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Research Article

First record of *Croce filipennis* Westwood, 1841 (Neuroptera: Nemopteridae) from Punjab, Pakistan

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ABSTRACT

The Thread-Winged Lacewing, *Croce filipennis* Westwood, 1841 (Neuroptera: Nemopteridae), is recorded for the first time from southernmost region of Punjab, Pakistan. This finding expands the *C. filipennis* geographic range into South Asia's arid and semi-arid regions. The finding emphasizes the importance of focused biodiversity surveys in Pakistan's poorly understood ecosystems, especially in habitats that are ecologically significant but frequently disregarded. The detailed diagnostic morphological traits are presented to aid in precise identification. This finding underscores the potential for additional knowledge on Neuropteran diversity within the country.

Keywords: New record; Thread-Winged Lacewing; Neuroptera; morphology; taxa; Pakistan.

INTRODUCTION

Thread-Winged Lacewing, *C. filipennis*, are known as long-necked antlions because of their huge long area, which makes their larvae somewhat similar to antlion larvae (Haug et al., 2021). Often raised in large quantities for pest control, these insects are predators of a variety of plant-sucking pests (Barkat et al., 2024). Because they feed on soft-bodied insects, such as agricultural pests, both as larvae and as adults, they are useful for biological control methods (Suryanarayanan & Bijoy, 2021). Numerous neuropterans are insecticide-resistant, making them important model organisms for toxicological studies. This has led to a global interest in Neuroptera research (Barkat et al., 2024). Lacewings are widely found in Africa, South America, Australia and Eurasia.

There are 36 genera and 146 species of Nemopteridae in the world. This comprises 98 species of Nemopterinae and 48 species of Crocinae (Oswald & Machado, 2018). Approximately 5% of the 5,813 known species of Neuroptera worldwide are found in Asian countries like India, where 312 species from 112 genera and 12 families have been discovered. Of these, Nemopteridae is a particularly interesting family in the Neuroptera, with two subfamilies still in existence: Nemopterinae, or spoon and ribbon-wings, and Crocinae, or thread-wings. This family is distinguished by its long, ribbon-like or thread-like hindwings and unique mouthparts with a long rostrum that is designed to gather nectar and pollen (Suryanarayanan & Bijoy, 2021). There are just four species of Nemopteridae from three genera known to exist in India (Oswald, 2020). Nearctic is only zoogeographical zone where Nemopteridae family is not present present. Bulk of its species richness is concentrated in southern Africa,

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where 72 species or 48% of world's fauna are found (Sole et al., 2013; Suryanarayanan & Bijoy, 2021). Furthermore, 57 species, mainly from subfamily Nemopterinae, are unique to Western and Northern Cape Provinces of South Africa and make up 38% of the world's biodiversity. With these species feeding on pollen from certain native plants (Picker, 1987), this points to possible evolutionary radiation associated with abundant Cape flora (Mansell, 1996). Nemopteridae belongs to Myrmeleontoidea superfamily, which also contains the extinct families Babinskaiidae and Rafaelianidae, as well as families Nymphidae, Myrmeleontidae, and Ascalaphidae (Engel et al., 2018).

Thread-like hindwings of Crocinae subfamily are a defining feature; they function as tactile sensors and aid in mate detection (Mansell, 1996). Larvae of Crocinae have specific ecological requirements and are frequently found in hollow tree trunks, tiny caverns, and underhanging rock. Adults are mostly crepuscular and nocturnal (Sole et al., 2013). Adult lacewings, especially those in only Fossil Group Kalligrammatidae, have fore- and hindwings that resemble butterflies or dragonflies in the distance (Labandeira et al., 2016). Most often, lacewing larvae are exceptionally skilled ambush predators. Its ability to inject venom, predigest its victim, and ingest the liquid contents is made possible by the fact that they use a pair of stylets, each of which is created by the union of the mandible and maxilla (Heckman, 2017).

Nemopteridae, are a specialized group of neuropteran insects characterized by elongated, filamentous hindwings, rostrum-like head, and moderately long, non-clubbed antennae. Neuroptera, the order to which they belong, comprises structurally diverse predatory insects that typically occur in low densities and exhibit weak flight, preying on soft-bodied arthropods in both immature and adult stages. *C. filipennis*, notable nemopterid species, displays a delicate, fluttering flight pattern at dusk, with larvae that develop in household debris and feed on minute insects such as psocids, completing their life cycle within one year (Imms, 1911). Different species from the Genus “Croce” and specie “*C. filipennis”* have been reported from different countries (Table 1). Biogeographically Pakistan is regarded as most diverse country around the globe and comprises of diversity of insects (Panhwar et al., 2025). In this study, *C. filipennis* has been recorded from Punjab Pakistan for the first time.

Table 1. Distribution records of thread-winged lacewings (Genus Croce, Nemopteridae) globally.

Species	Distribution/Local Areas & Notes	Citation
Croce aristata	Saudi Arabia (First record in the Arabian Peninsula), Distribution referenced to Asia, Africa, Oman	Letardi et al. 2020
Croce schmidti	Turkey (Mardin Province; egg & larval morphology studied)	Satar et al. 2007
Croce filipennis	India – Kerala: First state-level record	Suryanarayanan and Bijoy, 2021
	India – Tamil Nadu: New record	Gauthaman, 2024
	India, First record from Madhya Pradesh.	Chandra and Thilak, 2007.
	India – Northern India (Himachal Pradesh, Uttarakhand)	Westwood, 1841
	Bangladesh: First national record, with morphology + COX1 confirmation	Barkat et al. 2024

MATERIALS AND METHODS

Field Sampling and Specimen Preservation

Insect specimens were collected using sweep nets and light traps. Following collection, specimens were euthanized in a killing jar charged with 2–3 drops of ethyl acetate. The specimens were then air-dried, mounted on archival-quality cards, and secured with entomological pins, each accompanied by an appropriate identification label. Morphological examination was conducted using a Kruss light microscope. Species identification was performed following taxonomic keys and descriptions from Westwood (1841), supplemented by contemporary literature (Barkat et al., 2024; Suryanarayanan & Bijoy, 2021; Tjeder, 1957). The digital images were captured using a Nikon D5300 DSLR camera, mounted on an Olympus SZ61 stereomicroscope to document detailed morphological characters

Voucher specimens were deposited in the reference collection of the Insect Museum at the Center for Insect Farming and Entomological Entrepreneurship (CIFEE), Department of Agricultural Engineering, Khwaja Fareed University of Engineering and Information Technology (KFUEIT), Rahim Yar Khan, Punjab, Pakistan.

RESULTS AND DISCUSSION

Identification Characters

The adult female is predominantly blackish-grey in color (Fig. 1C). The total body length is approximately 5.5–7.3 mm, with a width of about 1.4 mm. The forewings measure 9.9–10.2 mm in length and 2.5 mm in width, while the hindwings are extremely elongated, measuring between 26.8–28.3 mm in length and about 0.5 mm in width—approximately 2.5 to 3 times longer than the forewings. The head is broader than long and light-yellow in coloration, with a distinct brown spot on the vertex. Eyes are large and prominent. The mouthparts are elongated, forming a noticeable slender rostrum (approx. 0.65 mm in length). Antennae are short, clubbed, about 1.2 mm long, tapering at the base and thickening towards the apex (Figure 1A). The clypeus is dark brown; labrum yellowish-brown with sparse ventral hairs. Mandibles are reddish-brown, darkening distally. Maxillary and labial palpi are reddish-brown. The thorax is well-segmented into a narrow pronotum, a broad mesonotum, and a short metanotum. The pronotum is chocolate-brown with fine setae; the mesonotum is wide, yellowish to dark chocolate-brown with sparse hairs; the metanotum is lighter brown. A short neck-like narrowing between the head and thorax is visible. Forewings are hyaline with brown venation. The base is narrow; the outer margin is slightly concave with a parabolic apex. The costal margin has 15 veins before the pterostigma. The pterostigma is elongated, gray to dark in color, occupying five rows of cells. Fine hairs are present along both the external margins and inner veins. Hindwings are slender, thread-like, and densely hairy in the basal three-fourths; they are dark brown at the base and white distally, with a visible central vein splitting at the base. The hindwings may be up to three times longer than the body. Coxa and trochanter are yellowish-brown; femur similarly colored and covered with short dark hairs. Tibiae are dark brown and lack tibial spurs. Tarsi are also dark brown and five-segmented, with small reddish-brown claws. The abdomen is shorter than the forewing, banded in alternating shades of blackish-grey and harbor-grey. In females, the abdominal tip is broad with no distinct sternite 8 (Figure. 1C). Males are distinguishable by a slender, elongated abdominal tip and the presence of a gonarcus with an arcessus (Figure 1B).

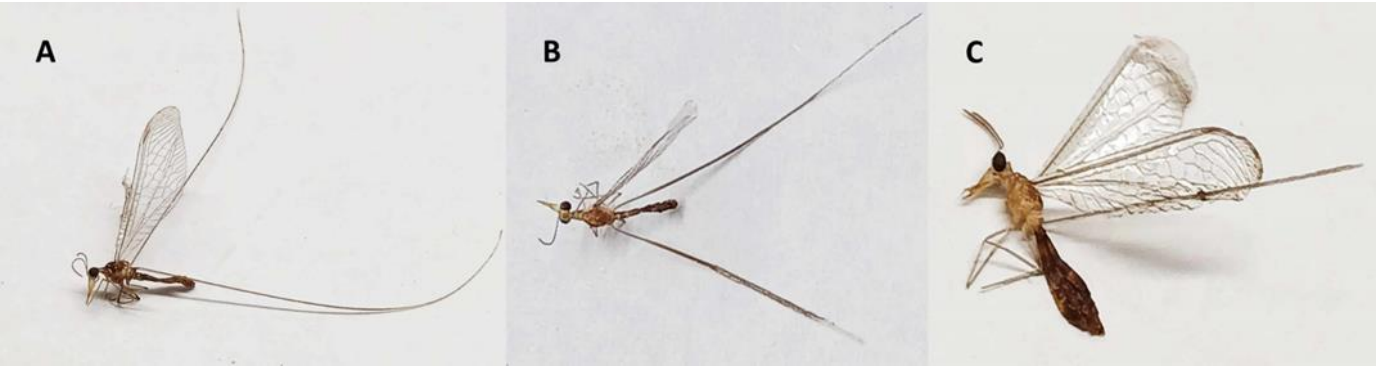

Figure1. Habitus in lateral view (A) Male (B) Female (C) specimens of *C. filipennis*.

Nemopteridae are pollen feeders; most are active during the day, but others, like as *C. filipennis*, are crepuscular or nocturnal. This species avoids sunlight and is rarely observed outdoors, with larvae commonly found on house floors or bungalow interiors. *C. filipennis*' biology is poorly identified, despite the fact that its life cycle lasts around a year, which is longer than that of most insect species. While adults feed predominantly on pollen, because of their elongated mouthparts and rostrum, larvae are purely carnivorous and geophilous, developing on dusty or sandy floors and preying on other small insects. Though rarely found, *C. filipennis* appears to occur more regularly in March and April, a pattern supported by both current observations and prior records (Barkat et al., 2024).

Nemopteridae is a family famous in the order Neuroptera, mostly because of their striking similarity to mosquitoes and their unique beauty. Like a lot of other neuropteran insects, this group wasn't able much scientific attention in Pakistan and hasn't been documented from the Punjab province before. The literature research indicates an apparent lack of information on *C. filipennis* in this area. This species however lives in a wide range of locations, according to recorded data, including China, Bangladesh, and India. Documenting the essential morphological characteristics of *C. filipennis* and confirming its existence in Pakistan are the goals of the current study. The purpose of this study was to serve as a useful point of reference for upcoming taxonomic and ecological studies of the Nemopteridae, both in Punjab and globally.

Remarks

The taxonomic character observed in current study was in line with the Suryanarayanan & Bijoy (2021) and Barkat et al. (2024).

CONCLUSION AND RECOMMENDATIONS

This study presents the first confirmed record of *C. filipennis*, from Punjab, Pakistan, enhancing our understanding of the regional neuropteran fauna. Through detailed morphological characterization, the species was identified based on key diagnostic traits, including its distinct wing morphology, elongated rostrum, and clubbed antennae. The biological notes indicate a crepuscular lifestyle and carnivorous, geophilous larval behavior, highlighting its ecological uniqueness. Given the lack of prior records from this region and the limited literature available on *C. filipennis*, this documentation fills a significant gap in the taxonomy and biodiversity of Neuroptera in South Asia. To build on these findings, it is recommended that future research include wider geographical surveys to map its distribution across different agroecological zones, along with detailed life history and behavioral studies to elucidate its developmental biology. Conservation assessments should be conducted to determine habitat specificity and potential threats, particularly in rapidly urbanizing landscapes. Additionally, public education efforts are encouraged to differentiate this harmless and potentially beneficial insect from pest species, ensuring its recognition and protection in local biodiversity frameworks.

AUTHOR'S CONTRIBUTION

Muhammad Adnan Bodlah: Conceptualization, writing of the original draft, Supervision, review & editing. Aleena Kanwal: Writing of the original draft, Methodology. Aleh Sinchuk: review & editing, Supervision Ayesha Younas: Conceptualization of the original draft. Alishbah Mohsin: Methodology, Conceptualization Muhammad Ahmad Mudassir: review & editing Yasir Niaz: Methodology, review & editing.

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AVAILABILITY OF DATA AND MATERIAL

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

NA.

CONSENT FOR PUBLICATION

NA.

CONFLICT OF INTERESTS

All authors attest to the validity of manuscript contents and agree for submission.

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