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SOME OBSERVATIONS ON THE EARLY BIOLOGICAL STAGES OF *EUSARCOCORIS CAPITATUS* DISTANT, A PEST OF HOLY TULSI, *OCIMUM SANCTUM* L.

SHILPI JAIN AND S.C. DHIMAN
ENTOMOLOGY RESEARCH LAB., DEPARTMENT OF ZOOLOGY,
M.S. (PG) COLLEGE, SAHARANPUR-247 001, INDIA

E. capitatus (Heteroptera : Pentatomidae) is a pest of holy Tulsi, *Ocimum sanctum* L. which in turn is an important medicinal plant grown in most of the pious Hindu families as well as in kitchen gardens. Damage is caused by desapping habit of the bug population to the seeds, inflorescence and leaves. The result of laboratory rearing revealed that a copulation period of 2 to 19 hrs with an average of 7.5 hrs is required and prior to it the bug needs a pre-copulation period of 4 to 13 days average being 7.8 days. Oviposition begins after 4 to 42 hrs of copulation average being 20.1 hrs. Oviposting female selects a suitable oviposting site with the help of rostral tip and antennal sensillae. After selecting a suitable site, it leans forward, levels her abdomen and its inter-valvular space is opened through which egg starts its journey out. As soon as candal end of egg is exposed a sticky substance is exuded by accessory gland. As soon as egg come out, it is glued to the substratum. 5 to 12 minutes are required for laying an egg and 30 to 480 minutes for laying an egg batch. Time between successive egg laying extends from 10 to 65 minutes. Egg are deposited on the inflorescence in between the flowers and seeds. Eggs are laid singly and rarely two or three eggs may be laid side by side. However, no egg was seen laid on leaves. Laid egg measures on an average 0.41mm in length and 0.29mm in width. Its chorion is rough, shape is cylindrical. On its cephalic end there is a ring of 10 to 16 (average 12) micropylar processes. Newly laid egg is milky white and its colour changes gradually as the development of embryo inside it proceeds. It turns light pinkish, light reddish, and at the last dark red before hatching. An incubation period of 3 to 5 days (average 4 days) is required prior to hatching. During hatching opercular part having micropylar rings ruptures which may separates off completely or remain attached at one side. Through opened egg, first instar nymph comes out. Hatching period varies from 3 to 7 minutes with an average of 4.5 minutes. After hatching, first instar nymph dries its appendages on exposure to air. Its colour was reddish brown. It requires 3 to 5 days (average 3.7days) nymphal period or growth period after which it moults into second instar nymph. It measures 0.88 mm to 1.00mm. in length (average 0.93mm) and 0.6mm to 0.72mm in width (average 0.67mm).

Key words : *Eusarcocoris capitatus*, *Ocimum sanctum* (Tulsi), copulation, oviposition period, egg structure, incubation, hatching.

INTRODUCTION

The name "Tulsi" means "the incomparable one". Its list of health benefits is extensive. It is grown in every pious Hindu home and kitchen garden as it is a remedy of many day to day aliments. Such an important medicinal plant is infested by a tingid bug, *Monanthia globulifera* (Dhiman & Bhardwaj, 2008). Besides this, recently it has been observed infested by a population of *E. capitatus*, a pentatomid bug, at Saharanpur. Pentatomid bugs are generally pest of agricultural crops, medicinal plants and forest trees. *Eusarcocoris capitatus* Distant infests inflorescence and leaves of Tulsi and in large number damage is caused by the bug population to the seeds, inflorescence and leaves. Though, on other pentatomid bugs a good piece of work has been carried out by Alam & Ahmad (1992); Irulandi *et al.* (2003); Candan *et al.* (2005); Dhiman & Kumar (2006); Panzzi (2006); Dhiman & Kumar (2007); Holtz *et al.* (2007); Matesco (2007) and Dhiman & Yadav (2008). On this bug only a few observations are made by Dhiman &

Jain (2008). In present paper an endeavor has been made to describe its early biological stages.

MATERIALS AND METHODS

Potted Tulsi plants (*O. sanctum* L.) were kept in the open field and some were caged by fine wire mesh. These plants were irrigated at regular interval. For the observation on the early biological stages, newly emerged couples of *E. capitatus* were reared in laboratory as well as in field in wire gauze cages. Rearing in laboratory was carried out in glass hurricane lantern chimneys covered at top by fine muslin cloth. In each chimney, fresh food was supplied daily and stale was removed. A cotton swab dipped in water was also placed in chimney in watch glass for maintaining necessary R.H. Magnifying hand lens was used to observe copulation, pre-oviposition period, oviposition behaviour, and period, incubation period, and hatching keenly. Laid eggs were collected at different time intervals and some of them were preserved in 70% alcohol and rest were kept for rearing. The preserved eggs were treated with H_2O_2 and then with lactophenol and mounted in Heinze polyvenyle mounting medium. Egg structure and structure of 1st instar nymphs were observed under stereoscopic binocular and microscope. Figures were drawn on graphsheets first using graticule.

RESULTS AND DISCUSSION

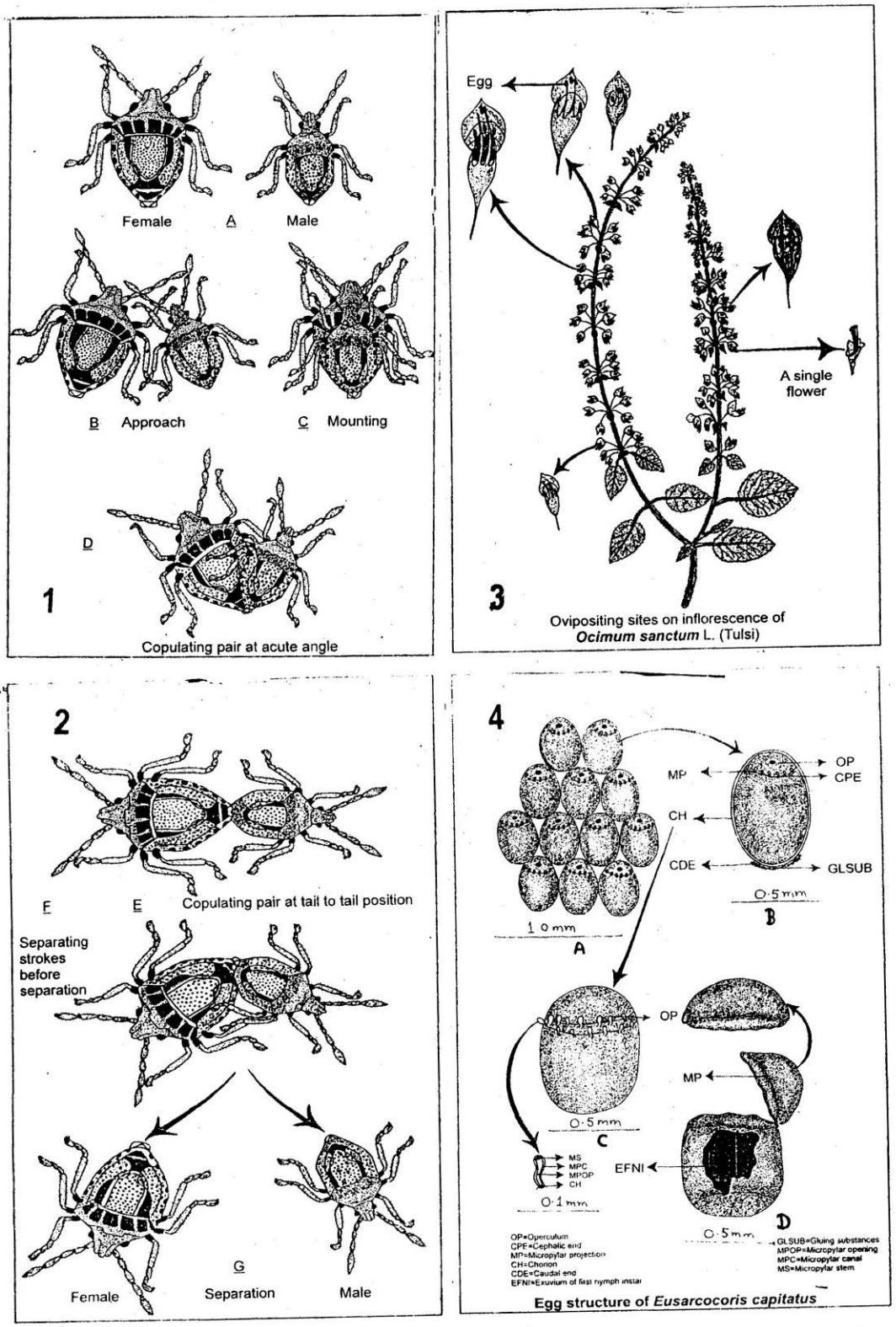
Various events of early biological stages of *E. capitatus* are described as under :

Copulation

Reproductive behaviour of any organism is of paramount significance for continuing the generation. In insects for sexual reproduction, mating is essential by which male transfer its sperm into female genital chamber. Male recognize its own species female by perceiving its chemical molecules (pheromone) by antennal sensillae.

Adult *E. capitatus* does not copulate at once after moulting from fifth instar. Instead, it needs a pre-copulation period of 4 to 13 days with an average of 7.8 days. This variation in pre-copulation period depends upon temperature, R.H., and food factors.

Copulation takes place at any time in the day preferably in the morning and evening in laboratory as well as in the field. Observations regarding the mode of copulation has revealed that male mostly takes active part in woeving the female in this process and approaches her itself. It touches the abdomen and antennae of female several times by his own antennae. When the female gets excited and gives positive consent, then the male tries to insert its erected aedeagus into the female genital chamber. After several repeated attempts, male gets success in his mission. During this process, male holds the female by his fore legs and touches his antennae with the female several time. This process occurs in mounted position and after the completion of process, male turns in opposite direction (Fig. 1). Hence in copulation condition both the sex remains in tail to tail position. In this posture, both the sexes generally do not move and feed and remain at one place but on disturbance, they may move to other place. During movement, female performs leading role. Copulation angle was observed 180° but they may come occasionally at acute angle. Copulation usually lasts for 02 to 19 hrs. with an average of 7.5 hrs. After which copulating partners free themselves from each other without showing any affection. During freeing process, male shakes his abdomen several times and tries to remove or



Figs. 1-4 : Biological stages of *Eusarcocoris capitatus* Dist., a pest of holy on Tulsi. **1.** Pairing; **2.** Copulation; **3.** Oviposition; **4.** Egg structure.

pull his aedeagus from female genital chamber (Fig. 2). This process lasts for 2 to 5 minutes with an average of 3.2 minutes. After separation male retracts aedeagus into its genital chamber. The female after separation rests and then resume feeding. Reengagement of copulation takes place after 5.5 to 72 hrs with an average of 22.35 hrs.

Oviposition

Prior to oviposition a pre-oviposition period of 4 to 42 hrs with an average of 20.1 hrs is required. Oviposition behaviour was observed in the laboratory as well as in the field which revealed that ovipositing female selects a suitable ovipositing site with the help of rostral tip having sensory setae and antennal sensillae present at the terminal clavate segment (Fig. 3). After probing a suitable site, it leans forward, levels her abdomen and opens intervalvular space through which egg starts its journey out. As soon as candal end of egg is exposed, a sticky substance is exuded which serves two main purposes, firstly it acts as lubricant for smooth egg laying and secondly it glues the egg with the substratum. 5 to 12 minutes are required for laying an egg and 30 to 240 minutes for laying an egg batch (average being 231 min.). Time between successive egg laying extends from 10 to 65 minutes. Eggs are deposited on the inflorescence in between the flowers and seeds, glued by a sticky secretion deposited by ovipositing female along with laid eggs. Eggs are laid singly and rarely 2 or 3 eggs are laid as said earlier. Egg are laid side by side. Generally, the eggs are glued vertically with substratum. The ovipositing female frequently copulates with male after laying eggs.

Egg structure

Newly laid egg is milky white in colour and its chorion is rough. Shape of egg is cylindrical. Laid egg measure on an average 0.41mm. in length and 0.29 mm in width. On its cephalic end there is a ring of micropylar processes which help in giving the passage for sperm entry during fertilization and for respiration as well. The number of micropyles varies from 10 to 16, average no. being 12. The length of micropylar process is 0.04 to 0.06 mm (average 0.05 mm). Each micropylar process is comma (,) shaped having cup like head, and a bent stem. Cavity of cup leads into a canal which opens inside the egg through the chorion (Fig. 4). During embryonic development, the egg colour changes from white to dark red. The sequence of gradual changes in egg colour till hatching is presented as under:-

Days	Change in colour
First day	Milky white
Second day	Light pinkish
Third day	Light reddish
Fourth day	Dark red before hatching

Hatching

After incubation period hatching occurs. During hatching, cephalic end of the egg chorion ruptures by the pressure exerted by the head of the nymph. This cephalic end opens or separate off like a lid along with micropylar process. The opercular lid may be left attached with egg chorion some time. The first instar nymph protrudes out through the opening, its head first and antennae, rostrum, legs, thorax, and at last abdomen is pulled out of empty egg shell. During hatching, egg or chorionic membrane also ruptures

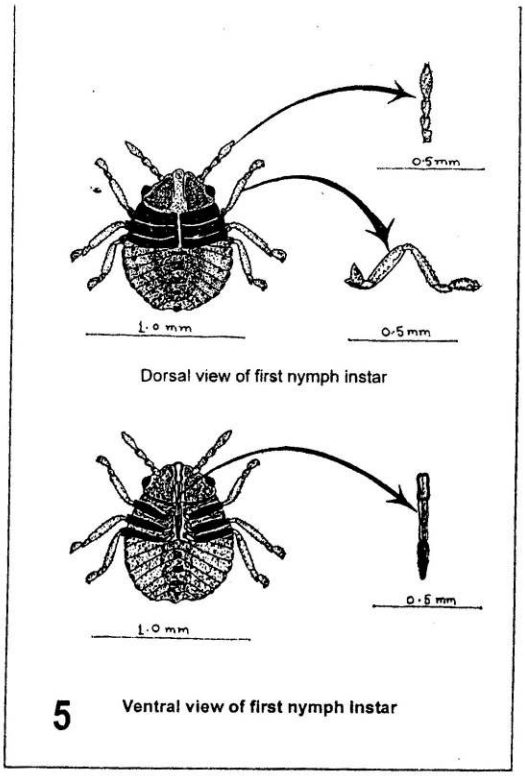


Fig. 5 : First instar nymph (ventral view) of *E. capitatus.*

and the instar also get free from it. A few nymphs could not emerge out in the act of emergence as they could not free their appendages from the egg shell membrane. The whole process of emergence of nymph takes 3 to 7 minutes with an average of 4.5 min.

After hatching, the egg shell along with exuvium of the post natal moult is left between the flower which appears to be white membrane. The newly emerged nymph moves forward and start feeding on the host plant.

Description of 1st nymph

The newly emerged 1st instar nymph is reddish black in colour. Later on, it change gradually to reddish brown on exposure to atmosphere. It measures 0.88 to 1.00 mm in length with an average of 0.93 mm and 0.6 mm to 0.72 mm in width with an average of 0.67 mm. Appendages are clothed with fine spines. The head is ophisthorhynclus and broadly triangular in shape. It has one pair of laterally bulging eyes and one pair of reddish ocelli. Antennae are clavate and 4 segmented. It measures 0.38 mm in length and comparative length of its segments is 0.06, 0.07, 0.08 and 0.17mm. Rostrum is brown in colour and the tip is dark black which extends up to the level of middle coxae. It is 4 segmented and measures 0.5 in length. Comparative length of its segments is 0.13 mm, 0.2, 0.07 and 0.1 mm. Wings pad are lacking. Legs are brown in colour with black spines. Prothoracic leg measures 0.83 mm in length. Tarsus is 2 segmented and its segments measures 0.07 and 0.12 mm in length. On abdomen dorsal abdominal scent gland openings are present (Fig. 5). Duration of this instar varies from 3.0 to 5.0 days with an

average of 3.7 days after which it moults into second instar nymph. During moulting, a longitudinal slit appears extending from the middle of the head to metathorax and through this slit first of all head comes out and later on rostrum and legs become free. At last abdomen is pulled out leaving the empty exuvium behind. It takes 10 to 25min., average being 16.5 min to complete this process. Moreover, in few cases first instar could not free itself from exuvium and died later on.

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