

**LIFE CYCLE AND LABORATORY REARING OF
LACOTREPHES MACULATES (HEMIPTERA:NEPIDAE)
FROM JAMMU (J & K, INDIA)**

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ABSTRACT: The life cycle of *Laccotrephes maculatus* was studied by rearing from egg to adult in laboratory conditions at a temperature of $28.9 \pm 1.08^{\circ}\text{C}$ with description of immature stages. Individuals were reared on nymphs of *Anisops* sp. (Hemiptera: Notonectidae) and mosquito larvae. The incubation period averaged 12.6 days. Durations of five subsequent instars averaged 8.1, 10.0, 10.3, 11.3 and 9.1 days respectively. Total life cycle averaged 61.4 days.

KEY WORDS: *Anisops*, *Laccotrephes maculatus*, laboratory rearing, Hemiptera, Nepidae.

Aquatic hemipterans play a significant role as the major predator of aquatic fauna (Blaustein, 1998). The members belonging to family nepidae feed on a variety of aquatic organisms such as aquatic insects and tadpoles (Menke, 1979). *Laccotrephes maculatus* Fabr. commonly known as water scorpion belongs to family Nepidae of order Hemiptera is carnivorous and air breather. Though most of the time they live in water but sometimes emerge out of water on the ground or under stones in damp beds of recently dried streams. All legs are employed in swimming but they are not good swimmers. Fore legs are moved up and down and middle is used for kicking motion, each pair operates simultaneously as a unit. In crawling on objects under water, normal alterations of legs occur. Abdominal appendages thrust up to the surface as the insect crawls or move slowly. They feed on various types of small aquatic animals after capturing them with front raptorial legs. Water scorpions inflict painful bite when handled. Though they have well developed wings but they seldom fly.

The information relating to life cycle of *Laccotrephes maculatus* is lacking in Jammu and Kashmir State of India but a limited aspect of life cycle studies has been reported in India. Rao (1976) carried out bioecological studies of *Laccotrephes robustus* and *Laccotrephes griseus* in Madras, India. The life cycle of *Laccotrephes japonensis* in Japanese rice fields and a pond was studied by Ohba and Goodwyn (2010). This paper presents information on the life cycle and laboratory rearing of *Laccotrephes maculatus* and includes description of the immature stages.

MATERIALS AND METHODS

The study was started with adults of *Laccotrephes maculatus* which were collected during mid July from pond, taken to laboratory and placed in glass troughs containing mud, water and aquatic vegetation and mosquito larvae and nymphs of *Anisops* sp. (Hemiptera: Notonectidae) as food at a temperature of $28.9 \pm 1.08^{\circ}\text{C}$. The glass troughs or aquaria were cleaned weekly and examined daily for eggs. Extracted eggs were placed on moistened petri dishes. Eggs were checked daily. Upon hatching, first instars were removed to other glass troughs.

As individuals moulted, they were transferred to new troughs. Each day, first and second instars were fed on mosquito larvae and subsequent instars on *Anisops* nymphs.

For morphological studies nymphs and adults were preserved in 70% ethyl alcohol. Eggs were preserved in 5% formalin with a few drops of glycerine. The description of immature stages is based on 5 individuals. Measurements were made with the help of an oculometer calibrated against stage micrometer, which includes total body length and breadth, egg and nymph. Standard graphic paper method wherever necessary was also applied. Descriptions of instars follow the protocol of McPherson & Packauskas (1987); i.e., the first instar is described in detail, but for subsequent instars only major differences from previous instars are described. Length is measured from the tip of clypeus to the tip of abdomen, and width across the mesonotum.

OBSERVATION AND DISCUSSION

Laboratory Rearing

Oviposition

Oviposition or egg laying started after 24 hours of copulation and approximately 15- 20 eggs are laid singly. Similarly McPherson & Packauskas (1987) in *Nepa apiculata* (Hemiptera: Nepidae) reported that few eggs were laid singly in mud away from the shoreline. On the contrary Rao (1976) reported 18 eggs in *Laccotrephes robustus* which are laid in groups of five and six. Oviposition period lasted 4-20 days.

Egg was white at oviposition but later turns pale white and reddish at the time of hatching. The incubation period averaged 12.6 days (Table 1). The first instar emerged through a circular opening in the cephalic end of the egg. It was reddish at this time but soon darkened to black. It fed on mosquito larvae within 1 day. The first, second, third, fourth and fifth instars averaged 8.1, 10.0, 10.3, 11.3 and 9.1 days respectively. The total life cycle averaged 61.4 days (Table 1).

Description of immature stages

The description of each stage is based on average of five individuals.

Egg (Fig. 1)

Length (excluding the length of filament): 2.06 ± 0.04 (range, 2.0-2.1 mm); Width: 0.94 ± 0.04 (range, 0.9-1 mm). Egg is oval and cylindrical and provided with 8 apical filaments; whereas in *Laccotrephes griseus* there are 6 apical filaments and in *Laccotrephes robustus* there are 10 filaments (Rao, 1976). Whereas Keffer et al. (1994) observed 12-17 apical filaments in the egg of *Curicta scorpio* (Hemiptera: Nepidae). Egg is whitish at oviposition but later turns pale white and reddish at the time of hatching. Similar observations regarding the morphology of egg of *Nepa apiculata* (Hemiptera: Nepidae) has also been observed by McPherson & Packauskas (1987). Incubation period averaged 12.6 days. Earlier similar incubation period of 12-13 days was observed by Wiley (1924) in closely related genus *Curicta drakei* (Hemiptera: Nepidae). But Rao (1976) observed an incubation period of 9 days in *Laccotrephes griseus* in Madras. On the contrary Packauskas & McPherson (1986) observed an incubation period of 11.3 days in *Ranatra fusca* (Hemiptera: Nepidae) and McPherson & Packauskas (1987) reported an incubation period of 14.1 days in *Nepa apiculata* (Hemiptera: Nepidae). Whereas Keffer et al. (1994) in *Curicta scorpio* (Hemiptera: Nepidae) observed an incubation period of 11.4 days.

Instars

There are five instars in the life cycle of *L. maculatus*. But McPherson & Packauskas (1987) reported four instars in the life history of *Nepa apiculata* (Hemiptera: Nepidae). Overall characters between instars remain same throughout the instars with minor differences such as lengths of body, abdomen, respiratory siphon and increasing wing pad length which are diagnostic features among instars.

First instar (Fig. 2)

Duration: 8.1 days Length: 4.2 ± 0.19 (mean \pm SD) Rostrum: 0.3 ± 0.1 . Respiratory siphon: 1.18 ± 0.13 . Body elongate oval, dorsoventrally flattened, pale yellowish at the time of hatching, turning brown to reddish brown later on. Head moderately declivent anterior to eyes, broader than long; eyes black. Antennae brownish, short, 3-segmented. Rostrum three segmented. Pronotum wider than long with two ridges lying posteriorly. Mesonotum and metanotum slightly convex. Wing pads seen slightly posterolaterally on both meso and metanota. Prothoracic legs raptorial, uniformly brown; coxa elongate, shorter than femur; trochanter shorter than coxa; tibia lighter proximally and distally, bordered by row of spines on either sides; femur with yellow stripe on anterior surface; tarsus one segmented with single claw, bordered each side by row of short spine. Middle and hind legs light brown with lighter areas; bearing paired claws. Abdomen flattened dorsoventrally, last segment terminating in siphon like tube that open along its ventral length.

Second instar (Fig. 3)

Duration: 10.0 days Length: 7.2 ± 0.83 (mean \pm SD) Rostrum: 0.42 ± 0.08 Respiratory siphon: 1.84 ± 0.20 . Body more elongate, varying from brown and reddish brown to brownish yellow. Antennae two segmented varying from yellow to brown. Pronotum with median depression. Mesonotum with posterior margin slightly produced posteromedially. Wing pads more pronounced. Prothoracic legs yellowish brown to brown having protarsus with row of tiny, dark tubercles replacing hairs of first instar and more pronounced yellow markings on femur. Meso and metathoracic legs yellowish brown to brown.

Third instar (Fig. 4)

Duration: 10.3 days Length 9.4 ± 0.65 (mean \pm SD) Rostrum: 0.68 ± 0.13 Respiratory siphon: 2.34 ± 0.20 . Antennal segments two. Lateral light brown spots more pronounced on thoracic region. Wing pads more pronounced, particularly on mesonotum.

Fourth instar (Fig. 5)

Duration: 11.3 days Length: 19.0 ± 0.79 (mean \pm SD) Rostrum: 2.16 ± 0.27 Respiratory siphon: 5.78 ± 0.19 . Head posterior to eyes. Antennal segments two. Mesonotal wing pad completely overlapping metanotal wing pad laterally. Pronotum more wider than long.

Fifth instar (Fig. 6)

Duration: 9.1 days Length: 20.0 ± 0.44 (mean \pm SD) Rostrum: 2.82 ± 0.21 Respiratory siphon: 6.78 ± 0.21 . Antennae two segmented Pronotum with lateral length subequal to posterior width. Mesonotal wing pads covering those of metanotum. Males slightly smaller than females.

Adult (Fig. 7)

Total body length: 28.6 ± 0.72 (mean \pm SD) Rostrum: 3.6 ± 0.48 Thorax length: 12.4 ± 0.48 Thorax width: 6.6 ± 0.48 Abdomen length: 12.2 ± 1.36 Abdomen width:

6.6±0.48 Respiratory siphon: 30.8±0.64. Head small, triangular, broadest in the middle, produced in front forming rostrum. Eyes oval, prominent antero laterally present in the middle of head. Antennae not visible dorsally, placed ventrally near the inner edge of each eye; 3 segmented, lamellate type. Pronotum slightly broader than long; scutellum triangular broader at base, pointed at apex. Hemelytra well developed; veins and membrane distinct. Forelegs raptorial; coxae long and trochanter short, femora flattened dorsoventrally; thick with a strong tooth. Tibia short, slender, dentate at the inner edge, tarsi one segmented, claw single. Middle and hind legs are moderately slender. Row of thin long hairs present on tibial and tarsal segments of middle and hind legs. Tarsi in both legs single segmented but with two sharp pointed claws. Abdominal appendages shorter than the body length. Apically respiratory siphons are present for breathing purpose formed by the cerci.

Duration of Life cycle of *Laccotrephes maculatus*:

The duration of individual instar is given in Table 1 and a perusal of the table revealed that the total life cycle of *Laccotrephes maculatus* to be completed in 50-70 days with an average of 61.4±8.11 days. The life cycle in laboratory conditions started in mid July and adults emerged in late September. First instar appeared in early August marked by overlapping of subsequent instars and active adults last observed in late September.

Though earlier Rao (1976) recorded total life cycle of 45-53 days in case of *Laccotrephes griseus* (Hemiptera: Nepidae) and 39-46 days in *Laccotrephes robustus* (Hemiptera: Nepidae) in Madras. Whereas McPherson & Packauskas (1987) recorded total duration of 59.8 days in *Nepa apiculata* (Hemiptera: Nepidae) and Packauskas & McPherson (1986) observed total duration of 47.0 days in *Ranatra fusca* (Hemiptera: Nepidae). On the contrary Keffer et al. (1994) recorded total duration of 79.87 days in *Curicta scorpio* (Hemiptera: Nepidae) and Kumari & Nair (1984) observed the total duration of 58 days in *Ranatra filiformis* (Hemiptera: Nepidae) in Kerala.

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Table 1. Duration (in days) of each immature stage of *Laccotrephes maculatus* under laboratory conditions.

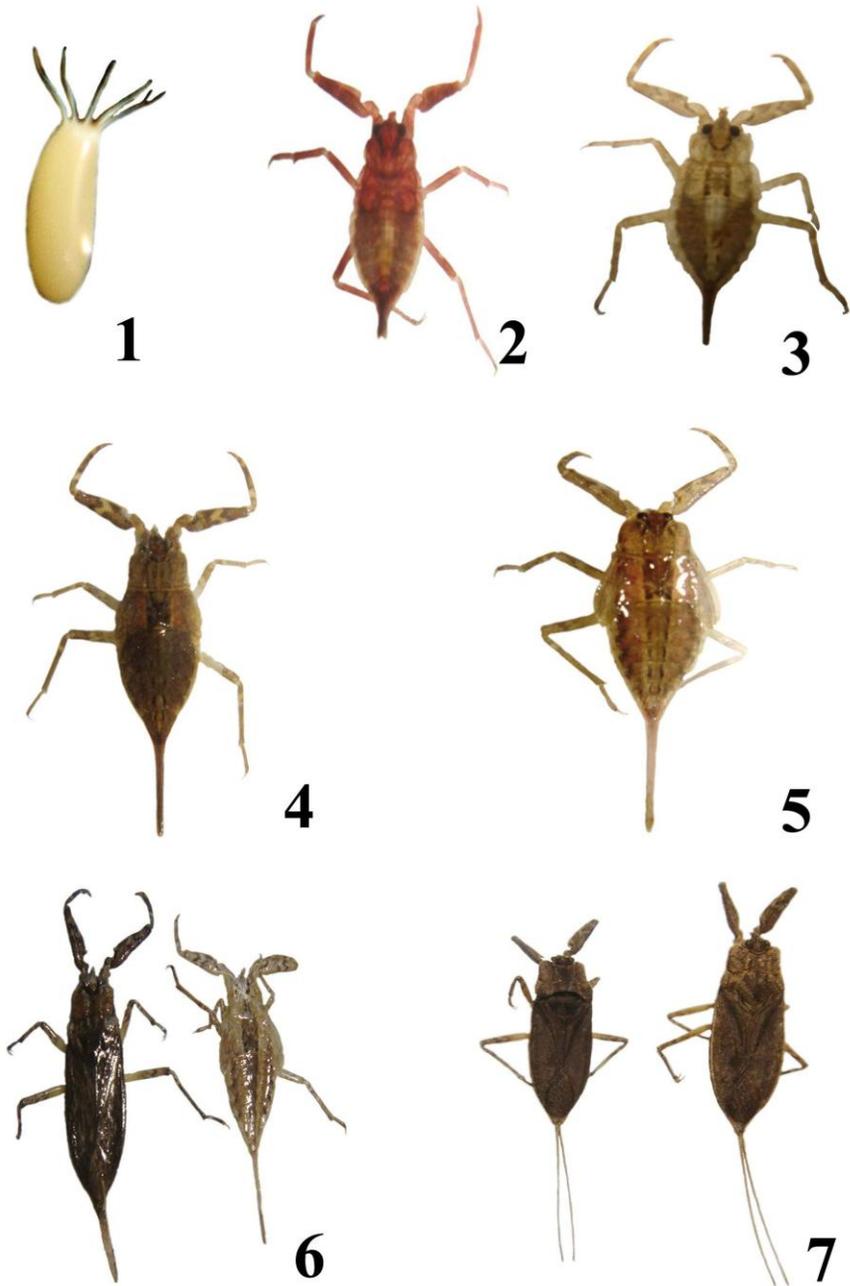
| Stage | Range | Mean \pm SD |
|------------------------------|-------|-----------------|
| Egg | 10-14 | 12.6 \pm 1.67 |
| 1st instar | 7-9 | 8.1 \pm 0.89 |
| 2nd instar | 8-12 | 10 \pm 1.69 |
| 3rd instar | 8-12 | 10.3 \pm 1.52 |
| 4th instar | 10-12 | 11.3 \pm 0.83 |
| 5th instar | 7-11 | 9.1 \pm 1.51 |

Table 2. Measurements (Mean \pm SD) of various organs of the different stages of *Laccotrephes maculatus* Fab. (based on 5 individuals of each instar).

| Stage | Body Length mm | Head | | Thorax | | Abdomen | |
|------------------------|-------------------|-------------------|-----------------|------------------|------------------|------------------|------------------|
| | | Length (mm) | Width (mm) | Length (mm) | Width (mm) | Length (mm) | Width (mm) |
| 1 st instar | 4.2 \pm 0.19 | 0.6 \pm 0.1 | 0.32 \pm 0.16 | 1.92 \pm 0.08 | 0.72 \pm 0.08 | 1.98 \pm 0.13 | 0.9 \pm 0.07 |
| 2 nd instar | 7.2 \pm 0.83 | 0.7 \pm 0.07 | 0.6 \pm 0.07 | 2.48 \pm 0.30 | 1.0 0 \pm .15 | 2.16 \pm 0.11 | 2.82 \pm 0.19 |
| 3 rd instar | 9.4 \pm 0.65 | 0.8 \pm 0.1 | 0.78 \pm 0.13 | 3.5 0 \pm .31 | 2.76 0 \pm .20 | 2.38 0 \pm .13 | 2.86 \pm 0.11 |
| 4 th instar | 19.0 \pm 0.79 | 1.1 0 \pm 0.15 | 0.9 0. \pm 15 | 4.66 0 \pm .23 | 3.96 0. \pm 11 | 5.26 0. \pm 18 | 5.02 0 \pm .08 |
| 5 th instar | 20.0 0 \pm .44 | 1.66 0 \pm 0.28 | 2.7 0.2 \pm 3 | 5.71 0. \pm 36 | 5.66 0.4 \pm 0 | 6.78 0.1 \pm 9 | 5.36 0. \pm 16 |
| Adult | 28.6 \pm 0.72 | 3.4 \pm 0.48 | 3.6 \pm 0.48 | 12.4 \pm 0.48 | 6.6 \pm 0.48 | 12.2 \pm 1.36 | 6.6 \pm 0.48 |

Table 2 (Cont.)

| Stage | Rostrum mm | Respiratory siphon | Fore leg | Mid leg | Hind leg |
|------------------------|-----------------|--------------------|------------------|-----------------|-----------------|
| 1 st instar | 0.3 \pm 0.1 | 1.18 \pm 0.13 | 2.4 \pm 0.1 | 2.2 \pm 0.08 | 3.12 \pm 0.08 |
| 2 nd instar | 0.42 \pm 0.08 | 1.84 \pm 0.20 | 3.14 \pm 0.18 | 2.98 \pm 0.13 | 3.94 \pm 0.27 |
| 3 rd instar | 0.68 \pm 0.13 | 2.34 \pm 0.20 | 4.12 \pm 0.13 | 4.02 \pm 0.08 | 5.08 \pm 0.13 |
| 4 th instar | 2.16 \pm 0.27 | 5.78 \pm 0.19 | 7.5 \pm 0.25 | 6.78 \pm 0.11 | 7.36 \pm 0.16 |
| 5 th instar | 2.82 \pm 0.21 | 6.78 \pm 0.21 | 11.26 \pm 0.20 | 6.81 \pm 0.19 | 7.84 \pm 0.18 |
| Adult | 3.6 \pm 0.48 | 30.8 \pm 0.64 | 23.8 \pm 1.04 | 13.2 \pm 0.64 | 21.8 \pm 1.04 |



Figures 1. Egg of *Laccotrephes maculatus*, 2. First instar of *L. maculatus*, 3. Second instar of *Laccotrephes maculatus*, 4. Third instar of *Laccotrephes maculatus*, 5. Fourth instar of *Laccotrephes maculatus*, 6. Freshly emerged adult with final instar, 7. Adult male and female.