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First Confirmed Record of the Genus *Merodon* Meigen, 1803 (Diptera: Syrphidae) from the Oriental Region

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ABSTRACT

This study presents the first confirmed record of *Merodon* Meigen, 1803 from India and the Oriental region, based on adult specimens of *Merodon nigroalatus* Vujić et al., 2023, collected from the Western Himalaya and Lower Gangetic Plains. The findings indicate a range extension of this genus, highlighting a previously undocumented distribution and a likely association with *Hippeastrum* spp. (Amaryllidaceae). A brief diagnosis, representative images of both sexes, including male genitalia, and a distribution map of the species in India are provided to facilitate its prompt identification and future records.

Keywords: Merodon nigroalatus, Hoverflies, phytophagy, new record, distribution, Oriental realm, India.

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INTRODUCTION

Syrphidae, or hoverflies, comprise one of the most diverse dipteran families, with over 6,300 described species across four subfamilies: Eristalinae, Microdontinae, Pipizinae, and Syrphinae (Mengual et al., 2023; Skevington et al., 2019). While adults are obligate pollinators, larvae display varied feeding strategies, including saprophagy, zoophagy, mycophagy, and phytophagy (Rotheray, 1993; Doyle et al., 2020). Phytophagy is particularly noteworthy due to its ecological and agricultural implications. Although present in some Syrphinae, phytophagy is predominantly characteristic of Eristalinae, where larvae feed on a wide range of plant tissues such as roots, stems, leaves, fruits, and bulbs (Rotheray, 1993; Rotheray & Gilbert, 1999). This plant dependence makes phytophagous syrphids a valuable bioindicator of habitat quality and potential agents of both crop damage and plant population regulation (Rotheray, 1993; Ricarte, Marcos-García, & Rotheray, 2008, Ricarte, Souba-Dols, Hauser, & Marcos-García, 2017; Popov et al., 2017; Aracil et al., 2023).

Among phytophagous syrphids, the genus *Merodon* Meigen, 1803 is notable for its specialized larval association with geophytes, especially Amaryllidaceae bulbs, with certain species, such as *Merodon equestris* (Fabricius, 1794), known to cause economic losses in horticultural systems (Stuckenberg, 1956; Ricarte et al., 2017; Vujić et al., 2018). Members of the genus *Merodon* exhibit high host-plant specificity and limited dispersal, often leading to localized endemism and cryptic speciation (Radenković et al., 2018; Vujić et al., 2018, 2020; Vujić, Radenković, Likov, & Veselić 2021). The genus currently includes approximately 205 described species, with its centre of diversity in the Mediterranean Basin and distribution extending through the Palaearctic and Afrotropical regions (Vujić et al., 2023). While *Merodon equestris* remains the only species to have expanded into the Nearctic and Australasian regions, no species has been reliably recorded from the Oriental region. In his original description, Macquart (1842) attributed *Merodon albifasciatus* to “Des Indes orientales” based on a single female specimen. This represents the first and only record of the species from that region. However, the validity of this locality has been widely disputed, and later assessments questioned its Indian origin (Brunetti, 1923; Vujić et al., 2018). Subsequent studies confirmed its placement in the *Merodon geniculatus* species group from the Eastern Mediterranean, whose host plants (*Narcissus*, *Amaryllis*) are not native to South or Southeast Asia, supporting the likelihood of specimen mislabelling or accidental introduction via horticultural trade (Vujić et al., 2018).

Despite the presence of various native and cultivated bulbous plants in the Oriental region (e.g., *Lilium*, *Allium*, *Crinum*, *Zephyranthes*, *Pancratium*, *Hippeastrum*, etc.), no *Merodon* species have yet been conclusively documented from this biogeographic realm. However, neighbouring Central Asia and Pakistan, forming a transitional zone between the western Palaearctic and the Indian subcontinent, harbour numerous endemic *Merodon* species (Vujić et al., 2021, 2023, 2024), illustrating the genus’s evolutionary success in arid and semi-arid montane ecosystems. The apparent absence of *Merodon* in the Oriental realm, despite its proximity to these centres

of diversity, represents a distinct biogeographic gap, comparable to other faunal discontinuities along climatic boundaries such as the Upper Amur. This gap may reflect ecological constraints or insufficient sampling across transitional habitats.

In view of this biogeographic context, the present work reports the first confirmed record of the genus *Merodon* from the Oriental biogeographic realm, represented by specimens of *Merodon nigroalatus* Vujić et al., 2023, collected from two ecologically distinct regions of India, the Western Himalaya (Himachal Pradesh) and the Lower Gangetic Plains (West Bengal). The specimens from West Bengal were obtained from a garden environment containing abundant *Hippeastrum* (Amaryllidaceae), suggesting a possible association with cultivated host plants. The available evidence suggests the possibility of accidental introduction via horticultural material and may indicate a broader ecological tolerance and potential for local establishment. In the present paper, a brief diagnosis of *M. nigroalatus*, including representative photographs and Indian distribution, is provided.

MATERIAL AND METHODS

Sampling was conducted during the daytime using sweep nets, and specimens were preserved in 70% ethanol for subsequent studies. The external morphology was examined under a Leica EZ4 microscope following optimal stretching of the specimens. Male genitalia were dissected with the aid of entomological pins, then immersed in 10% KOH and incubated at 60°C for 30-40 min to achieve more clarity. The genitalia were then neutralized in acetic acid and washed in 70% alcohol before mounting in glycerine for photography. The images were taken with a Leica M205A stereo iso-microscope coupled with a LEICA DFC 500 camera and Leica Application Suite LAS V3.6. Body length (in mm) measured from the apex of the frontal prominence to the abdominal tip. Morphological terminologies follow van Steenis, Miranda, Tot, Mengual, & Skevington (2023) and the specimens were identified based on the diagnostic characters and description provided by Vujić et al. (2023). The distribution map for the newly recorded species was generated using the ArcGIS software Version 10.8. All the examined materials are deposited in the National Zoological Collection (NZC) of the Diptera Section, Zoological Survey of India (ZSI), Kolkata.

Abbreviations used in the text are as follows: al- anterior surstylar lobe; c- cercus; ea- ejaculatory apodeme; l- lingula; pl- posterior surstylar lobe; r_{4+5}- fourth + fifth radial cell; R_1- first radial vein; R_{4+5}- third radial vein; Sc- subcostal vein.

RESULTS

Genus *Merodon* Meigen, 1803

Diagnosis: The genus can be distinguished by a combination of the following characters: presence of femoral lamina on metaleg, wing veins Sc and R_1 connected with a stigmal crossvein, and vein R_{4+5} deeply looped into wing cell r_{4+5}.

Merodon nigroalatus Vujić, Likov & Radenković, 2023 (Fig. 1, 2, 3, 4)

Material examined: 1♂, 1♀, INDIA: Himachal Pradesh: Kangra, Koka, 31.912121°N, 76.310035°E, 957 m, 14.03.2024, Dr. A.K. Sidhu & Party, ZSI 41787/H6, ZSI 41788/H6; 2♀♀, West Bengal: Birbhum, Suri, 23.906387°N, 87.528247°E, 20 m, 30.03.2024, B. Roy, ZSI 41789/H6, ZSI 41790/H6.

Diagnosis: Medium-sized (7.8-10 mm) pilose species with red abdominal markings and dark wings in males (Fig. 2d); reddish-yellow antennae, dorsally concave and dorsolaterally fossette postpedicel (Fig. 1c, d); protarsus expanded and modified (Fig. 2a). Male (Fig. 1, 2): metafemur with long pilosity, more than half width of metafemur (Fig. 2b), basitarsomere of metaleg with ventral setae (Fig. 2c); pruinose fasciae on terga 2-4 indistinct; sternum 4 with triangular posterior margin (Fig. 1b; Fig. 2b); male genitalia (Fig. 3): anterior surstylar lobe quadratic, longer than broad; posterior surstylar lobe bilobed; cercus rectangular; hypandrium (Fig. 3b) sickle-shaped, lacking any lateral projections; lingula narrow and medium sized. Female (Fig. 4): frons with pruinose vittae along eye margins (Fig. 4c); scutum with four distinct pruinose vittae; reddish-yellow markings on abdomen smaller (Fig. 4a) than those in male and limited to terga 2-3; pruinose fasciae on terga 2-4 distinct (Fig. 4a), sterna 4-5 black (Fig. 4b).

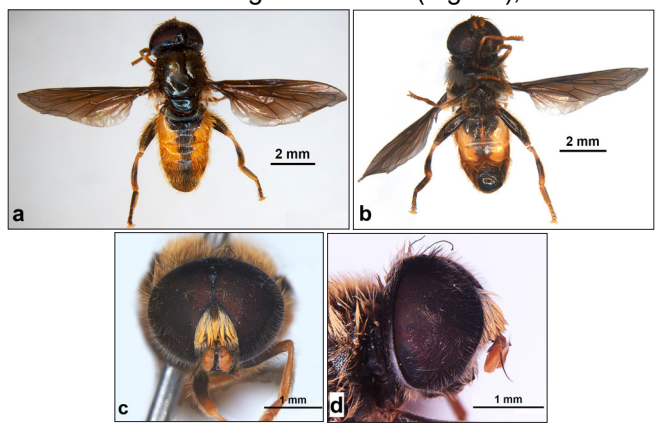

Figure 1. *M. nigroalatus*. ♂. a) Dorsal habitus; b) Ventral habitus; c) Head in front view; d) Head in lateral view.

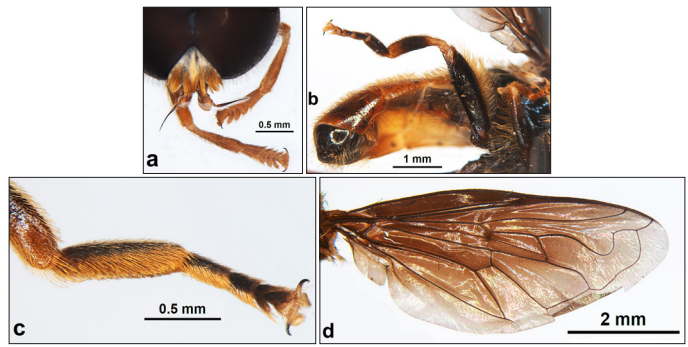

Figure 2. *M. nigroalatus*. ♂. a) Protibia and protarsus in dorsal view; b) Metaleg in ventro-lateral view; c) Metatarsus in dorso-lateral view; d) Right wing in dorsal view.

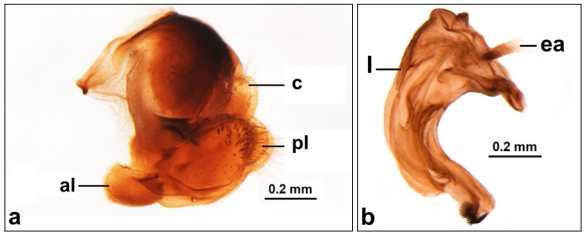

Figure 3. Male genitalia of *M. nigroalatus*. a) Epandrium; b) Hypandrium.

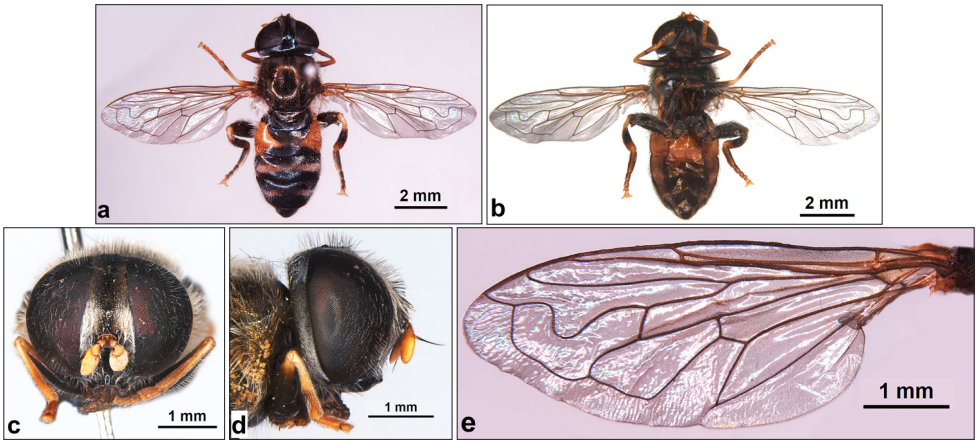

Figure 4. *M. nigroalatus*. ♀. a) Dorsal habitus; b) Ventral habitus; c) Head in front view; d) Head in lateral view; e) Left wing in dorsal view.

Distribution: India [Himachal Pradesh, West Bengal] (new record; Fig. 5); Pakistan.

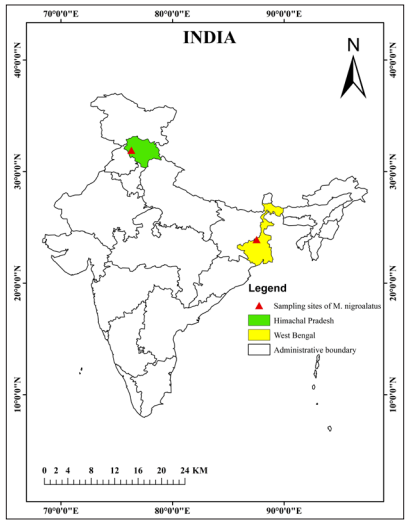

Figure 5. Map showing distribution of *M. nigroalatus* in India.

Remarks: *M. nigroalatus* was originally described from Pakistan and placed within the *avidus-nigritarsis* lineage of *Merodon*, based on the morphology of male genitalia and molecular data (Vujić et al., 2023). The Indian specimens examined (n=4) here align perfectly with the diagnostic features provided in the original description, confirming their identity as *M. nigroalatus*. Specimens from the Lower Gangetic Plains (West Bengal), recorded in March 2024, were collected in a garden with cultivated *Hippeastrum* (Amaryllidaceae), an introduced ornamental geophyte. This suggests a possible ecological association between *M. nigroalatus* and bulbous *Hippeastrum*, consistent with the genus's known larval specialization on geophytes. However, as *Hippeastrum* is not native to India, and host data for the specimens collected from Himachal Pradesh remain unknown, the possibility of association with native Indian Amaryllidaceae, such as *Crinum* spp., or cultivated *Hippeastrum* warrants further study.

DISCUSSION

This study represents the first confirmed record of the genus *Merodon* from India, establishing its occurrence in the Oriental biogeographic region. This finding fills a longstanding gap in the genus's range, previously thought to be restricted to the Palaearctic and Afrotropical regions, with its easternmost limits in Pakistan (Vujić et al., 2018, 2023). The identification of the Indian specimens as *M. nigroalatus* is based on morphological congruence with the original diagnosis and description. The species' occurrence in both the Western Himalaya and Lower Gangetic Plains suggests a broader ecological amplitude than previously recognized. The finding bridges an important biogeographic discontinuity between the Western Palaearctic, centre of *Merodon* diversity, and the Oriental region. While this distributional extension may reflect historical under sampling in the region, it may also be influenced by the relative scarcity of suitable wild host plants from India, particularly native bulbous Amaryllidaceae and other geophytes that serve as larval hosts for most *Merodon* species.

The association of female specimens with cultivated *Hippeastrum* (Amaryllidaceae) supports the genus's known trophic specialization on geophytes, particularly bulbous plants (Ricarte et al., 2017; Preradović et al., 2018; Vujić et al., 2018). However, since *Hippeastrum* is an introduced ornamental plant, this observation could represent incidental use of an available host or a case of local adaptation facilitated by anthropogenic habitats. Future surveys across both natural and managed habitats in the Western Himalaya and the Lower Gangetic Plains, including targeted searches for native or locally established geophytes, and the deployment of rearing or emergence traps, will be crucial to determine the true ecological niche, potential host associations, and biogeographic status of *Merodon* in South Asia.

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