

AGGREGATION OF OVIPOSITING TANDEMS IN ZYGOPTERA: ARE TANDEM PAIRS ABLE TO DISTINGUISH WHETHER THEY ARE APPROACHED BY SINGLE MALES OR TANDEMS?

In several zygopteran species apparently there is no inter-tandem competition for oviposition sites, so tandems may aggregate and oviposit in shared sites (e.g. E. SCHMIDT, 1926, *Konowia* 5: 134-144; W.J. CRUMPTON, 1975, *Odonatologica* 4: 149-168; — E. LOIBL, 1958, *Z. Tierpsychol.* 15: 54-81; — W. DREYER, 1978, *Odonatologica* 7: 309-321; — C. UTZERI, E. FALCHETTI & G. CARCHINI, 1983, *Odonatologica* 12: 259-278; — A. MARTENS, 1989, *Zool. Anz.* 228: 124-128; — G. REHFELDT, 1989, *Abstr. Pap. 10th Int. Symp. Odonotol.*, p. 29; — G. RÜPPELL, R. RUDOLPH & H. HADRY, 1987, *Publ. wiss. Filmen (Biol.)* 19(20): 1-9; — A. MARTENS & G. REHFELDT, 1989, *Anim. Behav.* 38: 369-374).

Since in the Zygoptera tandem pairs display their wings to closely approaching individuals, thus inducing them to retreat (C. UTZERI, 1988, *Odonatologica* 17: 45-54) and, if persistently dis-

turbed, may shift to another site, oviposition in communal sites suggests that tandem pairs must better tolerate to be approached by other tandems than by unpaired individuals. To test this, in 39 *Lestes virens* tandems in the field (Castel Porziano, Roma, Italy, August and September, 1989) we have recorded frequencies of the wing display, which were elicited by approaching (from 20 cm up to physical contact) unpaired or in-tandem conspecific individuals. In the observation site, this damselfly (1) is very abundant; (2) often oviposits in tandem in communal sites; (3) shows a male-skewed sex ratio at the reproductive sites, so there are usually many unpaired males besides several tandems on each day; and (4) single males frequently attempt to seize either the females or the males of tandem pairs. Reactions of the approached/disturbed tandems were mainly wing fluttering by one or both partners (C. UTZERI, E. FALCHETTI & R. RAFFI, 1987, *Fragm. ent.* 20: 1-22), which was sometimes joint to a short interruption of oviposition or followed by shifting of the pairs to other sites.

125 out of 156 unpaired approachers caused one or both partners to react (wing display and/or shifting), while 31 caused no reaction; 15 out of 35 in-tandem approachers caused the same reactions, while 20 caused no reaction ($\chi^2 = 18.6$; $p < 0.001$), i.e. tandem pairs significantly more often reacted to single individuals than to tandems.

Oviposition in communal sites may protect pairs from predation and from single males' interference and may also indicate good oviposition sites to other pairs (G. REHFELDT, 1989, *ibidem*; — A. MARTENS & G. REHFELDT, 1989, *ibidem*). MARTENS (1989, *ibidem*) concluded that tandems of *Coenagrion pulchellum* are attracted to oviposition sites where other tandems oviposit. Indeed, closeness of tandem pairs is likely of less disturbance to ovipositing tandems than that of single males, since the former never attempt seizure, thus neither interfering with oviposition nor with male guarding. Clues are not known in *L. virens* for discrimination between pairs and single individuals. However, from a functional point of view, to react differently to paired and unpaired individuals is the same as to distinguish the former from the latter. Apparently two paired individuals emit a "tandem-specific" stimulus, which does not equal the sum

of two "single-specific" stimuli, since the response to the approaching pair is even much more infrequent than that to the unpaired individual.

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