

A TWENTYFOUR-HOURS-LASTING TANDEM IN *COENAGRION SCITULUM* (RAMB.) IN THE LABORATORY (ZYGOPTERA: COENAGRIONIDAE).

In the framework of a research on copulation behaviour in *C. scitulum* (May-June, 1992), we have reared some individuals in the laboratory, in insectaries as large as 50x50x50 cm, at room temperature and natural photoperiod. Adult *Drosophila* were constantly available as food. All specimens had been collected as newly emerged teneral, or as last instar larvae at an artificial pond in Corrubedo, Galicia, NW Spain. About half of the sample died before reaching maturation; all others successfully emerged and/or matured and mated in their cages, the males (N=42) living on average 16.6 days (maximum age 30).

With non-receptive females (those that did not accept copulation), the precopulatory tandem lasted significantly shorter than with receptive ones ($\bar{x} \pm SE = 19.2 \pm 6.7$ min; $R = 0.6-90$; $N = 14$; and $\bar{x} \pm SE = 24.3 \pm 5.0$ min; $R = 0.5-136$; $N = 36$; Mann-Whitney $U = 4.7$, $p < 0.001$), but in most cases it did not generally exceed the duration of several minutes. However, two males kept their females for as long as 23 h 33 min and 5 h 35 min, respectively. Both these males made repeated invitations to copulate and often attempted to take flight, but since their females were in poor condition and did not perform any copulation or flying movements, often the tandems fell to the ground of the cage. The two

females died after a short time while still in tandem.

Observation of the longer lasting tandem was performed between 12:50 (time of tandem formation) and 22:40 h and between 10:00 and 12:23 h of the following day, having been suspended during the night; in the following morning the male was still grasping his motionless female and performing copulation attempts. He released her following an unintentional stroke by another (flying) female. After a quarter of an hour this male seized another female that rebelled to his grip and was released after 4 min. He died the following day at the age of 22 days.

When females are rare, and sexual competition is high, it is of advantage for the male to control the female he has happened to find, even if she is still unreceptive, in order to improve his probability to mate, which is named pre-copulatory mate guarding behaviour (G.A. PARKER, 1970, *Biol. Rev.* 45: 525-568). In several invertebrates, including insects, pre-copulatory guarding may last several hours or even days (R. THORNHILL & J. ALCOCK, 1983, *The evolution of insect mating systems*, Harvard Univ. Press). This implies that during this period the male and/or the female cannot feed. However, in damselflies, including *C. scitulum* (C. UTZERI & G. SORCE, 1988, *Atti 15 Congr. naz. ital. Ent.*, pp. 731-737), pre-copulatory guarding is not so long, since females are ready to copulate shortly after seizure. In the Odonata, there is evidence of intra-tandem communication (C. UTZERI, 1989, *Opusc. zool. flumin.* 35: 1-6), by which the partners coordinate their behaviour. Thus, in *C. scitulum* and other damselflies, unreceptive females rebel to the male grip by making vigorous movements; in this way probably producing a different stimulation to the male cerci compared to that by a receptive (motionless) female. When this occurs, the two partners may separate after a very short interval. On the other hand, if the female hangs motionless, the male will start invitation movements to copulation within a shorter or longer time. Since our males did not receive any unreceptiveness communication from their females, they continued invitation behaviour for many hours.

Another caged *scitulum* male performed 25 unsuccessful attempts to copulate in 22 min, that is 1.14 attempts per min. Assuming the same rate

for the male of the longest-lasting tandem, the latter may have flexed his abdomen more than 830 times, consuming about as much energy as 275-830 times that employed by a male for normal wheel-binding in the field (1-3 attempts). Probably energy expenditure was even higher due to its flying efforts. This unusually prolonged performance may have weakened this male, but he was still able to catch another female shortly after releasing the former, thus indicating that mating motivation was stronger than feeding motivation. Anyway, after releasing the second female, apparently he was no longer able to feed, although plenty of food was available in his box. Even though this was a long-lived individual, starvation may have helped to bring him to death.

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