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'SAILING' ON THE WATER SURFACE BY ADULT MALE *ENALLAGMA NIGRIDORSUM* SELYS (ZYGOPTERA: COENAGRIONIDAE)

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Adult males alighted on the open water surface midstream in a shallow river in the Cape Province, South Africa. They remained on the water surface for up to a few min, sailing against the current upstream in the wind. The behaviour apparently was associated neither with mating nor feeding. The open water surface appears to be a relatively safe place to rest when mid-stream perches are in short supply. Such a resting spot is away from predators of the marginal vegetation, such as frogs and large Odonata. There is possibly relatively low risk from birds. Predation from fish is also unlikely. It is tentatively concluded that the water surface is a thin layer of relatively enemy-free space where risks from predation are less than at other microsites.

INTRODUCTION

One of the most conspicuous features of Odonata is their developmental polymorphism, with, in most cases, a distinctly aquatic larva and an aerodynamic adult. Adult contact with the water surface is mostly confined to oviposition. In *Enallagma glaucum* (Burm.) for example, this involves complete submergence by the tandem pair. Certain male *Enallagma* spp., as well as many other Zygoptera, are therefore familiar with the water surface (CORBET, 1962).

It is well known that certain insects, especially some Coleoptera and Hemiptera, regularly inhabit the water surface (McCAFFERTY, 1981). Although the trapped or dead food resources (mostly insects) are great at the water surface (GUTHRIE, 1989), there are also risks from predation from large predators such as fish (BRÖNMARK et al., 1984).

Adult Odonata mostly catch live prey on the wing, and are not normally considered part of the neuston. This paper reports on the southern Cape of South

Africa where *E. nigridorsum* Sel. males alighted on, and spent some time at, the water surface.

THE SPECIES AND LOCALITY

E. nigridorsum is a typical, well-known, sky-blue and black widespread coenagrionid from Natal and the Transvaal in the south, and extending up to north, east and west equatorial Africa (PINHEY, 1984). This is the first record of it from the Cape Province. Body measurements for the male are: abdomen 20-21 mm, hindwing 13-14 mm.

On 1 April 1993, the species was recorded at the Grootrivier, Nature's Valley, near Knysna in the Cape Province, South Africa (33°59'S, 23°31'E), which is over 3° further south than previously recorded.

The site, 50 m x 25 m, had marginal vegetation of mixed long grass and forbs, open water, and an algae-mat island. The river had a stony bottom, and was, at the site, no more than 25 cm deep. The flow rate, measured by a floating stick, was about 8 mm s^{-1}. At the time of the observations, 10.10-11.45 h. 1 April 1993, the ambient shade temperature was 28°C, and the weather was sunny with a light intermittent breeze blowing against the current and causing ripples.

BEHAVIOURAL OBSERVATIONS

A total of 13 ♂ and 4 ♀ were at the site. Only two emergent sticks were present as perches. These were in much demand by *E. nigridorsum* and *Pseudagrion massaicum* Sjöst. There was, at times, distinct intraspecific competition between the male individuals of *E. nigridorsum* for a place on the sticks. Interspecific competition was negligible. Occasionally, males, as well as females, perched among the marginal vegetation.

Airborne males regularly alighted on the water surface and were blown along (Fig. 1). Females did not do so. As the wind was contrary to the current, the insects sailed upstream. The rate of movement across the water varied, depending on the strength of the gusts, but reached about 20 mm s^{-1}. Time spent on the surface ranged from 2s to about 4 min 20s. Travel on the water surface was anything from a few mm to about 20 m.

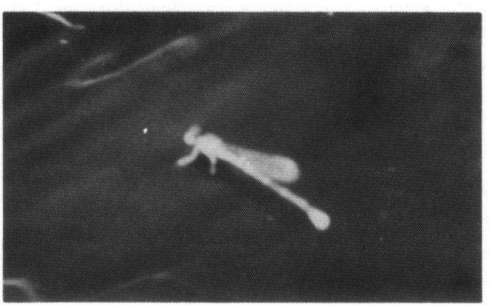

Fig. 1. A male *Enallagma nigridorsum* 'sailing' on the surface of the Grootrivier.

On leaving the water surface, the individuals flew upwind (i.e. downstream), realighted, perched on a stick, or moved into the marginal vegetation. At any one time, there were up to six individuals sailing, but independent of each other. They moved over the ripples apparently without being alarmed.

The behaviour was apparently passive, and did not involve feeding.

The insects travelled backwards, the lightest and largest sail-area being the folded wing tips and the tip of the abdomen. The contact with the water surface appeared to be the six tarsi, and at times the tip of the abdomen.

At the few emergent perches, there was jostling between *E. nigridorsum* males. They were also occasionally harried by males of *P. massaicum* and *Trithemis dorsalis* (Ramb.).

DISCUSSION

The sailing behaviour was not confined to any particular individuals, but was a general feature of the whole local male *E. nigridorsum* population. Although this species is common in Natal, it has never before been seen to sail. Further, the Cape population was distinctly lotic, whereas those seen in Natal were lentic. PINHEY (1984) records the species as inhabiting pools or streams with marginal vegetation, which encompasses both the Cape and the Natal observations.

None of the sailing males was observed to feed. They were distinctly passive, yet conspicuous on the water surface.

Although the sailing itself was non-active, the males nevertheless had to fly upwind to start. Non-living perches were clearly in short supply, with distinct occasional competition between *E. nigridorsum* males, and a continual jostling also with *P. massaicum* and *T. dorsalis* males for perch space. Occasionally, male *E. nigridorsum* landed on floating algae-mats, which, physically, is an intermediate step towards standing on the open-water surface.

Sitting on the water surface would seem to carry high risk of being predated, especially from aerial predators such as swallows and martins (Hirundinidae), bee-eaters (Meropidae), Kingfishers (Alcedinidae) and larger Odonata. Bee-eaters, in particular, are well-known to take Odonata (FRY, 1984). But possibly the risk of settling on the water surface is less than at other microsites. Perhaps the drifting damselfly looks fairly inanimate when sailing along in the breeze, without any leg or wing movements, or directional movement, to attract attention.

Possibly the risk of predation is less on the water surface than among the marginal vegetation. Frogs, as well as large Odonata, are conspicuous predators in this biotope.

The major submerged predators would be fish. However, in the shallow rivers of the Cape, there are none that are obvious candidates, as most are too small. The only obvious indigenous possibility is *Eutropius depressirostris* (Peters), but this is a more northerly fish, not occurring in the southern Cape (HEEG & KOK, 1988). A more likely candidate predator is the introduced rainbow trout [*Oncorhynchus mykiss* (Walbaum, 1792)], although this would not have been an evolutionary force, having been brought into South Africa.

A speculative conclusion from these observations is that the *E. nigridorsum*

sailing behaviour was in response to a shortage of perches in the relatively safe mid-stream area of the river. The behaviour was a resting type, yet requiring considerable energy input to fly upwind first. Possibly the conspicuousness on the water surface plus the energy expenditure is also indicative of some mild territorial behaviour.

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