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First record of two interesting genera of hover flies (Diptera: Syrphidae) in South India

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Abstract

The bee mimicking hover fly genus *Volucella* Geoffroy, 1762 and the potter wasp mimicking genus *Monoceromyia* Shannon, 1922 are reported for the first time from South India. Brief diagnosis of *Volucella trifasciata* Wiedemann, 1830 and *Monoceromyia javana* (Wiedemann, 1824), high-resolution images of the habitus and other important characters, as well as notes on their distribution, mimicry and biology are provided.

Key words: *Volucella*, *Monoceromyia*, batesian mimicry, new record, range extension

Introduction

True flies belonging to the family Syrphidae are small to large sized flies (ranging from 3–18 mm), commonly called hover flies or flower flies (Mitra *et al.* 2015; Hassan *et al.* 2019). The family comprises four subfamilies Eristalinae, Microdontinae, Pipizinae and Syrphinae (Mengual *et al.* 2015). Their larvae have different host preferences and members of Syrphinae are predatory especially on soft bodied insects in the order Hemiptera belonging to the families Aphididae, Aleyrodidae, Coccidae, Cicadellidae, Delphacidae, Eurybrachidae, Fulgoridae and Psyllidae. They also feed upon Thysanoptera, immature Coleoptera and eggs of Lepidoptera and Hymenoptera (Ghorpadé 1981; Rojo *et al.* 2003). As such, they act as potential predators in various agri and horticultural ecosystems. Members in the other three subfamilies feed upon dead wood (saprophagous), excrements (coprophagous), fungi (mycetophagous) and various plant parts such as bulbs, leaves and tubers (phytophagous). Some inhabit nests of ants, termites, wasps and bees (Mitra *et al.* 2015). Adults are free-living and can be effective pollinators of a number of plants. They exhibit batesian mimicry by mimicking bees and wasps. Up to date, 357 syrphid species in 69 genera are recorded from India (Mitra *et al.* 2015; Ghorpadé 2015; Sengupta *et al.* 2016) and the Eristalinae genera *Volucella* (tribe Volucellini) and *Monoceromyia* (tribe Cerioidini) are represented by 11 and 12 species, respectively. Apart from India, they are also distributed in neighboring countries such as China, Indonesia, Malaysia, Myanmar, Nepal and Singapore.

In India, both genera were previously recorded only from North-eastern hill regions, considered as a biodiversity hotspot, with humid subtropical climate. In this paper, we report them from South India for the first time, where the climatic conditions are different in the Western Ghat region (also a biodiversity hotspot) with wet tropical climate. This record indicates both *Volucella trifasciata* and *Monoceromyia javana* are spreading southwards to hitherto undistributed areas in India, showing a notable range extension for these two species. Notes on the diagnosis based on the collected specimens, bionomics and high resolution images are provided for both species.

Material and methods

During our regular surveys for the collection of insects across South India, several methods were adopted, viz - sweep nets, pan traps, malaise traps and light traps. Specimens of the hover fly genus *Volucella* were caught using light traps consisting of a 450 W mercury vapor lamp mounted in front of a 4 x 10 feet white gada cloth and few specimens were also collected by sweepnetting. Specimens of *Monoceromyia* were collected by sweepnetting across flowers and vegetation. The collected specimens were killed using fumes of Ethyl acetate and then pinned for identification consulting Brunetti (1923). Morphological terminology follows Thompson (1999), McAlpine (1981) and Han (1996). The dried specimens were photographed using a DMC 2900 camera attached to a Leica M205C stereo zoom trinocular microscope and image stacks generated processed using Combine ZP and further processed using Photoshop version 7.0. Images of the habitus and other important characters are illustrated to facilitate their identification and the diagnostic characters are marked by arrowheads. The examined specimens are deposited at the department of Entomology, Annamalai University, Chidambaram (EDAU), Tamil Nadu.

Results and Discussion

Volucella Geoffroy, 1762

Diagnosis

Volucella are large hover flies, mimicking bumble bees (e.g. *Volucella bombylans*) and wasps (e.g. *Volucella zonaria*). The genus can be recognized by wings with a closed marginal cell, the face protruding downward and the densely plumose arista. The head is as broad as thorax or narrower and the eyes are pubescent in both sexes. Thorax with long and dense pile, abdomen short ovate, broader than thorax, with pubescence just like on thorax. Legs simple. (Brunetti 1923; Nedeljković *et al.* 2003).

Volucella trifasciata Wiedemann, 1830

(Figs 1–8)

Volucella trifasciata Wiedemann, 1830

Volucella decorata Walker, 1859

Volucella nubeculosa Bigot, 1875

Material examined

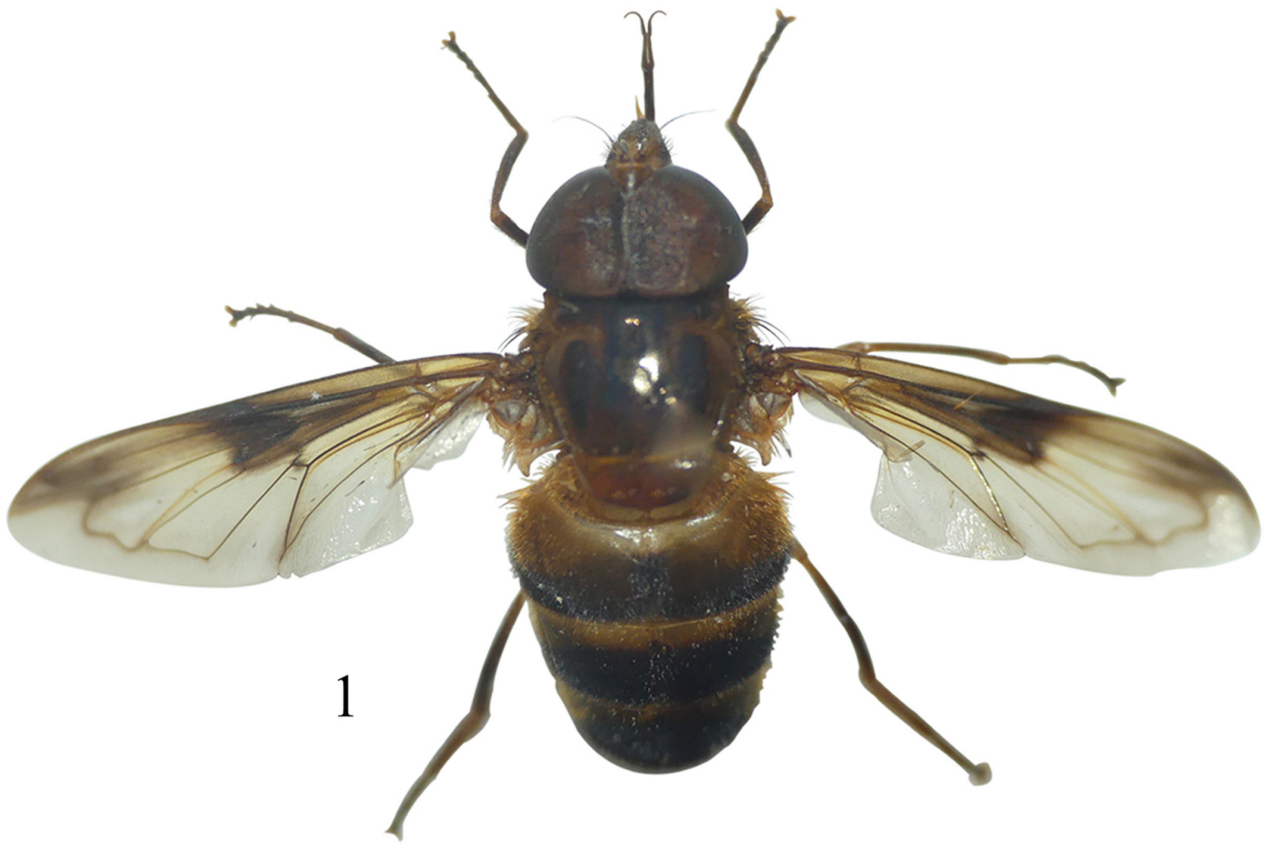
India, Tamil Nadu (Thadiyankudisai: 10°17'11"N, 77°42'8"E) Light trap, Coll. H. Sankararaman, 8 females, 3 males, 18.viii.2018; 3 females, 1 male, 13.ix.2018; India, Tamil Nadu (Kunjappanai: 11°22' N, 76°56' E) Sweep net, Coll. H. Sankararaman, 2 females, 1 male, 22.vii.2018.

Diagnosis

Head tawny (Fig. 1); face projecting forward and downwards, pubescent (Figs. 2, 5). Antennal arista orange with black hairs (Fig. 2). Eyes pubescent in both the sexes, at least in the antero-dorsal region of the eye. Female with frons yellow brown, wide above antenna and narrowing at vertex (Figs. 3, 6). Scutum smooth, black medially; rest of the thorax tawny, including scutellum (Figs. 1, 4, 8). Numerous long black setae on the lateral side of the thorax; 5–7 notopleural; 4–5 supra-alar; 4–5 postalar; 4–5 prescutellar; 4–6 marginal scutellar and 3–4 anepisternal. Wing membrane hyaline, infuscated in the middle and apex; narrow areas along M₁, dm-cu brown (Fig. 7); halter orange. Abdomen mainly black, tergite I entirely pale yellow, tergite II with a pale band apex and narrow dark black band at base, tergite III and IV with a narrow pale band apically and the rest black. First pale band on tergites II–III is broader than second on tergites III–IV (Figs. 1, 4). Pubescence on abdomen short. Legs tawny, except femur and tibiae with medial black ring; all tarsi brown.

Distribution

Cambodia, China, India (Meghalaya: Rhi-Bhoi, Sikkim, Tamil Nadu: Kunjappanai, Thadiyankudisai [**New record**]), Indonesia, Malaysia, Myanmar, Philippines, Taiwan, Thailand and Vietnam (Brunetti 1923; Ghorpadé 2014; Mitra *et al.* 2015).



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Figures 1–3. *Volucella trifasciata* (Male). **1**, Habitus; **2**, Head (lateral); **3**, Head (frontal).



4

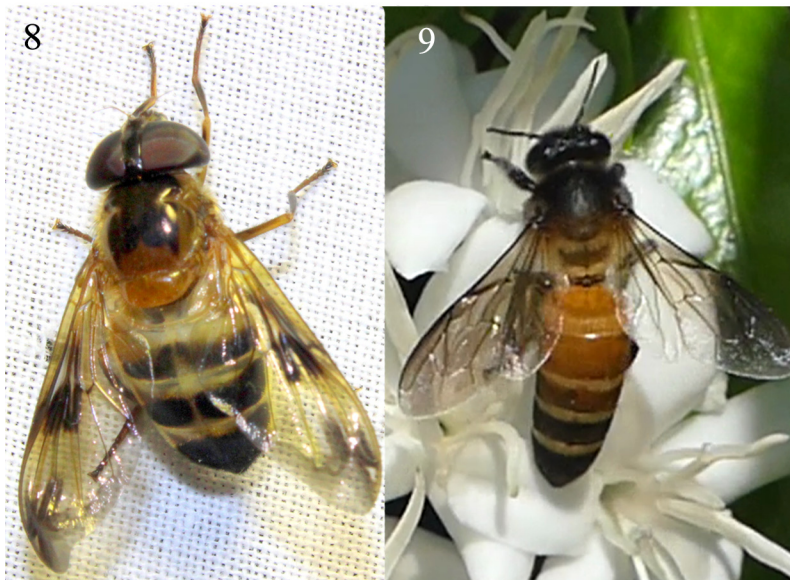


5



6

Figures 4–6. *Volucella trifasciata* (Female). 4, Habitus; 5, Head (lateral); 6, Head (frontal).



Figures 7–9. *Volucella trifasciata* and its model. **7**, Fore wing of *V. trifasciata* (arrows indicating infuscation in centre and apex); **8**, *V. trifasciata* (mimic) alive attracted to light trap; **9**, *Apis dorsata* (model).

Hosts. Unknown. The larvae of *Volucella* are usually inquilines in nests of bees and wasps, acting as detritivores and feeding upon dead larvae and pupae (Brunetti 1923, Stubbs & Falk 1983, Ghorpadé 2014) except for *V. inanis* which is a larval predator and *V. inflata*, found in association with sap runs on *Quercus*. (Rotheray & Gilbert 1999).

Mimicry. *Volucella trifasciata* is a batesian mimic of giant rock bees, *Apis dorsata* (Fig. 9) by having similar infuscated wings, general body colouration and bands on the tergites. It is likely to have an association with *A. dorsata* and their larvae acting as detritivores in the hives of rock bees. *V. trifasciata* were active even after 8 pm, attracted to the light trap. The localities where specimens of *V. trifasciata* were collected had many colonies of rock bees, which were also attracted to light trap along with this hover fly species. However, the host association and the exact nocturnal behaviour period of *V. trifasciata* are not clear and yet to be resolved.

Comments. According to Thompson *et al.* (2017), *Volucella* is mainly a northern temperate group, absent in Afrotropical, Australian and Neotropical regions. In India, *V. trifasciata* is reported only from North-eastern hill states (Meghalaya and Sikkim) where climatic conditions are different from those in the southern states. This is the first record for this genus in South India.

Monoceromyia Shannon, 1922

Diagnosis

The genus is recognized by the scape at least as long as frontal prominence. Furthermore, the abdomen is petiolated, abdominal tergite II is longer than wide, strongly constricted and the postmetacoxal bridge is incomplete (Brunetti 1923, Steenis *et al.* 2016).

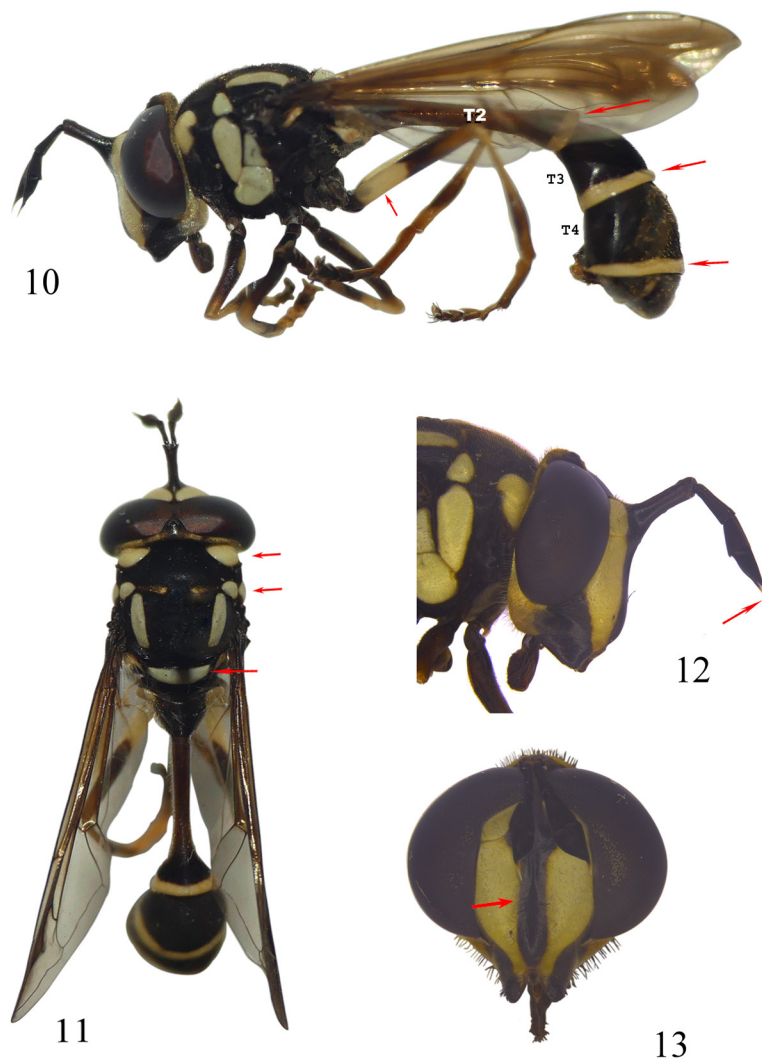
Monoceromyia javana (Wiedemann, 1824)

(Figs. 10–14)

Ceria javana Wiedemann, 1824

Material examined

India, Tamil Nadu (Thadiyankudisai: 10°17'11"N, 77°42'8"E) Sweep net, Coll. H. Sankararaman, 1 male, 1 female, 24.vii.2018; India, Kerala (Pathanamthitta: 9°15'53" N, 76°47'13" E) Sweep net, Coll. H. Sankararaman, 1 male, 06.xi.2018.



Figures 10–13. *Monoceromyia javana*. **10**, Habitus (Lateral) [T2, T3, T4 representing Tergite II, III, IV respectively; arrows indicating the yellow bands on each tergite]; **11**, Habitus (Dorsal); **12**, Head (lateral) showing frontal prominence; **13**, Head (frontal) [arrow indicating the facial vitta].

Diagnosis

Head wider than thorax, eyes bare (Fig. 10). Frontal prominence present, 4.0–4.3 times longer than wide; antennal scape slightly shorter than frontal prominence; arista yellow apically (Figs. 10, 12). Face protruding, antero-ventrally. Frons yellow with a narrow median black vitta (Fig. 13), width of facial vitta 0.19–0.24 times as wide as width of face. Frontal prominence black. Thorax mainly black, scutum with yellow maculae on postpronotum and notopleuron; a yellow vitta from postalar callus to suture on both sides; pleuron black with three yellow maculae on posterior anepisternum, dorsal katapisternum and on anepimeron (Fig. 10). Scutellum yellow (Fig. 11). Wing membrane hyaline except for anterior half, along spurious vein, vein M and cross-vein bm-cu; halter yellow. Abdomen black (except tergite II, brown), tergite I with pair of yellow spots, tergite II 4 times as long as wide; 3 transverse yellow bands on tergite II, III and IV, one on each tergite, posteriorly (Fig. 10). Legs including coxae and trochanter brown to black. Apical 1/8 of femur I and II brown to black, apical 1/5–1/3 of femur III black, rest yellow, medial 1/6 of all tibiae black, tarsi pale brown (Fig. 10).

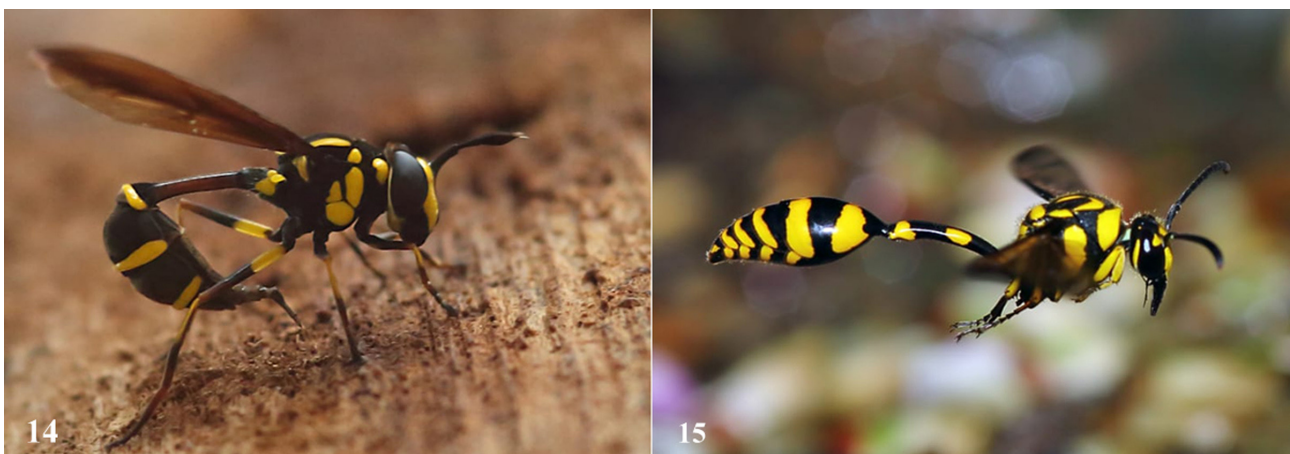
Distribution

Borneo, India (Arunachal Pradesh, Assam: Margherita, West Bengal: Darjeeling, Kerala: Pathanamthitta [**New record**], Tamil Nadu: Thadiyankudisai [**New record**]), Indonesia, Malaysia, Myanmar, Nepal and Singapore (Brunetti 1923; Kapoor *et al.* 1979; Ghorpadé 2015; Mitra *et al.* 2015).

Hosts. Unknown, but rearing records of cerioidines indicate that the larva feed on exuded tree sap (Lundbeck 1916, Bhatia 1931, Heiss 1938, Maier 1987, Rotheray *et al.* 1998, Sivova *et al.* 1999, Krivosheina 2001, Ricarte *et al.* 2007). In the present study, a female (Fig. 14) was collected while ovipositing in exuded sap from the bark of a tree.

Mimicry. Adult cerioidines are remarkable mimics of Vespidae: Eumeninae (potter wasps) and Sphecidae (thread-waisted wasps) (Nicholson 1927, Steenis *et al.* 2016). *Monoceromyia javana* mimics *Phimenes flavopictus* (Fig. 15) a species of potter wasp by having similar body coloration and few other Sphecidae in general appearance by having petiolated abdomen.

Comments. The earlier records show the distribution of *M. javana* along the North-eastern hill states of Arunachal Pradesh, Assam and West Bengal. According to Brunetti (1923), this species has been collected in 1917 from Sidapur, Coorg in Karnataka. However, occurrence of this species in South India was doubtful, because no subsequent collection was made after that. Ghorpadé (2014, 2015) & Mitra *et al.* (2015) stated that the material from Karnataka might be misidentified. Our present study confirms the occurrence of this species along the Western Ghats of South India.



Figures 14–15. Mimic and model. **14**, *Monoceromyia javana* (mimic) ovipositing in exuded tree sap; **15**, *Phimenes flavopictus* (model) [courtesy Mr. S. Karthikeyan].

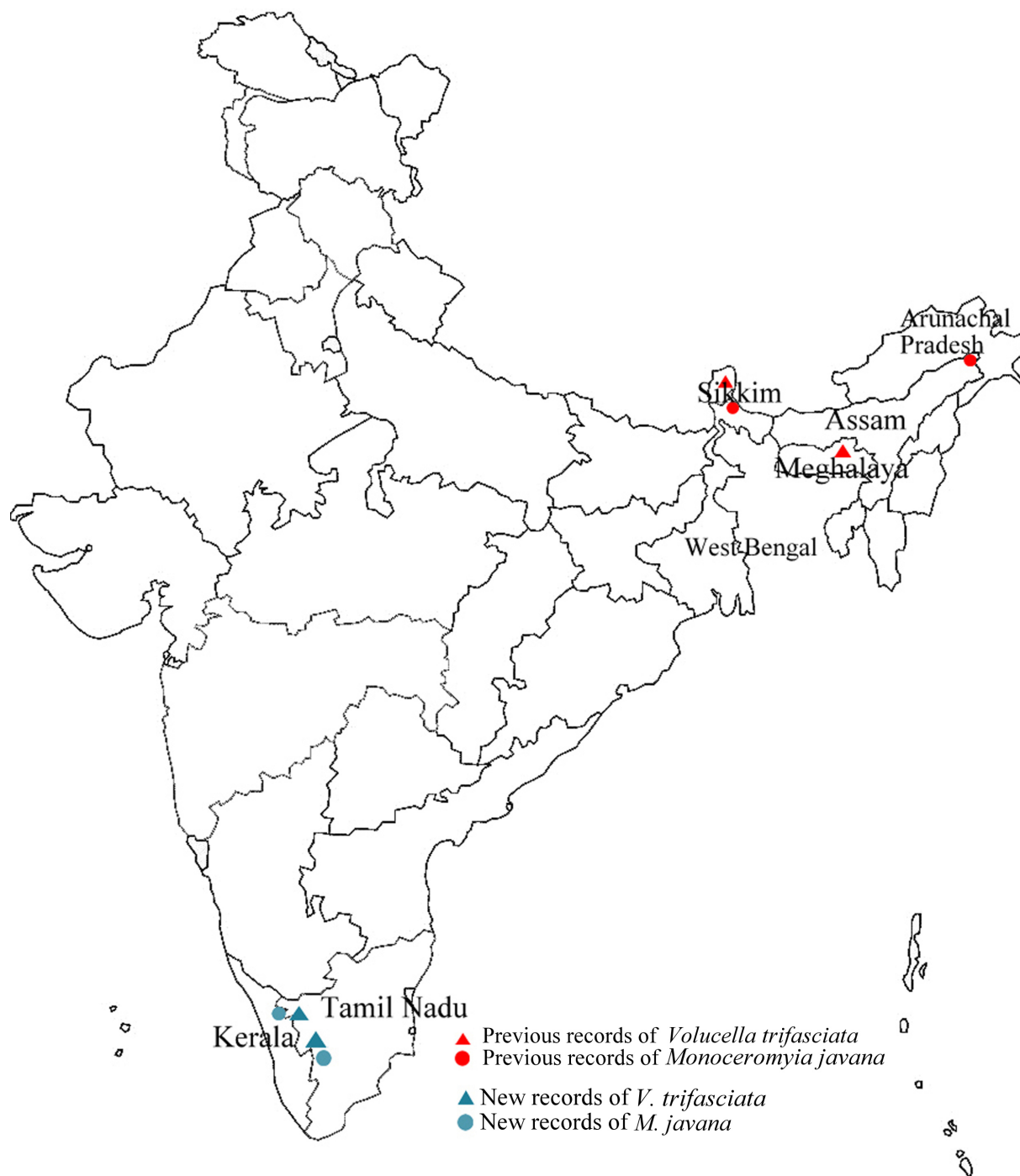


Figure 16. Map showing the previous and new records of *Volucella trifasciata* & *Monoceromyia javana* in India.

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