

A new species of *Protanilla* Taylor 1990 (Hymenoptera: Formicidae: Leptanillinae) from India

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Abstract

Protanilla flamma sp. n. from Goa, India is described, which is the thirteenth species in the genus *Protanilla* and the second record of this genus from the country. The new species morphologically appears close to *P. lini* Terayama, 2009 in terms of mandibular teeth count and the structure of petiolar and post-petiolar nodes. However, it can be very easily differentiated based on the short antennal scape which does not exceed the posterior margin of the head.

Keywords: *Leptanillinae, Protanilla, new species, key to species, India, Goa.*

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Introduction

The genus *Protanilla* Taylor, 1990 belongs to the subfamily Leptanillinae which recent studies have favourably considered as the sister group to all known extant ant species of the world (Ward, 2014). Currently represented by 12 valid species (Dias *et al.*, 2019), this genus is distributed across the Indo-Malayan, Australasian and southern-Paleotropical regions of the world (Bolton, 2020). This genus is typically characterised by its narrow, elongate, downcurved and triangular mandibles, with inner surface armed with numerous blunt and elongate peg-like to pencil-like teeth (Bolton, 1990). Much of the natural history knowledge of this genus remains unclear, except for information of two species from Taiwan (Hsu *et al.*, 2017), which is primarily due to their cryptic and subterranean life history making them a challenge to encounter while utilising conventional collection techniques (Man *et al.*, 2017).

Protanilla flamma sp. n. described here represents the second record of this genus from India (Bharti *et al.*, 2016) and the 13th valid species of this genus worldwide.

Materials and Methods

Two specimens were collected during field work in Netravali Wildlife Sanctuary at the foothills of the Western Ghats of Goa. The specimens were collected during the post-

monsoon season of 2016, when the top 4 cm thick leaf-litter and 2-3 cm of soil was disturbed to reveal the collected individuals within the soil. The area where the specimens were collected is situated at an elevation of 445 m above sea level with thick forest canopy, mostly dominated by moist-deciduous tree species. The forest floor was still wet from the just concluded monsoons and the temperature at the site on the time of collection was 33 °C. Two specimens of the new species were collected by hand and stored in 70% ethanol. Taxonomic analysis and measurements were recorded using a Leica 205 C stereomicroscope and are reported in millimeters. For acquiring digital images, a Leica MC 120 HD digital camera was used on the same microscope with an external stacking software Image J. Clarity of images were then enhanced using GNU Image Manipulation Program GIMP v 2.10.12. Standard measurements, indices, morphological terminologies, and description follow Bolton (1990) and Hsu *et al.* (2017).

TL The total outstretched length of the ant from the mandibular apex to the gastral apex.

HL Head length: The length of the head in full-face view, excluding the mandibles and measured in a straight line from the midpoint of the anterior

- clypeus margin to the midpoint of the posterior margin.
- HW** Head width: The maximum width of the head behind eyes in full-face view.
- CI** Cephalic index: $(HW \times 100) / HL$.
- SL** Scape length: The maximum length of the antenna scape excluding basal condyle and neck.
- SI** Scape index: $(SL \times 100) / HW$.
- ML** Mandible length: The length of the mandible from the base to the apex.
- PW** Pronotal width: Maximum pronotal width in dorsal view.
- WL** Weber's length: The maximum diagonal length of mesosoma from the anterior most point of the pronotal slope (excluding neck) to the posteroventral margin of the propodeal lobe in profile view.
- PNL** Petiolar node length: The maximum longitudinal length of the petiolar node, excluding its anterior and posterior peduncles in lateral view.
- PNH** Petiolar node height: The maximum vertical height of the petiolar node from summit to lowermost part of subpetiolar process in lateral view.
- PNW** Petiolar node width: The maximum width of the petiolar node in dorsal view.
- PI** Petiolar Index: $(PNW \times 100) / PNL$.
- PPNL** Postpetiolar node length: The maximum longitudinal length of the postpetiolar node, excluding its anterior and posterior peduncles in lateral view.
- PPNH** Postpetiolar node height: The maximum vertical height of the postpetiolar node from summit to lowermost part of subpetiolar process in lateral view.
- PPNW** Postpetiolar node width: The maximum width of the postpetiolar node in dorsal view.
- PPI** Postpetiolar Index: $(PPNW \times 100) / PPNL$.

Relative values of morphological measurements were plotted to understand how the new species differs from other *Protanilla* species. Further, to visualise the clustering of species, an ordination technique for dimension reduction, the t-Distributed Stochastic Neighbour Embedding (t-SNE), was used (Maaten and Hinton, 2008). This analysis was

done using *tsne* package V 0.1-3 (Donaldson, 2016) and visualisation was performed using *ggplot2* V 3.3.1 (Wickham *et al.*, 2020). All these analysis were performed on R version 1.2.5019 (R Core Team, 2013) for Mac OS.

Acronyms of Depositories

GKVK: Gandhi Krishi Vignana Kendra, Bengaluru.

IISc: Indian Institute of Science, Bengaluru.

Systematics

Protanilla flamma Baidya and Bagchi sp. n.

(Figs. 1a-c)

[urn:lsid:zoobank.org:act:5CC9B108-6D0F-41F3-9003-33FB174EA843](https://zoobank.org/act:5CC9B108-6D0F-41F3-9003-33FB174EA843)

Type Material

Holotype worker: India, Goa, South Goa District, Netravali Wildlife Sanctuary, 15.599° N, 74.240° E, 445m asl, hand collected in moist deciduous forest, 25.ix.2016, Pronoy Baidya leg.

Paratype: One worker with same method of collection and data as holotype. Holotype deposited in IISc and Paratype will be deposited in GKVK.

Measurements (in mm)

Holotype: TL 2.5, HL 0.428, HW 0.355, CI 82.944, SL 0.323, SI 90.986, ML 0.249, PW 0.227, WL 0.724, PNL 0.199, PNH 0.288, PNW 0.218, PI 109.548, PPNL 0.179, PPNH 0.279, PPNW 0.221, PPI 123.464.

Paratype: TL 2.45, HL 0.425, HW 0.350, CI 82.353, SL 0.300, SI 85.714, ML 0.230, PW 0.225, WL 0.70, PNL 0.190, PNH 0.285, PNW 0.213, PI 112.105, PPNL 0.174, PPNH 0.275, PPNW 0.217, PPI 124.713.

Description

Body uniformly bright yellow and shiny. In full face, head longer than broad, anteriorly narrow with evenly convex sides. Antero-lateral corners of head produced into prominent angles. Posterior margin of head gently concave. Eyes absent. Mandibles elongated, smooth and shiny, apically strongly down-curved, basal margin rounded and masticatory margin with ~10 peg like teeth and a longitudinal groove runs along the dorsolateral margin of the mandible. Clypeus in full face is trapezoidal with depressed longitudinal central line, anterior margin

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Figure 1. *Protanilla flamma* sp. n., holotype worker: **a.** Full-face view; **b.** Body in dorsal view; **c.** Body in profile view.

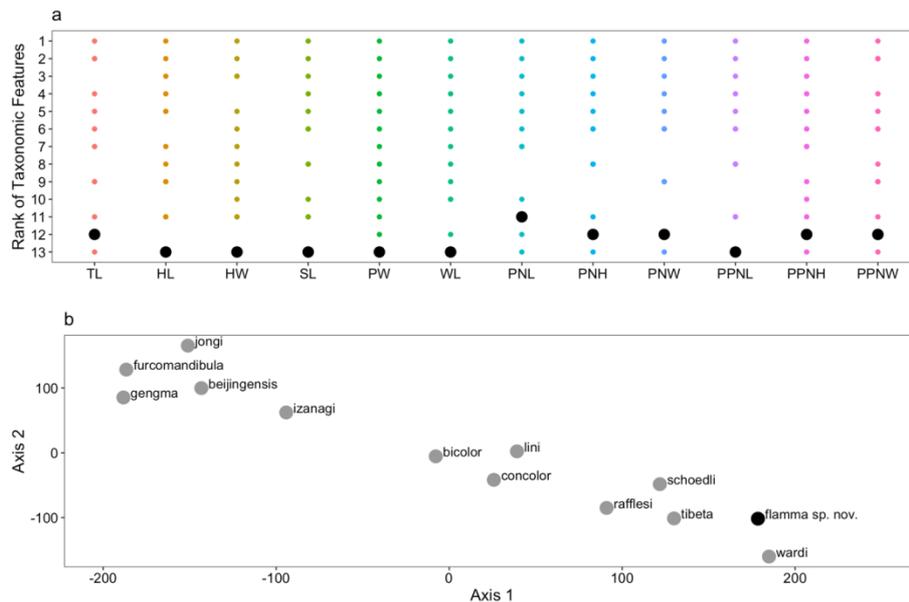


Figure 2. Morphometric comparison of *Protanilla flamma* sp. n. **a.** Relative morphological measurements of 13 species in the genus *Protanilla* ranked from 1 (largest) to 13 (smallest), with *P. flamma* sp. n. represented by black dots. **b.** t-SNE ordination of morphometric data for *Protanilla flamma* sp. n. and other congeneric species.

slightly concave. Antenna 12 segmented; scape short not exceeding the posterior margin of the head; segments 2-4 wider than long; segments 5-10 nearly as long as broad; terminal segment almost twice as long than broad.

In profile view, dorsum of pronotum gently convex, and approximately twice the size of mesonotum. Promesonotal suture distinct and slightly depressed. Dorsum of mesonotum almost straight and sloping downwards. Metanotal groove strongly notched. Dorsum of propodeum slopes posteriorly, postereodorsal corner rounded. Petiolar node narrows slightly upwards; anterior and posterior faces both straight and dorsum slightly convex. Subpetiolar process reduced. Post-petiolar node straight with dorsum slightly convex; ventral face strongly inclined forward and anteroventral corner blunt; broadly attached to abdominal segment with free posterior face above the articulation with segment IV. Gaster oval in shape and more constricted anteriorly; length of Tergite I more than half the length of gaster. Sting well developed.

In dorsal view, mesonotum constricted, and 1.5 times smaller in width than the pronotum. Petiolar and post-petiolar nodes as long as broad with convex sides and of comparable size. Anterior margin of abdominal segment IV deeply concave to accept the laterally compressed post-petiole.

Dorsum of head, mesosoma, petiolar node, post-petiolar node and gaster, with short pubescence. Entire body covered sparsely with suberect hairs.

Etymology

The name of the new species is inspired by Prof. Vaibhav Chindarkar. In Sanskrit, “vaibhav” means eminence – like the glow of a flame in the dark. Incidentally, this species is also yellowish-orange in colour (Fig. 1). Hence, “flamma”.

Differential Diagnosis

In terms of the number of mandibular teeth and the structure of petiolar and post-petiolar nodes, *P. flamma* sp. n. appears morphologically close to *P. lini* Terayama, 2009. However, the new species can be very easily differentiated based on the short antennal scape which does not exceed the posterior margin of the head (SI 91.0 in

comparison to *P. lini* where the scape exceeds the posterior margin of the head (SI 104.2).

In terms of individual morphometric measurements (TL, HL, HW, SL, PW, WL, PNL, PNH, PNW, PPNL, PPNH and PPNW) the new species has generally smaller features than the other congeneric species (Fig. 2a). In two-dimensional ordination space, the new species is closer to *P. wardi* Bharti & Akbar, 2015, described from Kerala, India than the other *Protanilla* species (Fig. 2b).

Key to known valid species of *Protanilla* of the world based on the worker caste

The new species, keys out to *P. lini* based on the key provided by Hsu *et al.* (2017), however differs based on a shorter antennal scape leading us to introduce a new couplet #9 and moving the last couplet to #10 as below. Therefore couplet #1 through #8 are identical to the existing key for *Protonilla* as provided by Hsu *et al.* (2017).

1. Mandibles with a large convex dorsal lamella and a large longitudinal groove on outer surface.....***P. izanagi* Terayama (Japan)**
 - Mandibles thin, long and narrowly triangular, without a dorsal lamella; with or without a groove on outer surface.....**2**
2. Lateral or ventral margin of mandibles with 1–2 denticles. Postpetiole broadly attached to abdominal segment IV..... **3**
 - Lateral and ventral margin of mandibles smooth, without denticle. Postpetiole narrowly attached to abdominal segment IV.....**4**
3. Ventral faces of mandibles with only one inconspicuous denticle. Anterior margin of abdominal segment IV in dorsal view slightly concave. Side of abdominal segment IV with a deep and narrow notch between the tergite and sternite at the anterior margin. In profile view, postpetiolar sternite nearly straight, and anterior corner forming a right angle.....
.....***P. jongi* Hsu *et al.* (Taiwan)**
 - Lateroventral margins of mandibles armed with 2 distinct teeth (one long and one short). Anterior margin of abdominal segment IV in dorsal view deeply concave. Side of abdominal segment IV without a deep and narrow notch between the tergite and sternite at the anterior margin. In

- profile view, postpetiolar sternite deeply concave.....*P. furcomandibula* Xu (China: Yunnan)
4. In full face view, anterior margin of clypeus strongly concave. In dorsal view, petiole distinctly longer than broad. Body bicolored, the middle portion black, the rest brownish yellow.....5
 - In full-face view, anterior margin of clypeus straight to weakly concave. In dorsal view, petiole as broad as long or broader than long. Body concolorous, uniformly yellowish brown or reddish brown.....6
 5. In full-face view, anterior 1/3 of the head distinctly narrowed. In profile view, anterior and dorsal faces of petiolar node some-what differentiated, meeting at a broadly rounded angle. Head brownish yellow. Body small (HW 0.42–0.45 mm in types).....*P. bicolor* Xu (China: Yunnan)
 - In full face view, anterior half of head distinctly narrowed. In profile view, petiolar node evenly rounded, with no differentiation of anterior and dorsal faces. Head light black to blackish brown. Body large (HW 0.60–0.65 mm in types).....*P. gengma* Xu (China: Yunnan)
 6. In profile view, anterior face of petiole distinctly concave, anterodorsal corner protruding.....7
 - In profile view, anterior face of petiole straight, sloped or slightly convex.....8
 7. Petiole distinctly broader than long, slightly widened posteriorly. In profile view, top half of postpetiole slightly inclined anteriorly and roughly round.....*P. rafflesii* Taylor (Singapore and Malaysia)
 - Petiole nearly square in dorsal view, as broad as long, weakly narrowed posteriorly. In profile view, top half of postpetioleroughly rectangular, with straight anterior and posterior face.....*P. wardi* Bharti & Akbar (India: Kerala)
 8. Top half of postpetiole not inclined forward, posterodorsal corner angled. In dorsal view, both petiole and postpetiole round, as long as broad.....9
 - Top half of postpetiole strongly inclined forward. In dorsal view, at least petiole or postpetiole compressed anteroposteriorly, broader than long.....10
 9. Scape exceeds the posterior margin of the head (SI 104.167).....*P. lini* Terayama (Taiwan)
 - Scape does not extend beyond the posterior margin of the head (SI 90.986).. *P. flamma* sp. n. (India: Goa)
 10. In full face view, anterolateral corners of head prominent and tooth-like. In profile view, petiole relatively thick and roughly trapezoidal, dorsal face long, approximately as long as anterior face.....*P. tibeta* Xu (China: Tibet)
 - In full face view, anterolateral corners of head smooth and without prominent tooth-like structures. In profile view, petiole relatively thin and roughly triangular, dorsal face short, approximately half the length of anterior face.....*P. concolor* Xu (China: Yunnan)

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