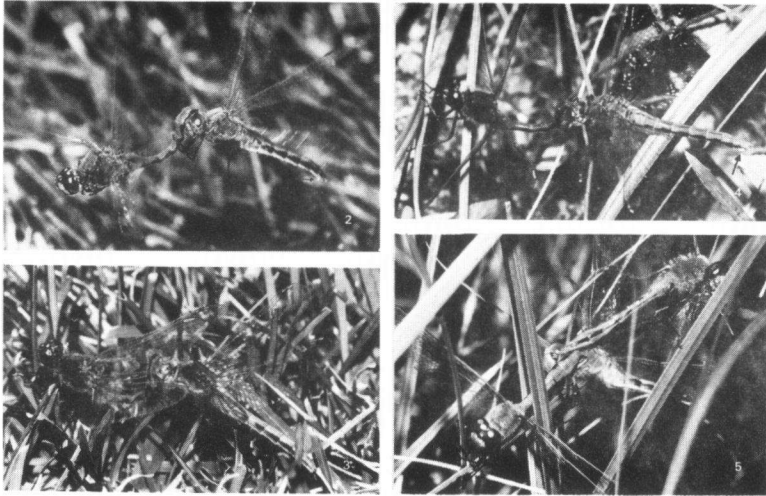


Fig. 2. *Sympetrum internum*: (2) Tandem flight over wet lawn, University of Calgary campus, August 19, 1983 (note curvation of the male's abdomen, touching the mate's head down to frons, and a single egg at female's vulvar lamina just before dropping down, and the forewings of the female); — (3) Start signal before taking off for a new flight: the male bending its wings backward, University of Calgary campus lawn, August 19, 1983; — (4) Tandem settling within a cluster, the female with two eggs at vulvar lamina just before dropping down, Spy Hill pond, Alberta, August 13, 1983 — (5) Triplet connection within a cluster, Spy Hill pond, Alberta, August 13, 1983).

tion site.

Oviposition was performed in these clusters in flight as well as in settling of the male on the vegetation, the female hanging free. The eggs dropped down one by one very inconspicuously, as the oviposition movements sometimes were completely reduced even in flight. Actual egg-laying could not be recognized in the field, but on the photo series taken it could (Fig. 4).

In the cluster oviposition seemed to alternate with short copulations, but because of the crowd it could not be followed exactly. Separation of the pairs usually took place within the cluster, the mates left one by one after short settling.

No free males were seen in the cluster of copulating and ovipositing pairs, and there was nearly no interference by solitary males. Only once (at Spy Hill) a male just after separation from his mate did grasp a settling tandem by the female's head for a short time, thus forming a y-shaped triplet (Fig 5).

No specimen of any other *Sympetrum* species was ever seen in the clusters. The only other odonate species ovipositing at the same site was *Lestes congener* Hagen, which preferred parts of tall reed stems for insertion of eggs, often 2-3 tandems on the same stem.

The wet lawn at Calgary University Campus

The University campus had the usual lay-out: lawns between the buildings, rows of bushes along paths and buildings. The grass was rather long (about 5 cm) and thick. In the morning of sunny days it was very wet with dew but it dried up completely during forenoon. Several parts of the lawn were sprinkled at forenoon/noon, and these parts were still wet at high noon.

S. internum was a common species on the lawns throughout the day, resting at evening on sunny bushes. On two hot, sunny days the peculiar reproduction behaviour described above was observed. The sprinkled parts of the lawn were taken as oviposition sites. The clusters

remained on and near to the lawn surface and thus could be studied better than in natural habitats. The accidentality of initiation was obvious: any pair, staying at the wet parts of the lawn could be the condensation germ of a cluster. On the lawn the clusters usually were smaller, often only 3-5 pairs on 0.2 m², and only up to 9 pairs on 0.15 m², but the concentration on these small, changing patches of the large homogeneous lawn areas was striking.

On the lawn the free males preferred the dry parts at noon, but sometimes some of them were attracted by the conspicuous clusters on the sprinkled parts. They did not, however, disturb the pairs much. Only once a male was observed grasping a settling tandem with his legs at the female's head and thorax for a second.

Discussion

Sympetrum internum differs from other *Sympetrum* species in location and timing of the initiation of mating, and in the oviposition site preferred. By the curvation of the male's abdomen there is a striking broad contact with the female's head. These facts, in addition to the structure of the genitalia, may help to recognize the species by the females.

The specific clustering of pairs at various randomly chosen, inconspicuous small patches of the oviposition site may mainly serve to prevent interference by free males. The inclusion of copulating pairs in the cluster obviously serves the same purpose: In other *Sympetrum* species (e.g. *S. costiferum*, *S. danae*) the oviposition site is occupied by free males, the pairs leave the area to copulate in the surroundings, where the free males do not disturb them. In *S. internum* the situation is just opposite: the surroundings are occupied by free males and at the oviposition site pairs are undisturbed; to be included in the cluster may give a pair additional shelter. — The starting signal described, the reduction of movement while ovipositing as well as the supposed short duration of copulation, alternating with oviposition, may be special adaptations to clustering.

Of special interest is the concentration of oviposition at late noon of hot sunny days. This seems to be essential for distinguishing the preferred habitat site among similarly shaped grasslands in the surroundings that in spring would not be reached by water long enough for larval development to be completed. Moisture near the ground even at late noon of a hot sunny day can be an indication that the site is suitable for oviposition.

A lawn sprinkled at forenoon and therefore still sufficiently wet at late noon thus must cause an error in habitat selection like that observed at the campus. Here larval development of *S. internum* surely can be excluded!

Oviposition by dropping down single, dry eggs instead of sticky egg clusters is typical of *Sympetrum* species that prefer habitat sites above water level (CORBET, 1983: *S. sanguineum* (Müller)).

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