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Two New Reports of *Stigmatomma* Roger, 1859 (Hymenoptera, Formicidae, Amblyoponinae) Species from the Indian Subcontinent

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Abstract

Two species of *Stigmatomma* Roger, 1859, namely *Stigmatomma amblyops* Karavaiev, 1935 and *Stigmatomma luyiae* Hsu, Esteves, Chou & Lin, 2017 are reported for the first time from the Indian subcontinent. *Stigmatomma amblyops* was previously known from Vietnam and China whereas *S. luyiae* was recorded from Taiwan. Workers of the aforementioned species were collected from the Eaglenest Wildlife Sanctuary, Arunachal Pradesh, Northeast India.

Introduction

Amblyoponinae is a subfamily of subterranean predators, commonly known as dracula ants as the adult ants pierce the larval integument and imbibe hemolymph (Ward & Fisher, 2016). These ants are slow in their movements but are excellent hunters of other arthropods (Brown, 1960). The subfamily was historically considered as a tribe within Ponerinae and later treated as a valid subfamily by Bolton (2003). The crown group (i.e., a clade defined by extant species which consists of the last common ancestor and all of its living descendants) of the Amblyoponinae have been estimated to have originated in the Afrotropical region during the mid-Cretaceous, and to have dispersed to the Neotropical, Indomalayan, and Australasian regions (Ward & Fisher, 2016). To date, nine extant genera and one fossil genus have been described in this subfamily (Bolton, 2021a). This is a monophyletic group with two well-supported clades namely POA and XMMAS. The POA clade consists of *Prionopelta*, *Onychomyrmex* and *Amblyopone* genera while the XMMAS clade consists of two important groups: one with genus *Fulakora* and the other with genera *Xymmer*, *Mystrium*, *Myopopone*, *Adetomyrma* and *Stigmatomma* (Ward & Fisher, 2016).

Stigmatomma Roger (1859) is the largest genus within Amblyoponinae (Bolton, 2021b), and is currently represented by 55 extant species and 2 fossil species (AntWeb, 2023a). Initially, it was considered as a junior synonym of *Amblyopone* Erichson, 1842 (Brown, 1960) but was revived as a valid genus (Yoshimura & Fisher, 2012). *Stigmatomma* is distributed worldwide and the members of the genus are solitary hunters and prey upon other arthropods, especially geophilomorph centipedes (Brown, 1960; Gotwald & Lévieux, 1972). Non-destructive cannibalism is also reported in the genus with adults making punctures in the larval integument and feed on the exuding hemolymph (Haskins, 1928; Masuko, 1986). However, this specific feeding habit does not seem to

harm the larvae which eventually emerge as normal adults (Garcia et al., 2013). The queens of *S. silvestrii* Wheeler, 1928 have been found to exclusively feed on larval haemolymph for nutrients (Masuko, 1986). The *Stigmatomma* species like other Amblyoponine ants are inhabitants of forest floors, nesting and foraging in soil and rotten logs (Esteves & Fisher, 2016). This cryptobiotic lifestyle of *Stigmatomma* hampers access to their colonies, therefore, their behaviour and biology are poorly studied (Ward & Fisher, 2016).

In the Indian subcontinent, a region coincident with the Indian sub-region. *i.e*., the area south of the Himalayas bounded by Afghanistan, Burma, and the Chagos archipelago (Akbar et al., 2021), the genus *Stigmatomma* has been recorded only from India, Bangladesh, Nepal, and Sri Lanka (Fig 1). In India *Stigmatomma* is represented by eight species: *S. awa* (Xu & Chu, 2012); *S. bellii* (Forel, 1900); *S. boltoni* (Bharti & Wachkoo, 2011); *S. minutum* Forel, 1913; *S. pertinax* (Baroni Urbani, 1978); *S. reclinatum* (Mayr, 1879); *S. rothneyi* (Forel, 1900) and *S. xui* Bharti & Rilta, 2015 (Bharti & Rilta, 2015; Bharti et al., 2016; Bolton, 2021b). *Stigmatomma bellii* (Forel, 1990), *S. rothneyi* (Forel, 1900) and *S. pertinax* (Baroni Urbani, 1978) are the species reported from Sri Lanka, Bangladesh and Nepal respectively (Musthak, 1991; Dias et al., 2020; Subedi et al., 2020). The genus has not been recorded from Pakistan (Rasheed et al., 2019).

Herein we report two new records of the genus *Stigmatomma* to the Indian subcontinent: *S. amblyops* Karavaiev, 1935 and *S. luyiae* Hsu, Esteves, Chou & Lin, 2017. The former was previously known from Vietnam and China (Karavaiev, 1935; Chapman & Capco, 1951; Hamer et al., 2023) whereas the latter was recorded from Taiwan and China (Hsu et al., 2017; Hamer et al., 2023).

Material and Methods

An extensive sampling of ants using pitfall traps and Winkler extraction methods in the Eaglenest Wildlife Sanctuary (EWS), located in West Kameng district of Arunachal Pradesh, Northeast India, in the year 2013 was carried (Fig 1). Specimens belonging to the genus *Stigmatomma* were recovered from two Winkler samples only. EWS sanctuary 27° 4’ 25” N 92° 26’ 32” E receives an average annual rainfall of 3,000 millimeters on its southern slope and 1,500 millimeters on the northern slopes (Choudhury, 2003). The vegetation of the EWS sanctuary ranges from tropical evergreen forests in the lower elevations, temperate broad-leaved forests in the mid altitudes and rhododendron stands and small patches of coniferous forest near the highest elevations.

The taxonomic study of collected material was conducted on Zeiss SteREO Discover.V8 microscope. Extended focus montage images were taken using Keyence VHX 6000 digital microscope at 200×magnification. Images were aligned into plates using Adobe Photoshop CC 2019©. AxioVision 4.8 (Carl Zeiss, Germany) software was used for taking body measurements. Standard measurements and indices as stated in Hsu et al. (2017) were followed. The species were identified using a taxonomic key to Asian *Stigmatomma* provided by Xu and Chu (2012) and Hsu et al. (2017). We also compared the specimens with original species descriptions

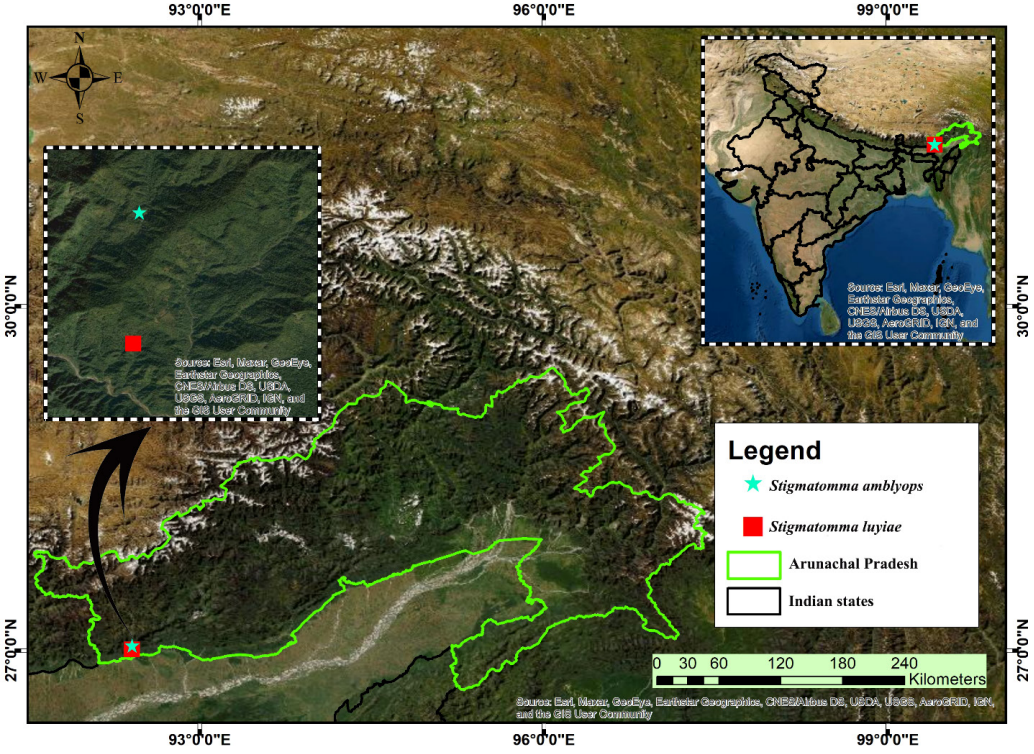

Fig 1. Google Earth image of the study region. The light blue star and red square depict the respective location within the Eaglenest wildlife sanctuary, from where *S. amblyops* and *S. luyiae* were collected.

and images of *S. amblyops* and *S. luyiae.* The images of the syntype of *S. amblyops* were accessed on AntWeb (2021) (CASENT0916796) while the holotype images of *S. luyiae* were examined from Hsu et al. (2017). The distribution of *Stigmatomma* species in the Indian subcontinent was assessed using antmaps (Janicki et al., 2016; Guénard et al., 2017) and Bharti et al. (2016). A map showing the collection sites of the newly recorded species in the EWS sanctuary was prepared using QGIS v. 3.10.4 (QGIS, 2020). The specimens are deposited in the ant collection of ATREE Insect Museum, Bangalore, India (AIMB).

Measurements and Indices

TL (Total Length): The maximum length of the specimen in lateral view, measured from the mandibular apex to the gastral apex excluding the sting.
HL (Head Length): The length of the head in full-face view, excluding the mandibles, measured to the medial point of the posterior line drawn between the posterior lobes of the head.
HW (Head Width): The maximum width of the head in full-face view, excluding the eyes.
HW2 (Head Width 2): In full-face view, width of the head immediately posterior to the posterolateral margin of the clypeus.
SL (Scape Length): The maximum length of the scape, excluding the basal constriction and condyle.
ML (Mandible Length): The length of the mandible measured from apex to the lateral base.
WL (Weber's Length): The diagonal length of the mesosoma in profile, measured from the base of the anterior slope of the pronotum to the propodeum lobe.
PPW (Propodeal Posterior Width): The width of the propodeum in dorsal view, measured across the posterior margin of the propodeum.
PnW (Pronotal Width): The maximum width of the pronotum in dorsal view.
PtW (Petiole Width): The maximum width of the petiolar tergite in dorsal view.
PtL (Petiole Length): The maximum diagonal length of the petiole in profile, measured from the anterior-most point of the subpetiolar process to the posterodorsal corner of the petiolar tergite.
CI (Cephalic index) = HW/HL × 100.
MI (Mandibular index) = ML/HL × 100.
SI (Scape index) = SL/HW × 100.

Depositaries

SIZK - Schmaulhausen Institute of Zoology, Kiev.
NMNS - National Museum of Natural Science, Taichung City, Taiwan.
TARI - Taiwan Agricultural Research Institute, Taichung City, Taiwan.

Results

***Stigmatomma amblyops* Karavaiev, 1935** (Fig 2 A–C)

Fig 2. Worker of *Stigmatomma amblyops*. **A.** Head in full-face view. **B.** Body in dorsal view. **C.** Body in profile view.

Stigmatomma amblyops Karavaiev, 1935a: 57. Syntype workers, Vietnam ("Cochinchine"): Cauda, Nr 5675 (K. Davydov) [SIZK].
Amblyopone amblyops (Karavaiev); Brown, 1960a: 167; combination in *Amblyopone*.
Stigmatomma amblyops Karavaiev; Yoshimura & Fisher, 2012: 19; combination in *Stigmatomma.*

Material examined - INDIA: 2 workers; Arunachal Pradesh, West Kameng district, Eaglenest Wildlife Sanctuary; 27.0460°N, 92.4157°E; 1200 m a.s.l; 14.iv.2013; Marathe Aniruddha leg.; Winkler extraction method; AIMB/Hy/Fr 25004, AIMB/Hy/Fr 25005.

Measurements (mm): TL – 3.77- 3.92; HL – 0.7- 0.75; HW – 0.62 - 0.69; HW2 – 0.65 – 0.67; SL – 0.39; ML – 0.5 – 0.52; WL – 1.00- 1.01; PPW – 0.35- 0.36; PnW – 0.41- 0.44; PtW – 0.37- 0.40; PtL – 0.50 - 0.54. **Indices:** CI – 88.5 - 92; MI – 69.3 - 71.4; SI – 52 - 62.9.

Differential diagnosis

Stigmatomma amblyops is easily separated from most of its congeners in Asia by the following combination of characters: i) antennae 12 segmented; ii) head in full-face view, elongate trapezoidal, longer than broad; iii) anterior clypeal margin with 6 dentiform setae, the lateral setae larger than the others. *Stigmatomma amblyops* is similar to *S. minutum* in having 12 segmented antennae, and anterior clypeal margin with 6 dentiform setae. However, *S. amblyops* and *S. minutum*, has strong difference in the width of the posterior extension of the clypeus between the toruli, being wide in the former species and narrow (almost obliterated) in the latter. Lateral dentiform setae on anterior clypeal margin are larger than the rest of the dentiform setae in *S. amblyops,* whereas lateral dentiform setae on anterior clypeal margin are subequal in *S. minutum*.

Variation: Indian specimens differ from those of Chinese in having more pilosity and larger dentition.

***Stigmatomma luyiae* Hsu, Esteves, Chou & Lin, 2017** (Fig 3 A–C)

Stigmatomma luyiae Hsu, Esteves, Chou & Lin, 2017. Holotype worker, China (Taiwan): Nantou County, LFDP (Lienhuachih Forest Dynamics Plot) [NMNS]. Paratype with same data [TARI].

Fig 3. Worker of *Stigmatomma luyiae*. **A.** Head in full-face view. **B.** Body in dorsal view. **C.** Body in profile view.

Material examined – INDIA: 1 worker; Arunachal Pradesh, West Kameng district, Eaglenest Wildlife Sanctuary; 27.0078°N, 92.4084°E; 770 m a.s.l; 12.iv.2013; Marathe Aniruddha leg.; Winkler extraction method; AIMB/Hy/Fr 25006.

Measurements (in mm): TL – 2.15; HL – 0.45; HW – 0.37; HW2 – 0.42; SL – 0.25; ML – 0.38; WL – 0.57; PPW – 0.22; PnW – 0.29; PtW – 0.21; PtL – 0.12. **Indices:** CI – 93.3; MI – 84.4; SI – 59.5 (n = 1).

Differential diagnosis

Stigmatomma luyiae is unique in the following combination of characters: i) antennae with 11 segments; ii) baso-masticatory margin of mandible with undivided teeth arranged in a single row: iii) frontal carinae short, not surpassing mid-length of the head; iv) antennal scrobe absent; v) median mandibular teeth jigsaw-tab-shaped; vi) anterior clypeal margin flat, clypeal setae rise from the anterior portion of the median area of the clypeus (Hsu et al., 2017). *Stigmatomma luyiae* is similar to its Chinese congeneric *S. mulanae* (Xu, 2000) in general appearance including the presence of 11 segmented antennae, jigsaw tab-shaped arrangement of the median mandibular teeth. However, *S. luyiae* is easily distinguished from *S. mulanae* based on the combination of following characters: i) anterior clypeal margin flat, clypeal setae arise from the anterior portion of the median area of the clypeus in *S. luyiae* (clypeal setae arise from small tubercular projections of the anterior clypeal margin in *S. mulanae*); ii) head approximately square in *S. luyiae* (head distinctly rectangular in *S. mulanae*); iii) mandibles as long as head in *S. luyiae* (mandibles shorter than head in *S.mulanae*) (Hsu et al., 2017).

Variation: *S. luyiae* worker specimen from India has prominent body hairs and striations and slight differences in the body measurements in comparison to holotype.

Discussion

Although 55 valid species of *Stigmatomma* are described from all over the world, only eight species are known from India so far. Among these, *S. awa* and *S. xui* are reported only from the Eastern Himalayas. *S. boltoni* is reported from the Western Himalayas, while *S. pertinax* is found on the southern slope of the Himalayas and in the Eastern Himalayas. *S. minutum* and *S. reclinatum* are reported exclusively from the Western Ghats. On the other hand, *S. rothneyi* and *S. belli* are known from both the Western Ghats and the Eastern Himalayas (Bharti et al., 2016; AntWeb, 2023b). Our study reports the occurrence of *S. amblyops* and *S. luyiae* in the Indian subcontinent, bringing the total number of known *Stigmatomma* species in the region to ten. This report and other recent discoveries show that insects of the Eastern Himalayas are still underexplored and several species, including ants, await discovery (Aswaj et al., 2020; 2021a; 2021b).

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Authors' Contributions

RS: methodology, investigation, writing-original draft, writing-review & editing, visualization. PA: methodology, investigation, writing-original draft, writing-review & editing, visualization. MA: conceptualization, methodology, writing-review & editing. DRP: conceptualization, resources, methodology, writing-review & editing, project administration, funding acquisition.

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