SCANNING ELECTRON MICROSCOPY OF MANDIBLE, IN WORKER FORM OF CARPENTER ANTS, CAMPONOTUSCOMPRESSUS, FABRICIUS

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A B S T R A C T

In most of the ant species, the mouthparts are adapted for grasping the prey and feeding. The mouth parts in all polymorphic forms of carpenter ant, Camponotuscompressus(Fabricius) (Hymenoptera: Formicidae) are adopted for grasping the prey and feeding. The workers are the sterile female forms possesses unsegmented strongly sclerotized, large, shovel-like cuticular and powerful mandibles. Each mandibles consists four insicors and three molar teeth in female and worker while only two incisors teeth in male. In the adult worker ant the mouth parts are well equipped with mechanoreceptors and chemoreceptor situated in the lower pair of jaws distinguish different flavours, of sweets and aromatic liquids using cuticularsensilla hairs. SEM study of dorsal surface of mandibles in workers revealed fine SensillaTrichoidea hairs while the ventral surface shows SensillaTrichoidea and Sensillabasiconica

Keywords: Camponotuscompressus, SEM, Mandible, Sensilla, Trichoidea,Basiconica

1. Introduction

Ant uses their mandibles for a diverse array of activities so that constrained by the need to have mandibles which can fulfil different functions. The mouthparts of the ant species, are adapted for grasping the prey and feeding [6, 7, 27]. The receptors of taste are situated in the lower pair of jaws in the ants which distinguish different flavours, of sweets and aromatic liquids [25] reported that. The mandibles are paired appendages present most anterior of head and other oral appendages. The main function is typically to grasp, crush the food or to defend against predators or rivals [5].The mandibular gland secretion in ants is known to act as an alarm pheromone and to play an important role in defending the [1, 4, 5, 14] The secretion has also been reported to act as a sex pheromone in males of *Camponotuscompressus*[15]. The presence of seven teeth in female and workers while only two in male on the mandible of ant, *Mycetotaratoiscarinatus*suggested sexual dimorphism [3, 21, 22]. In the adult ants the mouth parts are equipped with mechanoreceptors and chemoreceptor [2, 24, 25, 30]. The present work has been explore the SEM structure and types of sensilla on mandibles and their role as mechanoreceptors and chemoreceptor in ant nest.

2. Experimental

The biting exposed mouth part, mandibles of carpenter ant, *Camponotuscompressus* were removed carefully from worker head and fixed in 70% alcohol for 12 hr. The external morphology of the head and mandibles was examined by scanning electron microscopy of critical point-dried specimens using a Zeiss DSM 962 SEM. After dehydrationfor external morphological study mandible were transferred to cold acetone to dry at room temperature and mounted on the carbon coated metallic stub at different angles. These stubs were proceeded for platinum coating in Poloron gold coating automatic unit and scanned underJeol (JSM 6380 A) scanning electron microscope (SEM) at desirable magnification at the Instrumentation Centre of VNIT Campus, Nagpur.

3. Results and Discussion

In workers forms of carpenter ant head is long and wide posteriorly broad convex anteriorly consists of paired mandibles form exquisite hunting weapon. The mandibles are slightly shorter than the head while pointed on apical teeth. The inner edge of mandible is

equipped with a row of sharp and inward pointing teeth that would capture the prey (Figure-1a). The paired cuticular mandible was measured about 1.85 ± 0.052 mm in total length while the width measured about 1.13 ± 0.002 mm towards anteriorly and 0.64 ± 0.015 mm at posteriorly.

In carpenter ant the head capsule consists paired anterolateral situated mandibular glands which directly opens through external cuticular ridges. The mandibular glands are saclike structures divided into reservoir and secretory part. The glands are located between the base of the mandible and the compound eyes (Figure - 1). In worker of carpenter ant, *Camponotuscompressus*the mandibles are cuticular, unsegmented, strongly sclerotized dorsally bearing strong pointed three apical molar teeth and four basal incisor teeth (Figure 1a and 2a). The worker ants of carpenter ant consist of large size mandibles covered by three types of sensilla located on dorsal and ventral region of head. The dorsal region of mandible shows dorsal sensillaTrichoidea however the ventral sensillaTrichoidea observed on ventral region of mandible. Ventral surface of mandibles consists of peg like sensilla known as Ventral Basiconicasensilla (VB) observed on the mid-ventral side of mandible (Figure 2a and 2b).

3.1 Sensillatrichoidea (ST)

The head of worker ant two types of sensilla such as Dorsal Trichoidea, Ventral Trichoidea. SensillaTrichoid (ST) can be classified into Dorsal sensillaTrichoidea observed on dorsal side and Ventral sensillatrichoidea observed on ventral side of mandibles. The DT-I and DT-II scattered throughout the dorsal surface while the DT-III are rarely observed (Figure- 2a and 3a).

3.1.1 Sensilla DT- I

The dorsal surface of mandibles is highly cuticular shows scattered long slender hairs, sensillatrichoidea were observed. The sensilla measured about 125.22 ± 2.4µm in length while 15.12 ± 2.42 µm in width (Figure- 2aand 2b).

3.1.2 SensillaDT- II

The dorsal surface of mandibles consist of slender, slightly narrow sensilla arising from a broad base. The sensilla measured about 92.21 ± 10.2 µm in length while 8.35 ± 1.72 µm in width(Figure- 2a,2b and 3a).

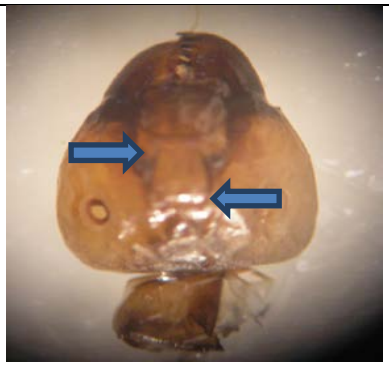
3.1.3 Sensilla DT- III

The dorsal surface of mandible consists fine sensilla were observed as short, pointed and curved towards the tip. The sensilla measured about 45.22 ± 3.12 µm in length while 5.12 ± 0.12 µm in width(Figure- 2b and 3a).

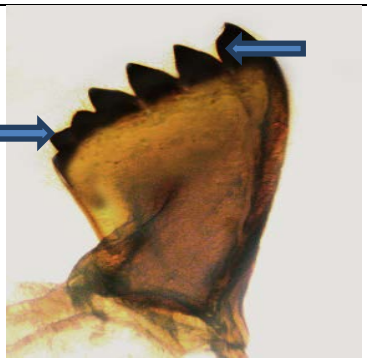
*3.1.4**SensillaVT-I***

Ventral surface of mandibles shows ventral trichoidsensilla observed as long, slightly curved with pointed end towards the dentition. The sensilla measured about 275.11 ± 15.42µm in length while 7.15 ± 0.44 µm in width(Figure- 3b).

Illustrations-

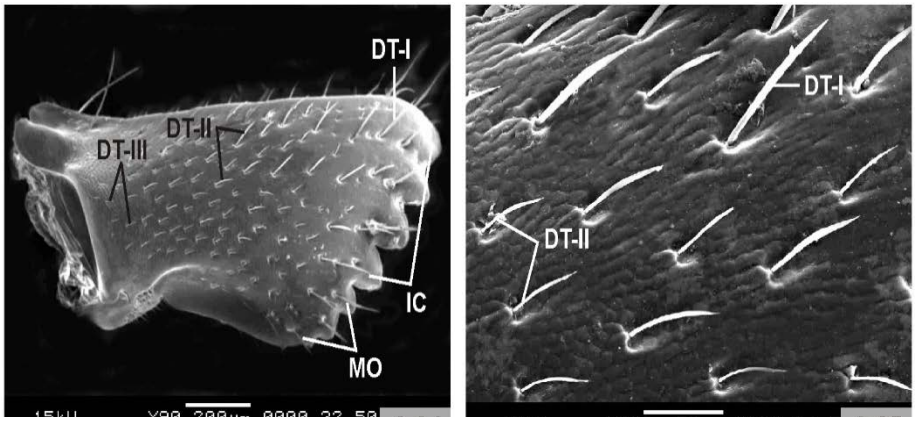


a.



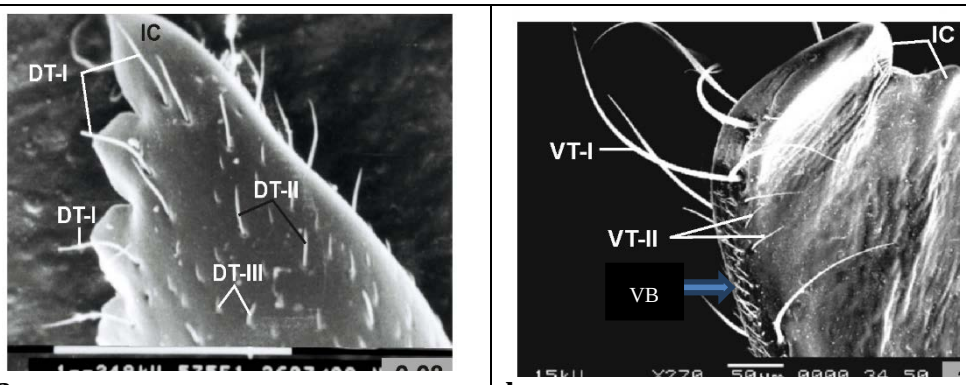
b.

Figure-1:a.showing sclerotized mandibles with duct of Mandibular gland.
b.showing sclerotized mandibles of carpenter ant, ***Camponotuscompressus***.



a. **b .**

Figure- 2 :a.SEM showing three apical Molar and 4 distal incisors on mandibles. **b**. SEM structure of sensilla located on Dorsal region of mandibles of carpenter ant, ***Camponotuscompressus***.



a. **b.**

Figure- 3 : **a.**SEM structure of Dorsal sensilla Trichoidea on mandibles. **b.**SEM structure of Ventral sensilla Trichoidea and ventral sensilla Basiconica(VB) on mandibles of carpenter ant, ***Camponotuscompressus***

3.1.5 SensillaVT-II

These sensilla are also long and pointed observed on the marginal ventral surface. The sensilla measured about 72.22 ± 5.26 µm in length while 3 ± 2.42 µm in width (Figure- 3b).

3.2 SensillaBasiconica (VB)

The postero-ventral surface of mandible in worker ant shows the basiconic type of sensilla denoted as VB, Ventral Basiconicsensilla. The basiconic type of sensilla protruded from a disclike raised bulbous base consisting a pointed terminal end (Figure- 3b). The sensilla measured about 12.5 ± 3.5 µm in length while 0.22 ± 0.012 µm in width. These sensilla were observed only in worker the important sterile form of ant colony.

4. Conclusion

In carpenter ant, *Camponotuscompressus*the mandibles are large and powerful tools for prey-catching, fighting, digging, seed-crashing or wood-scraping, grooming brood care and trophyllaxis [12, 16]. In ant, *M. pharaonis* has two mandibular glands, one on either side of the head. As in all other ant species investigated, the secretory part of the gland consists of bicellular glandular units [23] which lead into a common reservoir [4]. In the *Camponotuscompressus* the mandibles are similar in structure to that in the ant *Mycetotaratoiscarinatus*[21, 22]. Grasso *et al.* [11] describe the closing mechanism of the mandibular gland in the slave-making ant *P. rufescens.* The opening and closing of the mandibles forces are transferred to the reservoir duct by means of a triangular cuticular plate having different sensilla. The function of the mandibular gland is usually associated with social communication in the colony. The mandibular gland secretion in ants is known to act as an alarm pheromone and to play an important role in defending the colony [1, 4, 5, 14]. The secretion has also been reported to act as a sex pheromone in males of *Camponotus* [15].

The presence of seven teeth as four incisors and three molars in females and workers while two incisors teeth in male[21, 22] suggesting the species specific modification of the mandibles

accordance with feeding habit and sexual dimorphisms in carpenter ants, *Camponotuscompressus* as found in ants, *Mycetotaratoiscarinatus*. Similarly in worker form of carpenter ant, *Camponotus*the mandible having four incisors and three molars were observed.The dorsal side of mandibles in carpenter ant, *Camponotuscompressus*three types ofTrichoidsensilla, DT- I, DT- II and DT- III are densely distributed while on the ventral side, VT-I and VT-II are rarely observed. But the sensillabasiconica, VB are found only in queen and worker mandibles. In ponerinae ant *Odontomachus* workers evolved a mechanism that allows them to use long mandibles as warfare tool to catch prey. This trap jaw mechanism triggers by long mechanosensory hairs sensilla supplied by giant nerves [12]. In Dragon fly the trichoidsensilla and small peglikesensillabasiconica dorsal and ventral surface of mandibles were reported as the mechanoreceptors and chemoreceptor respectively [3, 8, 20, 26, 29, 31] which are similar to the sensillabasiconica present on the mandible of carpenter ants, *Camponotuscompressus*[2].In the adult carpenter ants the mouth parts are equipped with mechanoreceptors and chemoreceptor [10, 30]. The present study demonstrate general design of mandibles lead to substantial functional changes to perform the delicate work, social interaction and brood care.

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