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Studies on biology, morphology and karyotype of *Chironomus stigmaterus* Say (Chironomidae: Diptera) from Aurangabad (M.S.) India

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Abstract

The present communication deals with the studies on morphological and a karyological features of *Chironomus stigmaterus* from Aurangabad district of Maharashtra. During the present study morphology of fourth instar larva, pupa and adult was explored. A larva of present specimen shows mentum with 12 teeth and caudolateral tubules at posterior abdominal region. Pupa is red in colour and exuviae type. In male the setation of tergites and sternites highly variable in size and numbers. Adult female is larger than of male. Polytene chromosome observed at $2n=8$ in number. These are the thummi complex specimens. The chromosome AB and CD are submetacentric, EF with metacentric and chromosome G is telocentric.

Keywords: *Chironomus stigmaterus*, Biology, Morphology, Karyotype, Aurangabad

1. Introduction

Members of the family chironomidae are substantial components of true flies belonging to order –Diptera of the class-Insecta. It is most diverse group of aquatic insects occurring in different environmental conditions and often make up about one third of the microinvertebrate fauna of fresh water ecosystems. These are holometabolus insects with life cycle completed in four stages such as egg, larva, pupa and adult and the greatest part of life cycle is in larval form, hence for identification and classification of this insect larvae are preferred than adult. The chironomidae generally possess good quality polytene chromosomes and these can be used to provide additional characters for study of both taxonomy and phylogeny. Chironomids are a widely distributed and abundant group of species in fresh water ecosystems. Their larval stage is most critical responsive to environmental stress and metabolically active stage of their life. Chironomid larvae are prospective subjects for cytogenetic monitoring because their polytene chromosomes have large size and a very good banding pattern. The review of literature shows that genus *Chironomus* (Meigen) is generally occurring in fresh waters all over the world except Antarctica. The occurrence of *C. stigmaterus* was first of all reported at Aurangabad [1]. The present investigation deals with systematic study of *C. stigmaterus* from Aurangabad District (M.S.) India, with the help of morphological features of larva, pupa and adults, along with cytological studies.

2. Material and method

Collection

Harsul tank is small percolation tank formed due to construction of dam across the Kham River before she enters into the Aurangabad city. It is located at $19^{\circ}55'45''$ North, $75^{\circ}20'10''$ east. Majority of the tank bottom is consists of rocks and slit. The larva, Pupa and adult forms of *C. stigmaterus* for the present study were collected during January to July 2015 from study area. After isolating the salivary glands, the head capsule and the larval body were preserved in 70% ethanol and treated with 10% KOH. Permanent slides were made for identification in Canada balsam [2].

Morphology and Karyotype

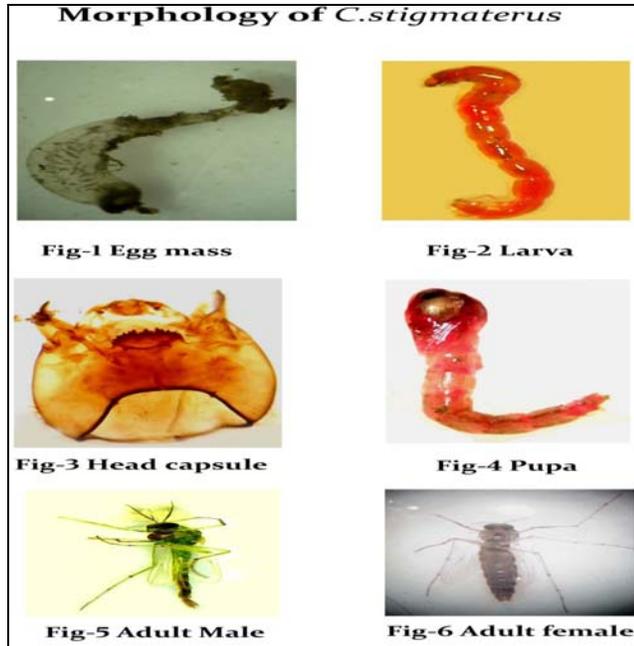
The larvae, pupa and adults were identified using standard keys [2, 3, 4]. The salivary gland chromosomes of *C. stigmaterus* were studied by using a catalogue based on the method [6]. Polytene chromosome preparations were made by the squash procedure using 1.6% orcein in lactic acid: propionic acid: water (2:2:1). All squashes with well spread polytene chromosome

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were preserved as permanent slides and microphotograph of polytene chromosomes were prepared [5, 6]. Identification of specimens were carried out with the help of keys [2, 4, 3, 7]. Abbreviation and morphological terminology of specimen used as described [3]. Specimens are deposited in Entomological Research Laboratory, Dr. Babasaheb Ambedkar Marathwada University Aurangabad, and M.S. India.

3. Result and Discussion

The genus *Chironomus* was erected by (Meigen) and the *C. stigmaterus* was described by (Say). During the present work all the four forms of *Chironomus* were studied. The morphological and karyological characteristics of *C. stigmaterus* are given below.



Eggs

Egg is the first stage of life cycle. It is found at bottom of the sediments and planktonic vegetation. The egg mass is elongate ribbon or a more compact cylindrical to tear shaped globule. The egg mass is elongated and ribbon like structure [8]. The eggs are arranged helically. (Fig-1.)

Larva

Larvae are red in colour. The medium sized larvae length upto 23-25mm. The body has 12 segments; 3 thoracic and 9 abdominal. A larva having a well-developed, complete, head capsule, with mandibles operating in an oblique to horizontal plane, narrow, elongate segmented body that lacks thoracic legs. The spiracles are absent. The prolegs which occur on the first thoracic and terminal abdominal segments are paired (Fig-2). Mentum with trifold median tooth and 12 lateral teeth premandible apically bifid with at most one additional small tooth near center widespread. Anteromedian margin of ventromental plate smooth. (Fig-3). There is no marked differentiation between thorax and abdomen except prior to pupation the thoracic segments enlarge. These characters are similar to noted by other workers [2, 4].

Pupa

The pupal stage of chironomid is short-lived. The pupa is red in colour and exuviae type-The alternating dark and light

colour breakup the pupal outline. During present study it was noted that the pupa is comma-shaped, with a swollen cephalothorax and dorsoventrally flattened abdomen. Cephalothorax with pair of wedge shaped ovoid elongate, multibranching to plumose, thoracic horns; smooth, reticulate with few spines with setae with plastron plate [3] (Fig-4).

Adult

Eyes generally ovoid to reniform elongated dorsomedially separated in both sexes. The adult male antenna is more plumose and hairy than that of female adult antenna. In the male genitalia segment 8th is modified and is anteriorly tapered to a narrow waist there they are connected. The male genitalia the T internal supporting structures or apodemes vary though less markedly than the external structures. A sternopodeme which may be divided into one transverse sternopodeme and paired lateral sternopodeme each of which is associated with a coxapodeme, the apodeme within the cavity of the gonocoxite. The phallapodeme, the anterior margin of a hyaline aedeageal lobe, is a pivoted lever which everts the endophallus. In female adult the antenna is less plumose and small less hairy than that of male. Female adult size is larger than that of male. Abdomen with eight simple pregenital segments stouter in female than in male setation of tergites and sternites highly variable in size and numbers connected. Wing narrows broader in female at rest lying flat or forming peak over abdomen. Membrane hyaline sometimes with dark markings. Macrotrichae present. Legs long and slender [4].

4. Karyotype

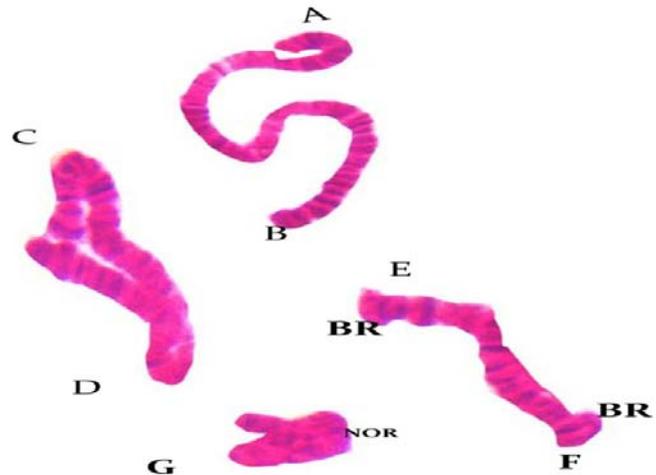


Fig: Karyotype of *C. stigmaterus* AB-Chromosome-I, CD Chromosome-II, EF-Chromosome-III, G-Chromosome-IV, Br-Balbani ring, NOR-Nuclear Organization

Polytene chromosome observed at $2n=8$ in number. These are the thummi complex specimens. Bands are easily observed on the chromosome arms. The results are similar to keys [9]. The chromosome AB is large and I chromosome. It contains mix band. Chromosome CD contains large dark and small light band. Chromosome EF contains two balbiani rings at the end position and the Chromosome G is the small chromosome contains nucleolar organization region. These characters are similar to keys [10].

5. Conclusion

The morphological studies of larva, pupa and adult demonstrate the identification of present specimen as

Chironomus stigmaterus which is confirmed with the help of study of karyotype.

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