

**Sting apparatus of *Tetraponera rufonigra* Jerdon (Hymenoptera, Formicidae), a medically important ant species in Sri Lanka**

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**Abstract**

The stings of *Tetraponera rufonigra* Jerdon, 1851 can cause inflammation and serious allergic reactions in human beings. The morphology of the sting apparatus, its differences among adult castes and the modifications for stinging were investigated. The dissected sting apparatus of the worker, winged female and the queen and dissected last two gastral segments of the male were kept in lactophenol; a drop of glycerin was added. The sting apparatus was photographed at  $\times 100$  magnification using a high-power, trinocular microscope-camera unit (Optica M6 18). The images were carefully examined. The pronotal width and sting shaft length were measured using a calibrated micrometer eyepiece to calculate the Index of Reduction.

Males lack the sting apparatus. The pentagonal spiracular plate, semi-circular quadrate plate, oblong plate and the single segmented gonostylus were common in other three castes. The retractable sting of the worker and the winged female consists of long and slender, slightly concave, distally pointed lancet which bear 3 pairs of short barbs. The de-alate queen had a short, distally blunt sting without barbs. Weakly sclerotized gonostylus of worker has few sensilla, while winged female and queen have many sensilla at the tip of gonostylus. The Index of Reduction values for worker (0.69), winged female (0.70) and queen (0.65) are presented.

**Keywords:** stinging ants, *Tetraponera rufonigra*, morphology, medical importance

## **Sting apparatus of *Tetraponera rufonigra* Jerdon, 1851 (Hymenoptera, Formicidae), a medically important ant species in Sri Lanka**

### **Introduction**

*Tetraponera rufonigra* Jerdon, 1851 is widely distributed in the forests and urban parks throughout the Indian subcontinent<sup>1</sup>. It is commonly known as “Arboreal bicolor ant” and considered as a medically important species. The stinging by its worker is very painful, causing considerable inflammation in the victim<sup>2</sup>. The venom of *T. rufonigra* can cause allergic reactions in some people<sup>3</sup>. Nests of the species were reported from host trees identified in selected localities and, methods for temporary suppression were also described for the prevention of health hazards in an outbreak<sup>4</sup>.

Generally, the sting apparatus of the family formicidae is a set of sclerites derived from abdominal segments 8, 9 and 10 and enclosed in a chamber formed by the 7<sup>th</sup> tergum and sternum. The sting apparatus consists of a spiracular plate, quadrat plate, anal plate, oblong plate, gonostylus, triangula plate, lancet and sting<sup>5, 6, 7</sup>. Worker, winged female, de-alate queen and male are the adult castes found in a *T. rufonigra* colony<sup>4</sup>.

The current investigation investigated which adult castes of *T. rufonigra* are capable of stinging, through studying the detailed morphology of the sting apparatus of each caste.

### **Materials and method**

The *T. rufonigra* colony was collected from an *Acacia catechu* (Willd) tree at the Colombo Royal golf ground, life stages in the colony were collected and preserved in 70% alcohol. The adult castes were sorted according to the morphology.

The sting apparatus of worker ants (05), winged females (02) and the queen (01) and the last two gastral segments and attached appendages of a male (01) were dissected using insect pins, at x 45 magnification using a low-power stereo-microscope. Hot lactophenol was added to the dissected insect parts and kept for one hour. A drop of glycerine was added to each slide after draining the lactophenol. The sting apparatus of the worker, winged female and dealate queen and the posterior gastral segments of the male were photographed at ×100 magnification using a high power, trinocular microscope-camera unit (Optica M6 18). The structures of the sting apparatus were described while observing those under the high-power microscope and examining the images.

The pronotal width and the sting shaft length of each caste except that of males were measured using a calibrated micrometre eyepiece. The Index of Reduction (= Sting shaft length/ Pronotal width) for each caste was calculated<sup>7</sup>.

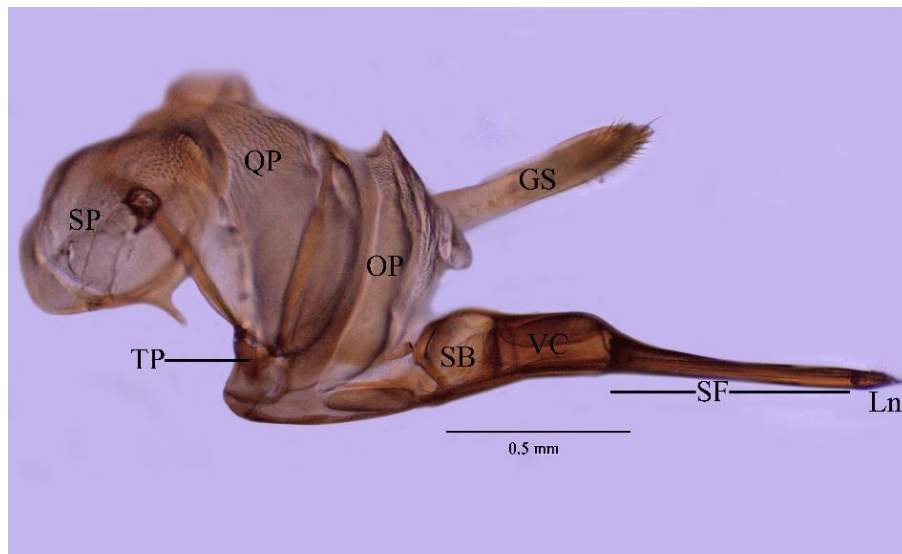
### **Results**

#### **Morphology of worker sting apparatus**

*T. rufonigra* worker sting is a well-sclerotized, longer and slender appendage, with a distally pointed lancet. It is retractable and consists of a spiracular plate, quadrate plate, oblong plate,

gonostylus, triangula plate, lancet and the sting shaft. Spiracular plate is pentagonal shape, anterior apodeme is sclerotized and narrow, median area is transparent and a sharp triangular ventral tip is present. Spiracle is normal in size and it lies behind the midline of the spiracular plate. Quadrate plate is semi-circular, its inner edges sclerotized; much of the quadrate plate overlaps with the posterior arm of the oblong plate. Anterior apodeme of oblong plate is short, narrow and sclerotized. Its posterior arm is with a dorsal ridge and the ventral arm is taller than wide.

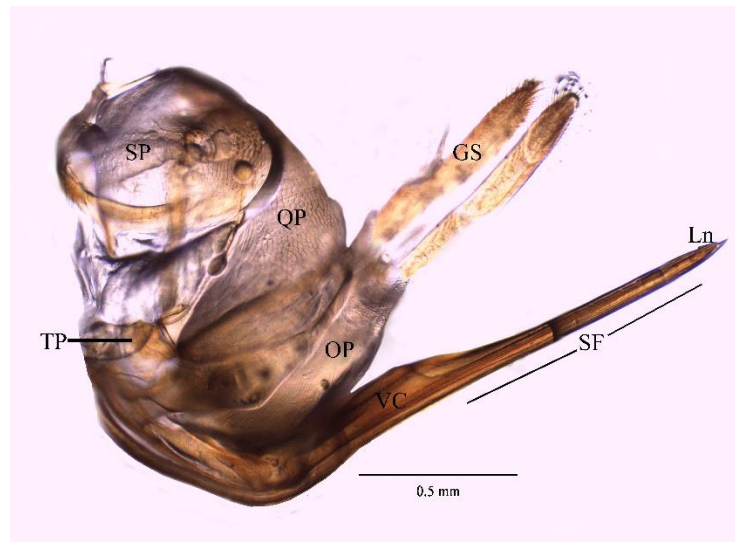
Gonostylus is single-segmented, slender, long and weakly sclerotized; its distal end is covered with a few setae. Triangula plate is smaller, triangular-shaped, with well-sclerotized edges and a less sclerotized median part. Sting bulb (SB) is weakly sclerotized and the valve chamber is well-sclerotized. Valve chamber is wider than the base of sting shaft. The lancet at the tip of the sting consists of three pairs of short barbs. The index of reduction for worker sting is 0.69 (Fig. 1).



**Figure 1** Sting apparatus of the *T. rufonigra* worker. The structures of the sting apparatus are labeled as SP: Spiracular plate, QP: Quadrate plate, OP: Oblong plate, TP: Triangula plate, GS: Gonostylus, SB: Sting bulb, VC: Valve chamber, SF: Sting shaft and Ln: Lancet

### Morphology of winged female sting apparatus

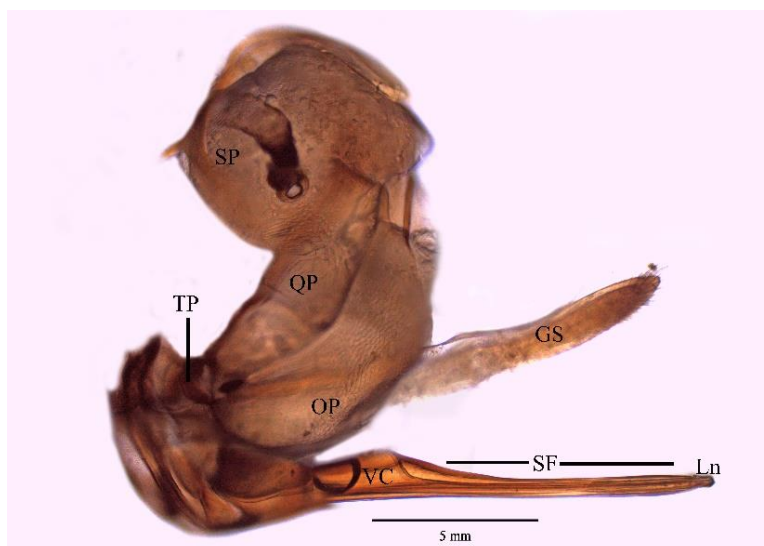
This is a retractable, longer and slender sting. All plates that are mentioned under worker sting apparatus are larger in size. Gonostylus is also longer than that of the worker and with fringes of dorso-terminal hairs. The sting shaft is longer than that of the worker. Well-sclerotized sting apparatus is visible. Lancet distally pointed, with a prominent pair of barbs. The index of reduction for this sting is 0.70 (Fig. 2).



**Figure 2** Sting apparatus of the *T. rufonigra* winged female. The structures of the sting apparatus are labelled as SP: Spiracular plate, QP: Quadrate plate, OP: Oblong plate, TP: Triangula plate, GS: Gonostylus, VC: Valve chamber, SF: Sting shaft and Ln: Lancet

### Morphology of de-alate queen's sting apparatus

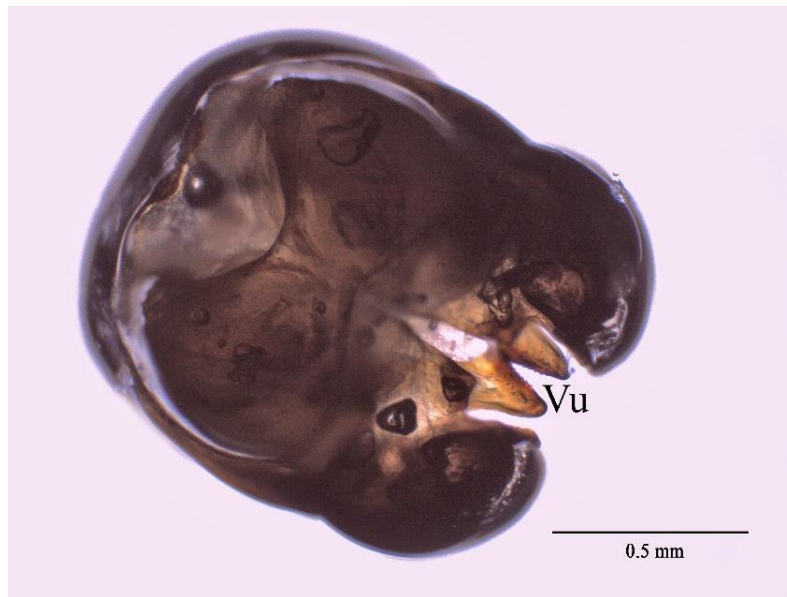
This is a retractable, longer, slender and well-sclerotized sting apparatus. Morphology of all plates in the apparatus is similar to those of the worker. Gonostylus of dealate queen is relatively longer and has fringes of dorso-terminal hairs. Sting shaft has a distally blunt and slightly rounded lancet, without barbs, which could be a modification for the oviposition. The index of reduction for this sting is 0.65 (Fig. 3).



**Figure 3** Sting apparatus of the *T. rufonigra* de-alate queen. The structures of the sting apparatus are labeled as SP: Spiracular plate, QP: Quadrate plate, OP: Oblong plate, TP: Triangula plate, GS: Gonostylus, VC: Valve chamber, SF: Sting shaft and Ln: Lancet

## Male

The male lacks the sting apparatus (Fig. 4).



**Figure 4** Last gastral segment of the *T. rufonigra* male. Vu: Vulvura.

## Discussion

The adult castes of *T. rufonigra* worker, winged female and de-alate queen have a retractable sting apparatus and the male lacks the sting apparatus. The pentagonal spiracular plate, semi-circular plate, quadrate plate, oblong plate, triangular plate, the single-segmented slender elongate gonostylus and sting shaft were common to the sting apparatus of worker, winged female and de-alate queen<sup>6</sup>. As the barbs on the lancet are very short, the sting is unlikely to remain inside the victim after the stinging action unlike the honeybee sting.

The plates of sting apparatus of winged female and de-alata queen is larger compared to the sting apparatus of worker, caused by the larger body size of winged female and de-alate queen. The sting of the worker and winged female consists of a well-sclerotized, longer and slender, slightly concave, distally pointed lancet which bears three pairs of barbs. The Index of Reduction calculated for the worker (0.69) and the winged female (0.70) are comparable. This helps those two castes to cause a painful stinging to their victims and the barbs in the distal end probably assist

in keeping the sting for a longer time in the victim's body until the venom is injected. The longer gonostylus with larger number of sensilla in the winged female and the de-alate queen could play a role in mating and oviposition.

Current findings clearly showed that the sting apparatus of workers and winged females have structural modifications for stinging people. Also, the lack of barbs in the lancet of the dealate queen should be further investigated because a single specimen was available for the investigation. Male lacks the sting apparatus as it lacks the ovipositor and is unable to sting.

### **Acknowledgements**

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