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MORPHOLOGICAL STUDIES ON ANTENNAL SENSILLA OF BICOLOURED ANT, *TETRAPONERA RUFONIGRA* (HYMENOPTERA: FORMICIDAE) IN SINDEWAHI TEHSIL, DISTRICT CHANDRAPUR, MAHARASHTRA

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Abstract

The antenna of arboreal bicoloured ant, *Tetraponera rufonigra* composed The antenna is broadly divided into two parts, the scape and funiculus, the latter consisting of the pedicel and flagellum; the pedicel was smaller in females and workers than in the male ant, while the flagellum was longer in the female than in the male and worker were observed. In sensilla chaetica these are slender hair like sensilla. Which vary in length with the shortest found in the area just ahead of the joint with the next segment. And the longest found just below projecting over the joint.

Introduction :

Studies on the antennae of hymenopteran insects reveal the presence of various types of sensilla, showing wide ultra-structural variation among the polymorphs (Agren & Svensson 1972; Esslen & Kaissling 1976; Agren 1977). The castes play sex-specific roles in colonial life and communicate using chemical signals, and the antennae are major sense organs that receive environmental information and specific communication through a variety of sensillum receptors (Hölldobler & Wilson 1990). The present studies were undertaken to elucidate the surface micro-morphology of the antennal sensilla of *Tetraponera rufonigra*. A part from chemoreception, ant sensilla provide information about mechanical cues, humidity, temperature and CO2 level in the surrounding area (Fresneau, 1979; Ozaki *et. al*. 2005; Roces and kleineidam, 2000; Soroker *et. al*. Wilson, 1972). Behavioural modifications in the host or mate selection, locomotion including flight and trail following, and defence are frequently elicited by chemical stimuli in insects. The antenna is a major sensory organ for such stimuli. The type, abundance and distribution of sensilla on this organ depend on the chemosensory needs in their Behaviour (Chapman, 1982). Therefore, present work has been carried out to known the morphological structure of Antenna, and various sensilla present on the different parts of the Antenna of worker of bicoloured arboreal ant *T. rufonigra* with the help of morphological preparation.

Material and Methods :

Material

The study area for the investigation of diversity of Ants include the whole of geographical area under the Sindewahi administration of Chandrapur district in Sindewahi region area there is no listed the diversity of ant species, thus the main aim of this research to determine the ants species diversity in the selected study area in Sindewahi region of Maharashtra by random sampling collection.

Method

Morphological Preparations (In Situ)

The collected ants were immobilized on ice and preserved in 70% alcohol for further study. For morphological study antenna were dissected out in binocular microscope, the antenna were treated with 10% KOH at 80^{o} C for 15 minutes. They were washed several times in the water and latter on dehydrated by passing through ascending grades of alcohol, cleared in Xylene and Mounted in DPX.

Observations and results :

In *Tetraponera* species, the antennae are lodged in an elliptical-shaped socket on the dorso-lateral side of each frontal carina. The socket was narrower towards the anterior and broader towards the posterior end. The antenna is broadly divided into two parts, the scape and funiculus, the latter consisting of the pedicel and flagellum; we observed the pedicel was smaller in females and workers than in the male ant, while the flagellum was longer in the female than in the male and worker. The flagellum was folded up against the scape, representing the elbowed geniculate type of antenna in adult ants. There were ten flagella segments in the female and worker, and 11 in the male. Morphology under the varied distinctly in shown in Table. 1.

Morphology and function: This section outline the external morphology of each type of sensillum and gives some indication of its function based on its anatomy and evidence from previous studies some of the terminology used here, such as the ‘dorsal ’ and ‘ventral’ sides of sensilla, and length of each sensillum are explained in the methods section above in figure. We refer to the external aperture of sensilla as ‘openings’ as that is show how they appear externally. However, they are no true opening into the underlying haemolymph, but depression or invigilation of the cuticle.

1. **Scalpel sensilla**: The dorsal and ventral surfaces of the scape were found to be covered with polygonal cuticular plates which cause the cuticular micro-sculpturing. Three types of basiconica sensilla, sensilla basiconica I (SB-I), sensilla basiconica II (SB-II) were observed on the postero-dorsal region of the scape, The SB-I were smooth on the dorsal as well as the ventral surface, long and straight with a tapering end and broad at the base. The sensilla were longer in the female and worker than in the male.
2. **Pedicel sensilla**: Trichoid sensilla were present throughout the dorsal and ventral surface of the pedicel in the ants, while sensilla basiconica were observed on the dorso-ventral region of the pedicel in the female ant only.
3. **Flagellar sensilla**: Sensilla trichodea (ST) were present

densely on the dorsal and ventral surfaces of the flagellar segments. Besides these two types, the last two flagella segments showed two other types of sensilla, SB and SC, The shafts of STC are long, tapered, and slightly curved apically, while those of ST are long, narrow towards the apex and continuously tapering terminally. The SB is short and were observed on the dorso ventral surface of the terminal flagella segments of female and worker ants only.

4. **Sensilla trichodia**: These sensilla have slender pegs which are comparable in length to sensilla chaetica they have deep longitudinal grooves in and an apical pore which are always observed in an either closed or collapsed stage. The peg insert s into an opening surrounded by a region of smooth slightly suppressed cuticle of oval shaped. In contrast to other sensilla. In contrast to other sensilla that are angled towards the tip of the antenna, these sensilla project almost perpendicularly from the antennal surface which makes them quite conspicuous.
5. **Sensilla chaetica**: These are slender hair like sensilla. Which vary in length with the shortest found in the area just ahead of the joint with the next segment. And the longest found just below projecting over the joint. They have smooth surface.

Table 1: Morphology of antenna and types of sensilla present on it

Total Length of Antenna	Length of Scape		Length of Pedicel		Flagellum	
	Length	Width	Length	Width	Length	Width
2.936 mm	0.927 mm	0.068 mm	0.183 mm	0.062 mm	1.832 mm	0.105 mm

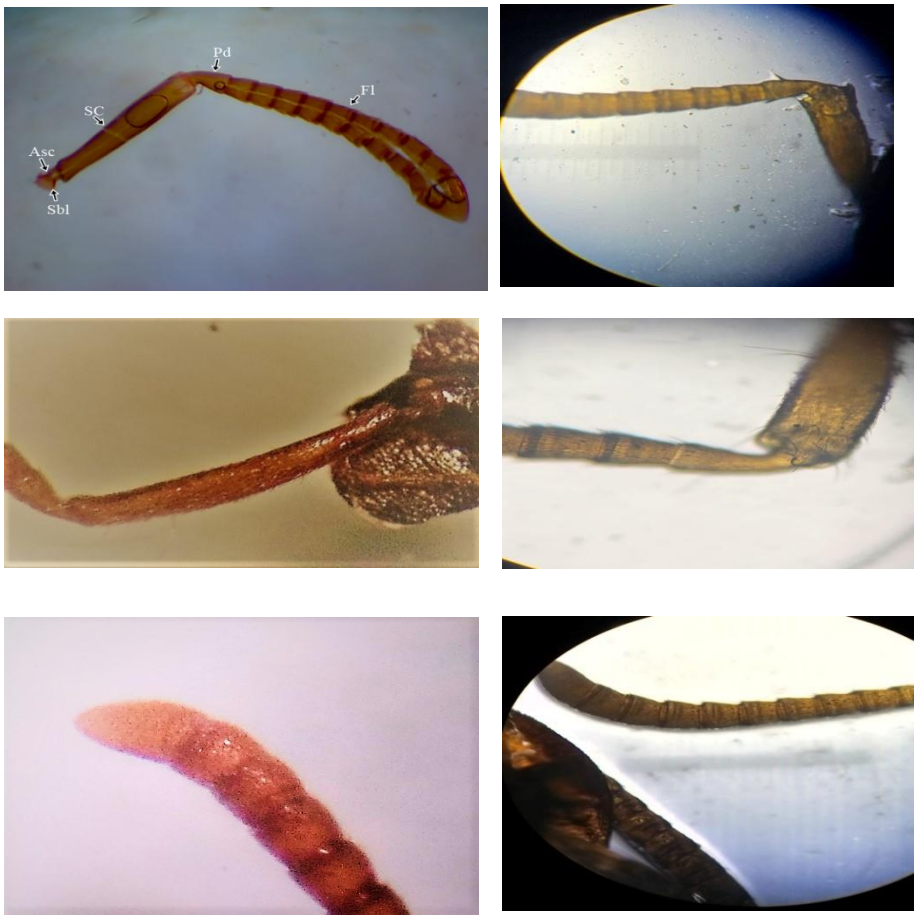

Fig. 1. A & B: Whole mount of antenna showing all parts
C & D**:** Magnified view of Scape
E & F: Magnified view of flagellomere
Abr.: Sc- Scape, Sbl- Scape ball, Pd- Pedicel, Fl- Flagellum, Asc- Antennal socket, ST- Sensilla trichoidea, Stc- Sensilla trichoidea curvata, SB- Sensilla basiconica, Sch-Sensilla chaetica

4. Discussion :

The geniculate types of antennae found in *Tetraponera rufonigra* are characteristic of the aculeate Hymenoptera (Michener 1974; Richards & Davies 1988; Okada *et. al*., 2006; Mysore *et. al*., 2009; Nakanishi *et. al*.,. 2009). In *Tetraponera rufonigra* the antennae are longer in worker ants. Okada *et. al*., (2006) described a ball-like modification at the base of the scape in the ants, *Diacamma* sp. and in *Camponotus japonicas* (Nakanishi *et. al*., 2009), and in *C. compressus* (Barsagade *et. al*. 2013).

In present study it has been also we observed that the antenna of *Tetraponera rufonigra* are geniculate type consisting of scape, pedicel and flagellum. The scape contain ball at the base which fited into the socket on dorso-lateral side of head. The pedicel in *Tetraponera rufonigra* is long and broad with an imbricate surface and covered with patches of sensilla, similar to that in bees (Wcislo 1994) and the ants, *C. japonicus* and *C. compressus* (Barsagade et. al., 2013).

In the present study four basic types of sensilla viz., sensilla basiconica, sensilla trichoidea, sensilla trichoidea curvata and sensilla chaetica are observed on the antennae of worker ants of *Tetraponera rufonigra*. The presence of

sensilla trichoidea, sensilla trichoidea curvata and sensilla chaetica in all three adults polymorphic forms supporting the previous work carried out on the antennal sensilla in Hymenoptera (Dumpert, 1972; Esslen and Kaissling, 1976; McIver, 1982; Martini and Schmitz, 1984; Zacharuk, 1985; Ilango, 2000; Ozaki et. al., 2005; Corrie et. al., 2006 and Okada et. al., 2006).

The SB on the antennae of *Tetraponera rufonigra* exhibit similar morphological structure to previously-studied ant species, and may function as contact gustatory receptors, perhaps involved in nest mate recognition (Ozaki *et. al*., 2005; Nakanishi *et. al*., 2009; Mysore *et. al*., 2010). Antennal SB of fire ants, *Solenopsis invictaare* also known to function as contact chemoreceptors (Renthal 2003).

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