



## Ultrastructural Study on Male External Genitalia of the Weaver Ant *Oecophylla smaragdina* (Fabricius), (Hymenoptera: Formicidae)

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**Abstract-** The male genitalia of *Oecophylla smaragdina* appear to be phallic structures. The phallus is usually a large, highly complex arising from the wall of the genital chamber above the ninth sternum. The male external genitalia consist three parts, Basimere, Telomere and Adeagus. The scanning electron microscopic (SEM) studies revealed that five types of sensilla, sensilla trichoidea ST-I, ST-II and ST-III, sensilla trichoidea curvata (STC) and sensilla basiconica (SB) are present on the genitalia.

**Keywords:** Male External Genitalia, *Oecophylla smaragdina*, phallus, Sensilla, etc.

### Introduction

The weaver ant *Oecophylla smaragdina* are social insect forming a large colony composed of worker, queen and male castes. Male of *Oecophylla smaragdina* posses a well developed, conspicuous retractile genital capsule. It consists of a central adeagus, provided with lateral or terminal processes and on the outer side surrounding the adeagus a large two segmented phallobase bearing various lobes and processes.

The extensive work has been carried out on the morphology of last abdominal segment and male genitalia of hymenoptera<sup>[1, 5, 10, 11]</sup>. The surface ultrastructural study of head, antenna, mouthparts, thoracic appendages and genital organs using scanning electron microscopy which has explored various types of sensilla on the hymenopteran insect body. A morphological study on the male genitalia of *Paracryptocerus pusillus* was carried out by<sup>[2]</sup> and on many Hymenopteran species by<sup>[10]</sup>. While ultrastructure of male genitalia of *Camponotus compressus* has been studied by<sup>[11]</sup>. But though *Oecophylla smaragdina* is economic insect, there is no information on male reproductive system and male genitalia. Therefore the present work has been undertaken to study the structural morphology of male genitalia and surface ultrastructure of various sensilla present on the external genitalia of weaver ant, *O. smaragdina*.

### Material and Methods

The colony of the weaver ant *O. smaragdina* was collected from the *Terminalia arjuna* from the tasar silkworm rearing field. The male from the colony were

separated, the external genitalia were dissected carefully and fixed in 70% alcohol for 12 hours. For light microscopy the genital complex were boiled in 5% aqueous KOH for 5 minute, dehydrated with ethanol, cleared in xylene and mounted in DPX. For SEM study, the dehydrated genitalia were transferred to cold acetone, dried at room temperature, mounted on the carbon coated metallic stubs at different angles and proceeded for platinum coating in the poloron gold coating automatic unit separately. Finally, the genitalia were scanned under JEOL (JSM 3680 A) scanning electron microscope (SEM) at desirable magnification at the instrumentation centre of Vishveshvarya National Institute of Technology (VNIT) Nagpur, India.

### Results

The male genitalia consists of a basal plate apically, a pair of outer gonocoxites (parameres) and inner penis. The gonocoxites consists of basal segment basimere, and distal region telomere. The basimere is flattened, basally broad and distally narrow while telomere is almost cylindrical cuticular rod like structure. The penis (adeagus) of either side is long tubular structure and terminally modified into bulblike structure (Figure 1, 2 and3)

The length and width of each gonocoxite is measure about  $147 \pm 3.22\mu\text{m}$  and  $615 \pm 6.54\mu\text{m}$  at basal plate respectively.

The length and width of basimere and telomere is measured about  $147 \pm 3.22\mu\text{m}$ ,  $115 \pm 6.45\mu\text{m}$  and  $185 \pm 6.45\mu\text{m}$ ,  $55 \pm 6.45\mu\text{m}$  respectively. The surface of

basimere and telomere covered with tetragonal and hexagonal cuticular plates measuring about  $8 \pm 0.91 \mu\text{m}$  length and  $9.5 \pm 0.64 \mu\text{m}$  width. On the surface of basimere two types of sensilla are observed arise from the cuticular plates, Sensilla trichoidea ST-I and Sensilla trichoidea ST – II (Figure 3 and 4). The sensilla ST-I are long, pointed towards the apex arise from the tetragonal and hexagonal cuticular plates. The sensilla are measured about  $34.25 \pm 0.45 \mu\text{m}$  in length and  $2.02 \pm 0.17 \mu\text{m}$  in width. The sensilla ST-II are fine sensilla scattered though upper portion of basimere. The sensilla are narrow and pointed, curved towards the distill end and measured about  $28.5 \pm 0.64 \mu\text{m}$  in length and  $2.35 \pm 0.06 \mu\text{m}$  in width (Figure 5).

Four types of sensilla are present on the telomere of weaver ant *O. smaragdina*. Sensilla ST-I are long, curved at anteriorly arising from the tip of telomere, measured about  $68 \pm 6.13 \mu\text{m}$  in length and  $3.37 \pm 0.10 \mu\text{m}$  width (Figure 6 and 7). Sensilla ST-II and ST-III are smaller than ST-I and present on the dorsal surface of telomere. The ST-II are arranged in a row on the external surface, measuring about  $16.25 \pm 1.1 \mu\text{m}$  length and  $1.45 \pm 0.06 \mu\text{m}$  width while ST-III are smallest sensilla situated on inner surface of telomere measuring about  $5.5 \pm 0.64 \mu\text{m}$  in length and  $0.97 \pm 0.04 \mu\text{m}$  in width (Figure 7). Sensilla trichoidea curvata (STC) are present on the tip of telomere, they are long, curved with tapering end and is measured about  $42 \pm 1.22 \mu\text{m}$  in length and  $1.82 \pm 0.08 \mu\text{m}$  in width (Figure 6).

**Aedeagus:** The penis or aedeagus is an elongated and bilobed structure (Fig 8). Each lobe consists of serrated edges. It measures about  $479 \pm 7.59 \mu\text{m}$  in length and  $115 \pm 6.45 \mu\text{m}$  in width. The distal surface of aedeagus shows trichoidea sensilla (ST) and basiconica sensilla (SB) (Figure 9 and 10).

The distal surface of aedeagus shows two or three pairs of sensilla trichoidea (ST). These are fine long sensilla pointed towards the tip. The sensilla are measured about  $9.75 \pm 0.47 \mu\text{m}$  in length and  $1.52 \pm 0.2 \mu\text{m}$  in width at the base. The sensilla basiconica are observed on the anterior and posterior distal surface of bilobed structure of aedeagus. The sensilla are short arising from a broad base

pointed towards the tip. The sensilla are short peg-like measured about  $5 \pm 0.4 \mu\text{m}$  in length and  $0.85 \pm 0.02 \mu\text{m}$  width.

## Discussion

In the *Oecophylla smaragdina*, three pairs of appendages extended from the anular lamella in male and form male external genitalia. The anular lamella is a modified structure of concealed IX sternum while the outer, middle and inner pairs of appendages represents gonocoxites are stipi (basemere), volsellae and penis-valve respectively. Stipies and volsellae may function as claspers while both the penis-valve come close together and form a penis (adeagus) or intromittent organ similar to that found in the other ants<sup>[3, 4, 6, 11]</sup>.

In *O. smaragdina* the gonocoxites consist of the basal plate originated from the IX segment, basimere, telomere and centrally placed adeagus. The basimere are large oval shape robust and covered with apically cuticular plates and randomly distributed sensilla trichoidea ST-I and ST-II. The distal part of basimere separated and form rounded structure called as telomere. On the telomere sensilla trichoidea ST-I, ST-II, ST-III and sensilla trichoidea curvata (STC) are present in numerous numbers.

The penis (adeagus) valve consists of serrated edges on the distal surface in *Apis mellifera*<sup>[3]</sup> and in *Apis dorsata*<sup>[9]</sup>. While in *Camponotus compressus* the terminal surface of adeagus consist of marginal serrated edges with musculature broad surface<sup>[11]</sup>. In *O. smaragdina* the terminal surface of the adeagus is broad, smooth on the outer side and highly rough on the inner side. On the terminal broad surface of adeagus, the sensilla basiconica are uniformly distributed while only few pairs of sensilla trichoidea have been noticed.

In *O. smaragdina* the serrated edges of adeagus and the sensilla present over them are known to hold the penis at the proper place in the female genitalia during mating. Moreover the scanning electron microscopic ultrastructural observations demonstrated first time the presence of sensilla on the male genitalia in *O. smaragdina*.

**Table 1**  
**Morphological observation of the external genitalia of male**

S. No.	External genitalia	Types of sensilla	Length ( $\mu\text{m}$ )	Width ( $\mu\text{m}$ )
1	Basimere	Cuticular plate	$8 \pm 0.91$	$9.5 \pm 0.64$
		Sensilla trichoidea ST-I	$34.25 \pm 0.45$	$2.02 \pm 0.17$
		Sensilla trichoidea ST –II	$28.5 \pm 0.64$	$2.35 \pm 0.06$
2	Telomere	Sensilla trichoidea ST-I	$68 \pm 6.13$	$3.37 \pm 0.10$
		Sensilla trichoidea ST-II	$16.25 \pm 1.1$	$1.45 \pm 0.06$
		Sensilla trichoidea ST-III	$5.5 \pm 0.64$	$0.97 \pm 0.04$
		Sensilla trichoidea curvata	$42 \pm 1.22$	$1.82 \pm 0.08$
3	Aedeagus	Sensilla trichoidea ST	$5 \pm 0.4$	$0.85 \pm 0.02$
		Sensilla basiconica SB	$9.75 \pm 0.47$	$1.52 \pm 0.2$

## Conclusion

The male external genitalia consist of three parts basimere, telomere and aedeagus. On the basimere, sensilla trichoidea ST-I and ST-II are present, while telomere consist of sensilla trichoidea ST-I, ST-II, ST-III and sensilla trichoidea curvata. Aedeagus is bilobed structure and contain sensilla trichoidea on lateral side while sensilla basiconica are predominantly present on the tip.

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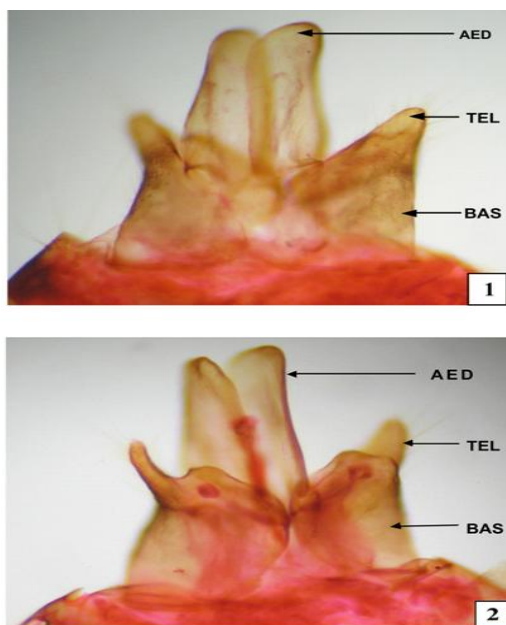


Plate 1

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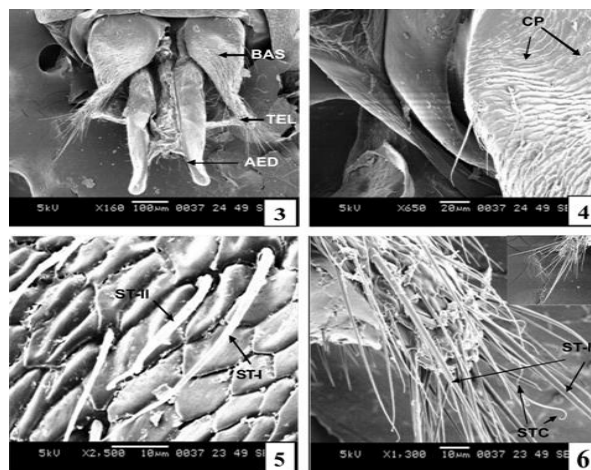


Plate 2

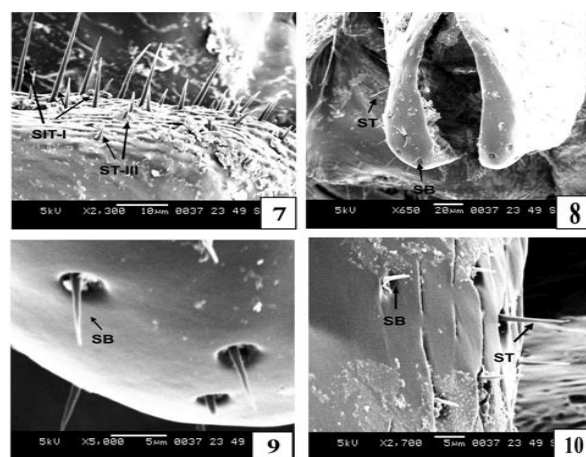


Plate 3

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