

# Two new species of the genus *Myrmica* (Hymenoptera: Formicidae: Myrmicinae) from the Himalaya

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Two new species of the genus *Myrmica* are described from the Himalaya. *Myrmica adrijae* sp. n. is reported from North-western region in India, while *Myrmica pseudorugosa* sp. n. is reported from North-eastern Pakistan. *Myrmica adrijae* sp. n. and *Myrmica pseudorugosa* sp. n. belong to the *smythiesii* and *rugosa* species groups respectively. Both species are considerably distinct from already described species in these groups.

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## Introduction

The genus *Myrmica* Latreille, 1804 is represented in the old world by 146 valid species, which are well distributed in the Palearctic zone and in south-east Asian tropical and subtropical regions (Radchenko & Elmes 2010; Bharti 2011, 2012; Bharti & Sharma 2011a, 2011b, 2011c). The central Asian mountains, which comprise Hindu Kush, Karakorum and the south-western slopes of the Himalaya (Afghanistan, Pakistan, India, Nepal and Bhutan), harbour 37 species representing seven species groups. Of these, 35 species (94%) are endemic to this region. The diversity of this region is quite interesting because the species from this region show a plesiomorphic state of features (Radchenko & Elmes 2010). However, much less is known from the Indian Himalaya. One of the significant reasons is the lack of material from this region. Given the geological history of Himalaya, and as elucidated by Moreau et al. (2006), the diversification of major ant lineages occurred from the beginning of the early Paleocene to the late Cretaceous, 60 to 100 million years ago in the age that the angiosperms diversified. Interestingly, it is the same time span during which the Himalaya was formed. The initial mountain building processes were underway about 70 million years ago when the Indo-Australian plate col-

lided with the Eurasian plate, followed by a second phase of mountain development about 65 million years ago. Rising of the Himalaya as an isolation barrier has led to a high degree of endemism (Radchenko & Elmes 2001, 2010; Bharti 2008a, 2008b, 2011, 2012; Bharti & Sharma 2011a, 2011b, 2011c). Only during the last ten years, the author has started exploring the Himalayan fauna. The region appears to have quite a number of undescribed or unnoticed species which would contribute in understanding the systematics of *Myrmica* of the old world.

The species groups in *Myrmica* as created by Radchenko & Elmes (2001, 2010) are arbitrary divisions, but the groups seem to be supported by molecular studies (Jansen et al. 2009, 2010) and appear to be monophyletic. The two new species, viz., *Myrmica adrijae* sp. n. and *Myrmica pseudorugosa* sp. n., which are described in the present paper, belong to the *smythiesii* and *rugosa* species groups, respectively. The *rugosa* species group is currently represented by nine species and is endemic to central Asian mountains. The *smythiesii* species group is currently represented by three species from central Asian mountains and two species from the Tibetan Plateau. The two new species are quite distinct from already known species in these species groups.

## Material, methods and terminology

Specimens were preserved in 70% alcohol. These were later pinned as per standard procedure in ant taxonomy, and examined with a Nikon SMZ-1500 stereo zoom microscope. Digital images were captured using Auto-Montage software (Syncroscopy, Division of Synoptics). These images were cleaned by using Helicon Filter 5 and Adobe Photoshop CS. For morphological measurements, Radchenko & Elmes (1998, 2010) have been followed.

## Depositories

BMNH, The Natural History Museum, London, UK; PUAC, Punjabi University Patiala, Ant Collection at Department of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab, India.

Holotypes of both the new species are in PUAC, while one paratype of each species will be deposited in BMNH.

## *Myrmica adrijae* sp. n.

Figs 1–3, Table 1

**Type Material.** Holotype: worker, **India**, Himachal Pradesh, Kothi, 2479 meters above msl, 29.vi.1999 (H. Bharti coll., code = 193) (PUAC). **Paratypes:** 5 workers: collected from the same nest (BMNH; PUAC). GPS coordinates 32.1890°N–77.1170°E.

## Description of worker

**Measurements.** For measurements and indices, see Table 1.

**Head.** Head much longer than broad, sides parallel, occipital margin straight; mandibles with 8–9 teeth (apical and preapical one largest), longitudinally rugulose and with punctures; clypeus convex, longitudinally rugulose, anterior clypeal margin prominent, very narrowly rounded medially and extending over mandibles, space between rugae smooth and shiny; frontal triangle highly polished, smooth and shining; frontal carinae short, curve outwards to merge with rugae that surround the antennal sockets; frontal lobes partially cover condylar bulb; frons wide and frontal lobes not extended; antennae 12 segmented, apical 4 segments forming club, apical 3 segments densely punctated and following segments minutely punctated, scape slender, narrow, weakly curved at base without any trace of lobe or carina, widening towards apex, just extending beyond the upper margin of head, antennae with oblique short hairs; eyes almost at midlength of head; head dorsum and sides with reticulate sculpture, punctated except for small area behind frontal triangle up to the level of eyes longitudinally rugose; head with numerous

short suberect hairs and few long hairs combined together.

**Alitrunk, petiole and postpetiole.** Alitrunk dorsum feebly convex; promesonotum with weak suture and irregular reticulate sculpture with few very wide transverse reticulations; mesonotum dorsally slightly depressed; metanotal groove broad, deep, longitudinally rugose; anterior half of propodeum transversally rugose dorsally, posterior part irregularly rugose, propodeal spines long, pointed, widened at base, projected backward, divergent; propodeal lobes rounded apically; sides of alitrunk with longitudinal striations except anterior part of pronotum with reticulations; tibiae of hind and middle legs with well developed pectinate spur; petiole longer than broad, with short anterior peduncle with a tooth like subpetiolar process, node obliquely truncate, shagreenate, punctated; postpetiole almost as broad as long, punctated and shagreenate; promesonotum with long erect to suberect hairs; metanotal groove with long hairs; propodeum with one pair of short hairs and minute pubescence; petiole and postpetiole equipped with long hairs which are directed upwards and backwards.

**Gaster.** Gaster highly polished and shiny; tergites and sternites with numerous long suberect hairs and with pubescence between them.

**Coloration.** Whole body blackish brown, mandibles, antennae and legs brown.

## Etymology

Species has been named after Adrija, younger daughter of author; as she was always accompanying the author in recent times to collect ants.

## Remarks

*Myrmica adrijae* sp. n. belongs to the *smythiesii* species group based on the following combination of characters: frontal carinae merge with the rugae that surround antennal sockets. Frons wide and frontal lobes not extended. Scape very smoothly curved at the base, not angled and with no trace of lobe or carina. Anterior clypeal margin is distinctly prominent, without a medial notch. This species group is currently represented by five species, viz.: *M. smythiesii* Forel, 1902, *M. bactriana* Ruzsky, 1915, *M. fortior* Forel, 1904, *M. ruzskyana* Radchenko & Elmes, 2010 and *M. wittmeri* Radchenko & Elmes, 1999. Three of these species (*M. smythiesii*, *fortior* and *wittmeri*) are restricted to the central Asian mountains, while two species (*M. bactriana* and *ruzskyana*) are native to Tibet. However, the Tibetan species are very distinct with HW < 0.95 mm, AL < 1.55 mm, PI 1.29–1.32 and different sculpture, *Myrmica adrijae* with HW 0.99 mm, AL 1.75 mm, PI



**Figs 1–6.** *Myrmica adrijae* (1–3) and *M. pseudorugosa* (4–6). – 1, 4, Heads; 2, 5, profiles; 3, 6, dorsal view.

**Table 1.** *Myrmica adrijae* mean, standard deviation, and minimum and maximum values (in mm) of measurements and indices taken from workers ( $n = 6$ ).

Measurements	Mean $\pm$ SD	Min	Max	Indices	Mean	Min	Max
HL	1.29 $\pm$ 0.04	1.24	1.35	CI	1.30	1.30	1.31
HW	0.99 $\pm$ 0.03	0.95	1.03	FI	0.44	0.44	0.44
SL	0.99 $\pm$ 0.03	0.95	1.03	FLI	1.08	1.09	1.08
PL	0.49 $\pm$ 0.02	0.47	0.52	PI1	1.50	1.56	1.44
PH	0.33 $\pm$ 0.02	0.30	0.36	PI2	0.49	0.49	0.50
PW	0.26 $\pm$ 0.01	0.25	0.27	PI3	0.26	0.26	0.26
PPL	0.38 $\pm$ 0.02	0.36	0.41	PPI1	0.98	1.125	0.85
PPH	0.38 $\pm$ 0.06	0.32	0.48	PPI2	1.03	0.84	1.23
PPW	0.38 $\pm$ 0.01	0.38	0.39	PPI3	1.48	1.52	1.44
FLW	0.47 $\pm$ 0.02	0.46	0.50	PP14	0.38	0.40	0.37
FW	0.44 $\pm$ 0.02	0.42	0.46	S11	0.76	0.76	0.76
ESL	0.29 $\pm$ 0.04	0.22	0.32	S12	1.00	1.00	1.00
AL	1.75 $\pm$ 0.07	1.67	1.82	ESLI	0.27	0.23	0.31
ESD	0.39 $\pm$ 0.03	0.34	0.43	ESDI	1.44	1.54	1.34
PNW	0.71 $\pm$ 0.02	0.69	0.73				

**Table 2.** *Myrmica pseudorugosa* mean, standard deviation, and minimum and maximum values (in mm) of measurements and indices taken from workers ( $n = 4$ ).

Measurements	Mean $\pm$ SD	Min	Max	Indices	Mean	Min	Max
HL	0.93 $\pm$ 0.02	0.91	0.94	CI	1.28	1.26	1.30
HW	0.72 $\pm$ 0	0.72	0.72	FI	0.44	0.44	0.44
SL	0.75 $\pm$ 0.01	0.74	0.75	FLI	1.00	1.00	1.00
PL	0.38 $\pm$ 0	0.38	0.38	PI1	1.46	1.52	1.40
PH	0.26 $\pm$ 0.01	0.25	0.27	PI2	0.52	0.52	0.52
PW	0.21 $\pm$ 0	0.21	0.21	PI3	0.29	0.29	0.29
PPL	0.30 $\pm$ 0	0.30	0.30	PPI1	1.00	1.00	1.00
PPH	0.30 $\pm$ 0	0.30	0.30	PPI2	0.96	0.96	0.96
PPW	0.31 $\pm$ 0	0.31	0.31	PPI3	1.47	1.47	1.47
FLW	0.32 $\pm$ 0	0.32	0.32	PP14	0.43	0.43	0.43
FW	0.32 $\pm$ 0	0.32	0.32	S11	0.80	0.81	0.79
ESL	0.16 $\pm$ 0	0.16	0.16	S12	1.03	1.02	1.04
AL	1.25 $\pm$ 0.02	1.23	1.26	ESLI	0.22	0.22	0.22
ESD	0.27 $\pm$ 0	0.27	0.27	ESDI	1.68	1.68	1.68
PNW	0.53 $\pm$ 0	0.53	0.53				

1.50 does not belong to this category. From the three central Asian mountain species, *M. adrijae* is clearly separated by the following characters: head dorsum and sides with reticulate sculpture, promesonotum with irregular reticulate sculpture with few transverse rugae; metanotal groove longitudinally rugose; anterior half of propodeum transversally rugose dorsally, posterior part irregularly striate. In two species, *viz.*, *M. smythiesii* and *M. fortior*, the head dorsum is longitudinally striate without reticulate sculpture and whole alitrunk also longitudinally rugose except for reticulations restricted to promesonotum, without a trace of transverse rugosity; finally *M. wittmeri* differs well from this species by the presence of strongly reduced sculpture on head and alitrunk. In summary *M. adrijae* differs from the other species of the *smythiesii* group by its quite unique sculpture of head and alitrunk.

### Ecology

*Myrmica adrijae* has been collected from patchy *Cedrus* forest, with grass cover. The workers were collected under a stone.

### *Myrmica pseudorugosa* sp. n.

Figs 4–6, Table 2

**Type Material.** Holotype: worker, **Pakistan**, Kaghan valley, Gittidas, 3600 meters a.s.l., 17.ix.2005 (Seiki Yamane coll. code = PK05-SKY-42) (PUAC). **Paratypes.** 3 workers: collected from the same nest (BMNH; PUAC). Tentative GPS coordinates 35.1167°N–73.9833°E.

### Description of worker

**Measurements.** For measurements and indices, see Table 2.

**Head.** Head much longer than broad, sides parallel, occipital margin straight; mandibles with 7 teeth (apical and preapical ones largest), longitudinally costulate, rugulose and with punctures; clypeus convex, longitudinally rugulose, anterior clypeal margin prominent, convex and equipped with setae, rounded medially and extending over mandibles, space between rugae smooth and shiny; frontal triangle highly polished and shiny; frontal carinae short, almost straight, and not curving outwards to merge with rugae that surround the antennal sockets, but merge with rugae that extend to occipital margin of head; frontal lobes partially cover the condylar bulb; frons wide; antennae 12 segmented, apical 3 segments densely punctated and following segments minutely punctated; scape slender, narrow, weakly curved at base without any trace of lobe or carina, widening towards apex, just extending beyond the upper margin of head, antennae with oblique short hairs, apical 3 segments highly pubescent; eyes somewhat below midlength of head; whole head dorsum longitudinally rugose except sides above eyes which are with reticulate sculpture; head with numerous short subdecumbent hairs and long suberect hairs; mandibles and clypeus with long suberect hairs.

**Alitrunk, petiole and postpetiole.** Alitrunk dorsum convex; promesonotal dorsum in profile forms regular arch, mesonotal dorsum is not impressed transversally and gently curves down to propodeum, metanotal groove is shallow, promesonotum with reticulate sculpture, suture indistinct; metanotal groove longitudinally rugose; propodeal lobes

rounded apically; propodeal spines short, pointed, widened at base, projected upward and backward; sides of alitrunk longitudinally rugose and spaces between rugae smooth and shiny; tibiae of hind and middle legs with well developed pectinate spur; petiole longer than broad, with short anterior peduncle with a tooth like subpetiolar process, node rounded in shape, with reticulate sculpture and punctated; postpetiole as broad as long, finely longitudinally rugose and punctated, posterior part transversally rugose; promesonotum with long hairs; propodeum with minute pubescence, long hairs absent; petiole and postpetiole with long and short suberect hairs directed backwards, peduncle and anterior part of petiole with pubescence.

**Gaster.** Smooth, highly polished and shiny; tergites and sternites with numerous long erect to suberect hairs with few short suberect hairs between them.

**Coloration.** Body brown, mandibles, antennae and legs golden-brown.

### Etymology

Named *pseudorugosa*, because it is allied to *M. rugosa* Mayr, 1865.

### Remarks

*Myrmica pseudorugosa* belongs to the *rugosa* species group because of the following combination of characters: frontal carinae merging with the rugae that extend to occipital margin, they do not curve outwards and do not merge with rugae that surround the antennal sockets. Frons wide and frontal lobes not extended. Scape very smoothly curved at the base, not angled and with no trace of lobe or carina. Anterior clypeal margin is convex and prominent, without a medial notch. This species group is further subdivided into two complexes, viz. the *rugosa* complex (with the promesonotal dorsum forming a more or less regular arch in profile, the mesonotal dorsum not impressed transversally and gently curves down to the propodeum so that the metanotal groove generally is shallow. Body sculpture fairly coarse) and the *cachmiriensis* complex (with promesonotal dorsum does not form regular arch in profile and the mesonotal dorsum impressed transversally, often saddle-shaped and curves down abruptly to the propodeum to form a deep and wide metanotal groove. Body sculpture is finer). Because of its features described above, *M. pseudorugosa* belongs in the *rugosa* complex. The *rugosa* complex comprises of six species, viz.: *M. rugosa* Mayr, 1865, *M. aimonissabaudiae* Menozzi, 1939, *M. erepatrix* Bolton, 1988 (socially parasitic species), *M. foreliana* Radchenko & Elmes, 2001, *M. hecate* Weber, 1947 and

*M. rupestris* Forel, 1902. Due to the sculpture of the petiole and postpetiole, *M. pseudorugosa* resembles *M. aimonissabaudiae*, *M. rugosa* and *M. hecate*. Because of its longitudinal sculpture on head dorsum and reticulate sculpture limited to lateral sides and occipit, sides of pronotum with longitudinal striations, it shows affinities with *M. rugosa* (in the other species, the whole head dorsum is covered with reticulate sculpture, except frons and sides of pronotum with sinuous rugae and reticulations). From *M. rugosa*, it can be easily separated by the much thicker, much shorter, and erect propodeal spines (maximum ESL 0.16 mm), in *rugosa* the spines are almost equal to the basal face of the propodeum, much longer (maximum ESL:0.30mm) and are inclined towards petiolar node (ESLI 0.33 and ESDI 1.03 in *M. rugosa* vs. 0.22 and 1.68 in *pseudorugosa*). Similarly, the petiole is longer in *M. rugosa* (PL:0.50 mm, PH:0.31 mm and PI11.61), while it is shorter in *pseudorugosa* (PL:0.38 mm, PH:0.26 mm and PI11.46) and the postpetiole is also much longer in *rugosa* than *pseudorugosa* (PPL: 0.41 mm in *rugosa*, it is 0.30 mm in *pseudorugosa*). Finally, *M. pseudorugosa* also differs from *M. rugosa* by much longer hairs on scape and legs.

### Ecology

This species has been collected at an altitude of 3600 meters a.s.l., which represents the trans Himalayan alpine zone. It is a dry desert above the timber line.

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