

SHORT COMMUNICATIONS

**PRECOPULATORY AND TANDEM DIRECTIONAL ACTIVITY
OF *SYMPETRUM SANGUINEUM* (MÜLLER) MALES
AT THE PLACES OF PAIRING
(ANISOPTERA: LIBELLULIDAE)**

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In the experiments with female models 2 questions were asked, viz. (1) How do perching males, which are oriented in different directions relative to the bank, respond to the females? (2) What is the flight direction chosen by a male after seizure of the female? The majority of perching males (46.5%) are directed towards the bank. Males facing towards the bank or parallel to it responded to the female model more often with tandem reaction than males facing away from the bank. 52% of males flew towards the bank after seizure of the female model. Thus, males which perch facing the water are most likely to fly towards it when in tandem. Nearly 8% of the males which captured female models (n=82) tried to oviposit with them usually after unsuccessful attempts of the male to mate. The results obtained suggest the leading role played by *S. sanguineum* males in oviposition behaviour.

INTRODUCTION

It is known that both sexes of some Odonata species can find potential larval habitats and recognize places of oviposition (GIBBONS & PAIN, 1992; WILDERMUTH, 1992). *Sympetrum* species, which may mate far from the potential larval habitats, have been observed in tandems flying in the direction of water bodies and then ovipositing there (MIYAKAWA, 1994; pers. observ.). These tandems often cannot see the water, but can find it. It seems that males of *Sympetrum* are able to find potential habitats for larvae and also the places for oviposition. MOORE (1952), EDA (1976) and UTZERI (1989) suggest that males, which can make the oviposition movements with dead females or without any female, are able to carry out oviposition behaviour. It is hypothesized that the complex behaviour related to ovi-

position (habitat search, choice of oviposition place, oviposition movements) is provided in *Sympetrum* mainly by males.

Sympetrum sanguineum males wait for females on low vegetation and recognize them against the sky, whenever a female flies above the male. Those males which occupy the lowest perches are most active. Males perching at the places of pairing face in different directions. Questions asked in this communication were: (1) How do perching males, which are oriented to different directions relative to the bank of the water body, respond to females? (2) What is the flight direction chosen by a male after seizure of the female?

METHODS

Field observations and experiments were carried out in July-August, 1992, at moist meadows near the Supoy Lake (Kiev prov., central Ukraine), at a distance of 10-30 m from the lake bank. Intact ovipositing tandems were photographed using a flash-unit.

Experiments with models were carried out from 10.00 to 15.00 h using a fishing-rod. Female models (dry specimens of conspecific females) were shown to each male only once in profile slightly above the male. Five male responses were recorded: (t) *tandem*: male seizes the model with anal appendages, (s) *survey*: male flies around the model without attempting to pair, (i) *indifference*: male continues to perch, (e) *escape*: male rapidly flies away, (a) *attack*: male suddenly rushes at the model, usually from bottom. Four directions of a perching male's body and a male's flight after seizure of a female were defined: *d1* – towards the bank of the lake (315°-45°), *d2* – to the right, parallel to the bank (45°-135°), *d3* – away from the bank (135°-225°), *d4* – to the left, parallel to the bank (225°-135°). The direction to which a male had been followed for more than 3 m just after seizure of the female model was registered as flight direction in the experiments in which the direction of tandem flight was recorded. In all 244 responses were recorded.

RESULTS AND DISCUSSION

BODY DIRECTION OF THE PERCHING MALES AND THEIR RESPONSES TO FEMALE MODELS

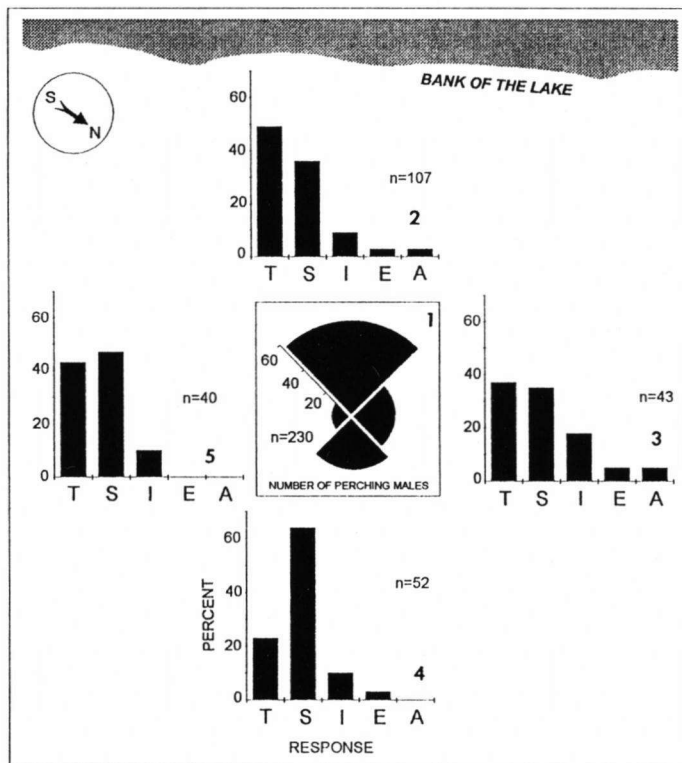
The majority of the perching males (46,5%, $n=230$) were directed towards the bank (Fig. 1). Moreover, males perching facing towards the bank or parallel to it responded to the female model more often with a tandem formation than males directed away from the bank (*d1* - 49%, *d2* - 37%, *d4* - 43% and *d3* - 23% respectively) (Figs 2-5). Ethograms obtained for perching males, which were directed to *d1*, *d2* and *d4* (*d1-d2*, $\chi^2=10.02$, $p=0.0401$, $df=4$; *d1-d4*, $\chi^2=5.24$, $p=0.0727$, $df=2$) significantly differ from ethograms obtained for perching males directed to *d3*, (*d1-d3*, $\chi^2=44.74$, $p<0.0001$, $df=3$; *d2-d3*, $\chi^2=44.39$, $p<0.0001$, $df=3$; *d4-d3*, $\chi^2=17.96$, $p=0.0001$, $df=2$). Thus perching males facing towards the bank respond more often with tandem reaction. Probably, these males have higher level of motivation for pairing.

FLIGHT DIRECTION OF THE MALE AFTER SEIZURE OF A FEMALE MODEL

Only true tandem formations were taken into account ($n=82$). 52% of males flew towards the bank (Fig. 6). The flight directions of *S. sanguineum* males were similar to the male perching directions ($\chi^2=11.52$, $p=0.0092$, $df=3$). Thus, the male can lead the female to the direction of the water. The male's orientation on the perch is probably some kind of preorientation before the tandem flight. This preorientation may help a male to find the water during tandem flight more quickly.

OVIPOSITION

In tandem the male flies actively and the female mainly keeps her balance. This



Figs 1-5. Results obtained in experiments with male responses to the female models. Charts are oriented according to the direction of perching males, for which the chart was obtained: (1) percentage of perching males directed to different directions; - (2) to the bank; - (3) along the bank to the right; - (4) from the bank; - (5) along the bank to the left. - [n = number of recordings].

suggests the leading role of the *S. sanguineum* males in habitat search, oviposition site choice and oviposition movement generation. However, tactile communication between the sexes exists in dragonfly tandems (UTZERI, 1989). Probably this communication is controlled by the ar-rester system (GORB, 1989; 1993) which is "on" in the female during tandem contact with the male (GORB, 1991) and can register head displacements relative to the neck postcervical sclerites with the aid of hair and campaniform sensilla at the points of contact.

Nearly 8% of males which captured female models ($n=82$) tried to oviposit with the female model ("oviposition" with a dead female has previously been reported by MOORE (1952), EDA (1976) and UTZERI (1989)), but such behaviour was observed usually after unsuccessful attempts by the male to stimulate the female to mate. Thus, in nature males may sometimes guard and oviposit with females which have refused copulations. Probably, after oviposition the male may repeat his attempts to mate. Therefore, oviposition in tandem with a female with which the male has not previously mated can give to the male a chance to mate with the female after oviposition.

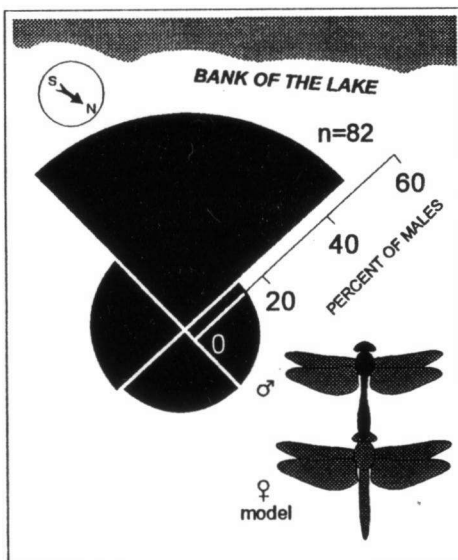


Fig. 6. Flight direction of *S. sanguineum* males after seizure of female. Percentage of 82 recordings is given according to the flight direction.

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