



ORIGINAL RESEARCH PAPER

Zoology

A STUDY ON THE TROPHI OF COFFEE WHITE STEM BORER (*Xylotrechus quadripes*) IN THE COFFEE PLANTATIONS OF KODAGU DISTRICT

KEY WORDS: *Xylotrechus quadripes*, *Coffea arabica*, trophi, mandibles, sensilla, striae

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ABSTRACT

Objective: to analyze the morphology of the mouthparts in the 5th instar larvae of coffee white stem borer (*Xylotrechus quadripes*).

Materials and Methods: The larvae of first instar to fifth instar were collected from Somavarapet and Shanivarasanthé of Kodagu District. The collected larvae in the field were preserved in 70% alcohol for further analysis. The fifth instar larvae were dissected and each part of their trophi was analyzed for their morphology.

Results and discussion: The mouthpart contains a labrum, a pair of mandibles, a pair of maxilla and a labium. The mouthparts have several types of sensilla (basiconica, digitiform chaetica, trichodea, styloconicum and coronal pegs). The mandibles have semi-circular apex, a distinct molar and a pointed prostheca. The striated region of each mandible is composed of several striae and each of these has several rows of blunt and stout pegs. These mouthparts of *X. quadripes* might play an important role to make galleries in the stem of coffee plants.

Conclusion: the mouthparts of Coffee white stem borer have 90 percent homology with the Clover stem borer. In the Clover stem borer mandibles have a trident apex were as in the Coffee stem borer mandibles have a broad and a semicircular apex.

INTRODUCTION

Coffee is one of the most widely traded agricultural commodities and popularly admired as "King of beverages". The arabica coffee production damaged in India by Coffee white stem borer, *Xylotrechus quadripes* is alarming and causing an economic yield loss of 2 to 20 percent¹. Coffee stem borer is a beetle belongs to order Coleoptera and family Cerambycidae. *Coffea arabica* is the most preferred and principal host plant of the Coffee White Stem Borer. Rarely, the Coffee white stem borer attacks weak robusta coffee plants as its stem and primary branches are much thicker and harder, due to which the larvae do not survive well, and as its bark is smoother, the females do not prefer to lay eggs on it and/or the eggs are more exposed to predation².

The economic losses caused by the uprooting of stem borer infested plants at the rate of one plant per hectare result in a total loss of about US \$642,585 annually in India³. In India, over nine million trees are destroyed each year because of CWSB infestation, costing around \$40 million annually for replacement and loss in production^{4,5} reported the annual loss due to the CWSB in India about \$17.5-26 million. Affected plants show externally visible ridges around the stem. The first incidence of coffee white stem borer was reported from Karnataka^{6,7}. After a lapse of 20 years suggested some remedial control measures against coffee white stem borer⁸.

Coffee white stem borer larvae produce galleries in the main stem and primary branches, and sometimes tunnel their way into the main root; consequently, the damaged plant withers, showing yellowing and wilting symptoms^{9,10}. The coffee plants of seven to eight years old are the most to suffer from the borer attack, as these plants do not survive for a year after the attack. The larvae attack and tunnel into the bark which hard wood of the main trunk, branches and cause extensive tunneling ultimately resulting in death of the plant. Tunneling by one larva may be sufficient to kill a five-year-old coffee plant¹¹. After tunneling by a larva under the bark region for about 2 months, a ridge develops on the surface of the stem which is as an external symptom of borer attack. In Vietnam the grubs infest the roots to a depth of about 18 cm below the surface and attack the stems up to height of 60 to 90cms reported that more than ten borers per five to six year old plant may be considered as the threshold limit for the pest^{12,13}.

The generalized insect mouthparts consist of 5 basic structures. Moving from anterior to posterior these structures are: the labrum, the paired mandibles, the paired maxillae, and the labium are present. The labrum is the anterior-most mouthpart. It serves to hold food in place during chewing by the mandibles. The mandibles are largest mouthparts of chewing insects. It is help for capture food and break it up into smaller pieces like cut, tear,

crush, and chew the food particles. The maxillae (single maxilla) are positioned laterally behind the mandibles. The maxillae cut food and manipulate it during mastication. The labium is the posterior-most mouthpart and is derived from the fusion of two maxillae-like appendages. It forms the protective "lower lip" to the mouth. It assists manipulation of food during mastication of food particles.

MATERIALS AND METHODS

The fifth instar larvae of coffee white stem borer collected from coffee estate of Shanivarasanthé, Somavarapet and other parts of Kodagu District (Fig-1). The collected larvae preserved in 70% alcohol and kept in the laboratory. These larvae dissected to study the mouthparts. The photography of mouthparts taken to study their arrangements. The labrum, mandibles, maxillae and labium dissected separately to study their structure and the function during their larval mode of life.

RESULTS AND DISCUSSION

The mouthparts of coffee white stem borers comprise of a labrum, a pair of mandibles and a pair of maxilla (Fig-2a). The broad rounded labrum has sensilla and chaetica (hair like or rod shaped cuticular projection) are mostly situated on the posterior edge of the labrum where they come in contact with mandibles. These sensilla are situated centrally on the midline of the labrum. Mandibles have a semicircular apex, a distinct mola and pointed prostheca (a small sclerite articulated to the base of the mandible in some insects) and striated region near the mola. A prostheca is distad (toward or near the distal part) of mola which is deeply grooved and the grooves increasing in the density from the basal region of the mola. Lateral of the mola is a striated region (at low magnifications) but each stria is composed of several rows of blunt, stout spines.

The labium comprises of sensilla on the ligula, mentum and submentum. The labial palpi are two segmented and the second segment is longer the apex of the segment has sensilla. The central sensory receptor has a sensillum which has a short base with a long peg (a short pin or limit on a scale). The maxilla is well developed with a three segmented palpus and a mola which is long and curved with two large dentes at the apex. Just below the dentes and on outer surface sensilla are located. The close proximity of the labral, sensilla and chaetica to the underline mandibles indicates that these sensilla probably act in monitoring the position of labrum and mandibles during feeding. Some other sensilla are none to act has stress receptors and the sensilla situated on the middle portion of the labrum may function has cuticular stress receptors.

The mandibles of *Languria mozardi* (Clover stem borer) has a

tridentated apex with distinct mola than prostheca and striated region, but mandibles of *Xylotrechus quadripes* is have a broad semicircular apex with a distinct striated region and a mola prostheca region are not clearly seen (Fig-2b). The deeply grooved mola surface of mandible aids in grinding plant material that is to be ingested. Several rows of blunt spines comprises each of the striae that are present on the same region of *Tribolium* larvae¹⁴. The general structure of labium is similar to the descriptions for other *languriid* species^{15,16}.

In conclusion, the mouthparts of Coffee white stem borer (*Xylotrechus quadripes*) have the similarity with the mouthparts of the Clover stem borer (*Languria mozardi latreille*) but the mandibles of Coffee white stem borer is differently modified when compared with Clover stem borer. In the Clover stem borer mandibles have a trident apex where as in the Coffee stem borer mandibles have a broad and a semicircular apex.



Fig 1: First to fifth instar larval stages of coffee white stem borer

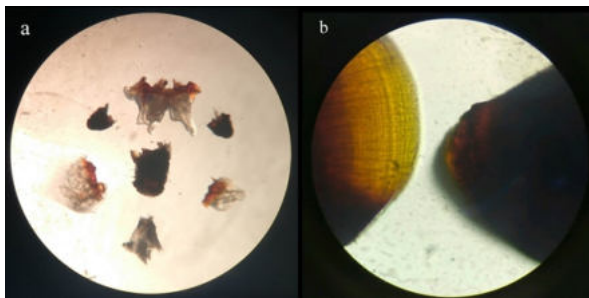


Fig 2a: Mouth parts (trophi) of fifth instar Coffee white stem borer- Mounted
2b Mandibles of fifth instar Coffee white stem borer (magnified)

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