

## ***Carebara periyarensis* sp. nov. (Hymenoptera: Formicidae) a New Species from India**

Tarun DHADWAL<sup>1</sup>

Himender BHARTI<sup>2\*</sup>

<sup>1,2</sup>Department of Zoology and Environment Sciences, Punjabi University, Patiala INDIA  
e-mails: <sup>1</sup>tarundadwal@gmail.com, <sup>2</sup>himenderbharti@gmail.com  
ORCID IDs: <sup>1</sup>0000-0001-5996-1808, <sup>2</sup>0000-0003-4261-8274

\*Corresponding author

### **ABSTRACT**

A new species of the genus *Carebara* Westwood, 1840, *Carebara periyarensis* sp. nov. is described and illustrated based on the worker caste. The new species resembles *C. affinis* and *C. diversa*, having 11 segmented antenna, however it can be differentiated from them by following combination of characteristics; small body size, short propodeal spine and body sculpture. An identification key to the genus *Carebara* is also updated.

*Key words:* Myrmicinae, new species, key, India, taxonomy.

## INTRODUCTION

The genus *Carebara* Westwood, 1840 is one of the largest ant genera in the subfamily Myrmicinae. It is represented by 224 species and 22 valid subspecies worldwide. The genus is extensively dispersed throughout the tropical and subtropical regions of the world (Bolton, 2022). The majority of *Carebara* species are hypogaeic ants that build their nests in the ground and leaf litter. Whereas certain species appear to be having lestobiotic mode of living and some of which exhibit a severe size dimorphism between females and workers (Hölldobler & Wilson, 1990; Fernández, 2010).

Currently, on the basis of morphological and molecular analysis *Carebara* is considered as a senior synonym of *Afroxyidris*, *Oligomyrmex*, *Paedalgus*, *Parvimyrma* and *Pheidologeton* (Fernández, 2004, 2006, 2010; Moreau et al., 2006; Fischer et al., 2014; Moreau & Bell, 2013). Ward et al. (2015) assigned genus *Carebara* to the tribe Crematogastrini. Formely it was treated in tribe Pheidolini (Emery, 1877), in Solenopsidini (Forel, 1893), in Myrmicariini (Ashmead, 1905) and in Pheidologetini (Emery, 1914; Bolton, 1994).

The significant contributions to the taxonomy of the genus from different parts of the world includes; from China (Li & Tang, 1986; Wu & Wang, 1995; Zhou & Zheng, 1997; Xu, 2003; Zhou et al., 2006), from Taiwan (Terayama et al., 2012), from Arabian Peninsula (Sharaf & Aldawood, 2013), from Afrotropical and Malagasy regions (Fischer et al., 2014, 2015; Azorsa & Fisher, 2018), from Thailand (Jaitrong et al., 2021), from Combodia (Fernández & Serna, 2019; Hosoishi et al., 2022).

Pertaining to the present study contribution from India includes Sheela & Narendran (1997), Bharti & Kumar (2013), Bharti & Akbar (2014), Akbar & Bharti (2017). A total of 25 species of genus *Carebara* are discovered so far (Bharti et al., 2016 ; Akbar & Bharti, 2017). However, there are still more ant species from India that need to be documented (Bharti et al., 2016). As a result, contributions in the form of new species and records are rather important. During the present study we describe a new species to the genus *Carebara* and also updated the identification key of the genus.

## MATERIALS AND METHODS

Taxonomic analysis was conducted on a Nikon SMZ 1500 stereo zoom microscope with maximum magnification of 112.5X. Digital images of the specimens were prepared using a MP (Micro Publisher) digital camera and Auto Montage (syncroscopy, a division of Synoptics Ltd.) software. Images were cleaned with Adobe Photoshop CS5 and Helicon Filter 5. Morphological measurements were recorded in millimeters with an oculometer fitted on a Nikon SMZ 1500 stereomicroscope. Automontage images of specimens were provided by <http://www.antweb.org/>. Morphological terminology and standard measurements follow Hosoishi et al. (2022).

**HL (head length):** maximum length of head in full-face view between lines drawn across anterior margin of clypeus and lines drawn across the posterolateral corners of head.

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**HW (head width):** width of head directly behind the eyes measured in full-face view.

**SL (scape length):** maximum scape length excluding basal condyle and neck.

**ML (mandible length):** the straight-line length of the mandible at full closure from the mandibular apex to the clypeal margin.

**EL (eye length):** maximum diameter of compound eye measured in oblique profile view.

**EM (eye to mandible):** distance from base of compound eye to the mandibular insertion, measured in profile view.

**WL (Weber's length):** diagonal length of mesosoma in profile view from the postero-ventral margin of the propodeal lobe to the anterior-most point of the pronotal slope, excluding the neck.

**PW (pronotal width):** maximum width of pronotum measured in dorsal view.

**MFL (femur length):** length of the profemur measured along its long axis in posterior view.

**MTL (tibia length):** maximum length of hind tibia.

**PTL (petiole length):** maximum length of petiole, measured in profile view.

**PTH (petiolar node height):** maximum height of petiolar node measured in profile view from the highest (median) point of the node to the ventral outline.

**PPL (postpetiole length):** maximum length of postpetiole measured in profile view.

**PPH (postpetiole height):** maximum height of the postpetiole measured in profile view from the highest (median) point of the node to the ventral outline. The measuring line is placed at an orthogonal angle to the ventral outline of the node.

**PPW (postpetiole width):** maximum width of postpetiole measured in dorsal view.

**GL (gaster length):** maximum length of the gaster measured in profile view.

**GW (gaster width):** maximum width of the gaster measured in dorsal view.

**TL (total length):** measured roughly from the anterior margin of head to the tip of gaster in fully stretched specimens in profile.

**CI cephalic index:**  $100 \cdot HW/HL$ .

**MI mandibular index:**  $100 \cdot ML/HL$ .

**SI scape index:**  $100 \cdot SL/HL$ .

**MLI metafemur length index:**  $100 \cdot MFL/HL$ .

**PPLI postpetiole length index:**  $100 \cdot PPL/PTL$ .

**PPI postpetiole width index:**  $100 \cdot PPW/PTW$ .

#### **Depositories.**

PUAC "Punjabi University Patiala Ant Collection" at Department of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab, India.

## RESULTS

### *Carebara periyarensis* sp. nov. Figs (1-6)

Type Material: Holotype (worker): India: Kerala: Periyar Tiger Reserve, 930m, 9.3230°N, 77.1315°E, 27.i.2017 [PUAC T 101], Paratype; 6 (w.) with same data as holotype, Hand picking method, leg. Tarun Dhadwal [PUAC T 103-108].

### Measurements

Holotype major worker: HL 1.03; HW 0.98; SL 0.57; ML 0.68; EM 0.36; WL 0.94; PW 0.58; MFL 0.66; MTL 0.51; PTL 0.30; PTH 0.22; PTW 0.16; PPL 0.28; PPH 0.20; PPW 0.26; GL 0.99; GW 0.70; CI 95.14; MI 66.01; SI 55.33; MLI 64.077; PPLI 93.33; PPI s162.50; TL 3.54 mm.

Paratype major workers (n=2): HL 1.01-1.06; HW 0.96-0.99; SL 0.52-0.57; ML 0.65-0.75; EM 0.33-0.39; WL 0.90-0.97; PW 0.54-0.63; MFL 0.64-0.69; MTL 0.51-0.53; PTL 0.30-0.33; PTH 0.22-0.24; PTW 0.14-0.16; PPL 0.24-0.28; PPH 0.21-0.22; PPW 0.25-0.28; GL 1.09-1.12; GW 0.74-0.84; CI 93.39-95.04; MI 64.35-70.75; SI 51.48-53.77; MLI 63.36-65.09; PPLI 80.00-84.84; PPI 175-178.57; TL 3.54-3.76 mm.

Paratype minor worker (n=4): HL 0.42-0.47; HW 0.45-0.49; SL 0.35-0.39; ML 0.28-0.31; EM 0.14-0.17; WL 0.52-0.55; PW 0.28-0.31; MFL 0.36-0.39; MTL 0.32-0.35; PTL 0.19-0.20; PTH 0.14-0.16; PPL 0.15-0.17; PPH 0.13-0.15; PTW 0.11-0.12; PPW 0.14-0.16; GL 0.48-0.53; GW 0.32-0.37; CI 104.25-107.14; MI 65.95-66.66; SI 82.97-83.33; MLI 82.97-85.71; PPLI 78.94-85.00; PPI 127.27-133.33; TL 1.76-1.92 mm.

### Description of major worker (Figs.1-3)

Head in full face view as long as broad, posterior margin concave in the middle with occipital corners rounded, lateral sides convex anteriorly; median portion of clypeus bicarinate and divergent anteriorly, anterior margin weakly concave; mandibles with 5 teeth; antennae slender, 11 segmented with a two segmented club, scape short reaching up to half of the head length; eyes small with 3 pair of ommatidium.

In profile view, promesonotum high and convex, promesonotal suture obsolete, metanotal groove deeply impressed; propodeum with a pair of short denticles; propodeal declivity slightly concave; petiole node thick and subtriangular furnished with a keel beneath; postpetiole subglobose in shape. In dorsal view, pronotum globular, large, strongly convex occupying most of mesosoma; mesonotum small, transverse, metanotum reduced; petiole emarginated; postpetiole with convex lateral sides.

Mandibles longitudinally striated and clypeus smooth and shiny. Head finely and longitudinally striate throughout except small smooth median area at the frontal region, occiput with transverse striations; promesonotum longitudinally striated, metanotum reticulate and propodeum reticulate with few transverse striations; lateral sides of pronotum and propodeum with transverse striations; mesopleuron reticulated; in lateral view petiole and postpetiole with transverse striations and microreticulate in dorsal view, with one or two longitudinal rugae on petiole; postpetiole dorsally smooth and gaster reticulate anteriorly and rest of gaster smooth with punctures.

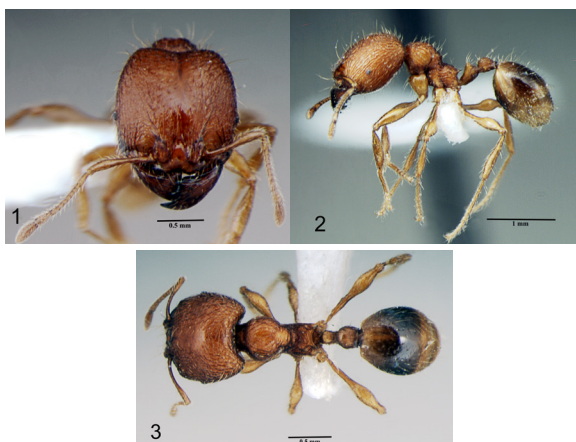
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Head and body with abundant erect to suberect hairs; scapes and tibiae with dense decumbent pubescence.

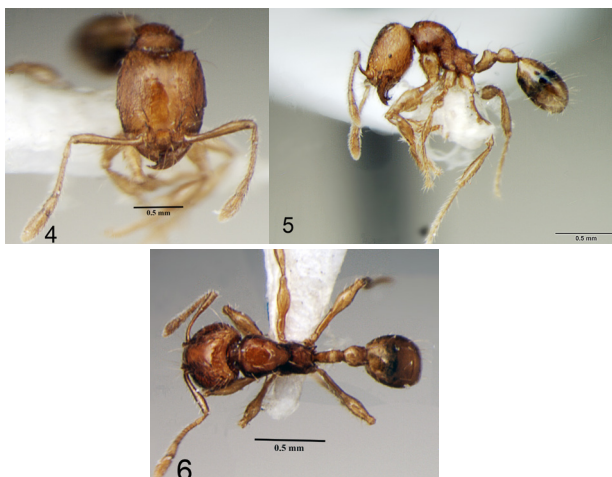
Body generally reddish yellow in color, head somewhat darker in color and legs lighter yellowish in color.

**Minor worker (Figs. 4-6)**

All characteristics are same except; size of minor worker is small, posterior margin widely emarginated in the middle, occipital corners almost straight, slightly rounded; mandibles smooth, head feebly longitudinally striate at sides, having smooth median portion and reticulated at occipital corners; pronotum smooth feebly reticulated anteriorly, mesonotum and metanotum reticulated, mesopleuron and metapleuron minutely reticulated. Body generally with less hair as compared to major worker.



Figs 1-3. Major worker of *Carebara periyarensis* sp. nov. 1. head in full face view 2. body in profile view 3. body in dorsal view.



Figs. 4-6. Minor worker of *Carebara periyarensis* sp. nov. 4. head in full face view, 5. body in profile view 6. body in dorsal view.

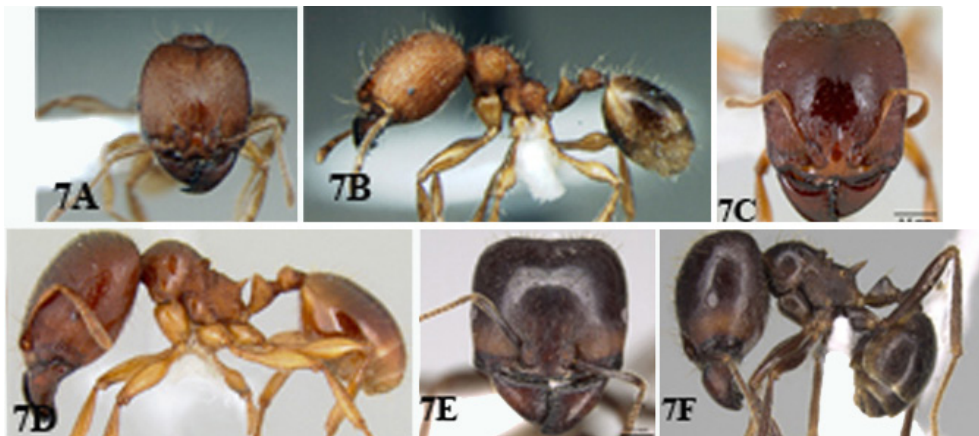
Queen. Unknown.

Male. Unknown.

Differential diagnosis. *C. periyarensis* sp. nov. can be differentiated from the already described species from India on the basis of antennal segment as new species have 11 segmented antenna while rest of the species have 9 segmented antenna excluding *Carebara affinis* (Jerdon, 1851) and *Carebara diversa* (Jerdon, 1851) having 11 segmented antenna.

Though, it can be differentiated from *C. affinis* on the basis of following characteristics (Fig. 7 A, B and Fig. 7 C, D); Head in *C. periyarensis* sp. nov. is as long as broad (head is distinctly longer than broad in *C. affinis*); in *C. periyarensis* sp. nov. petiole node dorsally emarginated (petiole node dorsally not emarginated in *C. affinis*); in *C. periyarensis* sp. nov. propodeum with a pair of denticles (propodeum with a pair of distinct long spines in *C. affinis*); in *C. periyarensis* sp. nov. head finely and longitudinally striate throughout except small smooth median area at the frontal region, pronotum dorsally with longitudinal striations and laterally with transverse striations (head feebly longitudinally striate and mostly smooth with punctures, pronotum mostly smooth with few transverse striations anteriorly in *C. affinis*).

From *C. diversa* (Fig. 7 E, F), it can be distinguished by the following combination of characteristics; in *C. periyarensis* sp. nov. body size not large TL (Major worker 3.54-3.76mm and Minor Worker 1.76-1.92mm) (body of *C. diversa* is disproportionately huge TL (Major worker 10.34-11.71mm and Minor Worker 2.08-2.57mm); in *C. periyarensis* sp. nov. head is short without a median ocellus in front and propodeum with a pair of short spine (head massive and subtriangular with a median ocellus in front and propodeum with a pair of distinct long spines in *C. diversa*)



Figs 7. A. Head in full face view of *Carebara periyarensis* sp. nov. B. Profile view of *C. periyarensis*. C. Head in full face view of *C. affinis*. D. Profile view of *C. affinis*. E. Head in full face view of *C. diversa* sp. nov. F. Profile view of *C. diversa*.



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Queen: Unknown

Male: Unknown

Bionomics: The workers were manually collected beneath a stone in Medaganam region of the Periyar Tiger Reserve. The ground is heavily covered with leaf litter and has a dense canopy overhead. The region has an average daily temperature of 32°C and is comprised of intact tropical wet evergreen forest with minimum light penetration.

Etymology: The species has been named after the name of the Periyar Tiger Reserve.

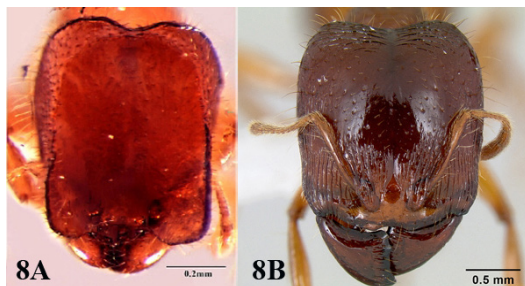
## ACKNOWLEDGEMENTS

Financial assistance rendered by the Ministry of Environment, Forest and Climate Change (Grant No. 22018/41/2010-CS (Tax)), Govt. of India, New Delhi is gratefully acknowledged. We also thank Forest and Wildlife Department, Govt. of Kerala for granting the permission to collect the research material vide Order No. WL 10-55389/2014 dated 07.01.2016.

## Identification key to the known species of genus *Carebara* from India

The identification key to the known species of genus *Carebara* from India is provided by Akbar and Bharti (2017). Since the new species mentioned here needs to be included, the following key couplets are slightly modified without changing the rest of the key.

1. Antenna 11-segmented ..... 2  
 - Antenna 9-segmented ..... 4
2. Head truncate, shield like, with frontal lobes extended forward forming broad rounded lamina; posterolateral edges sharply angulate (Fig. 8A).....  
 ..... *C. nayana* (Sheela and Narendran)
- Head not truncate, sides straight to weakly convex; posterolateral corners rounded (Fig. 8B) .....3



Figs. 8. A. Head in full face view of *C. nayana*; B. Head in full face view of *C. affinis*.

- 3a. Propodeum with a pair of distinct long spines (Fig. 9A).....3b  
 - Propodeum with a pair of denticles (Fig. 9B).....*Carebara periyarensis* sp. nov.



Figs 9. A. Profile view of *C. diversa* B. Profile view of *C. periyarensis* sp.nov.

3b. Head with a deep median longitudinal groove and a single ocellus, body strongly sculptured, relatively larger in size and dark reddish brown to black in color, (Fig. 10A)  
 .....*C. diversa* (Jerdon)

-Head without deep median longitudinal groove and without ocellus, body weakly sculptured, relatively smaller in size and reddish brown in color (Fig. 10B)  
 .....*C. affinis* (Jerdon)



Figs. 10. A. Head in full face view of *C. diversa* B. Head in full face view of *C. affinis*.

Note: From couplet 4 onwards there are no changes to the key presented by Akbar and Bharti (2017) and we refer to that publication.

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