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New additions to the fauna of ants of the genus *Temnothorax* Mayr, 1861 (Hymenoptera: Formicidae) of Pakistan

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Abstract. Two new ant species *Temnothorax himalaicum* sp. n., and *T. khatrii* sp. n., are described from Pakistan. *Temnothorax himalaicum* sp. n. is characterized by a head of moderate length, a mesosoma of medium length, without metanotal groove, propodeum with long, thin spines that are curved at the ends; the head dorsum is smooth and shiny, the rest of the head with coarse longitudinal rugose sculpture, the mesosoma with coarse longitudinal reticulate rugae laterally and dorsally, the gaps between which are smooth and shiny; the colour of the mesosoma and waist is reddish-orange, the head is dark brown, the gaster is almost black, without a light spot at the base. *Temnothorax khatrii* sp. n. is characterized by a short head, relatively long mesosoma with a deep metanotal groove, propodeum with very short, but distinct, acute triangular teeth; the head is smooth and shiny, only the areas around the eyes and genae with longitudinal rugae, the mesosoma is smooth and shiny, only the sides of the pronotum and mesopleurae with rare, fine longitudinal rugae; mesosoma and waist are light brown; head and gaster are darker. *Temnothorax microreticulatus* Bharti, Gul et Schulz, 2012 is recorded for the first time for this country. An identification key to worker caste of known species for Pakistan is provided.

Key words: Formicidae, ants, *Temnothorax*, taxonomy, new species, identification key, Pakistan.

Новые дополнения к фауне муравьев рода *Temnothorax* Mayr, 1861 (Hymenoptera: Formicidae) Пакистана

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Резюме. Два новых вида муравьев, *Temnothorax himalaicum* sp. n. и *T. khatrii* sp. n., описано из Пакистана. *Temnothorax himalaicum* sp. n. характеризуется головой умеренной длины, грудью средней длины без метанотального вдавления, проподеумом с длинными тонкими зубцами, которые изогнуты на концах; верх головы гладкий и блестящий, остальная поверхность головы с грубыми продольными морщинками, грудь с боков и сверху с грубыми продольными сетчатыми морщинками, промежутки между которыми гладкие и блестящие; цвет груди и стебелька красновато-оранжевый, голова темно-коричневая, брюшко почти черное, без светлого пятна у основания. *Temnothorax khatrii* sp. n. характеризуется короткой головой, относительно длинной грудью с глубоким метанотальным вдавлением, проподеумом с очень короткими, но явственными острыми треугольными зубчиками; голова гладкая и блестящая, только участки вокруг глаз и щеки с продольными морщинками, грудь гладкая и блестящая, только бока пронотума и мезоплеуры с редкими нежными продольными морщинками; грудь и стебелек светло-коричневые, голова и брюшко темнее. *Temnothorax microreticulatus* Bharti, Gul et Schulz, 2012 зарегистрирован впервые для этой страны. Приводится определительная таблица по рабочим для всех известных из Пакистана видов.

Ключевые слова: Formicidae, муравьи, *Temnothorax*, таксономия, новые виды, определительная таблица, Пакистан.

Introduction

Temnothorax Mayr, 1861 is one of the largest genera of ants in the world and one of the largest in the Palaearctic region. Currently, 414 species and 37 subspecies of this genus are known in the world, and more than 300 taxa are distributed in the Palaearctic [Bolton, 2020]. In the Palaearctic, the greatest species diversity of *Temnothorax* is registered in the Mediterranean, the Caucasus, mountains of Central Asia, and south of the Far East (Korean Peninsula, China and Japan) [Radchenko, 2016]. In total, 11 species and one subspecies of the genus *Temnothorax* are described from the Himalayas [Menozi, 1939; Bharti et al., 2012, 2016a, b; Rasheed et al., 2020].

The ant fauna of Pakistan is very poorly studied. At the present time, 103 species of ants are registered for this territory [Rasheed et al., 2019]. Of these, only three species of *Temnothorax* – *T. desioi* (Menozi, 1939), *T. pamiricus* (Ruzsky, 1902) and *T. pakistanensis* Rasheed et al., 2020 are known from Pakistan [Menozi, 1939; Rasheed et al., 2020]. Moreover, the territory of India and Pakistan is the type locality for the first species. Below we add two new species and one new record of *Temnothorax* for Pakistan.

Material and methods

This paper is based on the material collected by the second author, G.M. Lakho, in 2016–2017 in Pakistan.

Information on altitude (when GPS was not used) was taken from Google Earth Pro version 7.1.8.3036 based on coordinates. The main sampling method used to collect ants was hand collection targeting nests.

A Leica M205C stereo microscope was used for photography and morphological analysis. Subsequent image processing was performed using Helicon Focus Pro 7 software. SEM photographs were obtained from the scanning electronic microscopes Hitachi TM3000 and Quanta 200 3D. All measurements are given in millimeters (accurate to 0.01 mm) and follow standard measurements of Rasheed et al. [2020] with changes.

The type material is preserved in the Zoological Institute of the Russian Academy of Sciences (ZISP, St Petersburg, Russia), Ghulam Mujtaba Lakho's private collection (GMLK).

Measurements:

HL (head length) – maximum length of the head in dorsal view, measured in a straight line from the most anterior point of clypeus to the mid-point of occipital margin;

HW (head width) – maximum width of the head in dorsal view behind (above) the eyes;

SL (scape length) – maximum straight-line length of the scape from its apex to the articulation with condylar bulb;

OL (ocular length) – maximum length of the eye;

FW (frontal width) – minimal width of the frons between the frontal carinae;

FLW (frontal lobes width) – maximum distance between the outer borders of the frontal lobes;

AL (mesosomal length) – diagonal length of the mesosoma (seen in profile) from the anterior end of the neck shield to the posterior margin of the propodeal lobes;

AH (mesosomal height) – measured in profile from the imaginary line connecting uppermost points of promesonotum and propodeum perpendicularly to the lowermost point of mesopleuron;

PNW (pronotum width) – maximum width of the pronotum in dorsal view;

HTL (hind tibia length) – maximum length of the hind tibia;

PL (petiolar length) – maximum length of the petiole in dorsal view, measured from the posterodorsal margin of petiole to the articulation with propodeum (just below the posterior visible margin of propodeum); the petiole should be positioned so that measured points lay on the same plane;

PW (petiolar width) – maximum width of the petiole in dorsal view;

PH (petiolar height) – maximum height of petiole in profile, measured from the uppermost point of the petiolar node perpendicularly to the imaginary line between the anteroventral (just behind the subpetiolar process) and posteroventral points of petiole;

PPL (postpetiolar length) – maximum length of postpetiole in dorsal view between its visible anterior and posterior margins;

PPW (postpetiolar width) – maximum width of the postpetiole in dorsal view;

PPH (postpetiolar height) – maximum height of the postpetiole in profile from the uppermost to the lowermost point, measured perpendicularly to the tergo-sternal suture;

ESL (propodeal spine length) – length of propodeal spine, measured in lateral view from its tip to the base.

Indices: CI (cephalic index) – HL/HW; FLI (frontal lobe index) – FLW/FW; SI1 (scape index 1) – SL/HL; SI2 (scape index 2) – SL/HW; OI1 (ocular index 1) – OL/HL; OI2 (ocular index 2) – OL/HW; PI (petiolar index) – PL/PH; PPI (postpetiolar index) – PPL/PPH; ESLI (propodeal spine index) – ESL/HW; AI (mesosomal index) – AL/AH.

Temnothorax himalaicum

Yusupov, Lakho et Dubovikoff, **sp. n.**

(Figs 1–6)

Material. Holotype, worker (ZISP): Pakistan, Punjab Province, 60 km from Islamabad, Sindh house Koh mari, 33.912245°N / 73.383076°E, 1866 m a.s.l., 5.07.2017 (G.M. Lakho). Paratype: 1 worker (GMLK), same data as in holotype.

Description. Workers. Head of moderate length, with very weakly convex sides, feebly convex occipital margin and widely rounded occipital corners. Anterior clypeal margin slightly convex, gradually rounded, without a medial notch. Eyes rather big, subequal to length of genae, situated approximately at midlength of sides of head. Frontal lobes not extended, so that distance between their outer margins subequal to width of frons. Scape relatively long, extending nearly to the posterior margin of head when fully retracted. Masticatory margin of mandibles with 5 teeth, apical and preapical ones are the largest.

Mesosoma of moderate length, without metanotal groove, its dorsum feebly convex, promesonotal suture absent (seen from above). Propodeum with long and thin spines. Petiole relatively long, with distinct, but short peduncle, its anterior surface feebly concave in profile, petiolar node distinct, weakly convex, with well-developed horizontal or somewhat inclined posteriorly dorsal plate. Postpetiole subglobular, slightly shorter than height.

Whole head excluding dorsum and central part of frons, with coarse longitudinal rugosity, rest of the head smooth and shiny. Seen in profile, genae with coarse sinuous longitudinal rugae, while temples are smooth and shiny. Clypeus with few fine lateral longitudinal carinae, its surface smooth and shiny. Mandibles with very fine superficial striation; appearing shiny.

Mesosoma laterally and dorsally with coarse longitudinal reticulate rugae. Surface between rugae smooth and shiny. Petiolar node and postpetiole densely punctate, short rugae and reticulation also present. Gaster smooth and shiny.

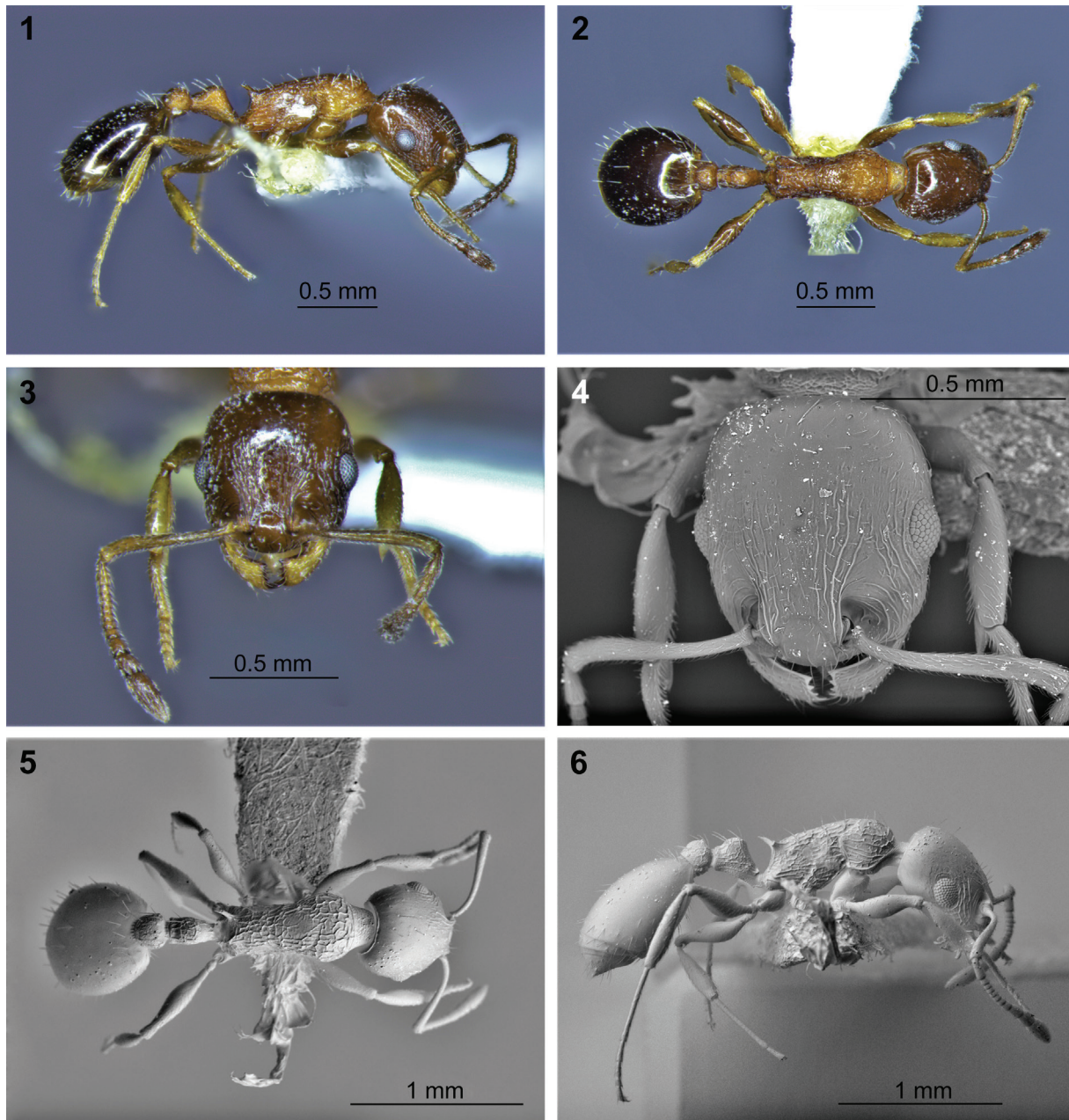
Whole body with numerous straight, moderately long and blunt standing hairs, legs with sparse decumbent pubescence, scape with abundant short subdecumbent pilosity. Mesosoma and waist reddish-orange, head dorsum dark brown, appendages and mandibles yellowish-brown, antennal club somewhat darkened. All gastral tergites almost black.

Measurements, ordered as holotype (paratype): HL 0.71 (0.68), HW 0.59 (0.56), SL 0.59 (0.51), OL 0.17 (0.15), FW 0.2 (0.18), FLW 0.21 (0.19), AL 0.86 (0.82), AH 0.4 (0.35), PNW 0.43 (0.41), HTL 0.49 (0.47), PL 0.26 (0.3), PW 0.18 (0.16), PH 0.23 (0.24), PPL 0.19 (0.21), PPW 0.22 (0.18), PPH 0.21 (0.23), ESL 0.14 (0.15), $n = 2$.

Indices: CI 1.2 (1.21), SI1 0.83 (0.75), SI2 1 (0.91), FLI 1.05 (1.05), OI1 0.24 (0.22), OI2 0.29 (0.27), PI 1.13 (1.25), PPI 0.9 (0.91), ESLI 0.24 (0.27), AI 2.15 (2.34).

Queens and males unknown.

Bionomics. Found at the altitude 1870 m a.s.l., collected on stones, under leaves.



Figs 1–6. *Temnothorax himalaicum* sp. n., worker, holotype.

1, 6 – habitus, lateral view; 2, 5 – habitus, dorsal view; 3–4 – head.

Рис. 1–6. *Temnothorax himalaicum* sp. n., рабочий, голотип.

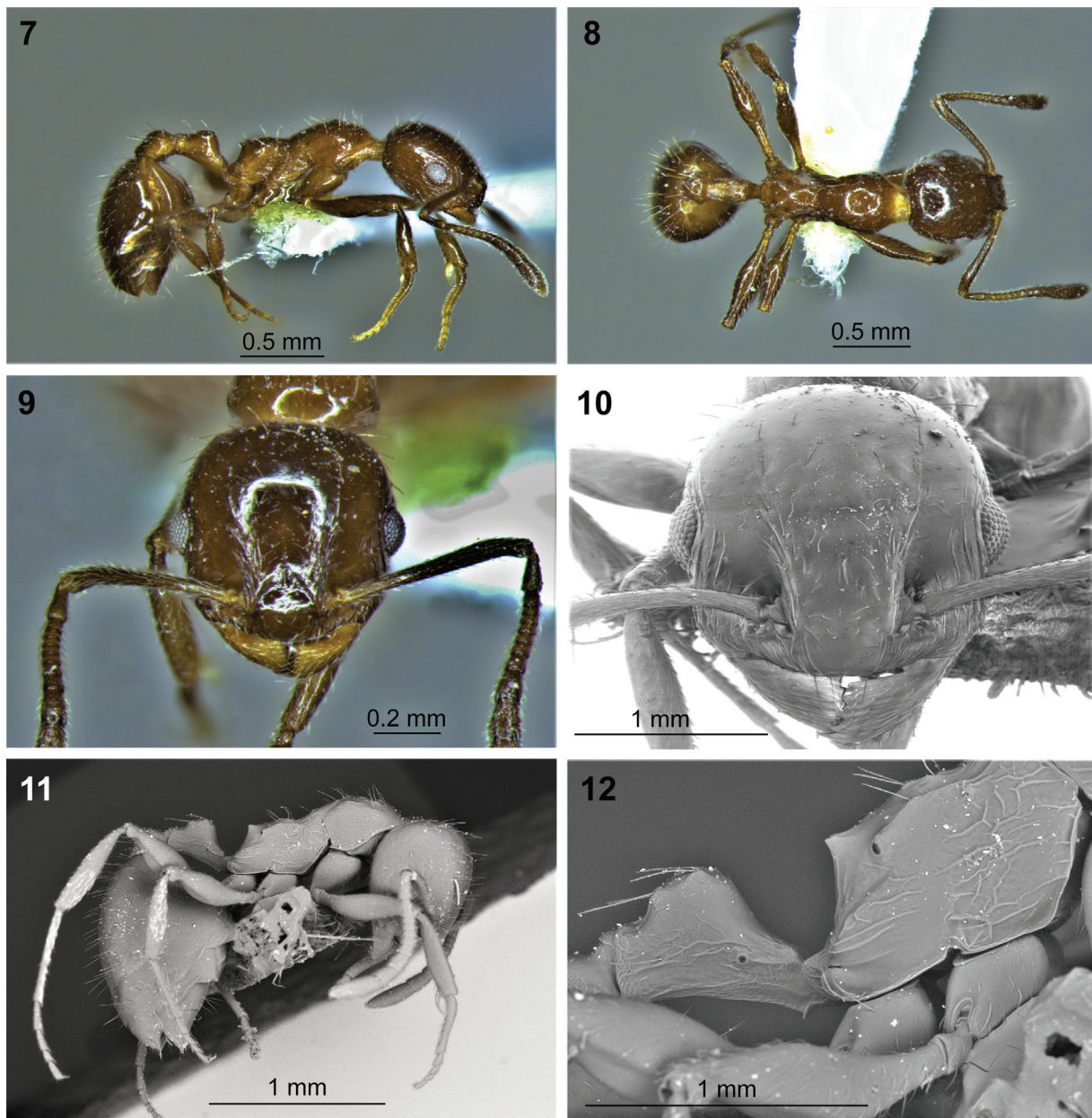
1, 6 – габитус, вид сбоку; 2, 5 – габитус, вид сверху; 3–4 – голова.

Comparative diagnosis. *Temnothorax himalaicum* sp. n. is related to *T. kashmirensis* Bharti, Gul et Schulz, 2012 (based on the original description and photos), but it well distinguished by the sculpture of the head and mesosoma: in *T. kashmirensis* the head is mostly smooth and shiny, whereas in *T. himalaicum* sp. n. only the occiput of the head and the central part of frons is smooth and shiny, the rest of the surface has coarse longitudinal rugulosity. *Temnothorax himalaicum* sp. n. has thick, longitudinal coarse reticulate rugae on the mesosoma, in *T. kashmirensis* the sculpture of mesosoma consists of

thinner longitudinal rugae. In addition, *T. himalaicum* sp. n. has more sparse hairs on the first gastral tergite than in *T. kashmirensis* and curved propodeal spines. From all other Himalayan species of *Temnothorax*, *T. himalaicum* sp. n. is distinguished by the long and thin spines of the propodeum, and contrasting bicoloured body, while other species are coloured differently.

Distribution. Pakistan: North-West Himalaya, Punjab Province.

Etymology. The species is named after the type locality, Himalaya.



Figs 7–12. *Temnothorax khatrii* sp. n.

7–10 – worker, holotype; 11–12 – worker, paratype. 7, 11 – habitus, lateral view; 8 – habitus, dorsal view; 9–10 – head; 12 – propodeum and petiole.

Рис. 7–12. *Temnothorax khatrii* sp. n.

7–10 – рабочий, голотип; 11–12 – рабочий, паратип. 7, 11 – габитус, вид сбоку; 8 – габитус, вид сверху; 9–10 – голова; 12 – проподоум и петиоль.

Temnothorax khatrii
Yusupov, Lakho et Dubovikoff sp. n.
(Figs 7–12)

Material. Holotype, worker (ZISP): Pakistan, Khyber Pakhtunkhwa Province, Mori Chitral, 35.98641692°N / 71.97583547°E, 1527 m a.s.l., 12.07.2017 (G.M. Lakho). Paratypes: 2 workers (ZISP), 2 workers (GMLK), same data as in holotype.

Description. Workers. Head longer than broad, with weakly convex sides, occipital margin convex, occipital corners widely rounded. Anterior clypeal margin slightly convex, gradually rounded, without a medial notch. Eyes of moderate size, somewhat shorter than length of genae, situated approximately at midlength of sides of head. Frontal lobes extended, so that distance

between their outer margins bigger to width of frons. Scape fairly long, slightly surpassing occipital margin when fully retracted. Masticatory margin of mandibles with 5 teeth, apical and preapical ones are the largest.

Mesosoma relatively long, with deep metanotal groove, and strongly convex mesonotal dorsum, promesonotal suture absent (seen from above). Propodeal dorsum lies lower than promesonotal dorsum. Propodeum distinctly convex in profile, with very short but distinct, acute triangular teeth. Petiole relatively high, with distinct long peduncle, its anterior surface concave, petiolar node distinct, weakly convex, with well-developed horizontal or somewhat posteriorly inclined dorsal surface. Postpetiole subglobular, slightly shorter than height.

Head dorsum smooth and shiny, sparse longitudinal rugae present only in the areas near the eyes, genae, and near the frontal carina. Seen in profile, genae with sinuous longitudinal rugae, while temples smooth and shiny. Clypeus with several fine lateral longitudinal carinae, its surface smooth and shiny. Mandibles with very fine superficial striation; appearing shiny.

Mesosoma laterally and dorsally smooth and shiny, only sides of pronotum and mesopleurae with sparse, fine longitudinal rugae. Petiolar node and postpetiole smooth and shiny, with short, fine striation laterally. Gaster smooth and shiny.

Whole body with numerous straight, long and blunt standing hairs, legs with sparse decumbent pubescence, scape with abundant short subdecumbent pilosity. Mesosoma and waist light brown (chocolate colour), head dorsum dark brown, appendages and mandibles yellowish-brown, antennal club somewhat darkened. All gastral tergite dark brown.

Measurements, ordered as holotype (min–max) [mean \pm SD]: HL 0.79 (0.74–0.85) [0.80 \pm 0.044], HW 0.69 (0.64–0.75) [0.70 \pm 0.046], SL 0.67 (0.63–0.72) [0.66 \pm 0.037], OL 0.17 (0.15–0.2) [0.17 \pm 0.020], FW 0.26 (0.23–0.27) [0.25 \pm 0.016], FLW 0.3 (0.27–0.31) [0.29 \pm 0.018], AL 0.98 (0.92–1.09) [1.01 \pm 0.076], AH 0.35 (0.32–0.41) [0.36 \pm 0.035], PNW 0.52 (0.46–0.56) [0.52 \pm 0.040], HTL 0.64 (0.58–0.64) [0.61 \pm 0.023], PL 0.32 (0.3–0.32) [0.31 \pm 0.008], PW 0.2 (0.18–0.22) [0.19 \pm 0.016], PH 0.25 (0.23–0.28) [0.25 \pm 0.022], PPL 0.22 (0.2–0.23) [0.21 \pm 0.011], PPW 0.26 (0.24–0.28) [0.26 \pm 0.017], PPH 0.23 (0.21–0.26) [0.23 \pm 0.022], ESL 0.04 (0.04–0.06) [0.05 \pm 0.008], $n = 5$.

Indices: CI 1.14 (1.12–1.15) [1.14 \pm 0.011], SI 0.85 (0.8–0.85) [0.83 \pm 0.027], SI2 0.97 (0.89–0.98) [0.94 \pm 0.039], FLI 1.15 (1.15–1.19) [1.16 \pm 0.016], OI1 0.21 (0.2–0.24) [0.21 \pm 0.016], OI2 0.24 (0.23–0.26) [0.24 \pm 0.013], PI 1.28 (1.14–1.34) [1.25 \pm 0.084], PPI 0.95 (0.88–1) [0.93 \pm 0.051], ESLI 0.06 (0.06–0.08) [0.06 \pm 0.008], AI 2.8 (2.66–2.87) [2.81 \pm 0.088].

Queens and males unknown.

Bionomics. Collected at 1527 m a.s.l., under stones partially covered with grass.

Comparative diagnosis. *Temnothorax khatrii* sp. n. is close to *T. fultonii* (Forel, 1902), but it well differs from the latter by the shorter head (CI 1.12–1.15 vs 1.20–1.39), as well as by the mesosomal sculpture, which is mostly smooth and shiny with sparse longitudinal rugae in *T. khatrii* sp. n., whereas rugosity is more pronounced in *T. fultonii*. From all other Himalayan species of *Temnothorax* with a deep metanotal groove, *T. khatrii* sp. n. differs by the smooth and shiny mesosoma and waist.

Distribution. Pakistan: Hindukush, Khyber Pakhtunkhwa Province.

Etymology. The species is dedicated to Dr Imran Khatri (Department of Entomology, Sindh Agriculture University, Tandojam, Sindh, Pakistan).

Temnothorax microreticulatus
Bharti, Gul et Schulz, 2012
(Figs 7–9)

Material. Pakistan: 10 workers (GMLK), Punjab Province, 60 km from Islamabad, Sindh house Koh mari, 33.912245°N / 73.383076°E, 1850 m a.s.l., 5.07.2017 (G.M. Lakho); 12 workers, Ghora galli, 33.907473°N / 73.277222°E, 1710 m a.s.l., 5.07.2017 (G.M. Lakho).

Bionomics. Collected on the rocky area covered with grasses and shrubs and big trees. Altitude 1700–1850 m a.s.l.

Distribution. Pakistan: Punjab Province; India: Himachal Pradesh [Bharti et al., 2012, 2016a, b].

**A revised key to the known Pakistan species
of *Temnothorax* based on worker caste**
(modified after Bharti et al. [2016b])

1. Mesosoma without metanotal groove 2
- Mesosoma with deep metanotal groove 4
2. Propodeum with long spines (Figs 1, 5, 6)
..... *T. himalaicum* sp. n.
- Propodeum with very short teeth or tubercles (Fig 12) ... 3
3. Mesosoma, the base of the first gastral segment, petiole, postpetiole, legs and antennae testaceous yellow to yellowish brown; head and rest of gaster brown
..... *T. desioi* (Menozzi, 1939)
- Whole body light yellow *T. pamiricus* (Ruzsky, 1902)
4. Whole body light to dark-yellow; scape short, not reaching the posterior margin of head when fully retracted; gastral tergite yellow, first tergite with a brown patch in the middle 5
- Whole body light-brown; scape long, reaches beyond the posterior margin of head when fully retracted; gastral tergite completely dark brown (Figs 7–9)
..... *T. khatrii* sp. n.
5. Head shorter (CI = 1.15–1.17), spines of propodeum straight, shorter (PSLI = 15–18)
..... *T. microreticulatus* Bharti, Gul et Schulz, 2012
- Head longer (CI = 1.25–1.32), spines of propodeum curved apically, longer (PSLI = 17–21)
..... *T. pakistanensis* Rasheed et al., 2020

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