ONE OF THE REPRODUCTION TACTICS IN THE MALES OF *LESTES SPONSA* (HANSEMANN) (ZYGOPTERA: LESTIDAE)

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Abstract – The behaviour at the water of individually marked ♂♂ was observed. Elements of territoriality and conservatism of individual reproductive tactics, despite a lasting absence of reproductive success, are demonstrated.

Introduction

The investigation of insect reproductive behaviour, the range of its plasticity, and the repertoire of tactics helped to elucidate the role of behaviour in the adaptiveness of individuals and species as a whole. The reproductive behaviour in Zygoptera is still far from being completely understood. The study by WATANABE & MATSUNAMI (1990) of the reproductive behaviour of *Lestes sponsa* revealed the tactics of male behaviour outside the oviposition zone. These authors described con-siderable copulation of *L. sponsa* at roost sites away from the water, during the first half of the day, and subsequent oviposition in tandem. It remains unclear which individuals meet at the water in the morning, how much time they spend there, whether they vary their reproductive tactics and in what way their presence at the water is associated with their reproductive success.

Material and methods

The reproductive behaviour of *L. sponsa* in the Trans-Carpathian region of Ukraine was observed in 1995 at the drying land-improvement canal in the floodplain of the Borzhava River (the basin of the Tissa River). A full-flowing section of canal, permanently limited with dams, about 26 m long and 1 m wide was chosen. The accompanying Odonata species are *Ischnura pumilio* (Charp.), *Platycnemis pennipes* (Pall.), *Calopteryx splendens* (Harr.), *Sympetrum sanguineum* (Mull.), *Libellula depressa* L., and *Orthetrum coerulescens* (Fabr.). Unfortunately, it was impossible to determine whether the *L. sponsa* imagos emerged from the canal or were individuals migrating from a nearby pond (500 m away), where the numbers of *L. sponsa* are high.

On July 21, we individually marked 8 males, all those that appeared at the selected plot from 9:30 to 10:30. The damselflies were marked on the wing with nail varnish. The marked individuals were monitored, recording their location every half hour from 21-VII to 27-VII-1995, from the time the damselflies appeared at the water in the morning until they disappeared in the evening, and for one hour per day from 28-VII to 9-VIII-1995.

Results

It was found that only four individuals at any one time remained in the 26-m site: nos 1, 3, 4 and 8 on 22-VII, and nos 2, 3, 4, and 8 from 23-VII to 27-VII. Subsequently, the marked individuals disappeared one after another to be replaced by unmarked ones. The last to be recorded was no. 4 (9-VIII).

The males spent all the time at the plot while it was sunny, i.e. from 9:30 to 18:30 local time. They flew away to roost in a tomato field in the direction of the pond, and they were not to be seen at a distance of about 20 m. At the water, the individuals either kept in a favoured zone, not more than 10 m in size, along the canal (nos 2 and 4), or constantly moved along the entire plot (nos 3 and 8). In the 10-m section, no. 2 was noted in 90% of the records and no. 4 in 80% of the records, which gives grounds to believe that they were attached to the site. Most of the time was spent by the damselflies perched on plants protruding from the water: *Phragmites communis* Trin., *Eleocharis palustris* (L.) R. Br. and *Potamogeton* sp. The distance between resting males was not less than 70 cm. The damselflies would constantly shift from one perch to another in short and, apparently, sponta-neous flights. In the case of rapprochement of the males their circle flight would begin, similar to that described in other Zygoptera (UTZERI et al., 1987; MESKIN, 1989). MESKIN (1993) considered such flight as fight. However, like UTZERI et al. (1987) we are not able to state un-equivocally that flight was aggressive or iden-tifying. Only once did we

observe a confrontation of two males with tactile contact, which looked like a fight. As a rule, after the circle flight the newcomer would disappear, while the resident remained on its original perch, or near it. Out of the 18 cases observed, only in two cases was the territory occupied by the newcomer. The resident victories are statistically significant ($\chi^2 = 15, P < 0.01$). In three cases both flew away. These ob-servations suggest protection of the occupied territory.

Over all the observation days only two females appeared at the water. Both arrived unaccompanied by a male and started to oviposit. No tandems or copulation were observed at the study site.

Discussion

Our observations revealed that the density of males at the water is maintained at a constant level, although the numbers of males in the study region could have permitted an increase in density. This finding coincides with that described for *Coenagrion puella* (L.) (MOORE, 1991). Early and constant appearance of males at the water in the morning gives grounds to believe that they do not use the tactics of capturing females at the roost at night as described by WATANABE & MATSUNAMI (1990). These authors suggested that only failures head for the water, one by one, which occurs only after the period of active copulation in the forest is over at about midday. In our case, some of the individuals insistently stuck to the tactics of waiting at the water throughout the entire individual reproductive period, which duration has been previously demonstrated (CORBET, 1980; UEDA, 1989). The same males arrived at the study site for several days and remained there throughout the entire day. Only old males disappeared from the site (with wings opaque and damaged). In the course of the observation period, these males did not reproduce; although doomed to reproductive failure, they did not change their tactics.

Although the site was apparently unattractive to females, males that left were immediately replaced by other individuals. This indicates the advantages of the initial owners over others. In combination with the constant density, this behaviour is suggestive that residents are not failures but, conversely, are highly competitive. This behaviour is so far not understood.

The intra-species plasticity of reproductive behaviour and the variety of tactics used by males have been demonstrated for numerous damselfly species. A number of factors for the choice of tactics, including social interactions, morpho-physiological properties of the individual, weather conditions (e.g. CONVEY, 1989; HILFERT & RUPPELL, 1997; POETHKE, 1988; REHFELDT, 1991) have been described. The individual plas-ticity of the reproductive behaviour in *Enallagma hageni* (Walsh) males has been described by FINCKE (1985) as one of the prerequisite conditions of evolutionary strategy. The fact that the species under study, *L. sponsa*, is described by one author as territorial in terms of reproductive behaviour (MOORE, 1991), but as non-territorial by another (WATANABE & MATSUNAMI, 1990), may indicate variability of the species reproductive behaviour as a whole. The individual variability of reproductive tactics of the *L. sponsa* males is only suggested in the studies by WATANABE & MATSUNAMI (1990). At the same time, our observations demonstrate considerable conservatism of the individual tactics of males under unchanged conditions, which does not seem to be conducive to individual reproductive success.

References – CONVEY, P., 1989, *Behaviour* 109 (1/2): 125-141; – CORBET, P.S., 1980, *Annu. Rev. Ent.* 25: 189-217; – FINCKE, O.M., 1985, *Anim. Behav.* 33: 1124-1137; – HILFERT, D. & G. RUPPELL, 1997, *Mitt. dt. Ges. allg. angew. Ent.* 11: 411-414; – MESKIN, I., 1989, *Odonatologica* 18(3): 253-261; – 1993, *Odonatologica* 22(1): 63-70; – MOORE, N.W., 1991, *Odonatologica* 20(2): 203-231; – POETHKE, H.-J., 1988, *Odonatologica* 17(3): 205--212; – REHFELDT, G.E., 1991, *J. Insect Behav.* 4(3): 293-303; – UEDA, T., 1989, *Odonatologica* 18(1): 75-87; – UTZERI, C., E. FALCHETTI & R. RAFFI, 1987, *Fragm. ent.* 20(1): 1-22; – WATANABE, M. & E. MATSUNAMI, 1990, *Odonatologica* 19(1): 47--59.

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