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## Biology and Morphometric Studies of Aquatic Bug, *Sphaerodema Molestrum* (Hemiptera: Belostomatidae) from Jammu (J&K, India)

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### ABSTRACT

The life cycle of *Sphaerodema molestrum* was studied by rearing from egg to adult in laboratory conditions at a temperature of  $26.9 \pm 1.08$  °C and pH of 8.0 with description of immature stages. Individuals were reared on mosquito larvae. The incubation period averaged 9.7 days. Durations of five subsequent instars averaged 8.2, 8.9, 11.1, 15.6 and 9.1 days respectively. Total life cycle averaged 62.6 days.

**Keywords:** Belostomatidae, Hemiptera, laboratory rearing, mosquito larvae, *Sphaerodema molestrum*.

### 1. Introduction

Aquatic insects belonging to order Hemiptera are important as fish food, bioindicators, predators and biocontrol agents. They are important food for many organisms including fish, amphibians, waterfowl and other animals (Clark, 1992) [1]. Certain families of the bugs may be utilised in the biological control of mosquito larvae (Saha *et al.*, 2007) [2]. Aquatic hemipterans play a significant role as the major predator of aquatic fauna (Blaustein, 1998) [3]. *Sphaerodema molestrum* belongs to family Belostomatidae, commonly called giant water bugs, known particularly in America as electric light bugs because they frequently fly to electric lights and as they are fish devouring hence also called fish killers. Some are more than 4 inches long and largest of all the insects. They live in clear, freshwater streams and ponds, preferring those with aquatic vegetation. Giant Water Bugs like slowly moving water, especially with emergent vegetation. They usually grab hold of a plant near the surface, and stick their short breathing tube out of the water to allow them to breath while waiting for prey. These bugs feed upon a large variety of aquatic animals such as insects, snails, fish, tadpole, frogs, toads and any other that they overcome. With their powerful front legs they are able to grab other bugs and prey as big as small fish, frogs and salamanders. They pierce their prey with their sharp beak and secrete enzymes that dissolve the body tissues, thus allowing them to suck up the resulting liquid. They are strong swimmers and nocturnal fliers and are a nuisance in light houses, aboard ships, residences etc. In genera *Belostoma* and *Diplonychus*, the female glues her eggs on the back of the males (Essig, 1941) [4].

The information relating to life cycle of *S. molestrum* is lacking in Jammu and Kashmir State of India. This paper presents information on the life cycle and laboratory rearing of *S. molestrum*.

### 2. Materials and Methods

*S. molestrum* adults were collected during mid-March from pond, taken to laboratory and placed in glass troughs containing mud, water and aquatic vegetation and mosquito larvae as food at a temperature of  $26.9 \pm 1.08$  °C and pH of 8.0. 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 transferred to other glass troughs. As individuals moulted, they were transferred to new troughs. The instars were fed on mosquito larvae.

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 and Packauskas (1987) [5]; i.e., the first instar is described in detail, but for subsequent instars only major differences from previous instars are described. Length is measured

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from the tip of clypeus to the tip of abdomen, and width across the mesonotum.

### 3. Results and Discussion

#### Laboratory Rearing

**Oviposition:** Oviposition or egg laying started after 24 hours of copulation on the back of male and approximately 60-70 eggs are laid in masses on the back of males until hatching. Similar observations regarding egg laying on the back of male have been observed by Smith (1974) <sup>[6]</sup>, Tawfik *et al.* (1978) <sup>[7]</sup>, McPherson and Packauskas (1986) <sup>[8]</sup> and Ohba *et al.* (2010) <sup>[9]</sup>. Oviposition continues for 12-48 hours. Similar oviposition period has also been recorded by Smith (1974) in *Abedus herberti* (Hemiptera: Belostomatidae) in Central Arizona. On the contrary Tawfik *et al.* (1978) <sup>[7]</sup> observed an oviposition period of 48.3 days in *S. urinator* Duf. (Hemiptera: Belostomatidae), another species of the same family and 11 days in *Limnogeton fieberi* Mayr (Hemiptera: Belostomatidae).

#### 4. Description of immature stages

##### Egg (Fig. 1)

Egg Length: 1.9±0.08 mm (range, 1.8-2.0 mm); Width: 0.96±0.04mm (range, 0.9-1 mm). Freshly laid eggs are oval and yellow in colour. As the time passes the eggs become darker with upper one-third cap more darker than rest of the egg. Similar observations regarding the shape and colour of egg of *Abedus herberti* (Hemiptera: Belostomatidae) has also recorded by Smith (1974). The eggs just prior to hatching become grayish- white in colour. Incubation period averaged from 9.7 days at water temperature of 27 °C and pH of 8.0. On the contrary Tawfik *et al.* (1978) <sup>[7]</sup> observed an incubation period of 6.7 days at 27.1 °C in *S. urinator* Duf. (Hemiptera: Belostomatidae) and incubation period of 13.9 days at 27.2 °C in *Limnogeton fieberi* Mayr (Hemiptera: Belostomatidae). Whereas McPherson and Packauskas (1986) <sup>[8]</sup> observed similar incubation period of 9.9 days in *Belostoma lutarium* (Hemiptera: Belostomatidae) at an average temperature of 26.7±1.5 °C.

**Hatching:** Hatching occurred continuously over 3-5 days and twenty- four hours prior to hatching, the free end of the egg swells dorsally. Finally rupture of cephalic cap takes place with the release of nymph. Freshly emerged nymphs are light yellow in colour and translucent but darken with the passage of time.

**Instars:** Many characters remain same throughout the instars with minor differences. The most noteworthy changes through instars of *S. molestrum* are the allometric development of wing pads and protarsal claws.

##### First instar (Fig. 2)

Average duration of first instar in the study area has been observed as 8.2 days, Length: 4.34±0.20 mm (mean±SD) and Rostrum: 1.1±0.1mm. Body oval, dorsoventrally flattened, pale yellowish at the time of hatching, turning greenish yellow later on; surface covered with small hairs, these more sparse ventrally. Head triangular, broader than long; eyes black; antennae two segmented. Wing pads rudimentary. Prothoracic legs raptorial, with tibia

bordered by row of spines on either sides, tarsus one segmented with single claw, bordered each side by row of short spine. Meso and Metatarsi two segmented bearing paired claws. Abdomen flattened dorsoventrally.

##### Second instar (Fig. 3)

Average duration: 8.9 days, Length: 4.56±0.31 mm (mean±SD) and Rostrum: 1.42±0.10 mm. Antennae remain two segmented. Wing pads rudimentary.

##### Third instar (Fig. 4)

Average duration: 11.1 days, Length: 7.3±0.21 mm (mean±SD) and Rostrum: 1.56±0.05 mm. Antennae remain two segmented. Wing pads start developing at the third instar stage.

##### Fourth instar (Fig. 5)

Average duration: 15.6 days, Length: 9.0±1.06 mm (mean±SD) and Rostrum: 1.7±0.1 mm. Antennae remain two segmented. Wing pads become more developed at this stage.

##### Fifth instar (Fig. 6)

Average duration: 9.1days, Length: 11.9±1.34 mm (mean±SD) and Rostrum: 2.22±0.17 mm. Antennae become three segmented. Wing pads become well developed in the form of hemielytra.

##### Adult (Fig. 7)

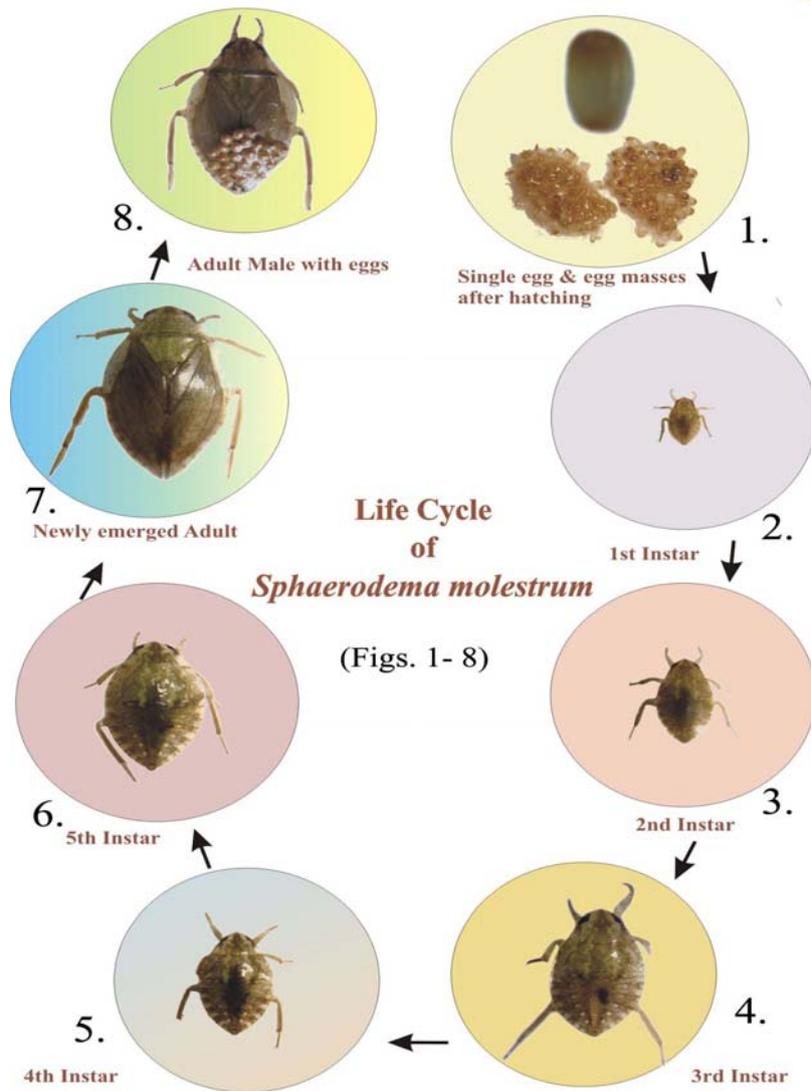
Total body length: 15.3±1.71 mm (mean±SD), Rostrum: 2.62±0.08 mm, Thorax length: 7.38±0.13 mm, Thorax width: 9.82±0.13 mm, Abdomen length: 6.2±0.18 mm and Abdomen width: 2.62±0.08 mm.

Body colour straw yellow at the time of emergence and later turns to pale, dull brownish medially. Head triangular, compressed; broadest at base, produced in front to form rostrum which is 3 segmented. Eyes prominent, present postero laterally. Antennae minute, 4 segmented, not visible dorsally. Pronotum broader than long, scutellum triangular, broader at base, pointed at apex. Hemielytra longer than broad, with oval shining spot beyond the middle of length at inner margin. Legs pale with dull spots; spines brownish. Forelegs shorter in length to middle and hind legs and are of raptorial type used in predation. Middle legs slender, longer in length; hairy and spiny clawed. Hind legs longer than middle one; claws two, curved but long and well developed. Abdomen gradually tapering towards apex

#### 5. Duration of Life cycle of *Sphaerodema molestrum*

The life cycle of *S. molestrum* given in following table was recorded to complete in 52- 70 days with an average of 62.6±7.49 days. The life cycle under laboratory conditions started in mid-March and adults emerged in late May. First instar appeared in early April marked by overlapping of subsequent instars and active adults last observed in late May.

Though earlier McPherson and Packauskas (1986) recorded total life cycle of 59.7 days in case of *Belostoma lutarium* (Hemiptera: Belostomatidae). Smith (1974) recorded total duration of 50-93 days in *Abedus herberti* (Hemiptera: Belostomatidae) in Central Arizona. Whereas Tawfik *et al.* (1978) observed the total duration of 41.4 days in *S. urinator* Duf. (Hemiptera: Belostomatidae).



**Table 1:** Measurements (Mean±SD) of various organs of the different stages of *S. molestrum* Fab

Stage	Body	Head		Thorax		Abdomen		Rostrum Mm	Foreleg	Midleg	Hind leng
	Length (mm)	Length (mm)	Width (mm)	Length (mm)	Width (mm)	Length (mm)	Width (mm)	Length (mm)	Length (mm)	Length (mm)	Length (mm)
<b>1<sup>st</sup> instar</b>	4.34±0.20	0.52±0.08	0.82±0.08	2.1±0.1	1.82±0.08	1.92±0.08	1.94±0.05	1.1±0.1	3.1±0.1	2.44±0.08	3.3±0.12
<b>2<sup>nd</sup> instar</b>	4.56±0.31	0.92±0.08	1.12±0.08	3.62±0.10	2.9±0.1	2.42±0.08	2.9±0.7	1.42±0.10	3.44±0.08	2.6±0.1	3.7±0.14
<b>3<sup>rd</sup> instar</b>	7.3±0.21	1.14±0.18	1.9±0.1	3.72±0.08	3.1±0.1	2.82±0.08	2.84±0.47	1.56±0.05	4.1±0.1	4.9±0.08	5.44±0.08
<b>4<sup>th</sup> instar</b>	9.0±1.06	1.68±0.13	2.82±0.08	4.1±0.1	5.38±0.08	4.9±0.1	5.1±0.1	1.7±0.1	5.08±0.10	6.1±0.07	7.68±0.13
<b>5<sup>th</sup> instar</b>	11.9±1.34	1.9±0.1	2.92±0.08	4.88±0.13	6.22±0.19	5.66±0.13	2.24±0.18	2.22±0.17	5.9±0.1	8.72±0.13	10.84±0.20
<b>Adult</b>	15.3±1.71	2.1±0.08	3.08±0.13	7.38±0.13	9.82±0.13	6.2±0.18	2.62±0.08	2.62±0.08	8.14±0.08	10.1±0.08	14.26±0.18

**Table:** Duration (in days) of each immature stage of *S. molestrum* under laboratory conditions

Stage	Duration (days)	Mean $\pm$ SD
<b>Egg</b>	7-12	9.7 $\pm$ 1.98
<b>1<sup>st</sup> instar</b>	7-9	8.2 $\pm$ 0.90
<b>2<sup>nd</sup> instar</b>	7-10	8.9 $\pm$ 1.24
<b>3<sup>rd</sup> instar</b>	10-12	11.1 $\pm$ 0.89
<b>4<sup>th</sup> instar</b>	15-16	15.6 $\pm$ 0.41
<b>5<sup>th</sup> instar</b>	6-11	9.1 $\pm$ 2.07
<b>Total duration in days</b>	52- 70	62.6 $\pm$ 7.49

## 6. Acknowledgement

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