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# Microscopic Structure of Mouth Parts Sensillae in the Fifth Instar Larvae of Eri Silkworm, *Philosamia ricini* (Lepidoptera: Saturniidae)

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Scanning electron microscopic studies revealed the presence of various types of sensillae on the mouth parts of V<sup>th</sup> instar larva of *Philosamia ricini*. The mouth parts of *P. ricini* belong to chewing types and composed of labrum, mandible, labium and maxilla. The three pair of long and short trichoid sensilla present on dorsal side around the groove of labrum. Dorso lateral margine of labrum consist of two pairs of sensilla trichoidea I and II (ST-I, II). On lateral side of mandible, ST-I and sensilla chaetica (SCH) are scattered while, some campaniform sensilla (CS) are present on the base of teeth. The sensilla trichoidea with or without basal ring present on maxillary palp in association with sensilla basiconica. The tip of palp contain sensilla styloconica while, short microtrichia, sensilla baiconica and sensilla styloconica observed on the stipes. Labial palp are tough and stout containing large and short trichoid sensilla. Various minute slite-like structures arranged in V shaped pattern, partially separated basal ring from bulbus base ST-I of labial palp. On the ventral side of mentum two layer of microtrichia MT-I and MT-II are overlapped each other. In the V<sup>th</sup> instar larvae of *P. ricini*, spinneret bulges out from prementum and bears a pair of horns on the tip.

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**Keyword:** Eri Silkworm, *Philosamia ricini*, Mouth Parts, Sensilla, Spinneret.

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### 1. Introduction

The mouth parts of fifth instar larvae of *P. ricini* consist of labrum, mandible, labium and maxilla. The SEM studies of *P. ricini*, revealed that the mouth parts of V instar larvae possess various type of sensillae with different functions and play an important role in various behaviours during larval life. Lepidopteran larvae in particular often display striking food preferences, which are due to presence of a small set of chemoreceptors. In large number of insects the chemosensillae have been found on the galea, maxillary palp and inner surface of the labrum [1, 2, 3, 4, 5, 6, 7, 8], while the mechanosensory sensilla reported on the

mouthparts<sup>9,10</sup>. In Lepidopteran larvae sensory receptors present on the mouth parts are found to be olfactory and gustatory and receive stimuli produced by the host plant [11, 12, 13, 14, 8, 15]. The styloconic sensilla are present on the maxilla, whereas microtrichia are distributed on the labrum, labium and maxilla [16, 17, 8] and *A. assamensis*<sup>[15]</sup>. The basiconic sensillae present on the maxillary palp are seemed to respond to gustatory, mechanical and olfactory stimuli<sup>[5, 18, 6, 19, 17]</sup>. Sensilla trichoidea are very common and found on mouth parts of *A. mylitta* [8], whereas sensilla chaetica are mechanoreceptors [6,20].

## 2. Material and Method

Mouth parts of V<sup>th</sup> instar larvae of eri silkworm, *P. ricini* were examined by scanning microscopy. For scanning electron microscopy mouth parts were washed thoroughly with distilled water and fixed in 10% formalin for a period of 12 h, dehydrated in various grades of alcohol, cleared in acetone, dried and fixed on the metallic stub at different angles with the help of fevicol. Mouth parts fixed on stub were processed for gold coating and scanned under the Jeol (JSM 6380A) Scanning Electron Microscope (SEM) at Visvesvarya National Institute of Technology (VNIT), Nagpur, India.

## 3. Result

Scanning electron microscopic studies revealed the presence of various types of sensillae on the mouth parts of V<sup>th</sup> instar larva of *P. ricini* (Table-1).

### 3.1 Labrum Sensilla

The Labrum is horseshoe shaped sclerotic structure. The deep groove found on the middle

region of anterior side which differentiates the two arms like structure of the labrum. The length of labrum is  $1178.6 \pm 15.1 \mu\text{m}$  and width about  $284 \pm 5.41 \mu\text{m}$ . On the dorsal surface of groove about six long sensilla trichoidia (ST-I) and short sensilla trichoidia (ST-II) observed. Similarly one long and one short sensilla trichoidia are present on the margin of each arm on the dorso-ventral side. Few small pointed, minute hair like structures are also observed behind the ST-I and ST-II (Fig 1).

### 3.2 Mandibular Sensilla

Mandibles are unsegmented strongly sclerotized triangular shaped structure. There are five teeth like denticles found on the anterior margin of mandible. On the lateral side long sensilla trichoidia (ST-I) and sensilla chaetica (SCH) are scattered. At the base of mandibular teeth, some rounded companiform sensilla (CS) are observed (Fig 2, 3).

**Table 1:** Various Sensillae Present on the Mouth Parts of V<sup>th</sup> larvae of *P. ricini*.

Sr. No.	Mouth parts	Sensilla	Length	Width
1	Labrum	Long sensilla trichoidia (ST-I) Short sensilla trichoidia (ST-II)	$450.8 \pm 1.19 \mu\text{m}$ $316.6 \pm 1.30 \mu\text{m}$	$16.6 \pm 0.57 \mu\text{m}$ $16 \pm 1.45 \mu\text{m}$
2	Mandible	Long sensilla trichoidia (ST-I) Sensilla chaetica (SCH) Campaniform sensilla (CS)	$812.8 \pm 4.30 \mu\text{m}$ $616 \pm 1.44 \mu\text{m}$ $116.7 \pm 1.54 \mu\text{m}$	$18.26 \pm 0.63 \mu\text{m}$ $16.6 \pm 0.94 \mu\text{m}$
3	Maxilla	Sensilla trichoidia (ST) Sensilla basiconica (SB) Microtrichia (MT) Sensilla styloconica (SS)	$160.8 \pm 2.47 \mu\text{m}$ $48.8 \pm 0.77 \mu\text{m}$ $8.5 \pm 0.72 \mu\text{m}$ $1.88 \pm 0.94 \mu\text{m}$	$12.08 \pm 0.46 \mu\text{m}$ $11.1 \pm 0.94 \mu\text{m}$ $5.84 \pm 0.41 \mu\text{m}$
4	Labium	Long sensilla trichoidia (ST-I) Short sensilla trichoidia (ST-II) Microtrichia I (MT-I) Microtrichia II (MT-II)	$186.3 \pm 1.53 \mu\text{m}$ $53.3 \pm 0.85 \mu\text{m}$ $11.22 \pm 1.6 \mu\text{m}$ $5.04 \pm 0.46 \mu\text{m}$	$13.3 \pm 1.21 \mu\text{m}$ $6.6 \pm 0.48 \mu\text{m}$ $3.78 \pm 0.51 \mu\text{m}$ $6.26 \pm 0.53 \mu\text{m}$

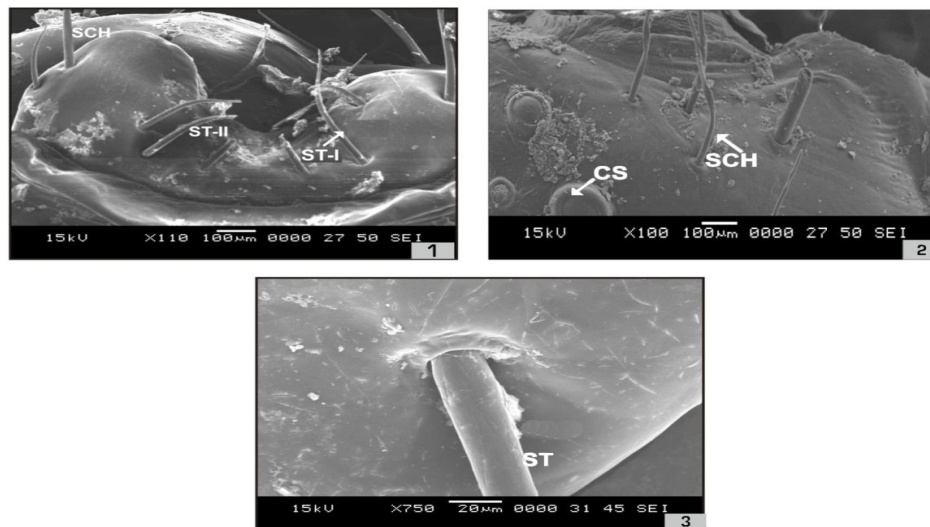
### 3.3 Maxillary Sensilla

The maxilla is a fused structure composed of maxillary palp, stipe and cardo. The cardo is a short, whereas stipe is large and rectangular in a shape. The sensilla trichoidia are present on the maxillary palp with association of prominent sensilla basiconica. The sensilla styloconica (SS) at the tip of each palp (Fig 4, 5). The sensilla trichoidia (ST) without basal ring on the lateral side of the stipe. The sensilla basiconica (SB) are more prominent on the maxillary palp. A large group of short and pointed microtrichia (MT) occupied the ventral side of maxillary palp. (Fig 6, 7).

### 3.4 Labium Sensilla

Labium is a triangular structure attached with the maxilla on the lateral side and consists of prementum, mentum and labial palp (Fig 8). The labial palps are tough and stout, each bearing two long and a short sensilla trichoidea. The long

sensilla trichoidia (LST) is present at the tip of labial palp measured about  $186.3 \pm 1.53 \mu\text{m}$  in length and  $13.3 \pm 1.21 \mu\text{m}$  in width. It arises from the bulbus base (Fig. 9), whereas the short sensilla trichoidia (ST-II) is without bulbus base. On the bulbus base of ST-I various minute deep slits-like structures arranged in V shaped and partially separated basal ring from bulbus base of ST-I of the labial palp (Fig. 9). On the ventral side of mentum overlapped groups of microtrichia are observed. The microtrichia are of two types pointed tip microtrichia MT-I and blunt tip microtrichia MT-II (Fig 10, 11). The spinneret (SP) is a cuticular tubular structure bulges out above the prementum of labium. Apically the spinneret bears an oriffis of  $44 \pm 0.98 \mu\text{m}$  in diameter midventrally. At the tip of spinneret a pair of horn like cuticular structure is present, which measured about  $31.1 \pm 0.92 \mu\text{m}$  in length and  $11.1 \pm 0.78 \mu\text{m}$  in width (Figs. 12, 13).



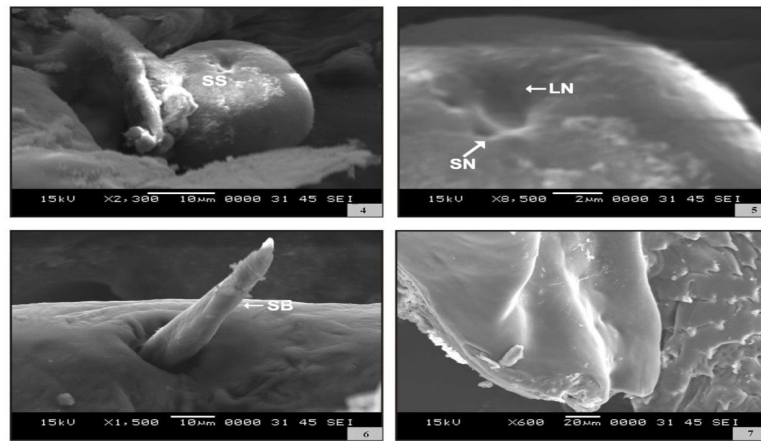
**Fig. 1 - 3 : Scanning electron microscopic (SEM) photomicrography of mouth parts of larvae of *P. ricini***

Fig. 1 : Dorsal surface of labrum showing ST-I, ST-II and SCH

Fig. 2 : SEM view of base of mandible teeth showing sensilla chaetica (SCH) and campaniform sensilla (CS)

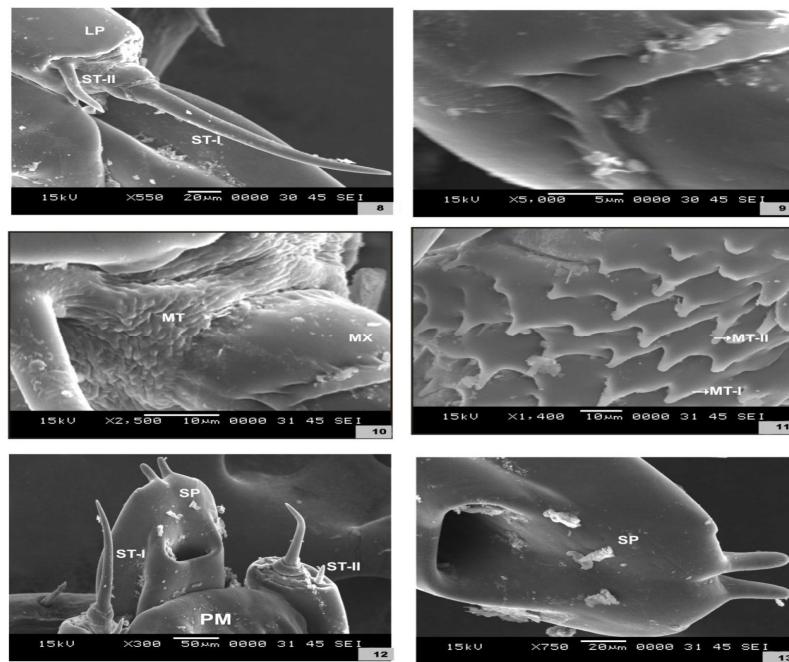
Fig. 3 : Magnified view of mandible showing ST-I

Abbr. : ST-I – sensilla trichoidea I, ST-II – sensilla trichoidea II, SCH- sensilla chaetica, CS- campaniform sensilla



**Fig. 4 - 7 : Scanning electron microscopic (SEM) photomicrography of mouth parts of larvae of *P. ricini***

- Fig. 4 : SEM structure maxillary palp showing styloconic sensilla  
 Fig. 5 : Magnified view of styloconic sensilla showing large and small notch  
 Fig. 6 : SEM structure of maxillary palp showing sensilla basiconica  
 Fig. 7 : SEM photomicrograph showing microtrichia present on maxilla.  
 Abbr. : SS- sensilla styloconica, SB- sensilla basiconica, MT- microtrichia, LN- large notch, SN- small notch.



**Fig. 8 - 13: Scanning electron microscopic (SEM) photomicrography of mouth parts of larvae of *P. ricini***

- Fig. 8 : Magnified view of labial palp showing sensilla trichoidea present on it  
 Fig. 9 : Magnified view showing groove at the base of ST-I on labial palp  
 Fig. 10: Blunt tip microtrichia present on the tip of labial palp  
 Fig. 11: Magnified view of mentum showing pointed tip microtrichia MT-I and MT-II  
 Fig. 12: SEM photomicrograph showing labium, spinneret, prementum and mentum  
 Fig. 13: Magnified view of spinneret showing two horn like structure at the tip  
 Abbr. : ST-I- sensilla trichoidea I, SP- spinnerate, MT-I –microtrichia, MT-II–microtrichia II  
 L- labial palp, PM- prementum, M- mentum.



#### 4. Discussion

The mouth parts of Lepidopteran larvae consist of various types of sensillae in different larval stages and play an important role in feeding behaviours during larval life. The scanning electron microscopic studies reveal that different types of sensillae are present on the mouth parts of V instar larvae of *P. ricini*, are partially similar to mouth parts sensillae of the tasar silk worm *A. mylitta*<sup>[8]</sup> with some variation in the appearance, location and number. In *P. ricini* larvae, the campaniform sensilla are present on the mandible, whereas the sensilla trichoidia distributed on the labrum, mandible, labium and maxilla. The microtrichia are found only on labium and maxilla. The styloconic sensilla on the maxilla and microtrichia on the labrum, labium and maxilla in *A. mylitta* and in *Spodoptera exigua* were reported earlier by<sup>[8]</sup> and<sup>[17]</sup>. The sensory peg present in *B. mori* are innervated by chemosensory neurons rather than mechanosensory neurons<sup>[1]</sup>.

Sensillae play an important role in the host plant recognition of insect and there are various reports on the types of sensillae found on the cephalic appendages of various lepidopteran larvae, specially olfactory sensilla on the antennae and gustatory sensilla on the maxilla<sup>[4, 2, 7, 1, 3]</sup>. The presence of mechanosensory sensilla on the mouth parts of Lepidopteran larvae has been reported earlier<sup>[9, 10]</sup> and are known to respond to olfactory and gustatory stimuli produced by the host plants<sup>[8, 13, 14, 12, 11, 15]</sup>. The earlier ultrastructural studies shown that the maxillary palp bears apical sensilla basiconica having multiple innervations and seems to respond to gustatory, mechanical and olfactory stimuli<sup>[5, 18, 6, 8, 17]</sup>. The presence of apical sensilla basiconica on the maxillary palp in *P. ricini* might be playing similar role and function as gustatory, mechanical and olfactory stimulus.

The sensilla styloconica plays a major role in discriminating plants and constitute biting response<sup>[9]</sup>. It plays an important function in food recognition as well as it is gustatory in nature responding to the water glycosides, sugars and other feeding stimuli<sup>[1, 6, 19]</sup>. The sensilla

styloconica present on the maxillae of *P. ricini* are gustatory in function as found in other Lepidopteran larvae. In *P. ricini* larvae, the group of microtrichia is present on the maxilla and labium are similar to microtrichia described on the labrum of *Acheta domesticus*<sup>[16]</sup>. The trichoid sensillae are commonly found on all mouth parts in *P. ricini* in various sizes and they differ in structure. Similar types of microtrichia and sensilla trichoidia have been observed in *A. mylitta*<sup>[8]</sup>. On the tip of *P. ricini* spinneret a pair of cuticular horn like structures are observed, but their sensory nature are not known. Also in *A. mylitta* the similar horn like structure were detected earlier<sup>[21]</sup>.

Mandibular sensilla chaetica are the mechanoreceptors<sup>[6, 20]</sup>. These sensillae are present at the tip of incisor cusps and between molar cusps. It is proved that these receptors help to monitor the hardness of food and modulate the power output of the adductor muscles<sup>[22, 23, 17]</sup>. In the present study, long sized sensilla chaetica are observed on the ventral side of mandible might be playing a similar role in monitoring hardness of host plant leaves and controlling the activity of mandibles. However to confirm the role and function of the mouth part sensilla in *P. ricini* larvae, further studies are required.

#### 5. Acknowledgement

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#### 6. Conclusion

Presence of various types of sensilla on the mouth parts of V<sup>th</sup> instar larva of *P. ricini* help for identification and detection of chemical nature of food plant.

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