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Mouthparts and stylet penetration of the lac insect *Kerria lacca* (Kerr) (Hemiptera:Tachardiidae)

Ayashaa Ahmad [a,d,*], Sandeep Kaushik [b], V.V. Ramamurthy [a], Suman Lakhanpaul [b], R. Ramani [c], K.K. Sharma [c], A.S. Vidyarthi [d]

[a] *NAIP Project (70-17), Division of Entomology, Indian Agricultural Research Institute, New Delhi, India*
[b] *Department of Botany, University of Delhi, Delhi, India*
[c] *Indian Institute of Natural Resins and Gums, Namkum, Ranchi, India*
[d] *Department of Biotechnology, Birla Institute of Technology, Mesra, Ranchi, India*

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ABSTRACT

Hitherto less known aspects on mouthpart morphology and penetration mechanism of the lac insect *Kerria lacca* have been explored. Unique details of the mouthparts, i.e. morphology of labium and stylets and salivary sheath have been brought out. The gross morphology of the mouthparts though resembled other plant sucking homopterans; a two-segmented labium with symmetrically distributed six pairs of contact-chemoreceptors on its surface was distinct; the mandibular stylets had serrations on its extreme apical region, while the maxillary stylets had their external surface smooth with parallel longitudinal grooves on their inner surface. Formation of flanges, salivary sheath and penetration pathway observed along with probing and penetration of the stylets intracellularly up to the phloem cells, as illustrated herein, are the addition to the existing knowledge on the structural details of the mouthparts and the feeding behavior thereupon.

1. Introduction

The phytophagous lac insect, *Kerria lacca* (Tachardiidae: Hemiptera) secretes true lac, the only resinous compound of animal origin having an immense economic importance. This insect had been reported from Oriental and Indo Malayan regions (Chamberlin, 1923; Varshney, 1976; Ben-Dov, 2006). It generally infests more than 400 plant species (Sharma et al., 2006), and feeds on the host tissues such as stem and sometimes petiole. Its mouthparts are specialized for piercing the plant tissue and sucking the sap like other phytophagous insects. Unlike many plant sucking homopterans, the lac insect inserts its mouthparts only once in its life-cycle, thereafter remains sedentary and continues feeding (Imms and Chatterjee, 1915). Within few hours of their emergence, the first instar nymphs find a suitable feeding site and successfully penetrate their stylets into the plant tissue to reach the vascular bundles.

In the lac insects too, the unique mouthparts have been acquired as a result of their diverse feeding mechanism during evolution. Also, the phloem is their well known target similar to other piercing and sucking insects as these utilize the transported fluid for efficiently fulfilling their nutritional requirements (Kehr, 2006). Mouthparts of hemipterans play an important role in host location, feeding and in transmission of viral and bacterial pathogens (Pollard, 1968; Backus, 1988). Extensive studies are available on the stylet penetration and feeding mechanism by the sap sucking homopterans such as aphids and whiteflies (Evert et al., 1973; Walker, 1985; Rosell et al., 1995).

However, little is known about the finer aspects of mouthparts' structure and their role in locating the phloem tissue within the host plant (Pollard, 1973). The position of sensilla on the labial tip in hemipterans makes it more interesting as it is the preliminary contact point between the food source and the insect during the events of host location and feeding. Studies done on the mouthpart morphology of the lac insect described it to be a piercing and sucking type as usually found among the Coccidae (Imms and Chatterjee, 1915; Misra, 1931; Roonwal, 1962; Krishnaswami et al., 1964). Though few studies explain the labium and stylets of lac insects, information on the ultrastructural morphology and stylet penetration is not available.

Hence the present study examined the ultrastructural morphology of the clypeolabral shield, labium and stylet fascicles.

* Corresponding author. NAIP Project (70-17), Division of Entomology, Indian Agricultural Research Institute, PUSA Campus, New Delhi, 110012 India. Tel./fax: +91 1125842042.
E-mail address: a.ayashaa@gmail.com (A. Ahmad).

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Also, the penetration pathway of the stylets and salivary sheath within the host tissue was explored. Light microscopy and scanning electron microscopy have been used for observations. The observations thus obtained could be useful in unraveling the details behind the feeding behavior and stylet penetration by the lac insect.

2. Materials and methods

The stock culture of brood lac with about to hatch gravid females was collected from Botanical Garden, University of Delhi, India, and was inoculated on *Ficus religiosa*. The first instar nymphs were allowed to feed on stem and petioles and collected on alternate days for a week. For elucidating the stylet penetration pathway infested petiole and stem with approximately 120 first instar nymphs settled per 2.5 cm^2 known to be a good settlement were selected (Figs. 1A and 3A). Emerging first instar nymphs from the brood lac collected in parafilm coated petri plates were fixed for further investigations. Both fresh and fixed material was used for the study of mouthparts.

The first instar nymphs were placed in 10% KOH for few hours to clear the internal body contents, then cleared in distilled water and the mouthparts dissected under Leica EZ4 stereozoom microscope at 35x.The samples were then dehydrated in a graded series of ethyl

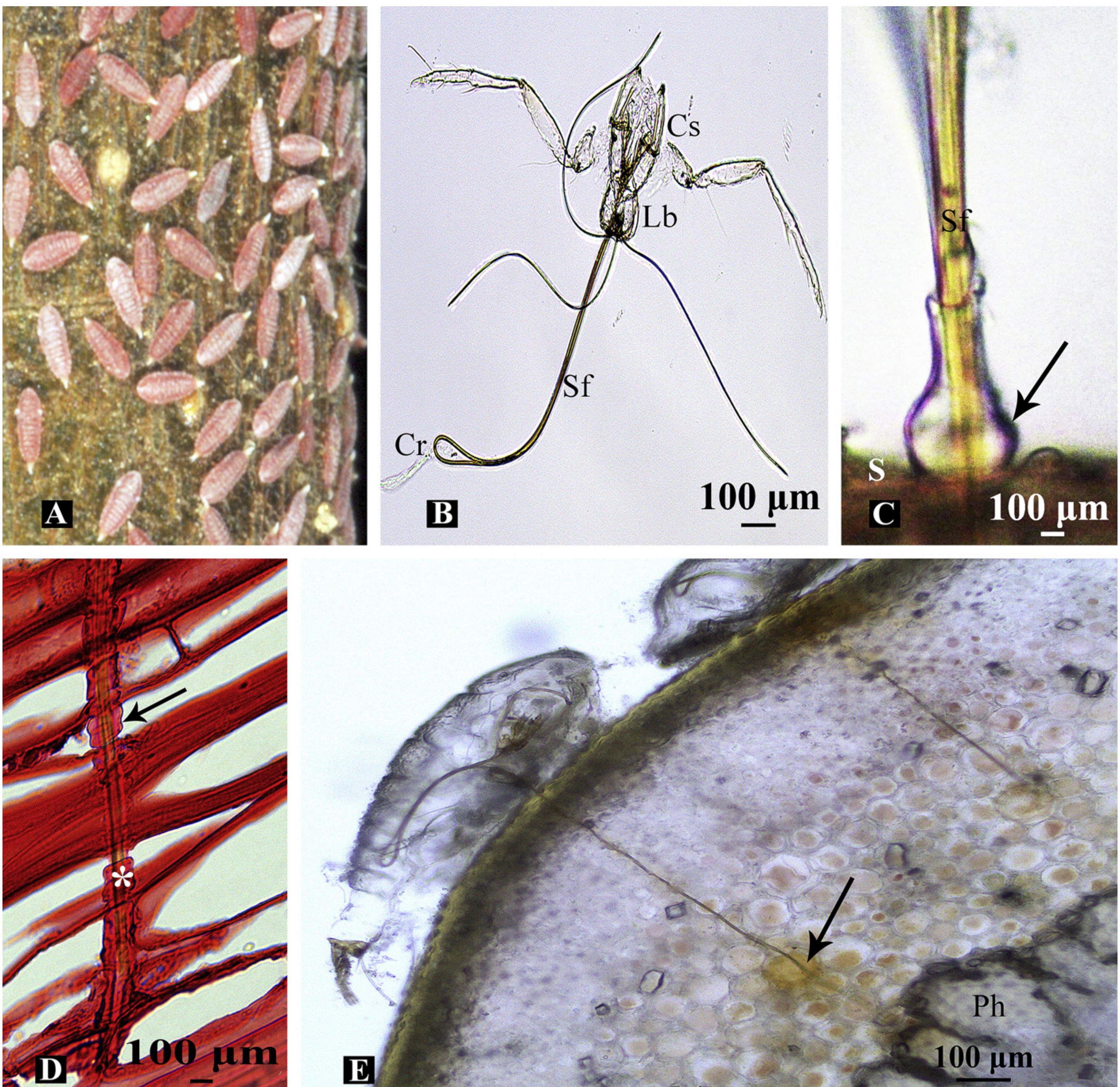

Fig. 1. Light Micrographs of first instar on *Ficus religiosa* stem. (A) Settlement on stem; (B) Mouth parts showing clypeolabral shield (Cs); labium (Lb); a stylet fascicle (Sf) and crumena (Cr); (C) Salivary flange (arrow) and S indicating stem surface; (D) Stylet fascicle (*) and salivary sheath (arrow) in a section; (E) Petiole section showing stylet fascicle (arrow) and Ph indicates phloem.