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Taxonomic Studies on the Genus *Vollenhovia* Mayr, 1865 (Hymenoptera: Formicidae): Five New Species from India

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Abstract
Five new species *Vollenhovia pfeifferi* sp. nov., *V. mawrapensis* sp. nov., *V. karimalaensis* sp. nov., *V. taylori* sp. nov. and *V. terayamai* sp. nov. are described from India. An identification key supplemented with digital images of the known species of the genus based on the worker caste from India is also provided.

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Introduction

The genus *Vollenhovia* Mayr, 1865 is one of the rare ant genera in the subfamily Myrmicinae. The species of the genus generally nest in decaying branches, wooden logs, and beneath tree bark (Eguchi, et al., 2011). It is represented by 60 species and 17 subspecies worldwide (Bolton, 2022).

Mayr (1865) erected the genus based on the type species *Vollenhovia punctatostriata.* Phylogenetic analysis of the subfamily Myrmicinae has placed the genus in the tribe Crematogastrini (Ward et al., 2015). Formerly, it was treated in the different tribes by subsequent authors: in Pheidolidae (Emery, 1877), in Myrmicini (Emery 1895), in Stenammini (Ashmead, 1905; Bolton, 2003), in Myrmecinini (Emery, 1912), Solenopsidini (Emery, 1914), and Metaponini (Hölldobler & Wilson, 1990).

The significant contributions to the genus taxonomy include studies from Australia (Taylor & Brown, 1985; Taylor, 1987; Taylor, 1991; Shattuck, 1999), China (Wu & Wang, 1995), Fiji (Sarnat & Economo, 2012), India (Bharti & Kumar, 2013; Sadasivan & Kripakaran, 2022), Japan (Terayama & Kinomura, 1997) and Taiwan (Terayama, 2009).

The workers of the genus *Vollenhovia* can be distinguished from other genera in the subfamily Myrmicinae by the following combination of characters (Terayama and Kinomura, 1997): antennal scrobes and frontal carinae are absent; frontal lobes present; antennae with 12 segments, rarely 11 segments, the funicles ending in a 3-segmented club; clypeus more or less longitudinally bicarinate; maxillary palp with 1-3 segments, usually 2 segments; eyes present, relatively large; ventral processes distinct on meso-and metasternum; middle and hind legs without tibial spur; petiole sessile or subsessile; subpetiolar process present, often blade-like; petiole not particularly more voluminous than postpetiole in dorsal view.

In India, the genus is represented by four species (Bharti et al., 2016; Sadasivan & Kripakaran, 2022). During the present study, we described five new species from India. An identification key supplemented with digital images of the known species is also provided.

Materials and methods

Taxonomic analysis was conducted on a Nikon SMZ 1500 stereo zoom microscope with a 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 the specimen (CASENT0904539) were provided by http://www.antweb.org/. Morphological terminology and standard measurements follow Bharti & Kumar (2013) and Sadasivan & Kripakaran (2022).

HL (Head Length): In full-face view, the length of the head proper, excluding the mandibles, measured in a straight line from the mid-point of the anterior clypeal margin to the midpoint of the occipital margin.
HW (Head Width): The maximum width of the head in full-face view (measured including the eyes).
SL (Scape Length): The maximum straight line length of the antennal scape excluding the basal constriction or neck close to the condylar bulb
EL (Eye Length): Maximum length of the eye measured in the same view as HL.
ML (Mesosoma Length): The diagonal length of the mesosoma in profile from the point at which the pronotum meets the cervical shield to the posterior extension of the propodeal lobes.
PTH (Petiole Height): Maximum height of petiole in profile.
PTL (Petiole Length): Maximum length of petiole in dorsal view.
PTW (Petiole Width): Maximum width of petiole in dorsal view.
PPTH (Postpetiole Height): Maximum height of postpetiole in profile.
PPTL (Postpetiole Length): Maximum length of postpetiole in dorsal view.
PPTW (Postpetiole Width): Maximum width of postpetiole in dorsal view.
PRNW (Pronotal Width): The maximum width of the pronotum in the dorsal view.
GL (Gaster Length): Maximum length of gaster in lateral view from the anteriormost point of the first gastral segment to the posteriormost point (excluding sting).
TL (Total Length): HL + ML + PTL + PPTL + GL.
CI (Cephalic Index): (HW/HL) × 100.
SI (Scape Index): (SL/HW) × 100.

Depositories

The type material for the New Species were deposited at PUAC "Punjabi University Patiala Ant Collection" at Department of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab, India.

Results

***Vollenhovia karimalaensis* sp. nov.** Dhadwal, Rilta & Bharti **(Figs 1-3)**

urn:lsid:zoobank.org:act:F6B04884-EDE9-46BF-B472-35379528730E

Material Examined: Holotype (worker) India: *Kerala*, Parambikulum Tiger Reserve, Karimala, 1100 m, 9.5517°N, 77.0639°E, 2.vii.17 (Holotype - PUAC T701; Paratypes - PUAC T703-T707). Paratype (5w) same data as holotype. Hand-picking method. Tarun Dhadwal leg.

Worker measurement

Holotype: HL 0.80; HW 0.72; SL 0.48; EL 0.14; ML 1.04; PRNW 0.55; PTL 0.32; PPTL 0.30; PTW 0.24; PPTW 0.27; PTH 0.28; PPTH 0.27; GL 1.02; TL 3.48 mm; CI 90.00; SI 66.66.
Paratype: HL 0.76-0.82; HW 0.69-0.78; SL 0.45-0.48; EL 0.12-0.14; ML 0.99-1.12; PRNW 0.50-0.58; PTL 0.30-0.33; PPTL 0.30-0.45; PTW 0.24-0.26; PPTW 0.27-0.32; PTH 0.26-0.30; PPTH 0.24-0.28; GL 1.02-1.05; TL 3.37-3.77 mm; CI 90.78-95.12; SI 61.53-65.21 (n = 5).

Description

In full-face view, head longer than broad (CI 90-95.12), posterior head margin concave in the middle, occipital corners rounded, lateral margins convex anteriorly; head posteriorly broader than the front; clypeus broad and convex, anterior margin convex and pointed in the middle; mandibles triangular, masticatory margin with 7-teeth; antennae 12-segmented, with a club of apical 3-larger segments, scape short and falling short of reaching posterior head; eyes small and placed laterally below the mid-length of the head.

In dorsal view, mesosoma is broad anteriorly; promesonotal suture indistinct; metanotal groove present; propodeal declivity weakly concave medially and laterally emarginated; petiolar node as long as broad; postpetiole broader than long; gaster subglobose.

In lateral view, the dorsal outline of the mesosoma is convex; posterodorsal corners of the propodeum rounded;

Figs 1-3. *Vollenhovia karimalaensis* sp. nov.: 1. head in full face view, 2. body in profile view, 3. body in dorsal view.

propodeal lobe subtriangular; petiolar node subrectangular with the anterior margin straight and the posterior margin slightly concave; subpetiolar process elongate and sickle-shaped; postpetiole node longer than high.

Head and mesosoma finely reticulate punctate; a narrow, smooth band extended up to the middle of eyes; clypeus smooth and with divergent carinae; mandibles smooth; propodeal declivity with coarsely small punctures; petiole and postpetiole reticulate rugose; dorsal surface of gastral tergite with piligerous punctures.

Body covered with long erect and sub-erect hairs, except head with short hairs; appressed pubescence sparse on the body but dense on antennae and appendages.

Head, mesosoma, and gaster black in color; mandibles, antennae, and appendages reddish brown.

Etymology: The species is named after the type locality.

Remarks: This species resembles *V. keralensis* Kripakaran & Sadasivan, 2022, but can be easily distinguished by the following characteristics: in *Vollenhovia karimalaensis* sp. nov. head distinctly longer than broad, mandibles with 7-teeth, subpetiolar process, elongate and sickle-shaped, whole body finely punctate. While in *V. keralensis* head is as long as broad, the mandibles with 8-teeth, the subpetiolar process lamellar wall is distinctly longer than high, and the whole body is foveolate.

***Vollenhovia mawrapensis* sp. nov.** Dhadwal, Rilta & Bharti **(Figs 4-6)**

urn:lsid:zoobank.org:act:5C0FEF6D-8BD3-40D9-AF65-68EAFB31D9E1

Material Examined: Holotype (worker) India: *Meghalaya*, Mawrap, 600 m, 25.1628° N, 91.3830° E, 12.ix.19 **(**Holotype - PUAC T710; Paratypes - PUAC T714-T715). Paratype (2w) same data as holotype. Winkler extraction. Tarun Dhadwal leg.

Worker measurement

Holotype: HL 0.48; HW 0.44; SL 0.30; EL 0.11; ML 0.56; PRNW 0.32; PTL 0.15; PPTL 0.14; PTW 0.16; PPTW 0.19; PTH 0.20; PPTH 0.18; GL 0.63; TL 1.96 mm; CI 91.66; SI 68.18.

Paratype: HL 0.44-0.48; HW 0.40-0.43; SL 0.28-0.30; EL 0.11-0.12; ML 0.56-0.60; PRNW 0.32-0.34; PTL 0.15-0.17; PPTL 0.14-0.16; PTW 0.14-0.16; PPTW 0.16-0.19; PTH 0.19-0.20; PPTH 0.15-0.18; GL 0.63-0.66; TL 1.92-2.07 mm; CI 89.58-90.90; SI 69.76-70.00 (n = 2).

Description

In full-face view, head is as long as broad (CI 89.58-91.66), posterior head margin concave in middle, occipital corners rounded, lateral margins slightly convex anteriorly; head posteriorly broader than the front; clypeus broad, anterior margin convex; mandibles triangular, masticatory margin with 7-teeth; antennae 12-segmented, with a club of apical 3-larger segments, scape short and falling short of reaching posterior head; eyes small and placed laterally below the mid-length of the head.

In dorsal view, mesosoma is broad anteriorly; promesonotal suture indistinct; metanotal groove present; propodeal declivity weakly concave medially and laterally emarginated; petiolar node as long as broad; postpetiole broader than long; gaster subglobose.

In lateral view, the mesosoma is feebly convex and almost straight; posterodorsal corners of propodeum rounded; propodeal lobe subtriangular; petiolar node subrectangular with anterior margin straight and posterior margin slightly concave; subpetiolar process, elongate and rectangular; postpetiole node as longer than high.

Head coarsely punctated; a narrow, smooth band extended up to the middle of eyes; clypeus smooth and with divergent carinae; mandibles smooth and with few punctures; pronotum and mesonotum longitudinally rugulose and densely punctated; propodeal declivity with coarsely small punctures; laterally pronotum coarsely punctate, mesopleuron and metapleuron transversely striate; petiole and postpetiole reticulate rugose; dorsal surface of first gastral tergite coarsely punctated and remaining gastral tergites with piligerous punctures.

Body covered with few erect and sub-erect short hairs and gaster with dense and long hairs; appressed pubescence sparse on the body except on antennae and appendages.

Head, mesosoma, and gaster dark brown; mandibles, antennae, and appendages reddish yellow.

Etymology: The species is named after the type locality.

Remarks: This species resembles *V. taylori* sp. nov. but can be distinguished from it by the following characteristics; in *V. mawrapensis* sp. nov. head as long as broad (CI 89.58-91.66), clypeal margin broadly convex, mandibles with 7-teeth, subpetiolar process, elongate and rectangular, mesopleuron and metapleuron transversely striate; petiole and postpetiole

Figs 4-6. *Vollenhovia mawrapensis* sp. nov.: 4. head in full face view, 5. body in profile view, 6. body in dorsal view.

reticulate rugose; dorsal surface of first gastral tergite coarsely punctated and remaining gastral tergites with piligerous punctures, body less pilose, covered with few erect and sub-erect short hairs. While in *V. taylori* sp. nov. the head is longer than broad (CI 85.18-86.20), the clypeal margin is convex and pointed in the middle, mandibles with 6-teeth, laterally mesosoma coarsely punctated; petiole and postpetiole finely punctated; the dorsal surface of the first gastral tergite sparsely punctated up to the middle of tergite and remaining gastral tergites smooth and shiny, body covered with dense, long, erect and sub-erect hairs.

***Vollenhovia pfeifferi* sp. nov.** Bharti, Dhadwal & Rilta **(Figs 7-9)**
urn:lsid:zoobank.org:act:0A343018-6CFA-4043-9AEF-E6BBBC15896C

Material Examined: Holotype (worker) India: *Kerala*, Parambikulum Tiger Reserve, Karimala, 900 m, 9.5538°N, 77.0610°E, 2.vii.17 (Holotype - PUAC T717; Paratype - PUAC T720-T724). Paratype (5w) same data as holotype. Hand-picking method. Tarun Dhadwal leg.

Worker measurement

Holotype: HL 0.57; HW 0.51; SL 0.34; EL 0.12; ML 0.60; PRNW 0.42; PTL 0.21; PPTL 0.18; PTW 0.20; PPTW 0.22; PTH 0.23; PPTH 0.21; GL 0.78; TL 2.34 mm; CI 89.47; SI 66.66.
Paratype: HL 0.56-0.70; HW 0.51-0.54; SL 0.34-0.38; EL 0.12-0.13; ML 0.60-0.62; PRNW 0.39-0.42; PTL 0.19-0.22; PPTL 0.18-0.19; PTW 0.18-0.20; PPTW 0.21-0.22; PTH 0.22-0.24; PPTH 0.20-0.21; GL 0.78-0.92; TL 2.31-2.65 mm; CI 77.14-91.07; SI 66.66-70.37 (n=5).

Description

In full-face view, the head is distinctly longer than broad (CI 77.14-91.07), the posterior head margin slightly concave in the middle, occipital corners rounded, lateral margin almost straight; head as broad anteriorly as posteriorly; clypeus broad, anterior margin convex; mandibles triangular, masticatory margin with 6-teeth; antennae 12-segmented, with a club of an apical 3-larger segment, scape short and falling short of reaching posterior head; eyes small and placed laterally below the mid-length of the head.

In dorsal view, mesosoma trapezoidal; promesonotal suture indistinct; metanotal groove weakly developed; propodeal declivity weakly concave medially and laterally emarginated; petiolar node as long as broad; postpetiole broader than long; gaster subglobose.

In lateral view, the mesosoma is feebly convex; posterodorsal corners of propodeum bluntly angulate, having small denticles; propodeal lobe subtriangular; petiolar node subrectangular with anterior margin straight and posterior margin slightly concave; subpetiolar process, subtriangular with anterior face rounded; postpetiole node as long as broad.

Head with large and coarse punctures; a narrow, smooth band extended up to the middle of eyes; clypeus smooth and with divergent carinae; mandibles smooth; pronotum and mesonotum reticulate rugulose and densely punctated; punctures on propodeum small and declivity transversely striated; laterally mesosoma coarsely punctated; petiole and postpetiole reticulate rugose; dorsal surface of first gastral tergite sparsely punctated up to the middle of tergite and remaining gastral tergites smooth and shiny.

Body covered with dense erect and sub-erect hairs; appressed pubescence sparse on the body but dense on antennae and appendages.

Head, mesosoma, and gaster brown in color; mandibles, antennae, and appendages reddish yellow.

Etymology: The species is named in honor of Dr. Martin Pfeiffer, Senior scientist at the Department for Biogeography, University of Bayreuth, Germany, for his significant contributions to the field of Ant ecology and biogeography.

Remarks: This species resembles *Vollenhovia mawrapensis* sp. nov. but can be easily distinguished from it by a combination of the following characteristics: in *V. pfeifferi* sp. nov. head distinctly longer than broad (CI 77.14-91.07), mandibles with 6-teeth, propodeum with a pair of small denticles, subpetiolar process, subtriangular with anterior face rounded, pronotum and mesonotum reticulate rugulose and densely punctated, dorsal surface of first gastral tergite sparsely punctated up to the middle of tergite and remaining gastral tergites smooth and shiny. Whereas in *Vollenhovia mawrapensis* sp. nov. head is as long as broad (CI 89.58-91.66), mandibles with 7-teeth, propodeal corners rounded without denticles, subpetiolar process, elongate and rectangular, pronotum and mesonotum longitudinally rugulose and densely punctated, dorsal surface of first gastral tergite coarsely punctated and remaining gastral tergites with piligerous punctures.

Figs 7-9. *Vollenhovia pfeifferi* sp. nov.: 7. head in full face view, 8. body in profile view, 9. body in dorsal view.

***Vollenhovia taylori* sp. nov.** Rilta, Dhadwal & Bharti **(Figs 10-12)**

urn:lsid:zoobank.org:act:0345856B-AF94-4FED-BF79-D838EB5A34CF

Type Material: Holotype (worker) India: *West Bengal*: Chapramari Wild Life Sanctuary, 200 m, 26.5304°N, 88.5107°E, 28.vii.2015 (Holotype - PUAC T728). Hand-picking method. Joginder Singh Rilta leg.

Worker Measurements

HL 0.50; HW 0.42; SL 0.30; EL 0.10; ML 0.54; PRNW 0.34; PTL 0.20; PPTL 0.14; PTW 0.16; PPTW 0.20; PTH 0.22; PPTH 0.18; GL 0.60; TL 1.98 mm; CI 84; SI 71.43 (n = 1).

Description

In full-face view, the head is distinctly longer than broad (CI 84), posterior head margin straight, occipital corners rounded, lateral margin almost straight; head slightly narrow anteriorly and broad posteriorly; clypeus broad and convex, anterior margin medially pointed; mandibles triangular, masticatory margin with 6-teeth; antennae 12-segmented, antennal club with an apical 3-larger segments, scape short and falling short of reaching posterior head; eyes small and placed laterally below the mid-length of the head.

In dorsal view, mesosoma trapezoidal; promesonotal suture indistinct; metanotal groove weakly developed; propodeal declivity weakly concave medially and laterally emarginated; petiolar node longer than broad; postpetiole broader than long; gaster elliptical.

In lateral view, the mesosoma feebly convex; posterodorsal corners of propodeum rounded; propodeal lobe small and rounded; the petiolar node is higher than long; ventrally with a transparent and roughly triangular subpetiolar process, posterior face of subpetiolar process crenulated, ventral face pointed and anterior face rounded; postpetiolar node higher than long.

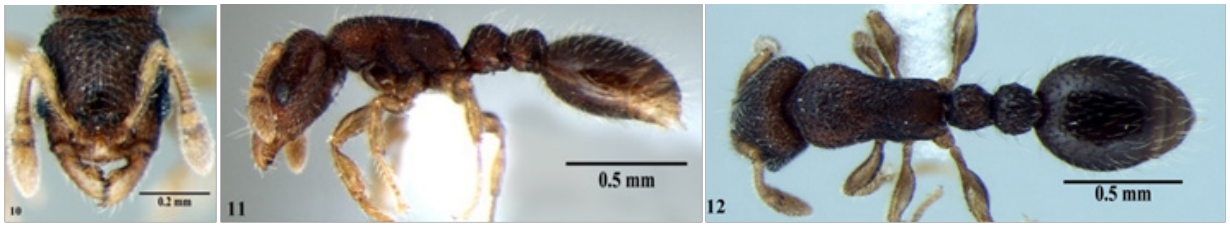
Dorsal surface of the head with large and coarse punctures; a broad and smooth band extended up to frons; clypeus smooth and with divergent carinae; mandibles smooth and with sparse piligerous punctures; pronotum and mesonotum longitudinally rugulose and densely punctated; punctures on propodeum and declivity smaller than promesonotum; mesopleuron coarsely punctated; petiole and postpetiole finely punctated; dorsal surface of first gastral tergite sparsely punctated up to the middle of tergite and remaining gastral tergites smooth and shiny.

Body covered with dense, erect, and sub-erect hairs; appressed pubescence sparse on the body but dense on antennae and appendages.

Head, mesosoma, and gaster reddish brown in color; mandibles, antennae, and appendages yellowish brown in color.

Etymology: The species is named after Dr. Brian Taylor for his contributions to ant systematics.

Remarks: *Vollenhovia taylori* sp. nov. shares some affinities with *Vollenhovia benzai* Terayama & Kinomura, 1997. It can be distinguished from the latter by the following combination of characters: anterior clypeal margin medially pointed; masticatory margin of mandibles with 6-teeth; propodeal corners rounded; subpetiolar process roughly triangular; dorsal surface of postpetiole finely punctated and first gastral tergite sparsely punctated. While, in *V. benzai* anterior clypeal margin is transverse; the masticatory margin of mandibles with 7-teeth; the propodeal corners angulated; the subpetiolar process is low and small; dorsal surface of postpetiole smooth, and the first gastral tergite is smooth and shiny.



Figs 10-12. *Vollenhovia taylori* sp. nov.: 10. head in full face view, 11. body in profile view, 12. body in dorsal view.

***Vollenhovia terayamai* sp. nov.** Rilta, Dhadwal & Bharti **(Figs 13-15)**

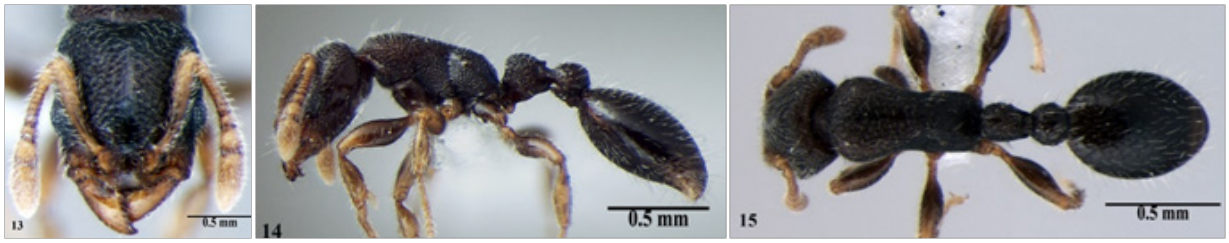
urn:lsid:zoobank.org:act:6176531D-534D-44E4-8C76-721D5485B46E

Type Material: Holotype (worker) India: *West Bengal*: Chapramari Wild Life Sanctuary, 200 m, 26.5304°N, 88.5107°E, 28.vii.2015 (Holotype - PUAC T731; Paratype - PUAC T733). Paratype (1w) same data as holotype, Hand-picking method. Joginder Singh Rilta leg.

Worker Measurements

Holotype: HL 0.54; HW 0.46; SL 0.34; EL 0.12; ML 0.66; PRNW 0.36; PTL 0.24; PPTL 0.18; PTW 0.16; PPTW 0.20; PTH 0.28; PPTH 0.16; GL 0.68; TL 2.30 mm; CI 85.18; SI 73.91.

Paratype: HL 0.58; HW 0.50; SL 0.36; EL 0.14; ML 0.68; PRNW 0.40; PTL 0.26; PPTL 0.20; PTW 0.18; PPTW 0.22; PTH 0.30; PPTH 0.18; GL 0.70; TL2.42 mm; CI 86.20; SI 72.00 (n = 1).



Figs 13-15. *Vollenhovia terayamai* sp. nov.: 13. head in full face view, 14. body in profile view, 15. body in dorsal view.

Description

In full face view, head rectangular, distinctly longer than broad (CI 85.18-86.20), posterior head margin feebly concave medially, occipital corners rounded, lateral sides almost parallel, clypeus broad, anterior margin weakly concave medially; mandibles triangular, masticatory margin with 6-teeth; antennae 12-segmented, with a club of apical 3-larger segments, scape short, falling short about 1/4th of its total length; eyes large and placed laterally below the mid-length of the head.

In dorsal view, mesosoma trapezoidal; promesonotal suture indistinct; metanotal groove feebly developed; dorsal surface of mesosoma flat; propodeal declivity weakly concave medially, laterally emarginated; petiolar node longer than broad; postpetiole broader than long; gaster large and oval.

In lateral view, the dorsal surface of the mesosoma is slightly slanting posteriorly; propodeal corners rounded; propodeal spiracle small and rounded, placed below the propodeal declivity; propodeal lobe small and rounded; petiolar node higher than long, anterior face erect, and dorsal surface rounded; petiole ventrally with transparent and knob like subpetiolar process; dorsal outline of petiole rounded.

The dorsal surface of the head is coarsely punctated, medially with a broad, smooth band extended from the posterior clypeal margin to the concavity of the posterior head margin; the clypeus smooth and laterally with two divergent carinae; mandibles smooth and shiny with scattered piligerous punctures; dorsal surface of pronotum and mesonotum finely longitudinally striated and punctated, medially with a smooth longitudinal band; propodeal dorsum coarsely punctated; laterally mesosoma coarsely punctated; dorsal surface of petiole coarsely punctated; dorsal surface of postpetiole smooth and very weakly punctated; dorsal surface of first gastral tergite with scattered punctures.

Body covered with dense, erect, and sub-erect hairs; appressed pubescence sparse on the body whereas dense on antennae and appendages.

Body dark brownish in color; mandibles, antennae, and appendages light brownish in color.

Etymology: The species is named in regard to Prof. Mamoru Terayama for his contributions to ant systematics.

Remarks: This species is similar to *Vollenhovia okinawana* Terayama & Kinomura, 1997. Both species can easily be separated based on the following combination of characters: In full-face view, head medially with a broad, smooth band extended from posterior clypeal margin to concavity of the posterior head margin; masticatory margin of mandibles with 6-teeth; subpetiolar process well developed and knob like; in lateral view, posterodorsal surface of postpetiole convex; dorsal surface of first gastral tergite with scattered punctures. While, in *V. okinawana* medial smooth band extended up to the frons; masticatory margin of mandibles with 7-teeth; subpetiolar process low and small; in lateral view, posterodorsal surface of postpetiole concave; dorsal surface of the first gastral tergite smooth and shiny.

Identification key to the known species of genus *Vollenhovia* from India based on the worker caste

1. Mesosoma sculptured (Fig 16A ……....……..**2**
- Mesosoma smooth and shiny, with a few delicate scattered punctures anteriorly (Fig 16B).....***V. oblonga laevithorax* Emery**

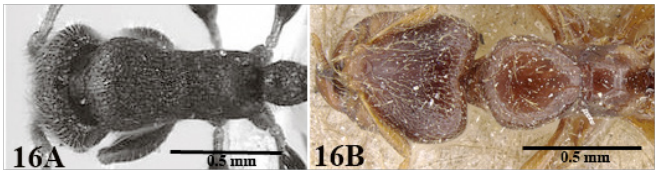


Fig 16. A: Dorsal view of *Vollenhovia gastropunctata* Bharti & Kumar, 2013; **B:** Dorsal view of *Vollenhovia oblonga laevithorax* Emery, 1889 (CASENT0904539). Image B from AntWeb (www.antweb.org); photographer, Z. Lieberman (B).

2. Dorsal surface of promesonotum without a smooth band (Fig 17A).....…….....**3**
- Dorsal surface of promesonotum with a smooth band (Fig 17B) ……....……..***V. terayamai* sp. nov.**

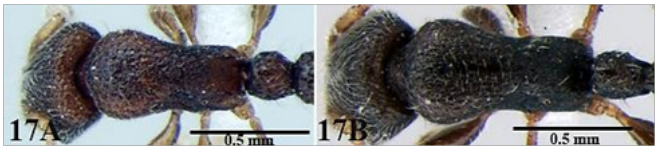


Fig 17. A: Dorsal view of *Vollenhovia taylori* sp. nov.; **B:** Dorsal view of *Vollenhovia terayamai* sp. nov.

3. Propodeum unarmed (Fig 1)...…….……..…**4**
- Propodeum armed with a pair of small denticles (Fig 18B) .....***V. pfeifferi* sp. nov.**
4. Body size small (TL <2.30)…….....…….……....5
- Body size large (TL >2.30mm)……6

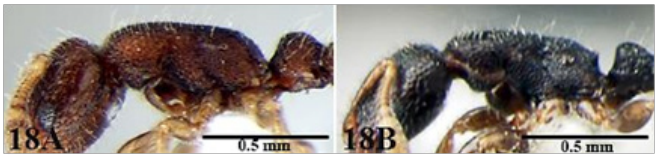


Fig 18. A: Lateral view of *Vollenhovia taylori* sp. nov.; **B:** lateral view of *Vollenhovia pfeifferi* sp. nov.

5. Mesopleuron transversely striate; subpetiolar process elongate and rectangular (Fig 19A)…...…..…*V. mawrapensis* **sp. nov.**
- Mesopleuron coarsely punctate; subpetiolar process roughly triangular (Fig 19B)……*V. taylori* **sp. nov.**

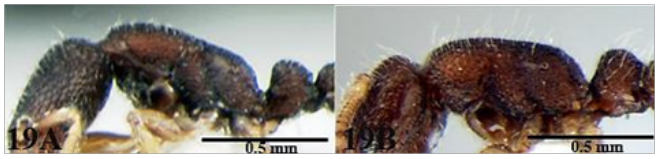


Fig 19. A: Lateral view of *Vollenhovia mawrapensis* sp. nov.; **B:** lateral view of *Vollenhovia taylori* sp. nov.

6. Anterior margin of clypeus convex pointed in the middle....**7**
- Anterior clypeal margin concave.....*V. gastropunctata* **Bharti & Kumar**

7. Body generally foveolate; mandibles with 8 teeth; subpetiolar process lamellar wall distinctly longer than high (Fig 20A)……*V. keralensis* **Sadasivan & Kripakaran**
- Body generally punctate; mandibles with 7 teeth; subpetiolar process elongate and sickle shaped (Fig 20B) ..... *V. karimalaensis* **sp. nov.**

Fig 20. A: Lateral view of *Vollenhovia keralensis* Sadasivan & Kripakaran, 2022; **B:** Lateral view of *Vollenhovia karimalaensis* sp. nov. Images (A) from Sadasivan & Kripakaran (2022).

(**Note**: *Vollenhovia penetrans* (Smith, 1857) is excluded from the key as the species is described based on the queen, and the key is worker based. However, none of the abovementioned species resembles the description of the reproductive caste of the *V. penetrans*).

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Authors' Contribution

DT: Conceptualization, investigation, writing-original draft, writing-review & editing.
HB: Conceptualization, investigation, writing-review & editing.
JSR: Investigation.

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