



## Studies on the Reproductive Behaviour of *Ischnura nursei* Morton (Odonata: Insecta) at Asan Reservoir, District Dehradun, Uttarakhand, India

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**ABSTRACT:** The reproductive behaviour of *Ischnura nursei* Morton was studied four times at Asan Reservoir, District Dehradun, Uttarakhand during June-July, 2019. Courtship is well marked and male demonstrate a circular territory with a radius of about 0.5-1 meter and defended it from the intruding intra or some inter specific male by warning signals like wing vibration or abdomen raising. As female entered into the territory, the male starts following her and forms a tandem link, catching hold of her prothorax by his anal appendages. The before wheel tandem lasted for 5-8 minutes and during this period intramale sperm translocation from the gonopore to the vesicular spermalis took place 2-3 times of 30-50 seconds duration. The courtship wheel lasts for about 6-10 minutes and is performed of perching on vegetation near the reservoir. After wheel tandem lasted for 5-8 minutes. Oviposition is endophytic among the aquatic vegetation and lasts for 7-12 minutes. The female in tandem climbs down underwater and uses her ovipositor to deposit eggs in the submerged vegetation. During oviposition the male in tandem and after release of grip hovers around the female, to defend her from intruding intra or inter specific males. The duration of reproductive behaviour lasts for 22-38 minutes.

**Keywords:** *Ischnura nursei*, Reproductive behaviour, Asan Reservoir, India.

### I. INTRODUCTION

Odonates (Damselflies and Dragonflies) demonstrate well developed complex behavioural patterns, of which the reproductive behaviour is a significant one. Reproductive behaviour of odonates has been studied extensively by several workers including Acharya (1961), Corbet (1962, 1980, 1999), Bick and Sulback (1966), Furtado (1972, 1974), Consiglio (1974), Sakagami *et al.* (1974), Jurzitza (1974), Ubukata (1975), Bick *et al.*, (1976), Kumar and Prasad (1977), Hassan (1978), Rowe (1978), Doerksen (1980), Bick and Bick (1980), Kumar (1980), Utzeri *et al.* (1983), Miller *et al.* (1984), Banks and Thompson (1985), Srivastava and Babu (1985a & b), Waage (1988), Miller (1988), Alcock (1989), Cordero (1989), Meskin (1989), Prasad (1990, 1991), Srivastava *et al.* (1994), Copper *et al.* (1996), Mitra (1996), Cordero *et al.*, (1997), Sharma (2011, 2014, 2015, 2017, 2018, 2019) *etc.* In the present study some observations are being highlighted on various aspects of the reproductive behaviour of *Ischnura nursei* Morton recorded at Asan Reservoir, District Dehradun, Uttarakhand, India.

### II. MATERIALS AND METHODS

The reproductive behaviour of *Ischnura nursei* Morton was studied four times at Asan Reservoir, District Dehradun, Uttarakhand, India, which is located 30°26'09" N, 77°39'56" E during months of June - July, 2019. The Asan reservoir or also known as Dhalipur Lake was constructed in 1967 at union of two rivers, Asan and Yamuna is small wetland of 4 Km<sup>2</sup> and now also famous tourist attraction for observation of migratory waterbirds during October to March every year. Field binocular (30 × 25 DCF) and stop watch have been used for taking observations. Identification of adult individuals was carried out using identification keys provided by Fraser (1933).

### III. RESULTS AND DISCUSSION

The reproductive behaviour of *Ischnura nursei* Morton has been studied four times at study site on dated 29.06.2019, 30.06.2019, 06.07.2019 and 07.07.2019. The noticeable sexual dimorphism with a shining multi-coloured red, yellow and black abdomen of male, while black yellowish abdomen

in females made easy to keep a close watch on a species. The observations on different activities, their duration and variabilities in the reproductive behaviour of *Ischnura nursei* Morton were recorded as below.

**(a) Territoriality:** The males of *Ischnura nursei* Morton arrived at the rendezvous during 9:30 to 10:30 a.m., while the females appeared from the surrounding vegetation late during 11:00 to 11:30 a.m. The males after arrival perched on nearby vegetation. The perch forms the centre of a circular territory with a radius of 0.5-1 meter, which was defended by the resident male from the intruding intra or some inter specific males. The resident male showed an aggressive abdomen raising display or by wing vibration against the conspecific and heterospecific male intruders.



**Male of *Ischnura nursei* Morton**

**(b) Before wheel tandem:** As soon as the female arrived in the territory, the male started following her and after a short dual flight, got success to bind her in tandem link, catching hold her prothorax by its anal appendages. The pair in tandem flew to some nearby vegetation, where the male anchored the plant and the female hanged vertically. The pair in tandem changes perch 2-3 times to nearby vegetation. The before wheel tandem lasted for about 5-8 minutes. This was the time when intramale sperm translocation, from the gonopore to the vesicula spermalis took place 2-3 times of 30-50 seconds duration at an interval of 1-2 minutes.

**(c) Copulatory wheel position:** After the completion of intramale sperm translocation, the male relaxed its abdomen and in tandem rest for 20-30 seconds, after this the male started bending its abdomen and also forced female to bend her abdomen to initiate process of wheel formation. The female then tried to interlock its vulvar region with the secondary copulatory apparatus of male by curling her abdomen forward to form the copulatory wheel. After 3-4 attempts, the spectacular courtship wheel was formed. At the starting of the wheel position, an upward and downward motion of the male's abdomen has been noticed. If the wheel breaks in the process

due to other conspecific males interfered or during change of perch, the pair in tandem formed the wheel again. The duration of the wheel position varied from 6-10 minutes.



**Copulatory Wheel position of *Ischnura nursei* Morton**

**(d) After wheel tandem:** After breaking of the wheel, the male lowered the female and the female also grasped some vegetation by her legs. After a rest of 2-4 minutes, the post copulatory flight was observed over the aquatic vegetation to choose the suitable spot for oviposition and it lasted for 5-8 minutes.

**(e) Oviposition:** The female of *Ischnura nursei* Morton oviposited endophytically among the aquatic plants and the eggs were laid in the tissue of leaf, petiole and stem. During oviposition the female hold the perch plant and the male, just stayed in the air, balancing upon the prothorax of the female. The surface oviposition process on vegetation lasts for about 2-3 minutes. Then the female started ovipositing underwater and within 1-2 minutes, the female was underwater except its wings which remain partially exposed in tandem position and oviposits endophytically. This underwater oviposition may be continued for 4-7 minutes and the total duration of oviposition process lasts for 7-12 minutes. During oviposition the male in tandem and after release of grip hovers around the female, to defend her from intruding intra or inter specific males. The duration of reproductive behaviour lasts for 22-38 minutes. Darwin (1859) stated in the "Origin of Species", that sexual selection, "depends, not on a struggle for existence, but on a struggle between the males for possession of females, the result is not death to the unsuccessful competitors, but few or no offspring". In odonates many different reproductive tactics have evolved to optimize the number of opportunities to successfully reproduce with females and the territorial behaviour, copulation and oviposition are carried out within or near the territory (Conrad & Pritchard, 1992). Several variation of the ovipositing behaviour exists in odonates, but the male has become territorial of

these oviposition sites respective to its species (Corbet, 1962).

The phenomenon of male territoriality amongst Zygoptera, is exhibited well in the damselflies of family Coenagriidae (Srivastava and Babu, 1985a; Utzeri *et al.*, 1983), Calopterygidae (Kumar and Prasad, 1977; Waage, 1988) and Protoneuridae (Srivastava and Babu, 1985b). Corbet (1980) observed that aggressive behaviour of mature male odonates at the rendezvous was directed predominantly towards conspecific males, but in *Ischnura nursei* Morton males demonstrate aggressive behaviour against both conspecific and heterospecific males. During present study in *Ischnura nursei* Morton the range of their territory is 0.5-1 meter is more as that of *Ceriagrion coromandelianum* and *Pseudagrion rubriceps* 30-80cm (Prasad, 1990) and in *Pseudagrion rubriceps* 40-70cm (Mitra, 1996). The duration of wheel position was 6-10 minutes, which is quite same to the duration 3-8 minutes recorded for the other Coenagriidae species (Prasad, 1990; Mitra, 1996) and the mating behaviour was similar to that of other zygopterans (Corbet, 1962; Rowe, 1978; Bick *et al.*, 1976).

The endophytic oviposition by the female and the upright tandem posture adopted by the male during oviposition was quite similar to that described by Furtado (1972), Sakagami *et al.*, (1974), Srivastava & Babu (1985), Prasad (1990), Srivastava *et al.* (1994) and Mitra (1996) for other species of Zygoptera. The upright tandem posture adopted by the male during surface as well as underwater oviposition is similar to that described by Jacobs (1955), Eriksen (1960), Furtado (1972), Srivastava and Babu (1985a) and Mitra (1996) for other species. Hence, it reveals that the time period during reproductive activities observed for a particular event during present and previous studies may relatively changes with the inter or intraspecific interference, according to habitats or by various environmental factors.

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