

**DESCRIPTION OF THE LARVA  
OF *NEUROTHEMIS INTERMEDIA* (RAMBUR),  
WITH NOTES ON BIOLOGY  
(ANISOPTERA: LIBELLULIDAE)**

B. SURI BABU

Scene of Crime Mobile Unit, Police Control Room,  
Jagdapur-494001 (M.P.), India

*Received September 22, 1999 / Revised and Accepted May 10, 2000*

The morphology of the final instar larva is described and illustrated, based on exuviae and larvae from Sagar, Madhya Pradesh, India. Notes on the larval habitat, life history pattern and emergence are added.

**INTRODUCTION**

The genus *Neurothemis* Brauer, 1867 comprises small to medium-sized dragonflies which are widely distributed in tropical Asia, the Indo-Malaysian Archipelago and Australia. Within Indian limits six species have been recorded of which *Neurothemis intermedia* (Ramb.) is distributed throughout India (PRASAD & VARSHNEY, 1995). The final instar larva of *Neurothemis tullia* (Drury) was described by KUMAR (1988) and BEGUM et al. (1990). Scanning of literature (KUMAR & KHANNA, 1983; KUMAR, 1985) revealed lack of information on the larva of *N. intermedia*. The present work was undertaken to elucidate its morphology.

**MATERIAL AND METHODS**

Total 15 male and 5 female penultimate instar larvae were collected from the littoral zone of Sagar Lake, Sagar (M.P.) India (23° 52'N, 78° 45'E) at about 533 m above mean sea level, on 10 September 1982. The larvae were successfully reared to imagoes by providing mosquito and chironomid larvae as food in the laboratory. The description and figures are based on live material and on slides of different parts of the final-instar larvae and exuviae of both sexes (cf. SURI BABU, 1998). Terminology used for the labium is adopted from CORBET (1953), for anal appendages from SNODGRASS (1954), and for the tibial comb from MacNEILL (1967). Larval sampling and field observations were carried out throughout 1982-1983.

The site from which larvae were collected has been described by SURI BABU (1998). A sample of water was taken and analyzed on the same date as the larval collection. The results of chemical analyses were: air and water temperature 27°C and 25°C, respectively. Secchi transparency 43 cm, pH 10.00, free carbon dioxide nil, bicarbonates 118 ppm, carbonates 30 ppm, total hardness 142.8 ppm, dissolved oxygen 4.2 ppm and chlorides 36 ppm.

## DESCRIPTION

**Measurements** (mean of 20 larvae, in mm). – Body length (excluding antenna and anal appendages) 15.20; – head width 04.05; – antenna 1.85; – prementum, length 04.10, width 04.02; – palpus, length 3, width 1.9; – movable hook, length 1.45; – wing sheath, fore 4.35, hind 4.50; – prothoracic leg (femur-tibia-tarsus) 3.2, 2.8, 2.1; – mesothoracic leg 3.7, 5.1, 3.1; – metathoracic leg 3.8, 5.4, 3.2; – abdomen, length 6.5; – epiproct, length 1.6, width at the base 0.7; – cerci 0.52.

The ground colour is blackish brown without significant colour pattern except two dark bands on the tibia of all legs, whereas the exuviae is pale brown.

**Head** (Fig. 1). – Triangular in shape, anterior margin convex, posterior region concave and posterolateral regions convex, beset with small setae. Eyes dark grey, ocelli not visible. Antennae filiform (Fig. 2), 7-segmented, pale brown, pedicle about twice as long as scapus. First flagellar segment bigger than other segments, which are equal in size, all segments beset with piliform setae. Labium (Fig. 3) typical libellulid type, spoon-shaped, pale brown in the middle of the prementum and reaching ventrally up to the coxae of the forepair of legs. Prementum well developed, its length and width are equal in size. Distal margin

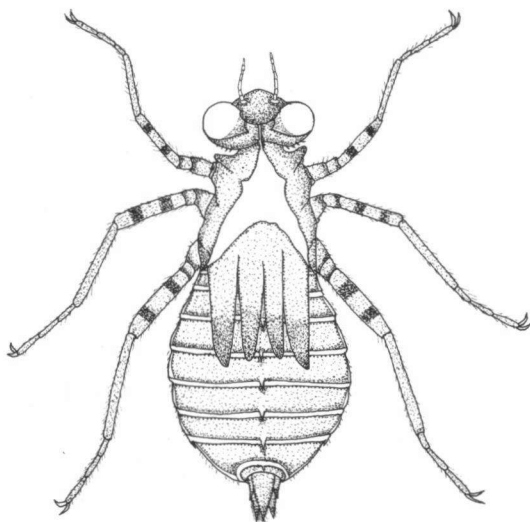
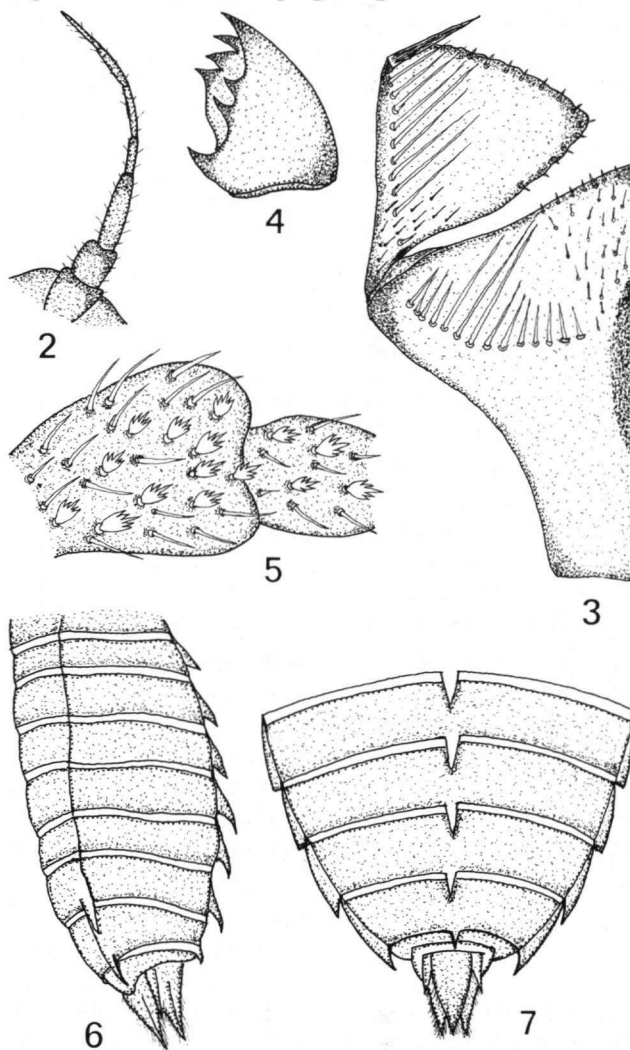


Fig. 1. *Neurothemis intermedia* (Ramb.), female exuviae: general aspect.

of the prementum convex and beset with claviform setae. Few scattered spiniform setae present in the distal region of the prementum. Premental setal formula (14-16) + (14-16). Palpus well developed and its distal margin modified into shallow crenations, each notch bearing a claviform seta. Movable hook slender, pointed and about half the length of palpus. 11 to 13 spiniform setae present below the base of each palpus. That at the base of each palpus is small as compared with the other palpal setae. Palpal setal formula (8-10) + (8-10). Mandible as shown in Figure 4.

**T h o r a x.** – Fore pair of wingbuds partially covered by the hind pair. The hind pair of wingbuds extends to the anterior half of the 6th abdominal segment. The impression of the developing wing venation is visible. Tarsi of all legs 3-segmented, claw prominent and hook-like. Tibial comb (Fig. 5) consists of scattered furcate setae and a few unidentate setae, while the inner margin of the tarsus consists of tridentate setae.



Figs 2-7. *Neurothemis intermedia* (Ramb.), larval features: (2) antenna; – (3) labium, inner view of prementum, left side; – (4) right mandible, dorsal view; – (5) tibial comb; – (6) lateral view of the abdomen, showing median and lateral spines; – (7) female appendages, dorsal view.

**A b d o m e n** (Fig. 6). – Oval-shaped, dorsal surface strongly convex, ventral side convex in the middle but concave laterally. Middorsal spines present on segments 3 to 9. The spine of the 3rd segment is small and straight, those of 4th and 5th segments are medium sized and projected at 45° angle to dorsum. The spines of the 6th, 7th and 8th segments are large and projected posteriorly. The spine of the

9th segment is small and projected backwards, reaching posteriorly to the 10th

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segment. Lateral spines are also present on segments 8 and 9. The 8th spine extended up to the anterior margin of the 9th segment. Lateral spines of the 9th segment reach up to the posterior half of the 10th segment.

Anal appendages (Fig.7). – Epiproct is wide at the base, but pointed at the distal end. In the male there is a triangular plate-like structure on the dorsal side of the epiproct. Paraprocts similar to length of the epiproct and pointed distally. Both epiproct and paraprocts best with small setae dorsally and laterally. Cerci distinct, slightly curved and pointed distally, about one-third as long as epiproct and paraproct.

### NOTES ON BIOLOGY

Larvae are sluggish weed dwellers. They are found among aquatic vegetation like *Hydrilla verticillata*, *Potamogeton crispus*, *P. natans*, *P. pectinatus*, *Vallisneria spiralis*, among the roots of *Eichhornia crassipes*, cultivated hydrophytes of economic value, such as *Trapa bispinosa*, and within algal mats of the littoral zone of Sagar Lake and perennial ponds and temporary monsoon pools in Sagar. They coexist with *Ictinogomphus rapax*, *Anax guttatus*, *Brachythemis contaminata*, *Trithemis pallidinervis* and *Urothemis signata*.

Adults were observed on the wing throughout the year except during severe winter months of January and February, when the temperature of the lake varies between 12-16°C. The emergence and oviposition occurred after the decline of monsoon during late September and October. Larval development of the winter brood is slow and completed by the following March and April. Emergence of this brood takes place during April to mid May. For emergence mature larvae climb on the floating leaves of aquatic vegetation. After emergence the adults flew to the surrounding forests, returned to Sagar Lake at the onset of the south-west monsoon and oviposited from July to mid August. Larval development of the monsoon brood is rapid and completed by late September to October. Emergence and oviposition from the monsoon brood takes place from mid October to November.

### DISCUSSION

The final instar larvae of *Neurothemis intermedia* can be distinguished from those of *N. tullia* which were described by KUMAR (1988) and BEGUM et al. (1990). In the latter species the premental and palpal setal formulas were reported as (13+13) and (8+8), respectively by KUMAR (1988), and as (10+10) and (9+9), respectively by BEGUM et al. (1990). The respective values of *N. intermedia* are (14-16) + (14-16) and (8-10) + (8-10). Median abdominal spines on segments 7 to 9 were described in *N. tullia* by KUMAR (1988). Middorsal spines on segments 3 to 9 and lateral abdominal spines on segments 8 to 9 occur in

*N. intermedia*. The tibial comb in *N. intermedia* is comprised of furcate setae, while KUMAR (1988) and BEGUM et al. (1990) did not describe it in *N. tullia*.

CHOWDHURY & MOHIUDDIN (1994) reported oviposition in *N. tullia* from April to August, in *N. intermedia* from June to August and in *N. fulvia* (Dru.) during June to November in Chittagong, Bangladesh.

In Sagar, oviposition of the *N. intermedia* winter brood does not take place in summer (mid May to late June), though by that time the adults do attain full maturity. It is delayed until the onset of the monsoon. The delay may be related to the seasonal decay of aquatic vegetation, because of which the larvae would be debared of concealment from predators. A similar observation was reported at Sagar Lake in *Ictinogomphus angulosus* (SURI BABU et al., 1995), and in the Dehra Dun univoltine *N. tullia* population that emerges during March and April and oviposits during September (KUMAR, 1988). There is also the possibility of the occurrence of a reproductive diapause in the Sagar *N. intermedia*, similar to that reported by UEDA (1989) in *Lestes sponsa* in southern Japan.

The emergence of the *N. intermedia* monsoon brood occurs in Sagar during October and November. The emergence of *N. tullia* was observed from April to November in Ramna Lake, Dhaka, Bangladesh by BEGUM et al. (1992). In the Chittagong, Bangladesh, CHOWDHURY & MOTIUDDIN (1994) recorded the emergence of the same species from January to March and again from September to November, *N. intermedia* from March to September and that of *N. fulvia* from June to November.

KUMAR & PRASAD (1981) reported the flight period for *N. tullia* from March to September, for *N. intermedia* from April to November and for *N. fulvia* from April to September, all in Western Himalaya. BEGUM et al. (1990) found *N. tullia* on the wing in Dhaka, Bangladesh, throughout the year. CHOWDHURY & MOHIUDDIN (1994) reported the flight period for *N. tullia* throughout the year, for *N. intermedia* from March to September and for *N. fulvia* from February to December, in Chittagong, Bangladesh. In Sagar, *N. intermedia* was found on the wing throughout the year except in January and February.

KUMAR & PRASAD (1991) found *N. tullia* larvae in lakes and perennial ponds, and *N. fulvia* in perennial and seasonal ponds in Western Himalaya. CHOWDHURY & MOHIUDDIN (1994) observed *N. tullia* and *N. fulvia* breeding in temporary monsoon pools and *N. intermedia* in rice fields in Chittagong, Bangladesh. *N. intermedia* occurs in the lake, in perennial ponds, and in monsoon pools in Sagar.

*N. intermedia* is a bivoltine species in Sagar Lake, with a monsoon brood and a winter brood. It is concluded that the larvae of *Neurothemis* species are stagnicolous.

#### ACKNOWLEDGEMENTS

Our grateful thanks are due to Dr B.K. SRIVASTAVA, Faridabad, India for guidance, Dr B. KIAUTA,

Bilthoven, the Netherlands for encouragement and to the late Dr M.A. LIEFTINCK for identification of imagoes. The University Grant Commission, New Delhi, India provided financial support and the Director, Forensic Science Laboratory, Sagar (M.P.) India granted permission to present this paper at the Fifth South Asian Symposium of Odonatology, Nagpur, India.

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