

Preliminary contributions toward a revision of the ant genus *Temnothorax* Mayr (Hymenoptera: Formicidae) from Pakistan

Muhammad Tariq RASHEED^{1*}, Imran BODLAH¹, Yusupov Zalikmhan MAGOMEDOVICH²,
Ammara Gull E FAREEN^{1,3}, Muhammad Adnan BODLAH⁴, Matthew PREBUS⁵, Aijaz Ahmad WACHKOO⁶

¹Insect Biodiversity and Conservation Group, Department of Entomology,

Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan

²Tembotov Institute of Ecology of Mountain Territories of Russian Academy of Sciences, Nalchik, Russia

³Department of Environmental Sciences, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan

⁴Fareed Biodiversity and Conservation Centre, Department of Agricultural Engineering,

Khawaja Fareed University of Engineering and Information Technology, Rahim Yar Khan, Punjab, Pakistan

⁵School of Life Sciences, Arizona State University, Tempe, AZ, USA

⁶Department of Zoology, Govt. Degree College Shopian, Jammu and Kashmir, India

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Abstract: *Temnothorax pakistanensis* sp. n., a new ant species from Khyber Pakhtunkhwa from the Himalayan range of Pakistan is described based on the worker caste and queen. An identification key and distribution map of the known Pakistani *Temnothorax* is presented. Summaries of the taxonomic history and biology of the three *Temnothorax* species of Pakistan is included.

Key words: *Temnothorax*, identification key, new species, Himalaya, distribution

1. Introduction

The ant genus *Temnothorax* Mayr is one of the most species-rich genera in the subfamily Myrmicinae, with 454 valid species and subspecies known worldwide from all zoogeographic regions (Salata and Borowiec, 2019; Sharaf et al., 2019). The taxonomic history of the genus is relatively long and complex, including the synonymy with *Leptothorax* Mayr, 1855 (Forel, 1890; Bolton, 1982) and subsequent removal from synonymy (Bernard, 1967; Bolton, 2003; Ward et al., 2015). Ants of this genus are found in a broad range of habitats, from deserts to rainforests (Guénard et al., 2016). *Temnothorax* ants are mostly monogynous; however, a few species have also been observed facultatively polygynous in nature (Buschinger, 1974; Alloway et al., 1983; Buschinger and Linksvayer, 2004). While most species are ground nesting, many species are documented as arboreal, and live in plant stems and the galleries of termites (Collingwood, 1961; Radchenko, 1994a, 1994b; Bharti et al., 2012; Prebus, 2017).

Members of the genus *Temnothorax* can be diagnosed on the basis of the following characters: clypeus feebly emarginated medially; stipes of maxilla without transverse crest; clypeal margin with carina medially; club of flagellum

usually with 3–4 distinct apical segments; antennae strongly clavate with 11–12 segments (Bolton, 2003; Salata and Borowiec, 2019).

Prebus (2017) reviewed the evolution, biogeography, and natural history of the *Temnothorax* ants; however, to date, very little is known about these ants from Pakistan, with reports of only two species, namely *T. pamiricus* (Ruzsky) and *T. desioi* (Menozi), reported from the Himalayan range of Pakistan (Menozi, 1939; Rasheed et al., 2019). We present what little is known about their biology below. In the present work, a new species of *Temnothorax* is described from the Himalayan range at Khyber Pakhtunkhwa based on the worker caste and queen (Figure 1).

2. Materials and methods

A colony of *Temnothorax* was collected from under a large stone with the help of a mouth aspirator. Collected specimens were examined under a LEICA MS5 microscope. Images of specimens were prepared using an Amscope 18 megapixel camera attached to a LEICA MS5 microscope. Prepared images were cleaned using CS6 Adobe Photoshop software as per requirements.

* Correspondence: tariq7262@gmail.com

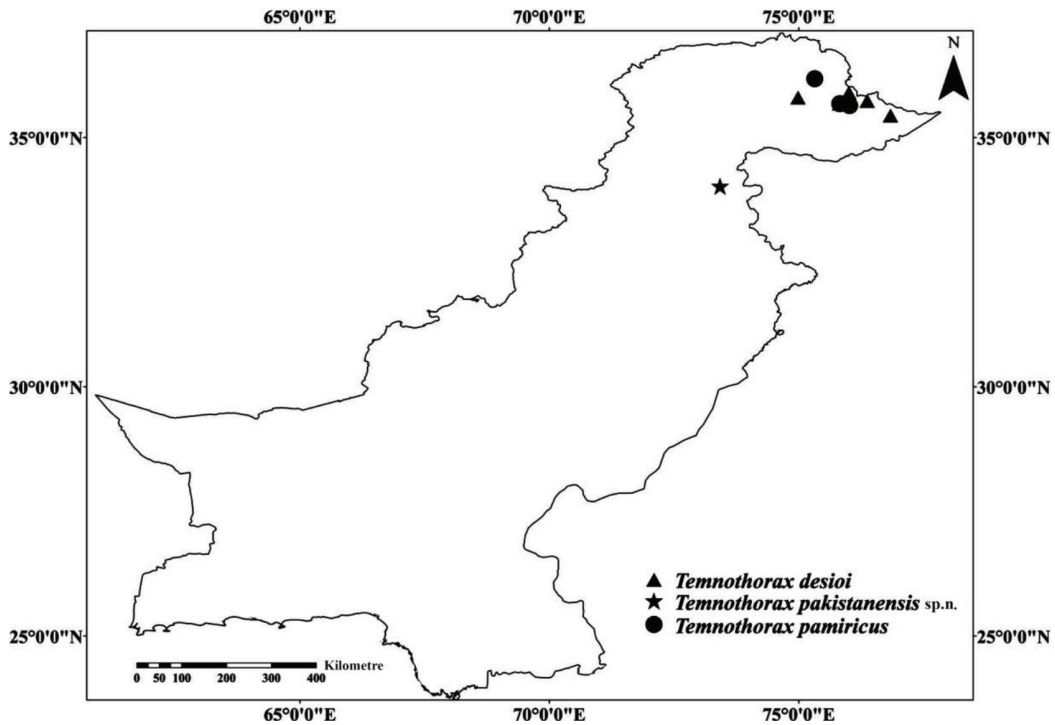


Figure 1. Distribution of known *Temnothorax* species across Pakistan.

All type material is housed in PMAS. Two paratype workers will be deposited at BMNH and two at CASC. The acronyms used and their equivalents are: BMNH: Natural History Museum, London, UK; CASC: California Academy of Sciences Collection, San Francisco, USA; MSNG: Museo Civico di Storia Naturale “Giacomo Doria”, Genova, Italy; MSNM: Museo Civico di Storia Naturale, Milano, Italy; PMAS: Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan.

Measurements were recorded in millimeters with measuring accuracies of ± 0.1 mm. The measurements within parenthesis are for the holotypes. Morphological terminology for measurements and indices are as follows:

EL: maximum diameter of compound eye measured in oblique lateral view.

FRS: Distance of the frontal carinae immediately caudal of posterior intersection points between frontal carinae and lamellae dorsal of torulus.

HL: Head length: maximum distance from midpoint of anterior clypeal margin to midpoint of posterior margin of head, measured in full-face view.

HW: Head width: width of head directly behind eyes, measured in full-face view.

PEW: Petiole width: maximum width of petiole node measured in dorsal view.

PH: Petiole height: maximum height of petiole, measured from apex of node to ventral edge of petiole, parallel to anterior margin of petiole.

PL: Petiole length: maximum length of petiole node measured in dorsal view from anterior notch close to propodeum to articulation with postpetiole.

PPH: Postpetiole height: maximum height of postpetiole measured in lateral view from highest (median) point of node to ventral outline.

PSL: Propodeal spine length: maximum length of spine measured in lateral view from base to tip of spine.

PW: Pronotal width: maximum width of pronotum measured in dorsal view.

SL: Scape length: maximum scape length excluding basal condyle and neck.

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

Indices.

CI: Cephalic index: $HW/HL \times 100$

PSLI: Propodeal spine index: $PSL/HW \times 100$

SC1: Scape index 1: $SL/HL \times 100$

SC2: Scape index 2: $SL/HW \times 100$

3. Results

3.1. *Temnothorax desioi* (Menozzi, 1939)

Figures 2A and 2B

Leptothorax desioi Menozzi, 1939: 303, figures. 7, 8. Syntypes, worker, queen and male, Spedizione Karakorum, Askole (Braldo) [MSNM] [Images of CASENT0904558 Syntype worker examined].



Figure 2. *Temnothorax desioi* (Menozzi, 1939) (Syntype worker) A–B. (A) Body, lateral view; (B) Head, full face view (CASENT0904558, photographer: Will Ericson).

Temnothorax desioi (Menozzi); Bolton 2003: 271. First combination in *Temnothorax*.

3.1.1. Distribution

India and Pakistan (Menozzi, 1939).

3.1.2. Ecological notes

T. desioi inhabits an elevational range of 3000–4300 m, and has been collected from meadows, the edges of springs, and rocky, vegetated slopes. It has been associated with *Tamarix*, *Salix*, *Juniperus*, *Ephedra*, and *Artemisia* (Menozzi 1939).

3.1.3. Comments

A subspecies, *T. desioi melanica*, was also described by Menozzi (1939).

3.2. *Temnothorax pakistanensis* sp. n.

Figures 3A–3D, 4A–4C

Holotype worker – (PMAS0001) Pakistan, Khyber Pakhtunkhwa, Khanspur (34.023106°N, 73.421944°E) 2184 m, 14-iii-2019 (PMAS); Paratype: 10 workers (PMAS0002–PMAS0011), same data as holotype (BMNH, CASC, PMAS) hand collection (coll. M. Tariq Rasheed); 1 queen (PMAS0012), same locality as above (PMAS) hand collection (coll. Imran Bodlah).

3.2.1. Description (worker): Figures 3A–3D

Head: In full face view longer than broad with feebly rounded posterior margin, rounded corners and feebly convex sides, anterior clypeal margin entire; mandibles armed with five teeth decreasing in size from apex to base; antennae 12-segmented; scape, relatively short clearly not reaching posterior margin of head by about the length of second funicular segment in full-face view.

Mesosoma: Promesonotal suture indistinct; promesonotum flat in profile; metanotal groove distinct; propodeal spines pointed, acute and broadly based. In profile petiole with a peduncle; the anterior face forms a shallow concavity; anterior face of petiolar node forms a right angle with posterior face; subpetiolar process reduced to a small denticle. In profile postpetiole globular and relatively lower than the height of the petiole; in dorsal view broader than long, trapezoidal, and broadest anteriorly.

Sculpture: Mandibles longitudinally rugulose; cephalic dorsum with fine but irregular striations; clypeus with 4–5 longitudinal rugulae. In lateral view pronotum weakly rugulose; meso and metanotum finely rugulose, smooth between rugulae; petiole weakly reticulate. In dorsal view mesosoma densely rugulose; petiole feebly rugulose. Postpetiole strongly microreticulate throughout.

Vestiture: Anterior clypeal margin convex with 4–5 protrusive setae. Body covered with erect and suberect hairs; antennae with appressed pubescence, abundant on the funicular segments.

Color: Head yellowish to light brown; antennae, mesosoma, petiole and post petiole yellowish all over; gaster brownish, basally light yellow.

Measurements (n = 5): EL: 0.10–0.13 (0.13); FRS: 0.10–0.12 (0.11); HL: 0.61–0.64 (0.61); HW: 0.46–0.56 (0.46); PEW: 0.9–0.13 (0.13); PH: 0.18–0.19 (0.18); PL: 0.24–0.28 (0.28); PPH: 0.10–0.11 (0.11); PS�: 0.08–0.11 (0.09); PW: 0.33–0.36 (0.34); SL: 0.45–0.46 (0.46); WL: 0.67–0.73 (0.68). Indices: CI: 125.49–132.60 (132.60); PSLI: 17.39–21.56 (19.56); SCII: 71.87–75.40 (75.40); SCII2: 80.70–102 (100).

3.2.2. Description (Queen): Figures 4A–4C

Measurements (n = 1): EL: 0.19; FRS: 0.30; HL: 0.69; HW: 0.62; PEW: 0.15; PH: 0.26; PL: 0.35; PPH: 0.15; PS�: 0.12; PW: 0.70; SL: 0.49; WL: 1.06. Indices: CI: 111.29; PSLI: 19.35; SCII: 71.01; SCII2: 79.03.

Resembles the worker, with modifications expected for caste, but with the following differences: and the following differences: body massive, frontal carina more prominent; eyes large placed at the middle of head, three prominent ocelli present; anterior clypeal margin rugulose longitudinally, posterior margin smooth; antennal scape short, reaching the level of ocelli; mandibles as in worker caste; mesosoma with scutellum at the same level as of the scutum; scutum with distinct rugae, scutellum mostly smooth, propodeal spines short, acute and broadly based, propodeal declivity very steep; petiolar node dorsum flat, postpetiole broad; gaster long and thick; color slightly darker than in workers: head, mesosoma, petiole, and post petiole brownish to dark brown; gaster brown with yellowish basal segment.

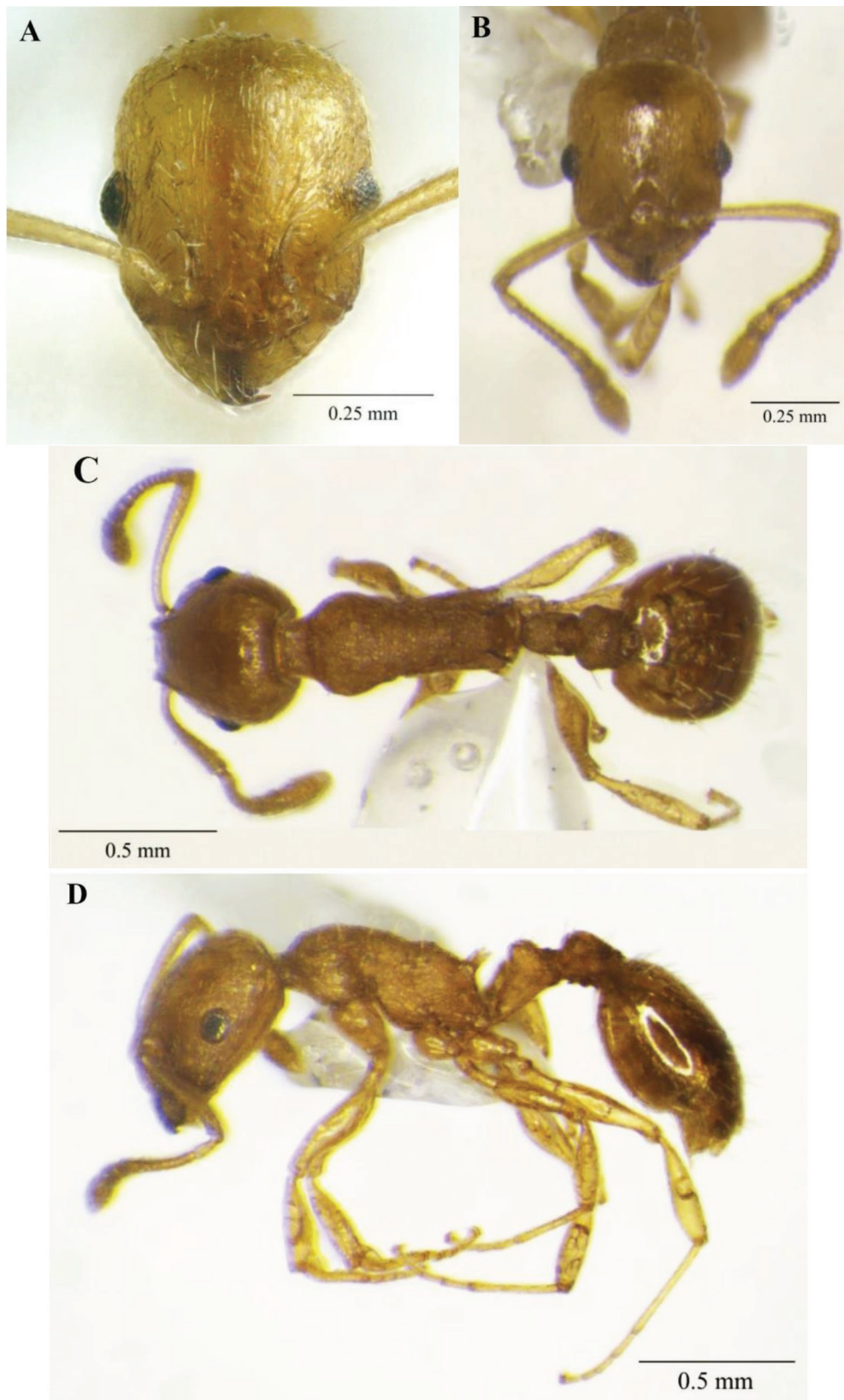


Figure 3. *Temnothorax pakistanensis* sp. n. (Worker) A–D. (A) Head, full-face view; (B) Head, full-face view with antennae; (C) Body, dorsal view; (D) Body, lateral view.

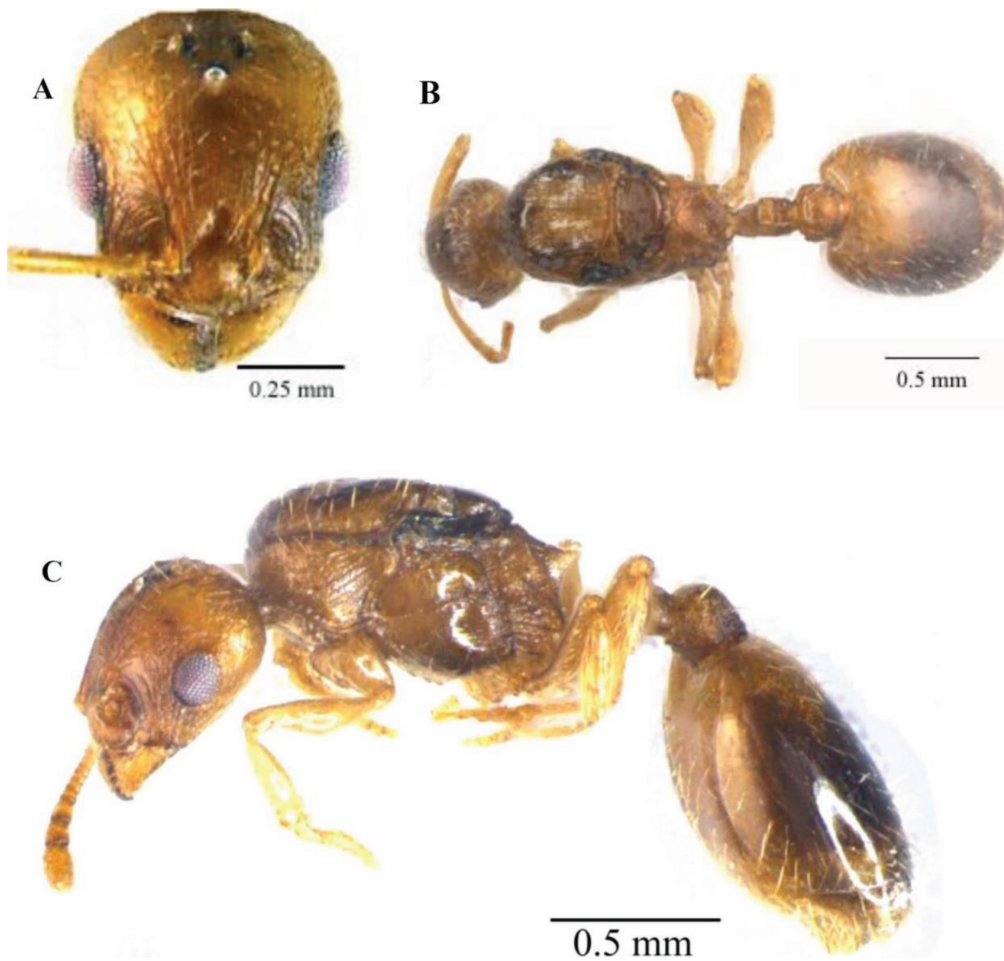


Figure 4. *Temnothorax pakistanensis* sp. n. (Queen) A–C. (A) Head, full-face view; (B) Body, dorsal view; (C) Body, lateral view.

3.2.3. Distribution

This newly recorded species has been collected from Khanspur village of Khyber Pakhtunkhwa province in the Himalayan range of Pakistan.

3.2.4. Etymology

This species is named after the type locality, Pakistan.

3.2.5. Ecological notes

A single colony of newly recorded species was collected from under a large stone in a thick pine forest of Khyber Pakhtunkhwa in the Himalayan range of Pakistan. Several individuals were observed foraging on small grasses alongside ants of the genus *Myrmica*. The nesting site was located a few meters away from a roadside. The collection locality has sufficient water sources, low temperature, high humidity, and low human activity.

3.2.6. Comparative notes

This species most resembles *T. himachalensis* Bharti, Gul and Schulz, 2012 (Figures 5A and 5B), but can be distinguished by nearly rectangular head, long and distinct

petiolar peduncle, smooth areas between rugae, longer propodeal spines and rounded postpetiole in dorsal view. Workers of *T. himachalensis* have subrectangular head, shorter peduncle, sculpture minutely microreticulate between small patches of rugae, relatively shorter propodeal spines and trapezoidal postpetiole in dorsal view.

3. 3. *Temnothorax pamiricus* (Ruzsky, 1902)

Figures 5C and 5D

Leptothorax pamiricus Ruzsky, 1902: 478. Lectotype worker, Pamir, Russia [MSNG] [Images of CASENT0904744 Lectotype worker examined].

Leptothorax bulgaricus pamiricus Ruzsky; Forel, 1904: 375; Kuznetsov-Ugamsky, 1926: 75; Menozzi, 1939: 303.

Leptothorax bulgaricus pamiricus Ruzsky; Menozzi, 1939: 303. Queen and male described.

Leptothorax pamiricus Ruzsky; Radchenko, 1994b: 152.

Temnothorax pamiricus (Ruzsky); Bolton 2003: 271. First combination in *Temnothorax*.

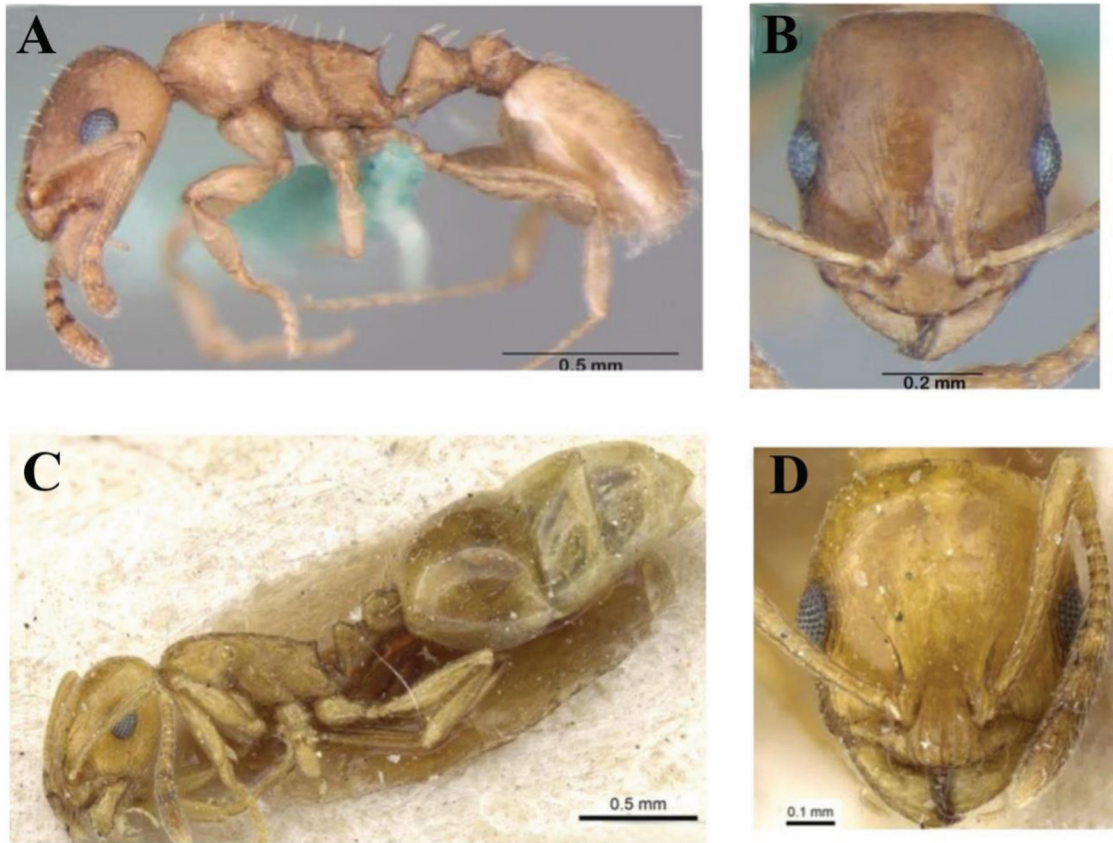


Figure 5. *Temnothorax himachalensis* Bharti, Gul and Schulz, 2012 (Holotype worker) A–B. (A) Body, lateral view; (B) Head, full face view (ANTWEB1008014, photographer: Himender Bharti); *Temnothorax pamiricus* (Ruzsky, 1902) (Lectotype worker) C–D. (C) Body, lateral view; (D) Head, full face view (CASENT0904744, photographer: Zach Lieberman).

3.3.1. Distribution

India, Pakistan and Tajikistan (Ruzsky, 1902; Menozzi, 1939).

3.3.2. Ecological notes

T. pamiricus inhabits an elevational range of 2100–3700 m and has been collected from meadows, along the edges of springs and glacial lakes, and from rocky slopes in arid habitats throughout its range (Menozzi, 1939). It has been associated with *Tamarix*, *Salix*, and *Artemesia* (Menozzi 1939).

3.3.3. Comments

T. pamiricus was originally described from worker material collected in the Pamir mountains in present-day Tajikistan (Ruzsky, 1902). Menozzi (1939) later described the queen and male of *T. pamiricus* and documented additional collections northern India and Pakistan. *T. pamiricus* has historically been considered a subspecies of *T. bulgaricus* and was synonymized with it soon after description (Forel, 1904; Kuznetsov-Ugamsky, 1926; Menozzi, 1939) until revisionary work by Radchenko (1994b, 1994c) revived it as a species.

4. Key to the Pakistani species of the genus *Temnothorax* based on worker caste

1. Metanotal groove present, propodeal spines distinct and long (Figure 3D) *T. pakistanensis* sp. n.
 - Metanotal groove absent, propodeal spines very short to reduced (Figures 2A and 5C) 2
2. Large species; body coloration yellowish; mesosoma smooth and shiny with a few rugulae; propodeal spines short but distinct (Figure 5C) *T. pamiricus* (Ruzsky)
 - Small species; body brownish; mesosoma dull with thick reticulae; propodeal spines reduced to triangular tubercles (Figure 2A) *T. desioi* (Menozzi)

Nomenclatural acts: This work and the nomenclatural acts it contains have been registered in ZooBank. The ZooBank Life Science Identifier (LSID) for this publication is: <http://zoobank.org/urn:lsid:zoobank.org:pub:CCB28C28-5A08-4F8B-85B5-419E319345F6>

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