SEM structure of mandibular sensilla in the carpenter ant, *Camponotus compressus* (Fabricius) (Formicidae: Hymenoptera)

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Abstract

The moutparts in all polymorphic forms of carpenter ant, *Camponotus compressus* (Fabricius) (Hymenoptera: Formicidae) are adapted for grasping and feeding the prey. The mandibles are unsegmented, strongly sclerotized, large, shovel like, cuticular and powerful structures. The mandibles consist of dorsal sensilla trichoidea DT-I, DT -II and DT-III and on the ventral side VT-I, VT-II and the Sensilla basiconica VB in female and workers, while similar type of sensilla are found in male except sensilla basiconica. Each mandible consists of four incisor and three molar teeth in female and workers while only two incisor teeth are present in male.

Keywords: *Camponotus compressus, SEM, Mandible, Sensilla.*

Introduction

In most of the ant species, the mouthparts are adapted for grasping and feeding the prey (Snodgrass, 1935; Dumpert, 1972; Richard and Davies, 1987; Chapman, 1982,1998). Paul *et al.* (2002) reported that the receptors of taste are situated in the lower pair of jaws in the ants which distinguish different flavors of sweets and aromatic liquids. Galewski (1971) reported small peg-like sensilla on the dorsal surface of mandible in water beetle, *Dytiscus arew.* Mayhe-Nunes and Lanziotti (1995, 2002) reported the presence of seven teeth in female and workers while only two in male on the mandibles of ant, *Mycetarotes carinatus* suggesting sexual dimorphism. In the adult ants the mouth parts are equipped with mechano and chemoreceptors (Gotwald, 1969; Wheeler and Wheeler, 1970; Paul, 2001; Paul *et al*., 2002).The present work therefore,has been undertaken to explore the surface ultrastruture of mandibles and different types of sensillae present on it in all polymorphic form of the carpenter ant, *Componotus compressus.*

Materials and Methods

The carpenter ant, *Camponotus compressus* colony was excavated from the semidried soil and the mandibles were removed carefully from polymorphs and fixed in 70% alcohol for 12 hours. The dehydrated mandibles 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 manibles were scanned under Jeol (JSM 6380 A) scanning electron microscope (SEM) at desirable magnification at the Instrumentation Centre of Vishveshvaraya National Institute of Technology (VNIT) Nagpur, India.

Results

In the carpenter ant, *Camponotus compressus* the mandibles are unsegmented, strongly sclerotized, large and shovel like cuticular mouth parts bearing strong basal three molar and

four distal incisor teeth in the female and workers while there are only two incisors in the male (Fig. 1,4). They differ in size among queen, male and workers (Table 1). They are indeed larger in worker, medium sized in female and small in male ants.

1. Sensilla in the Female Ants

On the dorsal as well as ventral surface of mandibles of female, two types of sensilla are observed viz., trichoid and basiconic sensilla. Trichoid sensilla (ST) are classified into five types as the dorsal sensilla trichoidea DT- I, DT- II, DT- III and ventral sensilla trichoidea VT- I, VT- II while the basiconic sensilla (VB) are located on the ventral side only.

In female the dorsal surface of dentition bears sensilla trichoidea (DT-I) (Fig. 1,2) while sensilla DT-II are long arising from a broad base and narrow towards the tip. The sensilla DT-III are short, pointed and curved towards the tip. The DT-I and DT-II scattered through out the dorsal surface (Table 2).

All over the ventral surface of mandibles, two types of trichoid sensilla are observed the VT-I and VT-II towards the dentition. The VT-I are long, slightly curved with pointed end. The VT-II sensilla are also long and pointed towards the tip lying on the marginal ventral surface. The postero ventral surface shows the basiconic type of sensilla, VB. The basiconic type of sensilla project from a slightly raised bulbous circular base and bears a pointed curved terminal end (Table 2).

2. Sensilla in the Male Ants

The dorsal surface of mandibles shows trichoid type of sensilla (Table 2) differentiated into three dorsal trichoid sensilla DT-I, DT-II and DT-III. The DT- I are lying on anterodistal margin of dentition while DT-II and DT-III are scattered throughout the dorsal surface of the mandibles (Table 2).

Similarly, the ventral surface of mandibles shows trichoid sensilla differentiated into VT- I and VT- II types and are located towards the marginal ventral surface similar to that of female except in size (Fig. 3,4). The basiconic sensilla are totally lacking (Table 2).

3. Sensilla in the Worker Ants

On the dorsal and ventral surfaces of mandibles, the trichoid and basiconic sensilla are observed. The trichoid sensilla on the dorsal surface are differentiated into DT-I, DT-II and DT-III and on the ventral surface into VT-I and VT-II types (Table 2). The sensilla DT-I are present on marginal area of the dorsal region of mandibles. The sensilla DT-II are long, slightly curved, pointed and DT-III are short, scattered throughout the dorsal surface (Fig. 5,6).

The ventral surface of mandibles shows trichoid sensilla differentiated into VT-I and VT-II types on the anteroventral margin and the basiconic sensilla (VB) on the posteroventral surface. The morphology of sensilla is similar to that of female except for difference in size (Table 2).

Discussion

In the carpenter ant, *Camponotus compressus,* the mandibles are large and powerful tools for prey catching, fighting, digging, seed crushing, wood-scraping, grooming, brood care and trophallaxis (Hölldobler and Wilson, 1990; Gronenberg *et al.,* 1998; Paul, 2001). In the *Camponotus compressus*, the mandibles are similar in structure to that in the ant *Mycetarotes carinatus* (Mayhé-Nunes and Lanziotti, 1995; 2002). In *Camponotus compressus*, dorsal side of mandibles possesses trichoid sensilla, DT- I, DT- II and DT- III which are densely distributed while VT-I and VT-II predominate ventral side and the sensilla basiconica, VB are found only in female and worker mandibles. The trichoid sensilla and small peglike sensilla basiconica, on the dorsal and ventral surface of mandibles in Dragon fly were reported as the mechanoreceptors and chemoreceptors respectively (Corbiere Tichane, 1971; Petryszak, 1977; Zacharuk, 1980; Kapoor, 1989; Wazalwar and Tembhare, 1999). The similar type of sensilla basiconica are also present on the mandible of carpenter ants, *Camponotus compressus.* The presence of seven teeth, four incisors and three molars in female and workers while two incisor teeth in male carpenter ants, *Camponotus compressus* suggest the species specific modifications of the mandibles in accordance with feeding habit and sexual dimorphism as found in ant, *Mycetarotes carinatus* (Mayhé Nunes and Lanziotti, 1995, 2002).

Table-1: Morphological observation on mandibles of adult polymorphic forms of *Camponotus compressus*

S. No.	Caste	Total length (mm)	Width (mm)	
			Anterior region	Posterior region
1.	Female	1.315 ± 0.086	0.7 ± 0.0056	0.5 ± 0.004
2.	Male	0.405 ± 0.0076	0.172 ± 0.003	0.0778 ± 0.006
3.	Worker	1.925 ± 0.071	1.016 ± 0.008	0.889 ± 0.021

Table-2: Morphological observations on the sensilla of mandibles of adult polymorphic forms of *Camponotus compressus*

S.No.	Caste	Dorsal region	Length (μm)	Width (μm)	Ventral region	Length (μm)	Width (μm)
1.	Female	Sensilla Trichoidea DT-I	133.34± 24.5	8.57± 5.43	Sensilla Trichoidea VT-I	243.48± 25.43	8.69± 2.15
		Sensilla Trichoidea DT-II	83.34± 14.5	8.35± 1.56	Sensilla Trichoidea VT-II	60.86± 12.4	4.76± 0.84
		Sensilla Trichoidea DT-III	41.67± 8.2	4.082± 0.56	Sensilla Basiconica VB	10.42± 1.56	0.361± 0.051
2.	Male	Sensilla Trichoidea DT-I	77.78± 11.54	2.89± 0.032	Sensilla Trichoidea VT-I	226.08 ± 23.54	3.78± 0.65
		Sensilla Trichoidea DT-II	44.45± 5.41	1.86± 0.045	Sensilla Trichoidea VT-II	16.67± 3.87	0.971± 0.015
		Sensilla Trichoidea DT-III	19.45± 2.65	1.11± 0.22			
3.	Worker	Sensilla Trichoidea DT-I	296.13± 25.5	20.1 ± 4.32	Sensilla Trichoidea VT-I	367.82± 45.3	16.41± 2.75
		Sensilla Trichoidea DT-II	123.4± 18.4	10.20 ± 1.82	Sensilla Trichoidea VT-II	137.94± 15.31	11.49 ± 2.82
		Sensilla Trichoidea DT-III	74.07± 15.2	6.75± 0.95	Sensilla Basiconica VB	13.31± 2.76	0.39± 0.035

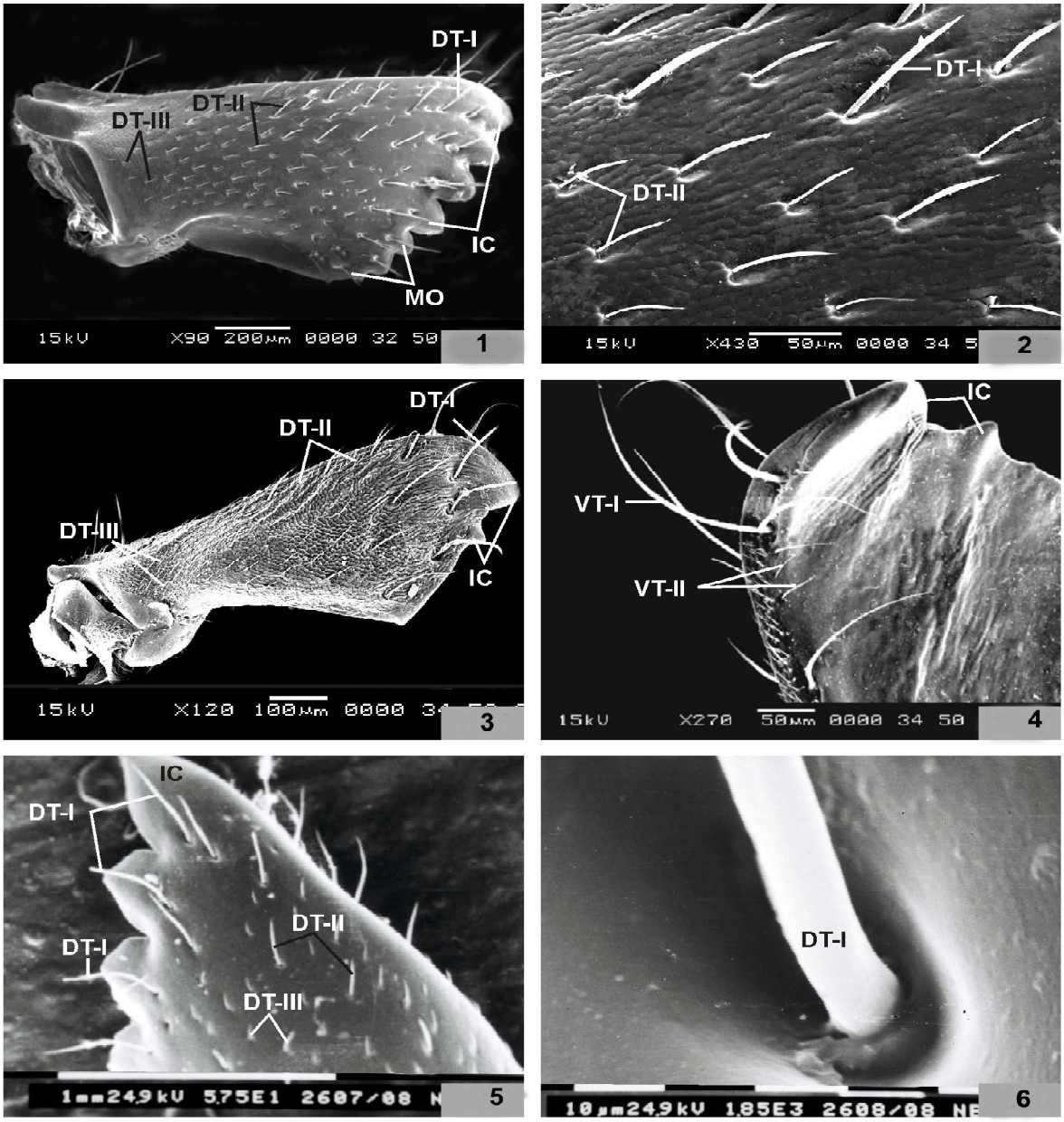

Figure: 1 SEM photomicrograph of dorsal surface of mandible showing four incisors (IC) and three molars (MO) teeth types of sensilla trichoidea DT-I, DT-II and DT-III in female.

Figure: 2 Magnified view of fig. 1 showing sensilla DT-I and DT-II on middorsal region in female.

Figure: 3 SEM photomicrograph of dorsal surface of mandible showing two IC and three types of sensilla DT-I, DT-II and DT-IIIon middorsal region in male.

Figure: 4 SEM photomicrograph of ventral surface of mandible showing sensilla trichoidea VT-I and VT–II in male.

Figure: 5 SEM photomicrograph of dorsal surface of mandible showing IC and DT-I, DT-II and DT-III in worker.

Figure: 6 Magnified views of fig. 5 showing sensilla DT-I arise from circular basal ring in worker.

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