First report of *Tetragonula calophyllae* Shanas & Faseeh 2019 (Apidae: Apini: Meliponini) from Goa state, India

Abstract

The occurrence of *Tetragonula calophyllae* Shanas & Faseeh 2019, in Goa state, India, is reported for the first time. Morphometric comparison between *T. callophyllae* workers from Goa and Type series are provided along with comments on the external nest entrance. The need for developing baseline database on species distribution is stressed for developing policies for conservation planning and climate adaptation strategies for future.

Key words: Stingless bees, *Tetragonula*, nomenclature, taxonomy, distribution, diversity

Introduction

The stingless bees (Meliponini) are highly eusocial bees restricted to the tropical and subtropical areas of the world (Ayala et al. 2013), represented by 605 extant species in 45 extant genera (Engel et al. 2023). They are particularly important pollinators of tropical plants, visiting approximately 90 crop species (Heard 1999). They are major pollinators in tropical areas and their use in managed pollination, to produce high-value honey, and as recreation is increasingly popular worldwide (Gonzalez et al. 2021).

The availability of different types of habitats affects the diversity value, abundance, and distribution patterns of stingless bees and temperature is one of the environmental parameters with the greatest impact (Trianto & Purwanto, 2022). A model study on habitat suitability for stingless bees in Colombia predicted that seven of the nine species of stingless bees used in meliponiculture would experience a significant reduction in their climatically suitable areas, and thus will likely influence agriculture and rural livelihoods (Gonzalez et al. 2021).

In India, stingless bees are represented by three genera *viz*., Lepidotrigona, Lisotrigona and Tetragonula among which, Tetragonula is the most speciose with 12 species described till date (Rasmussein 2013; Shanas and Faseeh, 2019; Viraktamath and Rojeet, 2021; Viraktamath and Roy, 2022).

Among the *Tetragonula* spp., *T. callophyllae* was categorised as endangered due to its rarity in the wild as well as in beekeeper managed colonies and unknown breeding behavior (Shanas & Faseeh, 2019). *T. callophyllae* currently known only from southern Kerala, is reported for the first time from Goa state, extending its distribution range about 1000 km north to the type locality indicating a need for proper surveys to map species distribution for long term conservation.

Materials and methods

Specimens studied: Workers of stingless bee *T. calophyllae* were collected from live colonies and preserved in 98-100% ethyl alcohol. The specimens were card mounted and labelled. Card mounted samples were examined under a stereoscopic binocular microscope and morphometric parameters were recorded. Species identifications were confirmed using morphological characters, and by using published records.

Results and Discussion

The specimen observed by us collected from Goa differed in respect of their size when compared to the type series. The identity of *T. calophyllae*, obtained from Goa, was confirmed by the presence of a yellow band on clypeus (Fig. 1A) and presence of weakly curved median vein on the hindwing (Fig. 1B). The Colouration and pilosity of the specimens were similar to the type species. However, few morphometric variations in size and character ratios observed are listed (Table. 1).

Table 1. Morphometric difference between *T. callophyllae* workers from Goa and Type series.

Sl.No	Character	T. callophyllae Workers (Goa)	T. callophyllae (Type series)
1	Length of body	3.10 mm (3.06- 3.15mm)	3.4mm (3.35-3.45)mm
2	Head length	1.25mm (1.22-1.26mm)	1.55mm(1.52-1.85)
3	Length of scape	0.54mm	0.62mm(0.62-0.64)
4	Length of 2^{nd} flagellomere	0.09mm	0.11mm
5	WL2	0.95mm (0.92-0.95mm)	1.12mm(1.01-1.12)
6	IOD/OD	2.50mm	2.22-2.38
7	Length /width of head ratio	0.83mm (0.82-0.84)	0.86-1.19
8	Malar space /F3	0.29mm	0.36-0.44

Hive entrance structure: The external hive entrance of *T. callphyllae* was found shorter, thicker and smoother, with patches of resin spread (Fig. 1D), probably to deter enemies, compared to the longer, thinner and drier nest entrance of *T. travancorica* which had debris spread all over (Fig. 1C).

Material examined: *T. calophyllae*: INDIA, GOA, 10 (workers): Colvale: North Goa, Arya, K. coll. 22-II-2022.

Distribution: INDIA (Kerala, Goa)

Only few studies have addressed the possible impact of climate change on the spatial distribution of stingless bees (Gonzalez et. al. 2021). There exists only a single comprehensive record on the occurrence of few stingless bee species in India, mapped by Rasmussein, 2013. Land use

changes and climate change pose a serious threat to the conservation of the stingless bees (Lima and Marchioro, 2021). Hence, it is concluded that, baseline distribution data on stingless bees used in meliponiculture is essential for developing conservation policies and climate adaptation strategies under present and future climate scenarios.

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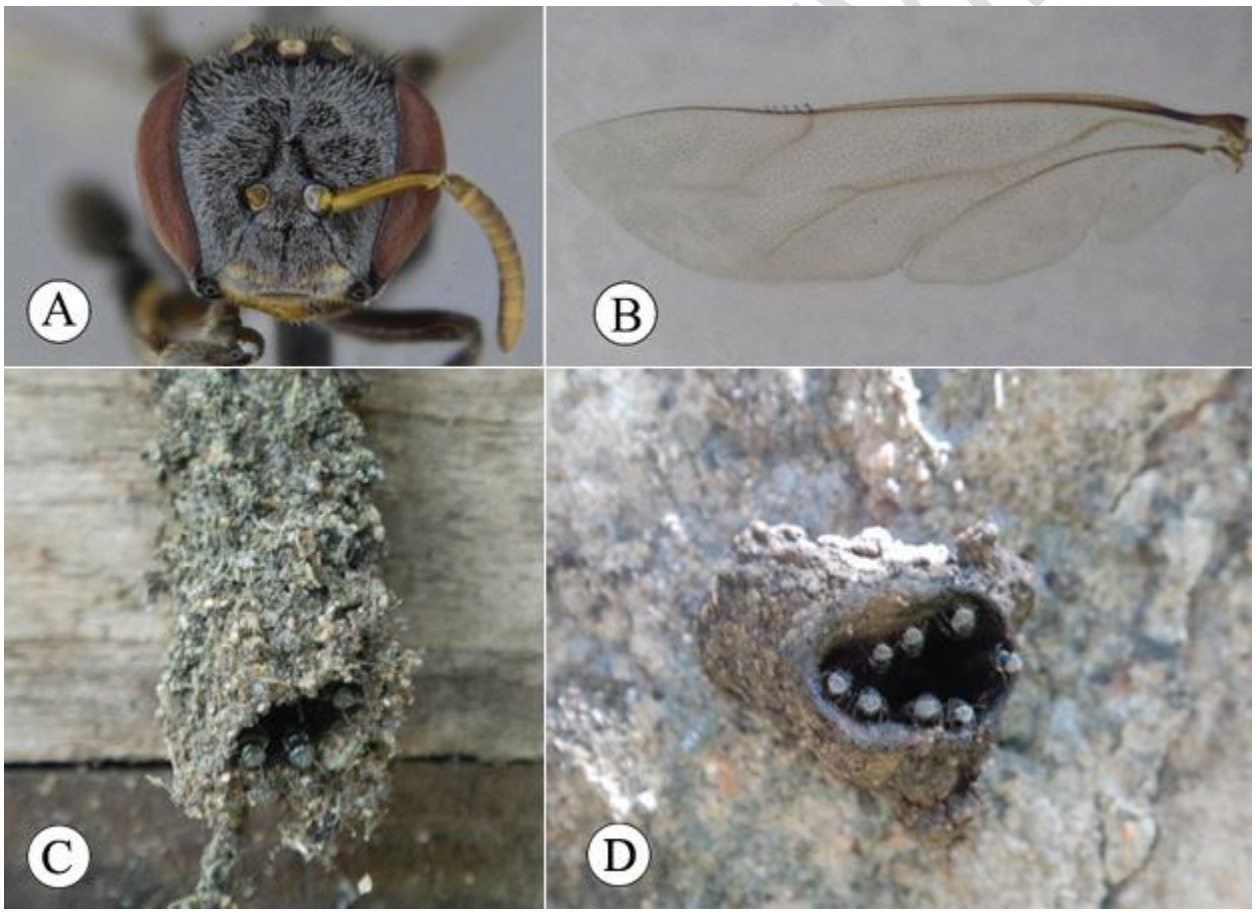

FIGURE 1. (A) Worker of *T. calophyllae*, head, frontal view (B) Worker of *T. calophyllae*, hind wing (C) Nest entrance of *T. travancorica*, (D) Nest entrance of *T. calophyllae*