Journal of Institute of Science and Technology, 27(1), 93-99 (2022)
ISSN: 2467-9062 (print), e-ISSN: 2467-9240
https://doi.org/10.3126/jist.v27i1.46661

© IOST, Tribhuvan University
Research Article

ANT GENUS *Tetraponera* SMITH, 1852 IN NEPAL, WITH TWO NEW RECORDS AND KEYS TO WORKERS (FORMICIDAE: PSEUDOMYRMECINAE)

Indra Prasad Subedi, Prem Bahadur Budha*, Vasanta Kumar Thapa
Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal
**Corresponding author: prem.budha@cdz.tu.edu.np*
(***Received**: October 22, 2021; **Revised**: May 22, 2022; **Accepted**: May 26, 2022)*

ABSTRACT
Tetraponera Smith, 1852 is one of the least studied ant genera in Nepal, with only four known species. A taxonomic study was carried out on Nepalese *Tetraponera* collected mostly from forested habitats ranging in elevation from 98 to 1400 m above sea level using pitfall trapping, baiting, beating low vegetation and hand collecting. The study reports four species – *Tetraponera aitkenii* (Forel, 1902) and *T. difficilis* (Emery, 1900) of *nigra* group as the first record, and *T. allaborans* (Walker, 1859) of *allaborans* group, and *T. rufonigra* (Jerdon, 1851) of *rufonigra* group as new distribution records for Nepal bringing the total number of known species to six. Taxonomic as well as distribution notes for all four species recorded in this study, and a distribution map of all Nepalese species, are provided. An identification key for Nepalese *Tetraponera* workers is also presented.

Keywords: Arboreal ants, distribution, Himalaya, species description, taxonomic notes

INTRODUCTION
The subfamily Pseudomyrmecinae constitutes a distinctive assemblage of large-eyed, slender, active and arboreal ants. They are widespread in the old and new world tropics (Ward, 2001). The subfamily includes three genera; a paleotropical *Tetraponera*, a neotropical and nearctic *Pseudomyrmex* and a south American *Myrcidris* (Ward, 1990; Ward & Downie, 2005). *Tetraponera* species are important in studying ant-plant interactions (Déjean *et al.*, 2008; Blatrix *et al.*, 2012; Kokolo *et al.*, 2019), biotic defense and toxicology (Qin *et al.*, 2017; Barassé *et al.*, 2019; Naephrai *et al.*, 2021), and nitrogen cycling endosymbiosis (Borm *et al.*, 2002; Stoll *et al.*, 2007).

Tetraponera workers may be diagnosed by the following character states: Usually monomorphic; mandible with distinct masticatory and basal margins, 3-6 teeth in masticatory and 0-2 teeth in basal margins; median clypeal lobe continuous, broadly convex and non-truncate, usually with toothed or crenulate anterior margin; antennae 12-segmented; large compound eyes with width 2/3 or more than length; metanotal groove distinctly impressed; sting apparatus membranous (Ward, 1990).

The ant genus *Tetraponera* has 89 extant species and seven fossil species distributed throughout old world tropics (Bolton, 2022). Ward (2001) revised this genus from the Oriental and Australian regions, revealing 33 species divided into four species groups: *allaborans* (11 species), *nigra* (20 spp.), *pilosa* (1 sp.) and *rufonigra* (1 sp.). Other noteworthy publications on these ants includes generic revision (Ward, 1990), phylogeny and evolution (Ward & Downie, 2005), species group revision (Ward, 2006; Ward, 2009), and regional keys for India (Bharti & Akbar, 2014) and China (Xu & Chai, 2004).

The earliest published record of *Tetraponera* species in Nepal, Collingwood (1970), includes two species, *Sima* (*Tetraponera*) *rufonigra* and *Sima* (*Tetraponera*) *allaborans*. Four Nepalese species, *Tetraponera allaborans* (Walker, 1859), *T. nigra* (Jerdon, 1851), *T. binghami* (Forel, 1902), and *T. rufonigra* (Jerdon, 1851) were mentioned in the Ward's comprehensive taxonomic revision of *Tetraponera* of Oriental and Australian regions (Ward, 2001). Thapa (2015) listed two *Tetraponera* species in his book, Insect diversity in Nepal. The most recent Nepalese ant checklist by Subedi *et al.* (2020) included four species along with new distribution record of *T. rufonigra* from Tanahun district. This paper reports two species, *Tetraponera aitkenii* (Forel, 1902) and *T. difficilis* (Emery, 1900) of *nigra* group as new records for Nepal bringing the total number of known species in the country to six. A brief worker diagnosis, morphometric measurements, and distribution of the species recorded in this study are provided. A dichotomous key to Nepalese *Tetraponera* workers is also presented.

MATERIALS AND METHODS
The specimens were collected in sporadic or systematic collections in different parts of Nepal applying different ant collection methods such as pitfall trapping, baiting, beating on lower vegetation, and handpicking in 2009, 2013, 2019 and 2020. Specific site location and collection dates are provided below in the specimens examined section. The point-mounted specimens were examined using a stereo zoom microscope (Coslab MSZ-115). Morphometric character measurements (in mm up to second decimal) of collected specimens were provided by using an ocular micrometer at 45× magnification. Images of profile and full face views were taken with a digital camera (Samsung SM-M625F). The point-mounted dry

specimens examined during this investigation are housed at the Central Department Zoology Museum of Tribhuvan University (CDZMTU). Species-level identifications were based on the keys (Ward, 2001; Xu & Chai, 2004; Bharti & Akbar, 2014), worker descriptions (Ward, 2001), and type image comparisons (https://www.antweb.org and https://www.antwiki.org). Using QGIS 3.16 (QGIS Development Team, 2020), a distribution map for all *Tetraponera* species in Nepal was created based on the current collection and previously published distribution data (e.g., Ward, 2001; Subedi *et al*., 2020; AntWeb, 2021).

Measurements and indices: Standard morphological measurements (in millimeters) and indices as defined by Ward (2001) are given below:
Head width (HW). Maximum head width in full-face view (including eyes).
Head length (HL). Maximum mid-line head length in full-face view (excluding mandibles).
Eye length (EL). Vertical line length of the compound eye in full-face view.
Minimum frontal carina distance (MFC). Minimum distance between the frontal carinae.
Scape Length (SL). Straight-line length of the first antennal segment (excluding radicle).
Profemur length (FL). Profemur length along longitudinal axis, measured in posterior view.
Profemur width (FW). Maximum profemur width, measured in posterior view.
Pronotum width (PrWM). Maximum pronotal width in dorsolateral margins.
Propodeum height (PDH). Maximum propodeal height, measured in lateral view.
Metapleural width (MTW). Maximum distance between the metapleura, measured in dorsal view.
Petiole length (PL). Maximum length of petiole in lateral view, from the anterior margin to the posterior margin.
Petiole height (PH). Maximum height of the petiole in lateral view, measured at right angle to PL.
Dorsal petiole width (DPW). Maximum width of the petiole, measured in dorsal view.
Metatibia length (LHT). Length of hind tibia (excluding proximomedial part of the articulation).
Cephalic index (CI). HW/HL.
Relative eye length (REL). EL/HL.
Relative eye length, using HW (REL2). EL/HW.
Frontal carina index (FCI). MFC/HW.
Scape index (SI). SL/HW.
Scape index, using HL (SI2). SL/HL.
Scape index, using EL (SI3). SL/EL.
Profemur index (FI). FL/FW.
Propodeal index (PDI). PDH/MTW.
Petiole length index (PLI). PH/PL.
Petiole width index (PWI). DPW/PL.
Ceplalic setal count (CSC). Number of standing hairs, visible on the posterior half of the head dorsum.
Mesosomal setal count (MSC). Number of standing hairs, visible in profile on the mesosoma dorsum.

Most of the measurements are illustrated in a full-face and lateral views of a *Tetraponera* worker (Figure 1).

Figure 1. Illustration of measurements in A. Full-face and B. Lateral views of a *Tetraponera* worker

RESULTS AND DISCUSSION

Four *Tetraponera* species, namely *aitkenii, allaborans, difficilis*, and *rufonigra*, have been reported, with two, *aitkenii* and *difficilis*, being new records for Nepal. Taxonomic and distribution notes for all four species studied (see also Ward, 2001), as well as a distribution map of all Nepalese species, are provided below. An identification key to *Tetraponera* workers is also given.

Synoptic species list of the Nepalese *Tetraponera allaborans* group

1. *Tetraponera allaborans* (Walker, 1859)
   Junior synonyms: *Tetraponera allaborans sumatrensis* (Emery, 1900); *T. ceylonica* (Motschoulsky, 1863); *T. compressa* (Roger, 1863); *T. femoralis* (Motschoulsky, 1863); *T. longinoda* (Forel, 1909);

T. minuta (Jerdon, 1851); *T. rufipes* (Jerdon, 1851); *T. subtilis* (Emery, 1889)

nigra **group**

2. **Tetraponera aitkenii* (Forel, 1902)
3. *Tetraponera binghami* (Forel, 1902)
   Junior synonym: *Tetraponera binghami lindgreeni* (Forel, 1902)
4. **Tetraponera difficilis* (Emery, 1900)
   Junior synonyms: *Tetraponera dilatata* (Karavaiev, 1933), *T. nitens* (Stitz, 1925); *T. stipitum* (Forel, 1912)
5. *Tetraponera nigra* (Jerdon, 1851)
   Junior synonyms: *Tetraponera atrata* Smith, 1852; *T. fergusoni* (Forel, 1902); *T. nigra insularis* (Emery, 1901); *T. n. krama* (Forel, 1912); *T. petiolata* Smith, 1877

rufonigra **group**

6. *Tetraponera rufonigra* (Jerdon, 1851)
   Junior synonyms: *Tetraponera rufonigra ceylonensis* (Forel, 1909); *T. r. testaceonigra* (Forel, 1903); *T. r. yeensis* (Forel, 1902)

*New records for Nepal

Species accounts

***Tetraponera allaborans* (Walker, 1859)**

(Figs. 2A, 2B)

Pseudomyrma allaborans Walker, 1859: 375; *Tetraponera*: Smith (1877): 69; *Sima*: Emery (1893): 53; *Tetraponera*: Wheeler (1921): 110. [For detail taxonomic history see Bolton (2021)]

Type locality: Ceylon (Sri Lanka)

Measurements and indices (n=4): HW 0.71-0.78, HL 0.92-0.99, EL 0.31-0.33, MFC 0.08, SL 0.44-0.47, FL 0.50-0.0.58, FW 0.14-0.22, PrWM 0.47-0.53, PDH 0.28-0.36, MTW 0.31-0.33, PL 0.67-0.69, PH 0.26-0.31, DPW 0.22-0.25, LHT 0.56-0.72, CI 0.77-0.85, REL 0.31-0.36, REL2 0.39-0.47, FCI 0.09-0.11, SI 0.57-0.67, SI2 0.45-0.52, SI3 1.42-1.51, FI 0.24-0.38, PDI 0.83-1.18, PLI 0.38-0.46, PWI 0.32-0.38, CSC 0-1, MSC 1-3.

Worker diagnosis: The workers are with black or dark-brownish black body with lighter appendages, petiole and postpetiole, small to medium size (HW 0.71-0.78, HL 0.92-0.99, LHT 0.56-0.72), eye size moderate (REL 0.31-0.36, REL2 0.39-0.47), pronotum with lateral margins, propodeum wide, relatively low (PDI 0.83-1.18), metanotal plate absent, very little or no standing hairs on cephalic dorsum and mesosoma (CSC 0-1, MSC 1-3). This species differs from other dark-bodied *allaborans*-group species in propodeal shape, pronotal margination, and mesopropodeal impression (Ward, 2001).

Materials examined: 2 workers, Tribhuvan University Campus, Kirtipur, Kathmandu, 27.681389 N, 85.283056 E, 1330 m, 29.v.2019, I.P. Subedi leg.; 2 workers, Nagarjun forest, Shivapuri-Nagarjun National Park (SNNP), 27.744444 N, 85.294167 E, 1400 m, 1.v.2019, I.P. Subedi leg; 1 worker, Tanahun, Sal forest, 27.98881 N, 84.2675 E, 496 m, 28.ix.2020, P.B. Budha leg.

Previous records: Namdu of Dolakha (Collingwood, 1970); Baglung, Gokarna Safari and Bajra Barahi of Kathmandu, Godawari of Lalitpur, Pokhara of Kaski, Iwa Khola below Sablako Pass of Taplejung (Ward, 2001).

Distribution: It is a wide-ranging species occurring in Australasian, Indo-Australian, Oriental and Palaearctic regions (Ward, 2001; Guénard *et al.*, 2017). It is largely variable taxon and possibly composed of over one species (Ward, 2001). Specimens examined in this study also differ slightly in the shape of the propodeum, but measurements and indices were not much different.

***Tetraponera aitkenii* (Forel, 1902)**

(Figs 3A, 3B)

Sima aitkenii Forel, 1902: 245; *Sima* (*Tetraponera*) *aitkenii* Forel: Emery (1921): 25; *Tetraponera* (*Tetraponera*) *aitkenii* Forel: Chapman and Capco (1951): 78

Type locality: Kanara, India

Measurements and indices (n=2): HW 0.78-0.81, HL 0.94, EL 0.40-0.42, MFC 0.08, SL 0.47-0.50, FL 0.50-0.61, FW 0.19-0.22, PrWM 0.46-0.47, PDH 0.36, MTW 0.29-0.31, PL 0.50, PH 0.28-0.32, DPW 0.25-0.26, LHT 0.46-0.47, CI 0.82-0.85, REL 0.43-0.44, REL2 0.50-0.54, FCI 0.10-0.11, SI 0.61-0.62, SI2 0.50-0.53, SI3 1.13-1.24, FI 0.36-0.39, PDI 1.18-1.24, PLI 0.56-0.64, PWI 0.50-0.53, CSC 16-18, MSC 32-44.

Worker diagnosis: The workers are black to brownish black with lighter appendages; relatively small size (HW 0.78-0.81, LHT 0.46-0.47); long standing hairs abundant on the head and mesosoma (CSC 16-18, MSC 32-44), and moderately dense pubescence on the gaster; eye length shorter than scape length, eyes modest size (REL 0.43-0.44, REL2 0.50-0.54), relatively long scapes (SI 0.61-0.62, SI3 1.13-1.24); sharp-edged pronotal lateral margins; thin petiole (PWI 0.50-0.53) without posteroventral teeth; largely smooth and shiny integument. The species differs from related species such as *T. polita* by having larger eyes, a thinner petiole, and longer standing hairs, and from *T. nitida* and *T. nixa* by having longer scapes, smooth integument and lacking posteroventral teeth in the petiole (Ward, 2001).

Materials examined: 2 workers, Haldibari- Jhapa, Mixed broad leaf forest, 26.47747 N, 87.98638 E, 98 m, 17.x.2020, P.B. Budha leg.

Distribution: This is a new record for Nepal which was earlier known from India, Malaysia (Ward, 2001), and Thailand (Khachonpisitsak *et al.*, 2020).

***Tetraponera difficilis* (Emery, 1900)**
(Figs. 4A, 4B)
Sima difficilis Emery, 1900: 677; *Tetraponera*: Wheeler (1919): 65.

Type locality: Sumatra (Indonesia)
Measurements and indices (n=1): HW 0.78, HL 1.06, EL 0.36, MFC 0.06, SL 0.53, FL 0.61, FW 0.25, PrWM 0.50, PDH 0.35, MTW 0.31, PL 0.78, PH 0.31, DPW 0.25, LHT 0.64, CI 0.74, REL 0.34, REL2 0.46, FCI 0.07, SI 0.68, SI2 0.50, SI3 1.46, FI 0.41, PDI 1.14, PLI 0.39, PWI 0.32, CSC 2, MSC 3.

Worker diagnosis: The workers are black to brownish black in color with lighter appendages; medium-sized (HW 0.78, HL 1.06, LHT 0.64) with short clypeus; medium-sized eye (REL 0.34, REL2 0.46); scape markedly longer than eye (SI3 1.46); sparse hairs (CSC 2, MSC 3); relatively slender profemur (FI 0.41); mesonotal impression open anteriorly with a posterior pit-like depression; propodeum as high as wide and its dorsal face rounding gradually into declivitous face; petiole with short peduncle and slender node; integument shiny and puncticulate, and moderately long legs. This species differs from other *nigra*-group species by intermediary eye-size, scant pilosity and the structure of mesonotal impression (Ward, 2001).

Materials examined: 1 worker, Tribhuvan University Campus, Kirtipur, Kathmandu, 27.681389 N, 85.283056 E, 1330 m, 11.iv.2009, I.P. Subedi leg.

Distribution: This is the first record of this species for Nepal. This species is known from Indo-Australian (Borneo, Indonesia, Malaysia, Philippines, Singapore) and Oriental (Thailand) regions (Guénard *et al.*, 2017).

***Tetraponera rufonigra* (Jerdon, 1851)**
(Figs. 5A, 5B, 5C)
Eciton rufonigrum Jerdon, 1851: 111; *Pseudomyrma*: Smith (1858): 159; *Sima*: Roger (1863): 25; *Tetraponera*: Smith (1877): 68.

Type locality: Southern India
Measurements and indices (n=5): HW 1.58-1.83, HL 1.63-2.04, EL 0.54-0.65, MFC 0.19-0.25, SL 0.96-1.15, FL 1.25-1.46, FW 0.40-0.48, PrWM 0.96-1.17, PDH 0.81-1.04, MTW 0.71-0.83, PL 1.04-1.38, PH 0.46-0.63, DPW 0.46-0.63, LHT 1.13-1.54, CI 0.90-0.97, REL 0.28-0.33, REL2 0.31-0.35, FCI 0.12-0.14, SI 0.55-0.63, SI2 0.50-0.59, SI3 1.68-1.77, FI 0.31-0.34, PDI 1.15-1.25, PLI 0.44-0.48, PWI 0.44-0.50, CSC 15-19, MSC 36-47.

Worker diagnosis: The workers are distinctly bicolored; large (HW 1.58-1.83, HL 1.63-2.04, LHT 1.13-1.54); relatively small compound eye (REL 0.28-0.33, REL2 0.31-0.35), three well-developed ocelli; mandibular masticatory margin with five teeth; abundant standing hairs (CSC 15-19, MSC 36-47); densely punctate head and mesosoma; pronotum with well-developed lateral margins; petiole with short peduncle and flattened and elongate node; profemur slender (FI 0.31-0.34). These ants are easily identifiable with a dark-brown to brownish-black head and gaster, a lighter orange-brown mesosoma and petiole, and a medium-brown to yellowish-brown mandible, antenna, and tarsi, with variations in the color patterns recorded from some Sri Lankan populations (Ward, 2001). Variations in color patterns have also been observed in the Nepalese specimens (see Figures 5A and 5B).

Materials examined: 2 workers, Jamune, Tanahun, 27.9875 N, 84.18305 E, 530 m, 28.xii.2006, hand collection, I.P. Subedi leg.; 2 workers, Nagarjun forest, SNNP, 27.744444 N, 85.294167 E, 1400 m, 1.v.2019, IP Subedi leg.; 1 worker, Ranibari community forest, Kathmandu, 27.73082 N, 85.32101 E, 1300 m, hand collection, 15.x.2019, I.P. Subedi leg.; 1 worker, Tribhuvan University Campus, Kirtipur, Kathmandu, 27.681389 N, 85.283056 E, 1330 m, 11.iv.2009, I.P. Subedi leg.; 1 worker, Bhandara, Chitwan, 27.60620 N, 84.63145 E, 10.iii.2013, hand collection, IP Subedi leg.; 1 worker, Budhitola, Kailali, Sal forest, 28.92357 N, 80.57027 E, 983 m, 15.x.2020, P.B. Budha leg.; 1 worker, Baikunda, Panchthar, Sal forest, 27.144422 N, 87.70204 E, 745 m, 12.x.2020, P.B. Budha leg.

Previous records: Cha Khola of Kavrepalanchok, Pokhara of Kaski (Collingwood, 1970); Chumlingtar of Chitwan, Sunkoshi river near Khurko, 12 km ENE Tumlingtar of Sankhuwasabha, Chitwan National Park, Arun valley (Ward, 2001); Jamune of Tanahun (Subedi *et al.*, 2020).

Distribution: It is widely distributed species found in Indo-Australian, Malagasy, Oriental and Palearctic regions (Ward, 2001; Guénard *et al.*, 2017).

Figures 2A. Habitus in profile view, 2B. Head in full-face view of *Tetraponera allaborans*; 3A. Habitus in profile view, 3B. Head in full-face view of *T. aitkenii*; 4A. Habitus in profile view, 4B. Head in full-face view of *T. difficilis*; 5A. 5B. Habitus in profile view, 5C. Head in full-face view of *Tetraponera rufonigra*

Distribution map of *Tetraponera* species in Nepal

The following distribution map for all *Tetraponera* species in Nepal was created in QGIS 3.16 (QGIS Development Team, 2020) using available data in publications (see Ward, 2001; Subedi et al., 2020; AntWeb, 2021) and locality data of specimens examined during this study (Figure 6). The map clearly shows that the western region of Nepal, as well as Tarai, mid-and high mountain regions are under-sampled. Furthermore, Nepal's geographic position and topography support high floral and faunal diversity, and thus additional sampling efforts are likely to yield new records, either of new species or of new species records for the country.

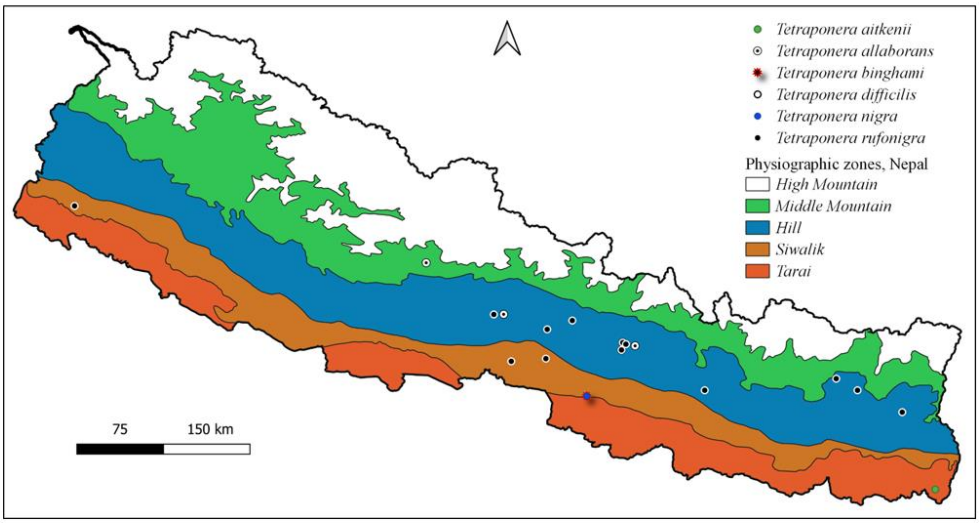

Figure 6. Distribution map of *Tetraponera* species in Nepal

Key to the Nepalese *Tetraponera* species based on worker caste (modified after Ward, 2001; Xu & Chai, 2004; Bharti & Akbar, 2014).

1. Head with three distinct ocelli. Mandible with five teeth on the masticatory margin. Petiolar anteroventral margin distinctly dentate. Larger species (HW 1.62-2.07), with smaller eyes. (*rufonigra* group) ……..……...……. *Tetraponera rufonigra*
- Head lacking ocelli, very rarely with two or three faint ocelli (in a few large workers of *T. nigra*). Mandible with 3-4 teeth on the masticatory margin. Petiolar anteroventral margin not dentate. Size

variable (HW 0.49-1.48), with variable eye size……..…...……...……. 2

2. Mandible slender, with three teeth on the masticatory margin, and 1-2 denticles on the basal margin; basal margin of mandible much longer than masticatory margin (*allaborans*-group). Larger species (HW 0.62-0.93, usually >0.70). Eye relatively larger (REL 33-41) ..... *T. allaborans*

- Mandible more robust, with four teeth on the masticatory margin, and 0-1 denticles on the basal margin; basal margin of mandible subequal to, or shorter than, masticatory margin. Size variable (HW 0.63-1.48), Eye size variable (*nigra*-group) …….....……..…….. 3

3. Larger species (HW 0.95-1.48), with long legs (LHT/HL 0.80-0.97). Mesopropodeal impression more or less open (except raised prominences containing metanotal spiracles), not bounded by lateral ridges enclosing a pit-like depression ….……...……...…. 4

- Smaller species, on average (HW 0.63-1.44), with generally shorter legs (LHT/HL 0.58-0.86, rarely >0.80). Mesopropodeal impression laterally bordered (partly or entirely) by raised ridges enclosing a pit-like depression ……..…..… 5

4. Head elongate (CI 0.70-0.77). Petiole very slender (PLI 0.34-0.43). Interspaces between cephalic punctures predominantly smooth and shiny. ……..……..…..…. *T. binghami*

- Head broader (CI 0.76-0.94, usually >0.80). Petiole short and robust (PLI >0.50). Interspaces between cephalic punctures finely reticulate... ……...…….. *T. nigra*

5. Standing pilosity common on head, mesosoma (CSC 18-28, MSC 26-54), mesonotum and propodeum. Eyes relatively larger (REL2 0.48-0.55). Lateral pronotal margin sharp-edged. ……...…. …….. *T. aitkenii*

- Standing pilosity sparse on head and mesosoma (CSC 2-4, MSC 1-5), absent from mesonotum and propodeum. Eye size intermediate (REL2 0.44-0.48). Lateral pronotal margin blunt-edged. …….. *T. difficilis*

CONCLUSIONS

This taxonomic research of ants from different parts of Nepal, largely from forested areas with elevations ranging from 98 to 1400 m above sea level, yielded four *Tetraponera* species. Two species (*Tetraponera aitkenii* and *T. difficilis*) are new records for the country, bringing the total number of species in the genus recorded from Nepal to six. The species diversity of Nepal needs further exploration because several regions, particularly in the west, as well as Tarai, mid- and high mountains, remain largely under-sampled, as well as taxonomic studies that are likely to discover new species to science and new records for the country. In the context of inadequate facilities and scanty publications on Nepalese ants, this work contributes to the ant taxonomy.

ACKNOWLEDGEMENTS

We are grateful to the Department of National Parks and Wildlife Conservation and the SNNP office for granting us a collection permit within the national park. We would like to thank Shambhu Adhikari, Raj Prakash Pokhrel, Anjeela Pandey, Tulsi Raj Adhikari, and Kiran Chaudhary for their assistance in the field.

AUTHORS CONTRIBUTION STATEMENT

Conceptualization: IPS, fieldwork: IPS & PBB, laboratory works: IPS, writing original draft: IPS, review and editing: IPS, PBB, & VKT.

CONFLICT OF INTEREST

The authors do not have any conflict of interest pertinent to this work.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

REFERENCES

AntWeb (2021). Genus: *Tetraponera*. Retrived from https://www.antweb.org/browse.do?subfamily=pseudomyrmecinae&genus=tetraponera&rank=genus&countryName=Nepal (Accessed 21 October 2021)

Barassé, V., Touchard, A., Téné, N., Tindo, M., Kenne, M., Klopp, C., Dejean, A., Bonnafé, E., & Treilhou, M. (2019). The peptide venom composition of the fierce stinging ant *Tetraponera aethiops* (Formicidae: Pseudomyrmecinae). *Toxins, 11*(12), 732. https://doi.org/10.3390/toxins11120732

Bharti, H., & Akbar, S.A. (2014). *Tetraponera periyarensis*, a new pseudomyrmecine ant species (Hymenoptera: Formicidae) from India. *Asian Myrmecology, 6,* 43-48.

Blatrix, R., Djiéto-Lordon, C., Mondolot, L., La Fisca, P., Voglmayr, H., & McKey, D. (2012). Plant-ants use symbiotic fungi as a food source: new insight into the nutritional ecology of ant–plant interactions. *Proceedings of the Royal Society of London. Series B: Biological Sciences, 279*(1744), 3940-3947. https://doi.org/10.1098/rspb.2012.1403

Bolton, B. (2022). An online catalogue of the ants of the World. Retrieved from https://antcat.org/catalog/429418?qq=tetraponera (Accessed 20 May 2022)

Borm, S.V., Buschinger, A., Boomsma, J.J., & Billen, J. (2002). *Tetraponera* ants have gut symbionts related to nitrogen–fixing root–nodule bacteria. *Proceedings of the Royal Society of London. Series B: Biological Sciences, 269*(1504), 2023-2027. https://doi.org/10.1098/rspb.2002.2101

Chapman, J.W., & Capco, S.R. (1951). *Checklist of the ants (Hymenoptera: Formicidae) of Asia*. Monographs of the Institute of Science and Technology. Manila, 317p.

Collingwood, C. (1970). Formicidae (Hymenoptera: Aculeata) from Nepal. *Khumbu Himal, 3*(3), 371-387.

Déjean, A., Djiéto-Lordon, C., & Orivel, J. (2008). The plant ant *Tetraponera aethiops* (Pseudomyrmecinae) protects its host

myrmecophyte *Barteria fistulosa* (Passifloraceae) through aggressiveness and predation. *Biological Journal of the Linnean Society, 93*(1), 63-69. https://doi.org/10.1111/j.1095-8312.2007.00927.x

Emery, C. (1893). [Untitled. Taxonomic changes in various genera attributed to Emery.]. Pp. 4-266 *in: Dalla Torre, K. W. 1893. Catalogus Hymenopterorum hucusque descriptorum systematicus et synonymicus. Vol. 7. Formicidae (Heterogyna). 289 pp.* (pp. 4-266). Leipzig: W. Engelmann,

Emery, C. (1900). Formiche raccolte da Elio Modigliani in Sumatra, Engano e Mentawei. *Annali del Museo Civico di Storia Naturale, 40*(2), 661-722.

Emery, C. (1921). Hymenoptera. Fam. Formicidae. Subfam. Myrmicinae. [part]. *Genera Insectorum, 174A,* 1-94+97 plates.

Forel, A. (1902). Myrmicinae nouveaux de l'Inde et de Ceylan. *Revue Suisse de Zoologie, 10*, 165-249.

Guénard, B., Weiser, M., Gomez, K., Narula, N., & Economo, E. (2017). The Global Ant Biodiversity Informatics (GABI) database: synthesizing data on the geographic distribution of ant species (Hymenoptera: Formicidae). *Myrmecological News, 24*, 83-89. https://doi.org/10.25849/myrmecol.news_024:083

Jerdon, T.C. (1851). A catalogue of the species of ants found in Southern India. *Madras Journal of Literature and Science, 17*, 103-127.

Khachonpisitsak, S., Yamane, S., Sriwichai, P., & Jaitrong, W. (2020). An updated checklist of the ants of Thailand (Hymenoptera, Formicidae). *ZooKeys, 998,* 1-182. https://dx.doi.org/10.3897%2Fzookeys.998.54902

Kokolo, B., Atteke, C., Mintsa, B.A.E., Ibrahim, B., McKey, D., & Blatrix, R. (2019). Congeneric mutualist ant symbionts (Tetraponera, Pseudomyrmecinae) differ in level of protection of their myrmecophyte hosts (Barteria, Passifloraceae). *Journal of Tropical Ecology, 35*(6), 255-259. https://doi.org/10.1017/S026646741900021X

Naephrai, S., Khacha-Ananda, S., Pitchakarn, P., & Jaikang, C. (2021). Composition and acute inflammatory response from *Tetraponera rufonigra* venom on RAW 264.7 macrophage cells. *Toxins, 13*(4), 257. https://doi.org/10.3390/toxins13040257

QGIS Development Team (2020). QGIS Geographic Information System. Open source geospatial foundation project. http://qgis.osgeo.org

Qin, Z., Munnoch, J.T., Devine, R., Holmes, N.A., Seipke, R.F., Wilkinson, K.A., Wilkinson, B., & Hutchings, M.I. (2017). Formicamycins, antibacterial polyketides produced by *Streptomyces formicae* isolated from African *Tetraponera* plant-ants. *Chemical Science, 8*(4), 3218-3227. https://doi.org/10.1039/C6SC04265A

Roger, J. (1863). Verzeichniss der Formiciden-Gattungen und Arten. *Berliner Entomologische Zeitschrift, 7,* 1-65.

Smith, F. (1858). Catalogue of Hymenopterous insects in the collection of the British Museum. Part VI. Formicidae. In Museum, B. (Ed.), (pp. 216). London.

Smith, F. (1877). Descriptions of new species of the genera *Pseudomyrma* and *Tetraponera*, belonging to the family Myrmicidae. *Transactions of the Entomological Society of London*, *II*, 57-72. https://doi.org/10.1111/j.1365-2311.1877.tb02901.x

Stoll, S., Gadau, J., Gross, R., & Feldhaar, H. (2007). Bacterial microbiota associated with ants of the genus *Tetraponera*. *Biological Journal of the Linnean Society, 90*(3), 399-412. https://doi.org/10.1111/j.1095-8312.2006.00730.x

Subedi, I.P., Budha, P.B., Bharti, H., & Alonso, L. (2020). An updated checklist of Nepalese ants (Hymenoptera, Formicidae). *ZooKeys, 1006*, 99-136. https://dx.doi.org/10.3897%2Fzookeys.1006.58808

Thapa, V.K. (2015). *Insect diversity in Nepal*. Kathmandu, Nepal. 1097 pp.

Walker, F. (1859). Characters of some apparently undescribed Ceylon insects. [part]. *Annals and Magazine of Natural History, 3*(4), 370-376.

Ward, P.S. (1990). The ant subfamily Pseudomyrmecinae (Hymenoptera: Formicidae): generic revision and relationship to other formicids. *Systematic Entomology, 15*(4), 449-489. https://doi.org/10.1111/j.1365-3113.1990.tb00077.x

Ward, P.S. (2001). Taxonomy, phylogeny and biogeography of the ant genus *Tetraponera* (Hymenoptera: Formicidae) in the Oriental and Australian regions. *Invertebrate Systematics, 15*(5), 589-665. https://doi.org/10.1071/IT01001

Ward, P.S. (2006). The ant genus *Tetraponera* in the Afrotropical region: synopsis of species groups and revision of the *T. ambigua*-group (Hymenoptera: Formicidae). *Myrmecologische Nachrichten, 8*, 119-130.

Ward, P.S. (2009). The ant genus *Tetraponera* in the Afrotropical region: the *T. grandidieri* group (Hymenoptera: Formicidae). *Journal of Hymenoptera Research, 18*(2), 285-304.

Ward, P.S., & Downie, D.A. (2005). The ant subfamily Pseudomyrmecinae (Hymenoptera: Formicidae): phylogeny and evolution of big-eyed arboreal ants. *Systematic Entomology, 30*(2), 310-335. https://doi.org/10.1111/j.1365-3113.2004.00281.x

Wheeler, W.M. (1919). The ants of Borneo. *Bulletin of the Museum of Comparative Zoology, 63*, 43-147.

Wheeler, W.M. (1921). Chinese ants collected by Prof. C. W. Howard. *Psyche* (Cambridge)*, 28*, 110-115.

Xu, Z., & Chai, Z. (2004). Systematic study on the ant genus *Tetraponera* F. smith (Hymenoptera, Formicidae) of China. *Acta Zootaxonomica Sinica, 29*(1), 63-76.