

New record of *Caenis nigropunctatula* Malzacher, 2015 (Ephemeroptera: Caenidae) from Southern India

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ABSTRACT

Caenis nigropunctatula Malzacher, 2015, a new mayfly record of the fauna of Indian Ephemeroptera, is recorded from the Vaigai River, Tamil Nadu, India. It is known before from Thailand, Java, and Sumatra. The distribution map of *C. nigropunctatula* is given.

Keywords: *Caenis nigropunctatula*, India, Mayfly, New record

Introduction

The following are the described species of *Caenis* known from India: *C. picea* Kimmins, 1947; *C. incurva* Malzacher, 2015; *C. piscina* Kimmins, 1947; *C. srinagari* Traver, 1939; *C. maratha* Malzacher, 2015; *C. kimminsis* Ali, 1967 and *C. americanii* Srinivasan, Sivaruban, Barathy, Malzacher & Isack, 2021. Of the seven species, three are known from Southern India (*C. maratha*, *C. kimminsis*, and *C. americanii*); however, the current status of *C. kimminsis* is vague as Ali (1967) described this species as a superficial one which lacks informative drawings (Staniczek *et al.*, 2020). We determine a new record of *Caenis nigropunctatula* Malzacher, 2015 based on comparing the samples that we have collected with the existing collections. Differential diagnosis of *C. nigropunctatula* is confirmed based on the literature of Malzacher, 2015. From this new record, the species number of *Caenis* in India has expanded to eight. With poor available data of *Caenis* species, the Biomonitoring status remains insufficient, so more work to be carried out on family Caenidae in India and other Oriental regions.

Material and Methods

The specimens were collected from the Vaigai River, Madurai, Tamil Nadu, India (Figure 1). 7 larvae were collected using a D net and all of them were subsequently reared into imago in the laboratory and were collected and preserved in 80% ethanol. The imagos of *C. nigropunctatula* were easily reared from mature nymphs having dark wing pads and they can become imagos within a week in the rearing tank at 32°C without any aeration and food. Adult characteristics of *C. nigropunctatula* were studied using Magnus MSZ binocular stereo microscope and photographs were acquired using Canon EOS 1500D. Specimens studied under Scanning electron microscope were first dehydrated using ethanol and dried by critical point drying and examined with an EVO-18 scanning electron microscope at 10 k. Digital SEM photographs were made and edited with Adobe Photoshop 7.0. Terminologies were followed based on Malzacher (1991) for male genital sclerites and Kluge (1994) for thoracic structures. The distributional map of *Caenis nigropunctatula* was done with the help of the software SimpleMappr (Shorthouse 2010). The collected specimens are deposited in the American College Museum (AMC), Madurai, and Tamil Nadu.



Figure 1. Habitat of *Caenis nigropunctatula* Malzacher, 2015

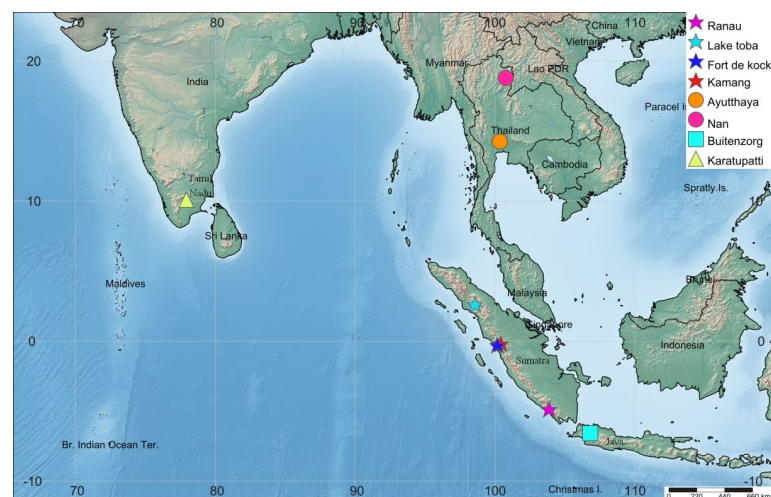


Figure 2. Distributional map of *Caenis nigropunctatula* Malzacher, 2015

Results and Discussion

Caenis nigropunctatula Malzacher, 2015 (Figure 3)

Caenis nigropunctatula Malzacher, 2015: 28, Figures 1a–l, 2a–e, 4l, 8–15.

Non-Type Material Examined

2 male imagos (AMC/ZN/199), 3 female imagos (AMC/ZN/200), South India, Tamil Nadu, Madurai, Vaigai River, 10°08'32.4"N & 77°93'22.0"E; 192 m; 3/X/2020, Pandiarajan Srinivasan & Rajasekaran Isack.

Description

Caenis nigropunctatula is known earlier from Thailand, Java and Sumatra (Malzacher, 2015). This is the first record that it is known from India and the extension of this species goes over 1000 kilometers (Figure 2). *C. nigropunctatula* also shows a wide range of intraspecific variations in leg ratios, however, the genitalia remains similar in all individuals of various populations (Malzacher, 2015). The Indian population of *C. nigropunctatula* shows the comparative kind of attributes of Thailand population as the apical dilation of tarsomere remains small. The characters of the Indian population are as follows: size of male imago- 3.5 mm (Figure 3A); size of female imago- 4.3 mm (Figure 3B); wing length- 2.1mm; cerci length- 5.4 mm; length of foreleg- 2.1 mm; head length ratios: c:a- 2.34; a:b- 1.07; ratio of forefemur: foretibia- 0.58; ratio of foretibia: foretarsus- 1.27; ratio of foreleg: hindleg- 1.47; ratio of segments of fore tarsus 1st : 2nd : 3rd : 4th : 5th = 1 : 4 : 2.2 : 2.1 : 1.3; ratio of body length : length of cercus : length of terminal filament = 1 : 2.8 : 3.8.

Caenis nigropunctatula can be distinguished from all other *Caenis* species in male imago (Malzacher, 2015) by strong prosternal ridges and forms an isosceles triangle (Figure 3C); tarsomeres 2-4 of fore tarsus apically broadened; broadenings with small strong spines, not tongue-shaped (Figures 3E & 3F); proportion of forefemur : foretibia = more than 0.46; proportion of foreleg : hindleg = less than 1.90; Penis broad, with rounded lobes of moderate length (Figure 3G); forceps marginally narrowed to the tip, with a short spine pretty much bent medially (Figure 3H).

The lone contrast of character we noted from the Indian population is the fore margin between lateral and frontal ocelli slightly bowed in the head of the adult imagos (Figure 3D) but in other populations, it looks straight (Malzacher, 2015). Therefore, further analysis is needed in other parts of India and the rest of the Oriental region to know the exact status of *Caenis nigropunctatula* and its disparities among various populations.

Of the eight known species of *Caenis* from India, *C. piscina*, *C. srinagari*, and *C. kimminsis* lacks important diagnostic characters, as both *C. piscina* and *C. srinagari* are distinguished based on their color pattern only whereas *C. kimminsis* lacks the novel diagnostic features of larvae. So, these three species should be redescribed soon based on the fresh material from their particular localities. The key to male for *C. picea*, *C. incurva*, *C. maratha*, and *C. nigropunctatula* was given by Malzacher (2015), Malzacher & Sangpradub (2020). So, based on modern diagnostic characters about half of the species of *Caenis* described from India needs quick re-description soon to sort out problems in the taxonomy of Caenidae in India.

Distribution

Thailand, India (new record), Indonesia (Sumatra and Java).

Conclusion

The present study confirms the presence of *Caenis nigropunctatula* in Tamil Nadu, Southern India. The distribution range of *C. nigropunctatula* remains unknown as the earlier findings in Thailand and Indonesia lack ecological characteristics of *C. nigropunctatula*, so it is unable to predict the distribution range of *C. nigropunctatula* at the present scenario. The findings of the present study reveal the taxonomy and morphology of this particular species and help to know more about the phylogenetic relationship of mayflies in India.

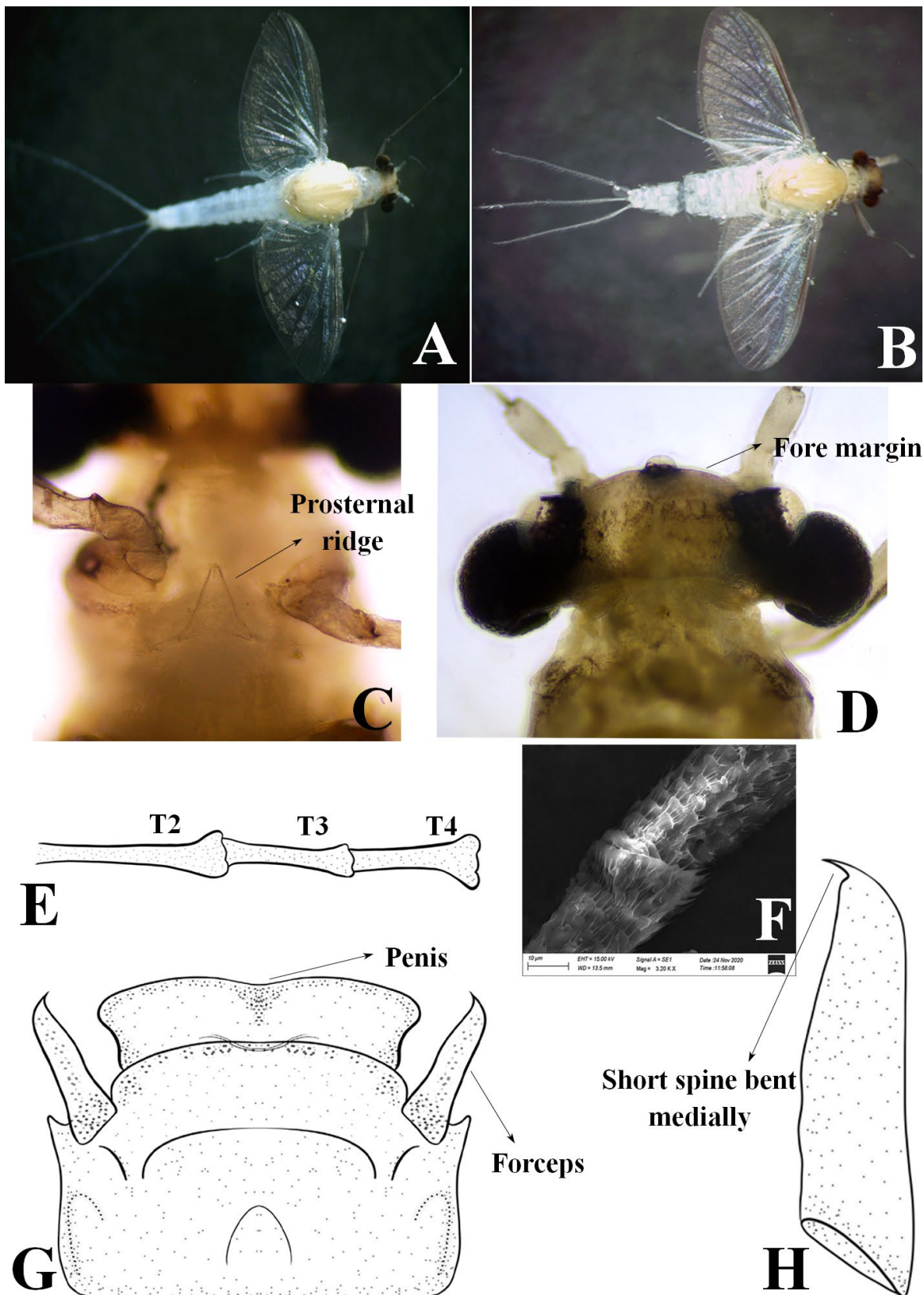


Figure 3. *Caenis nigropunctatula* Malzacher, 2015 (A-H). A- male imago; B- female imago; C- prosternal ridge; D- head of male imago; E- structure of fore tarsomere; F- SEM view of tarsomere 3; G- male genitalia; H- forceps

Compliance with Ethical Standard

Conflict of interests: The authors declare that for this article they have no actual, potential or perceived conflict of interests.

Ethics committee approval: All authors declare that this study does not include any experiments with human or animal subjects.

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Disclosure: -

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