First report of *Tetragonulacalophyllae*Shanas& Faseeh 2019 (Apidae: Apinae: Meliponini) from Goa state, India

ABSTRACT

The occurrence of *Tetragonulacalophyllae*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, nomenclature, taxonomy, distribution, diversity

1. 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 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, 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 and 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, indicating a need for proper surveys to map species distribution for achieving long term conservation.

2. MATERIALS AND METHODS

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.

3. 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- 3.15 mm)	3.4 mm (3.35-3.45 mm)
2	Head length	1.25 mm (1.22-1.26 mm)	1.55 mm (1.52-1.85 mm)
3	Length of scape	0.54 mm	0.62 mm (0.62-0.64 mm)
4	Length of 2nd flagellomere	0.09 mm	0.11 mm
5	WL2 (distance between Medio - Cubital bifurcation and basal tip of marginal cell)	0.95 mm (0.92-0.95 mm)	1.12 mm (1.01-1.12 mm)
6	IOD/OD (interocellar distance / ocellocular distance)	2.50 mm	2.22-2.38 mm
7	Length /width of head ratio	0.83 mm (0.82-0.84 mm)	0.86-1.19 mm
8	Malar space /F3 (funicle 3)	0.29 mm	0.36-0.44 mm

Hive entrance structure: The external hive entrance of *T. callphyllae* was found shorter, thicker and smoother, with patches of spread cerumen (Fig. 1D), probably to deter enemies, compared to the longer, thinner and drier nest entrance of *T. travancorica*Shanas and Faseeh, 2019, which had spread debris 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)

Although information is limited, few studies have addressed the possible impact of climate change on the spatial distribution of stingless bees (Gonzalez et. al. 2021). Land use changes and climate change pose a serious threat to the conservation of the stingless bees (Lima and Marchioro, 2021). Some species can gain suitable habitats or experience relatively small habitat reductions (Giannini *et al*., 2017, 2020), while others like *Melipona quadrifascita*Lepeletier, an endemic species to the Brazilian Atlantic Forest (Marchioro *et al*., 2020) and other species from the eastern Amazon of Brazil (Giannini *et al*., 2020) will have higher loss of occurrence area.

There exists only few reliable records on the occurrence of stingless bee species in India (Rasmussein, 2013; Shanas and Faseeh, 2019; Viraktamath and Rojeet, 2021; Viraktamath and Roy, 2022) which is insufficient to truly map species distribution.

4. CONCLUSION

Concluding, in this study, our results obtained indicate that, the rare stingless bee species, *T. calophyllae* has an extended distribution range of about 1000 km north to the known type locality, in Kerala. Hence, a 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. It is also essential that, occurrence records of different species of stingless bees have to be recorded in order to assess the threats to their conservation.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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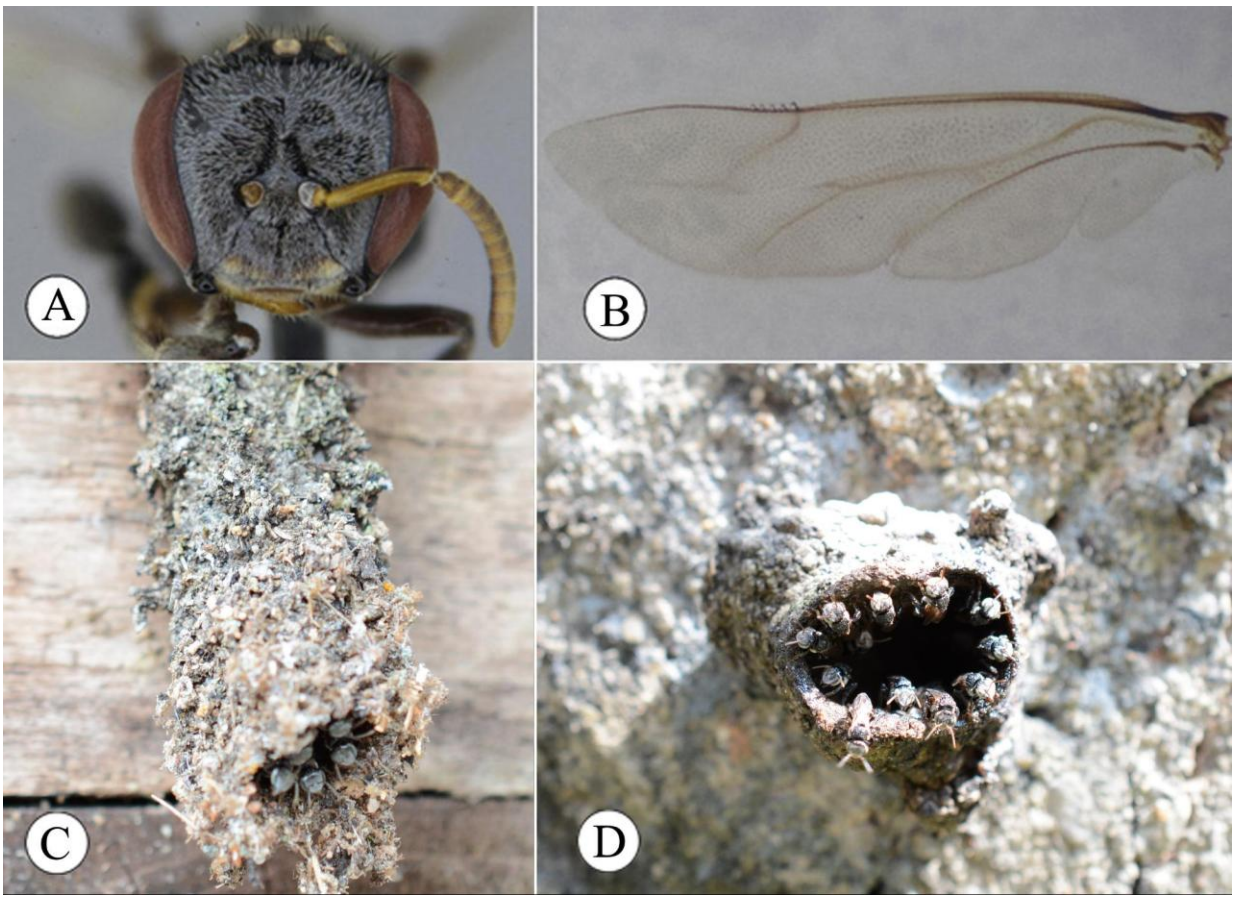

FIGURE 1. (A) Worker of *T. calophyllae*, head, frontal view (B) Worker of *T. calophyllae*, hind wing (C) Nest entrance of *T. travancorica*, (D) Nest entrance of *T. calophyllae*