



REDISCOVERY OF *Campanacella hamiltonella* (WESTWOOD, 1867) (NEUROPTERA: MANTISPIDAE) FROM INDIA AFTER 155 YEARS

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Conceptualization of the research and manuscript writing was done by author RK. Site visits, sample collections and data analyses were done by authors RK and AKS. Manuscript was reviewed and finalized by author AKS before communication. Correspondence to the journal and subsequent revisions were done by author RK. All authors read and approved the final manuscript.

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ABSTRACT

A rare neuropteran species *Campanacella hamiltonella* (Westwood, 1867) (family Mantispidae, sub-family Mantispinae) has been reported from the Chotanagpur Plateau, India for the first time. It is also the first record of this species from India after 1867. Morphological descriptions of the habitus are provided with digital illustrations. Mimetic features of this species are also discussed. A potter wasp species *Phimenes flavopictum* Blanchard, 1845 has also been reported from the same habitat whose abdominal coloration is mimicked by *C. hamiltonella*. Discovery of *C. hamiltonella* from Chotanagpur Plateau suggests its extended geographical range in India which was earlier known to be restricted to Arunachal Pradesh only.

Keywords: Distribution; eastern india; hazaribagh wildlife sanctuary; lacewings; mantidflies; mantispinae; mimicry.

1. INTRODUCTION

Mantispidae constitutes one of the most enigmatic neuropteran families exhibiting a complex life cycle. The natural history of most of the mantispids is still obscure. They are commonly known as mantidflies due to presence of raptorial forelegs and their

morphological resemblances with mantids (Mantodea). Globally 44 genera with 395 mantispid species are known out of which 8 genera with 22 species are found in India [2,3,4]. All Indian mantispid species fall under the same subfamily Mantispinae. Mantispinae are essentially predators on the egg sac of spiders during larval phase. Adults

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predate on small insects using raptorial forelegs. First instar larvae are known to feed on spider haemolymph which can even get transferred to other spiders during mating and cannibalism [5]. Many species are known to mimic wasps of the families Sphecidae, Vespidae and Eumenidae as adult [6].

Genus *Companacella* Handschin, 1961 is represented by only three species globally, viz. *C. hamiltonella* (Westwood, 1867), *C. radiata* (Navás, 1914) and *C. javanica* (Westwood, 1852) [7]. Out of these, only *C. hamiltonella* is found in India [4]. *C. hamiltonella* was described from Arunachal Pradesh, India in 1867 [1] (Westwood, 1867). After that there has not been any report concerning occurrence of this species anywhere else in India except Arunachal Pradesh. In the present work, we report the occurrence of *C. hamiltonella* in Chotanagpur Plateau, India for the first time. This is the second record of this species from India. In this regard, we have collected a specimen and studied its morphological features in detail. We have also provided a brief note on the mimetic features exhibited by this species through digital illustrations along with its possible synonymy with other *Companacella* species.

2. MATERIALS AND METHODS

2.1 Study Area

The specimen was collected from Hazaribagh Wildlife Sanctuary, Hazaribagh, Jharkhand which is a Sal dominated forest with other sub-dominant trees like Khair, Bamboo and Eucalyptus. Hazaribagh Wildlife Sanctuary is the largest forested area of Hazaribagh Plateau which in turn forms the northern landmass of Chotanagpur Plateau. Chotanagpur Plateau is considered the most ancient landmass on earth with geological signatures of ancient river channels, tidal plains and beaches over 3.2 billion years old, representing the earliest crust exposed to air [8]. Area of Hazaribagh Plateau coincides with present districts of Hazaribagh, Chatra, Koderma and Giridih with some parts of Bokaro and Ramgarh. Outline map of Hazaribagh Wildlife Sanctuary was drawn using previously published maps [9]. ArcGIS ver. 10.8.1 was used for geo-referencing and mapping purpose. Geo-tagged photograph of the sampling site was clicked using GPS Map Camera ver. 1.4.4. software installed in Samsung Galaxy M42 mobile device.

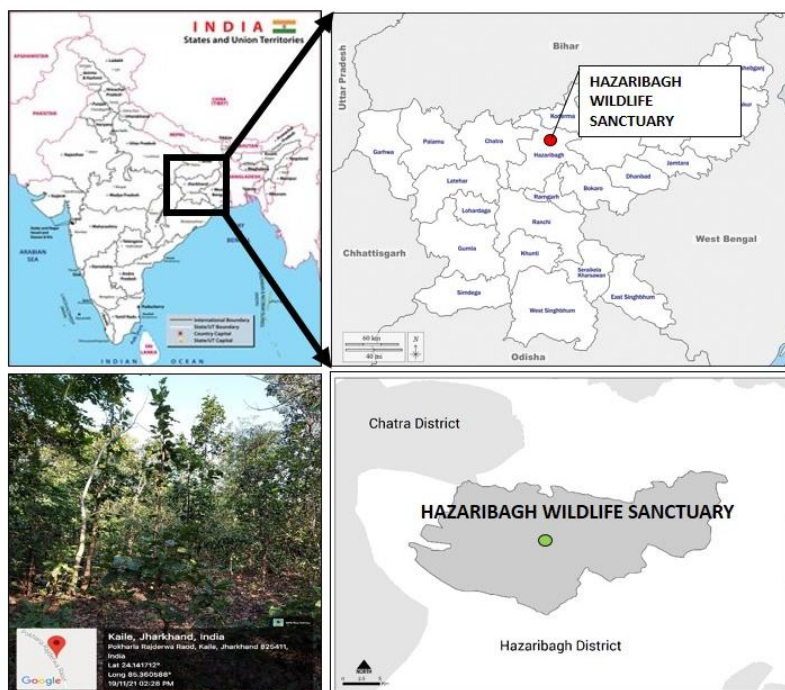


Fig. 1. Study area: Location of Hazaribagh Wildlife Sanctuary is shown on the map of India and Jharkhand in upper left and right images respectively. Collection site is indicated below inside outline of Hazaribagh Wildlife Sanctuary on the right. A geotagged photograph of the location displaying the longitude and the latitude of the collection site is given on the lower left side. Note the presence of Sal trees which are dominant tree species in this area

2.2 Sampling and Collection

The specimen was collected using light trap on 3rd July, 2021. Wasp model was also spotted and photographed for model-mimic comparison. Collected material was sacrificed using benzene followed by pinning and drying for further studies. Habitus was photographed before and after pinning. The specimen was deposited in the museum collections of University Department of Zoology, Vinoba Bhave University, Hazaribagh after study.

2.3 Morphological Investigations

The collected specimen was observed under dissecting microscope and morphological features were studied for identification based on previous descriptions. Digital illustrations were also created for abdominal markings and wing position for further characterization. All measurements were taken in millimeters (mm) using ocular micrometer placed within the eyepiece the dissecting microscope. Morphological descriptions follow Snyman, Sole and Ohl [6].

3. RESULTS

3.1 Taxonomic Notes

Campanacella hamiltonella (Westwood, 1867)
(Figs. 2A-K)

Mantispa hamiltonella Westwood, 1867: page 506-507.

Material examined (n=1). 1 adult female. Pokharia-Rajderwa Road, Hazaribagh Wildlife Sanctuary (24° 8' 30.1632" N, 85° 21' 38.1168" E), Hazaribagh, Jharkhand, INDIA, 03.07.2021, R. Kumar.

Diagnostic features of the genus. *Campanacella* Handschin, 1961 is characterized by non-pigmented transparent wings. The specimen fits well with *Campanacella* due to an anteriorly directed loop of the cu-m in the hind wing touching the R (Fig. 2E). Pronotum about 1.5 times longer than pterothorax. For a complete diagnosis and description of the genus, see Snyman, Sole and Ohl [7].

Diagnostic features of the species. The species can be distinguished from other *Campanacella* species by its characteristic abdominal markings. The mid dorsal region of the abdomen is dark, flanked by anteriorly converging yellow coloured vertical bands on each

side (Fig. 2H) which also matches the original description of the holotype [1]. The converging dorsal yellow bands are absent in the first abdominal segment. The first and second abdominal segments share a broad yellow region laterally which is absent in other segments. Ventrally, first abdominal segment bears a diamond shaped yellow marking which is continuous from the thoracic region but ends before beginning of the second abdominal segment. Each segmental margins are flanked with continuous yellow horizontal bands which are wider in the middle segments (Fig. 2I).

General morphological features. Head with a dorsal ridge in the interantennal space. Short, darkly pigmented, slender antennae. Antennae much smaller than thorax. Thorax divided into prothorax and pterothorax. Prothorax swollen towards anterior end near coxo-thoracic joint. The raptorial forelegs arise from this region ventrally (Fig. 2G). Prothorax longer than pterothorax. Prothorax regularly corrugated dorsally with a continuous fine light coloured line running throughout its length (Fig. 2C-D, F). Mesonotum of the pterothorax yellow in the centre with dark plates with fine yellow boundaries. These plates bifurcate towards anterior taking a distinct geometrical shape (two incomplete square shaped anterior horns and incomplete pentagonal posterior tail) (Figs. 2C, 2J). Long hyaline wings (Figs. 2A-E). Walking legs yellowish-white except the femur and the tarsus which are darker than other parts. Abdomen brightly coloured with conspicuous yellow and black markings as described above. Abdomen terminates at half of the wing length at rest (Figs. 2A, C). Bilobed subgenitale. Raptorial forelegs with almost triangular femur with a posteroventral carina. These are lodged with median row of anteroventral spines. Subbasal spine is biggest. Sickle shaped retractable tibia with sharp distal edge. Tarsus forms tip of the sickle shaped tibia. A thick dark coloured band is present over femur connecting the base of tibia with the base of subbasal spine (Fig. 2K).

Natural history. The biology of *C. hamiltonella* is obscure. The material for our study was collected from Sal tree dominated forest area using light trap. Therefore, it is assumed to be nocturnal. The model is not known for this species. A potter wasp *Phimenes flavopictum* Blanchard, 1845 is common in the area of collection. The colour pattern of *C. hamiltonella* exhibits similarities with this wasp (Fig. 4A).



A



B



C



D

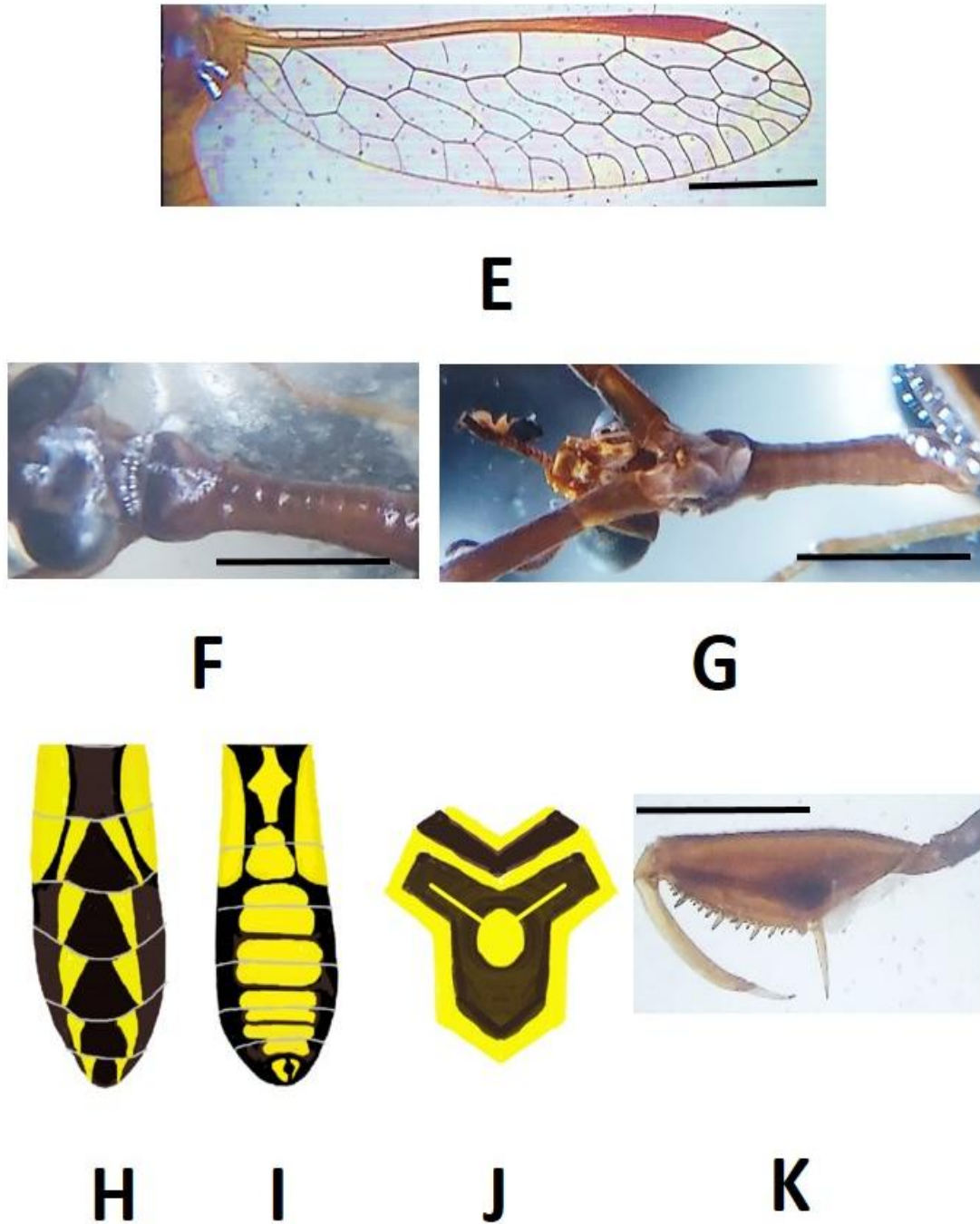


Fig. 2. *Campanacella hamiltonella* [1] (female): A. Habitus in ventral view before pinning. B. Habitus in ventral view after pinning. C. Habitus in dorsal view before pinning. D. Habitus in dorsal view after pinning. E. Hind wing (scale bar 200 mm). F. Head and prothorax in dorsolateral view (scale bar 60 mm). Note the presence of corrugations. G. Head and prothorax in ventrolateral view (scale bar 60 mm). Note the presence of coxo-thoracic joint from where raptorial legs originate. H. Illustration of abdominal markings in dorsal view. I. Illustration of abdominal markings in ventral view. J. Illustration of mesonotum in dorsal view. K. Right raptorial leg in anterior view (scale bar 30 mm)



Fig. 3. Distribution of *Campanacella hamiltonella* [1] in India

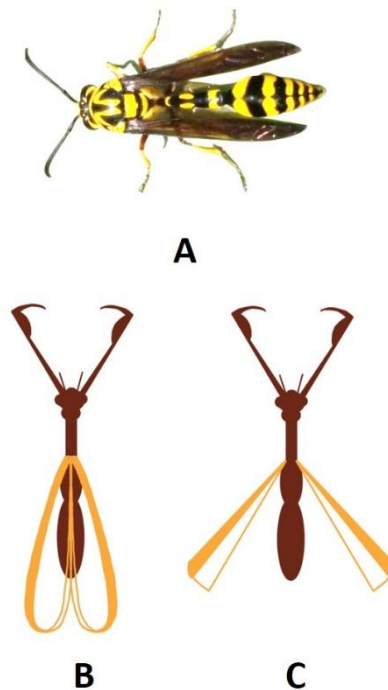


Fig. 4. Inaccurate wasp mimicry in *Campanacella hamiltonella* [1]: A. A common potter wasp *Phimenes flavopictum* Blanchard, 1845 (Hymenoptera: Vespidae) photographed from Hazaribagh Wildlife Sanctuary exhibiting colour pattern and resting wing position which is mimicked by many wasp mimics. B. Resting wing position in *C. hamiltonella*. C. Resting wing position in true wasp mimicking mantispids

Distribution. Malaysia. Indonesia and India. In India, it is only reported from Arunachal Pradesh [4] and Jharkhand (present study) (Fig. 3). It seems that the two records including the place from which the species was originally described are far distant (Arunachal Pradesh and Jharkhand).

4. DISCUSSION

Unlike most wasp mimicking Mantispinae which mimic its model wasp species both in body colouration and resting position of wings, *C. hamiltonella* mimic body colour of the wasp to a large extent but not the resting position of wings. The wings of *C. hamiltonella* are held in a roof-like manner over its abdomen unlike other true wasp mimicking genera where at rest the right and left wings are held at an angle away from the abdomen like wasps. The retrolateral margin of wings of *C. hamiltonella* overlap at rest whereas right and left wings never touch one another in resting position in most wasp mimicking genera (Figs. 2C, 4A-C). Therefore, *C. hamiltonella* may be considered an imperfect or inaccurate wasp mimic.

P. flavopictum is found both in Jharkhand and Arunachal Pradesh apart from 16 other States of India [10]. Presence of *C. hamiltonella* in both these places is an indication of its possible spread to other States too where *P. flavopictum* is found. Also wasp model and mantispid mimic have segregated their foraging niches temporally. While the wasp model is diurnal, the mimic is nocturnal. This temporal segregation provides dual benefit to the mimic by avoiding competition with the model for the prey during daytime and deterring predators by exhibiting wasp like colour pattern at night.

Possibility of synonymy has been suggested among all the three species of genus *Companacella* based on their colouration and overlapping geographical distribution pattern [7]. But the detailed description of colour pattern of all the three species is not available. It is also difficult to observe and described colour pattern of all these species based on the photographs of preserved materials already published. But we also do not rule out the possibility of homonymy as these are all morphologically similar. Even if difference in colour pattern is found among these three, molecular phylogeny would better suggest if these species should be considered different or one as many mantispids (e.g., *Climaciella brunnea* Say, 1824) are also polymorphic, i.e., they exhibit colour variations [11,6].

5. CONCLUSION

Discovery of *C. hamiltonella* from Chotanagpur Plateau points towards extended geographical range of this species in India which was otherwise known to be found in Arunachal Pradesh only. Occurrence of *P. flavopictum* in the same habitat from which *C. hamiltonella* has been reported and similarity in the abdominal colouration (but not the resting wing position) among these species suggest that *C. hamiltonella* is probably an imperfect mimic of *P. flavopictum*. Present study provides detailed morphological description of *C. hamiltonella* along with description of colour pattern over its body which would certainly help in solving taxonomic riddles associated with this species and its sister taxa.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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