

Elytral polymorphism of *Cheilomenes sexmaculata* (Fabricius), *Harmonia octomaculata* (Fabricius), *Coccinella septempunctata* Linnaeus and *Propylea dissecta* (Mulsant) (Coleoptera: Coccinellidae) in the Gangetic Alluvial Plain Zone of West Bengal, India

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Abstract

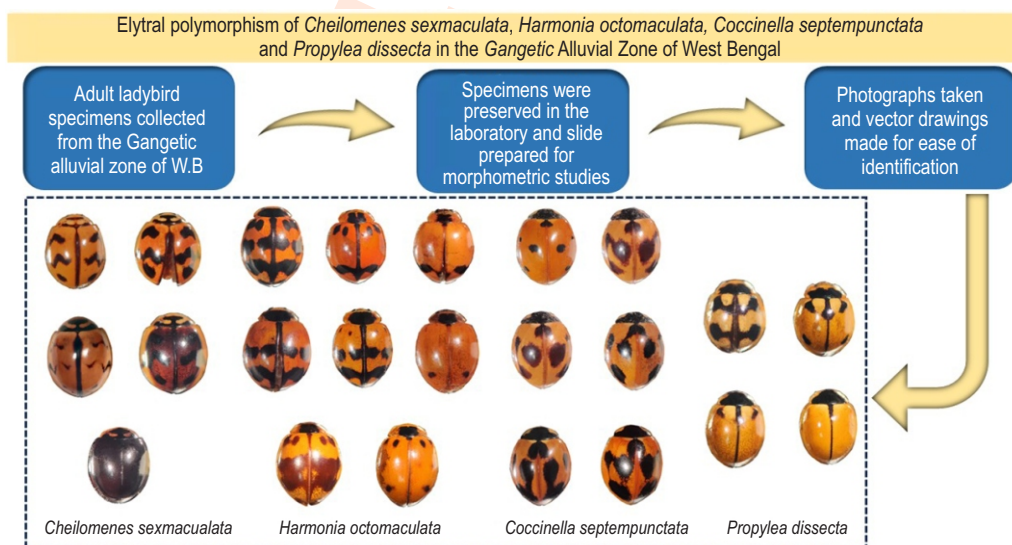
Aim: To provide information on the occurrence of polymorphic variants of four different ladybird beetles (*Cheilomenes sexmaculata*, *Harmonia octomaculata*, *Coccinella septempunctata* and *Propylea dissecta*) in West Bengal and to facilitate identification based on various morphological characters.

Methodology: Survey was carried out during 2022-2023 in the Gangetic Alluvial Plain Region of West Bengal. Fourteen localities of the agro-climatic zone were selected to survey for the collection of coccinellids. Adult specimens of four different ladybirds were collected, brought to the laboratory and preserved. Slides of different morphological body parts were prepared.

Results: In total, five morphs of *C. sexmaculata*, eight morphs of *H. octomaculata*, six morphs of *C. septempunctata* and four morphs of *P. dissecta* were recorded. These morphs comprised both melanistic and non-melanistic forms.

Interpretation: Polymorphic elytral pattern may lead to the ambiguity in correct identification of a ladybird species. The outcome of the study will definitely lead the researchers to arrive at the precise identity of the mentioned ladybird species, which is considered to be a criterion in any study allied to biological organism.

Key words: Coccinellid, Coleoptera, Elytral polymorphism, Diagnostics, Illustrative guide, West Bengal



Introduction

The occurrence of polymorphism, which is distinguished by distinct, hereditary and alternative phenotypes that result in population diversity, is seen in several insect orders, such as Lepidoptera, Isoptera, Hymenoptera, Coleoptera, Orthoptera, and Odonata (Gullan and Cranston, 2014). In a population, polymorphism refers to the occurrence of various individuals with several physical, behavioural or physiological traits which comes from the selection against ongoing or discontinuous variations (Caillaud and Losey, 2010). In several animal groups, polymorphism represents individuals within a species to exhibit unique appearance of forms or morphs different in body colour, number of spots and elytra colouration pattern within a single species. In addition to observable differences within a population, polymorphism can also be observed between individuals of different sexes as sexual dimorphism (male or female), between populations that are geographically separated as geographical polymorphism, and between generations that fly at different times of the year as seasonal polymorphism (Gullan and Cranston, 2014). In terms of foraging, mating, defending territories, and evading predators, organisms benefit from such diversity (Singh et al., 2016).

Colour polymorphism is one of the forms of polymorphism that has been extensively researched in view of its importance to function and ecology. There are multiple drivers of the colour polymorphism in animals, sexual selection and climate being the most commonly mentioned factors (Vesely et al., 2024). During the industrial revolution, air pollution caused directional colour polymorphism within the peppered moth (*Biston betularia*) population. This resulted in an increased frequency of dark-colored moths, a phenomenon known as industrial melanism, is an outstanding instance of an evolutionary case (Cook and Saccheri, 2013). Body color patterns act as important signals for visual interaction among organisms and play an essential part in ecological interactions for survival and reproduction (Wallace, 1877), such as courtship display (Houde, 1988; Milinsky and Bakker, 1990), intra-specific recognition (Bybee et al., 2012), mimicry (Bates, 1862) and warning (Saporito et al., 2007).

Many organisms show various geometric colour patterns on their bodies, and the developmental, evolutionary, genetic, and ecological bases of these patterns have been intensely studied in various organisms. Ladybird beetles display highly diverse patterns of wing (elytral) colour and are one of the most attractive model organisms for studying these characteristics (Ando and Niimi, 2019). Ladybird beetles belong to the taxonomic series Cucujiformia of superfamily Cucujoidea and suborder Polyphaga. They comprise about 490 genera and more than 6000 extant species worldwide (Ślipiński, 2007). Around 400 species under 79 genera and 22 tribes and five sub-families are known from the Indian subcontinent (Poorani, 2002). Family Coccinellidae consists of six sub-families viz., Chilocorinae, Coccinellinae, Coccidulinae, Scymninae, Sticholotidinae and Epilachninae. Of these, subfamily Epilachninae represents

phytophagous coccinellids and the rest are predaceous in nature. Ladybird beetles are known worldwide for being predators on several soft bodied tiny insects and phytophagous mites and are distributed in many Asian countries including India. Most ladybirds have a red-black and yellow-black spotted pattern (Majerus et al., 1989). The tribe Coccinellini, comprising “true ladybird beetles”, is among the best-known groups of Coccinellidae in India in view of their usually bright colour patterns that make them relatively easier to identify compared to other tribes (Poorani, 2023). Vibrant colours have been developed to help ladybirds visually communicate with their predators and serve as a powerful warning signal to deter attacks (Dolenská et al., 2009). Several species of ladybird beetles, including *Harmonia axyridis*, *Adalia decempunctata* and *A. bipunctata* exhibit elytral colour polymorphism, indicating geographical variation (Creed, 1975). Even so, little is known about the fundamental causes of elytral colour polymorphism's presence within populations and its variance across geographic gradients.

Geographical differences in elytral colour polymorphism are frequently explained as response to varying temperature and pollution from industry. Studying polymorphism is crucial because it provides clear explanations for the characteristics of living things and environmental influences. Researchers across the globe have investigated polymorphism of ladybird beetles over the years (Jiggins and Tinsley, 2005; Blehman, 2007; Michie et al., 2010; Zare et al., 2012). The study on ladybird beetles has a unique place in polymorphism research, since it focuses on the characteristic features of the dorsal surface of head, scutellum and elytra of coccinellids (Blehman, 2007). A rigorous survey of literature revealed dearth of information about polymorphism of coccinellid beetles inhabit in West Bengal. The paucity of information intends us to find the elytral polymorphism of ladybird beetle from the Gangetic Alluvial Plain Zone of West Bengal.

Materials and Methods

Study area: Adult specimens of four ladybird beetles were brought together from fourteen localities of farm lands and forest areas of the Gangetic Alluvial Zone of West Bengal during 2022-2023 (Fig. 1). Geographically, the survey localities fall between 22.71°N and 23.40°N latitude and 88.55°E-88.71°E longitude (Table. 1).

Insect sampling method: The ladybird beetles were collected by a “sweep net sampling method”, as suggested by Gadagkar et al. (1990). Other methods based on visual observation, such as aspiration and hand picking, were also used to collect the specimens. More than seventeen hundred specimens of adult ladybird beetles were collected, identified and preserved.

Preservation and identification of specimens: Immediately after field collection, the insects were put into killing jars that contained cotton soaked with ethyl acetate. The dead insects were put into a glass vial and brought to the laboratory. Later, beetles were stretched and glued to a triangular card point. Card

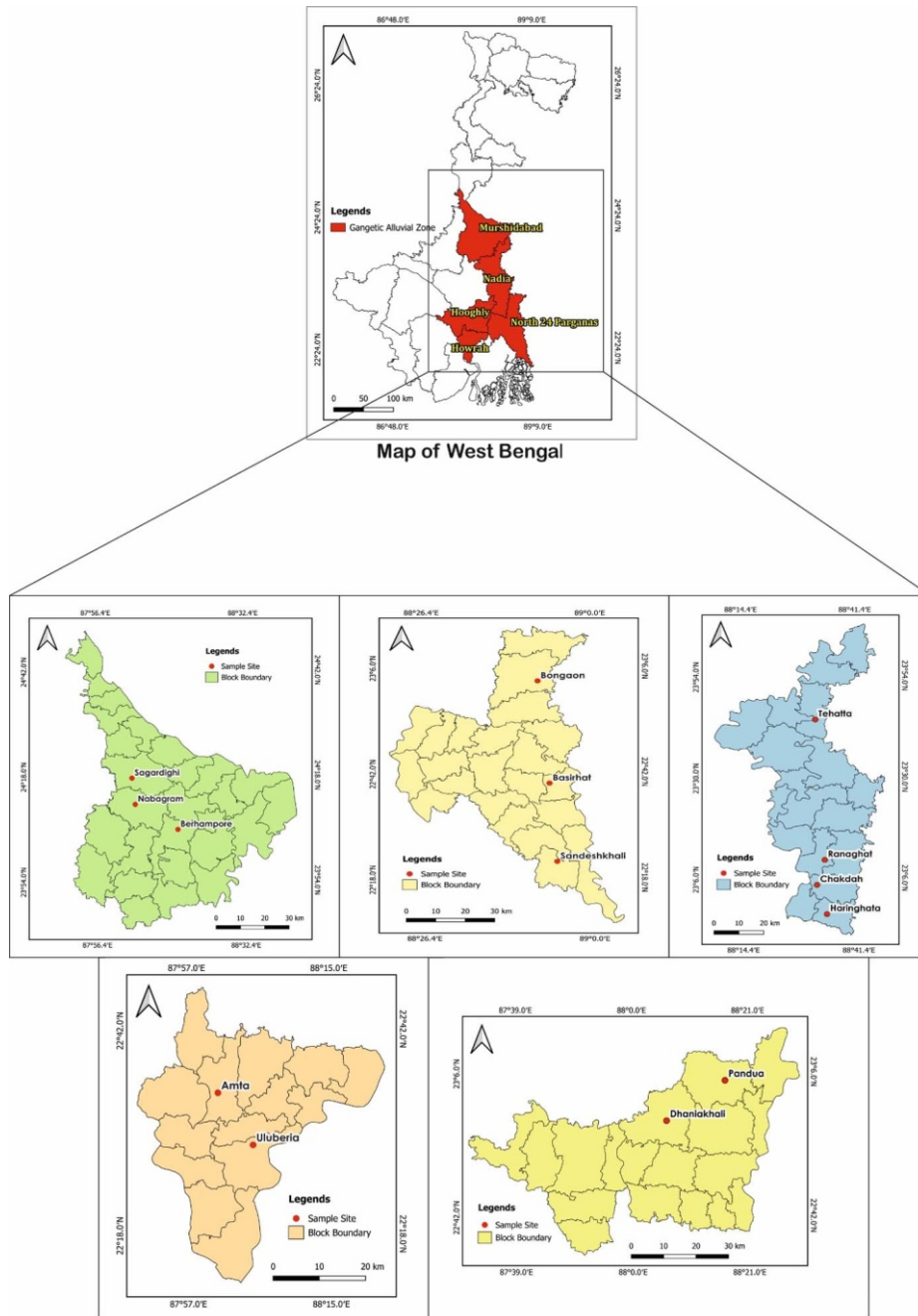


Fig. 1: Sampling sites of ladybird beetles in the Gangetic Alluvial Zone, West Bengal, India.

Table 1: Sample collection localities of ladybird beetles in the Gangetic Alluvial Zone, West Bengal, India

Study area	Location (s)	Latitude	Longitude	Elevation m (asml)
Murshidabad	Sagardighi Nabagram Berhampore	24.11°N	88.16°E	10 m
Nadia	Tehatta Ranaghat Chakdah Haringhata	23.40°N	88.50°E	14 m
North 24 Parganas	Bongaon Basirhat Sandeshkhali	22.08°N	88.30°E	7m
Hooghly	Pandua Dhaniakhali	22.90°N	88.38°E	22 m
Howrah	Amta Uluberia	22.34°N	88.19°E	9 m

mounted specimens were arranged in the wooden boxes and oven dried at about 60°C for 72 hr to preserve them. Each specimen was labelled with following information: name of the host insects/mites for predacious species, date of collection, place of collection with geographical information, collector's name and any other relevant information. Naphthalene balls were kept at the corner of the insect box for preserving the specimens. Each specimen was meticulously examined under a stereoscopic trinocular microscope (Model: SZM-T, Make: OPTIKA, Italy) fitted with a camera for studying their morphological characters and variations of elytral spots or markings. For record, the following information are presented: district, number and sex of specimens, locality, geographical coordinates, altitude, collection date, collector's name, and biotope. Photographs of the habitus and different body parts were taken with a Samsung S22 Ultra smartphone. Later the images were edited in Adobe Photoshop 2020 and arranged in CorelDRAW 2018.

Dissection of male genitalia: For genitalia extraction, the methodology described by Majerus *et al.* (1989) was followed. Terminology used for adult morphology, including the genitalia, largely followed Ślipiński (2007).

Drawing of elytral pattern: Vector drawings of different morphs of the beetle species were made from coloured images to understand every detail of the elytral spot. In vector graphics, only mathematical equations, lines and curves with the fixed points on a grid were used to draw an image, which was pixels and resolution independent. Vector drawings were made using CorelDRAW 2018 software.

Results and Discussion

Species account; Family Coccinellidae; Subfamily Coccinellinae; Tribe Coccinellini

Cheilomenes sexmaculata (Fabricius)

Material examined: Murshidabad, 10♂♂2♀♀, Aheripara, Sagardighi, 24°17'N 88°06'E, 32m, 27.iii.2022, Tamoghno Majumder, crop field; Murshidabad, 5♂♂7♀♀, Bajitpur, Sagardighi, 24°17'N 88°06'E, 32m, 27.iii.2022, Tamoghno Majumder, crop field; Murshidabad, 3♂♂8♀♀, Binodbati, Sagardighi, 24°17'N 88°06'E, 32m, 28.iii.2022, Tamoghno Majumder, crop field; Murshidabad, 2♂♂1♀, Dakshin Debagram, Sagardighi, 24°17'N 88°06'E, 32m, 29.iii.2022, Tamoghno Majumder, crop field; Murshidabad, 2♂♂1♀, Chandanbati, Sagardighi, 24°17'N 88°06'E, 32m, 30.iii.2022, Tamoghno Majumder, crop field. Murshidabad, 5♂♂1♀, Anantpur, Nabagram, 24°04'N 88°03'E, 35m, 12.iv.2022, Tamoghno Majumder, crop field; Murshidabad, 6♂♂, Bagmara, Nabagram, 24°04'N 88°03'E, 35m, 13.iv.2022, Tamoghno Majumder, open field. Murshidabad, 6♂♂7♀♀, Basudebkhali, Berhampore, 24°09'N 88°26'E, 18m, 12.iv.2022, Tamoghno Majumder, calotropis; Murshidabad, 6♂♂1♀, Banjetia, Berhampore, 24°09'N 88°26'E, 18m, 15.iv.2022, Tamoghno

Majumder, mango; Murshidabad, 2♂♂8♀♀, Bhatpara, Berhampore, 24°09'N 88°26'E, 18m, 17.iv.2022, Tamoghno Majumder, weed; Murshidabad, 2♂♂1♀, Baikunthapur, Berhampore, 24°09'N 88°26'E, 18m, 17.iv.2022, Tamoghno Majumder, crop field; Murshidabad, 2♂♂, Basabari, Berhampore, 24°09'N 88°26'E, 18m, 17.iv.2022, Tamoghno Majumder, open field.

North 24 Parganas, 12♂♂, Chamta, Bongaon, 23°04'N 88°82'E, 7m, 10.v.2022, Tamoghno Majumder, crop field; North 24 Parganas, 3♂♂5♀♀, Belta, Bongaon, 23°04'N 88°82'E, 7m, 12.v.2022, Tamoghno Majumder, crop field; North 24 Parganas, 2♂♂1♀, Bhulat, Bongaon, 23°04'N 88°82'E, 7m, 13.v.2022, Tamoghno Majumder, open field. North 24 Parganas, 7♂♂, Amarkati, Basirhat, 22°72'N 88°47'E, 6m, 25.v.2022, Tamoghno Majumder, crop field; North 24 Parganas, 5♂♂, Ghosuri, Basirhat, 22°72'N 88°47'E, 6m, 25.v.2022, Tamoghno Majumder, crop field. North 24 Parganas, 9♂♂, Agarhati, Sandeshkhali, 22°36'N 88°87'E, 7m, 05.vi.2022, Tamoghno Majumder, crop field; North 24 Parganas, 5♂♂, Bayamarii, Sandeshkhali, 22°36'N 88°87'E, 7m, 06.vi.2022, Tamoghno Majumder, crop field; North 24 Parganas, 14♂♂2♀♀, Ghatihara, Sandeshkhali, 22°36'N 88°87'E, 7m, 07.vi.2022, Tamoghno Majumder, crop field. Nadia, 13♂♂3♀♀, Bagadoba, Tehatta, 23°72'N 88°52'E, 13m, 12.vi.2022, Tamoghno Majumder, crop field; Nadia, 7♂♂2♀♀, Balarampur, Tehatta, 23°72'N 88°52'E, 13m, 12.vi.2022, Tamoghno Majumder, crop field; Nadia, 4♂♂, Betai, Tehatta, 23°72'N 88°52'E, 13m, 14.vi.2022, Tamoghno Majumder, crop field; Nadia, 9♂♂13♀♀, Kulgachi, Tehatta, 23°72'N 88°52'E, 13m, 14.vi.2022, Tamoghno Majumder, crop field.

Nadia, 10♂♂2♀♀, Baharpur, Ranaghat, 23°17'N 88°56'E, 8m, 20.vi.2022, Tamoghno Majumder, crop field; Nadia, 6♂♂7♀♀, Beleati, Ranaghat, 23°17'N 88°56'E, 8m, 22.vi.2022, Tamoghno Majumder, crop field; Nadia, 2♂♂, Takshali, Ranaghat, 23°17'N 88°56'E, 8m, 23.vi.2022, Tamoghno Majumder, crop field; Nadia, 5♂♂1♀, Suresh Nagar, Ranaghat, 23°17'N 88°56'E, 8m, 24.vi.2022, Tamoghno Majumder, open field. Nadia, 9♂♂2♀♀, Deuli, Chakdah, 23°08'N 88°52'E, 11m, 01.vi.2022, Tamoghno Majumder, crop field; Nadia, 7♂♂4♀♀, Kadamgachi, Chakdah, 23°08'N 88°52'E, 11m, 02.vi.2022, Tamoghno Majumder, crop field; Nadia, 2♂♂3♀♀, Mathurapur, Chakdah, 23°08'N 88°52'E, 11m, 02.vi.2022, Tamoghno Majumder, crop field.

Nadia, 18♂♂7♀♀, Balindi, Haringhata, 22°96'N 88°56'E, 10m, 08.vii.2022, Tamoghno Majumder, crop field; Nadia, 20♂♂9♀♀, Hatikanda, Haringhata, 22°96'N 88°56'E, 10m, 09.vii.2022, Tamoghno Majumder, crop field; Nadia, 10♂♂, Dakshin Datta Para, Haringhata, 22°96'N 88°56'E, 10m, 11.vii.2022, Tamoghno Majumder, crop field; Nadia, 27♂♂12♀♀, Mondouri, Haringhata, 22°96'N 88°56'E, 10m, 12.vii.2022, Tamoghno Majumder, crop field; Nadia, 15♂♂3♀♀, BCKV, Haringhata, 22°96'N 88°56'E, 10m, 12.vii.2022, Tamoghno Majumder, crop field. Howrah, 16♂♂, Begua, Amta, 22°57'N 88°01'E, 6m, 20.vii.2022, Tamoghno Majumder, crop

field; Howrah, 12♂♂1♀, Dadpur, Amta, 22°57'N 88°01'E, 6m, 21.vii.2022, Tamoghno Majumder, crop field; Howrah, 3♂♂2♀♀, Habla, Amta, 22°57'N 88°01'E, 6m, 22.vii.2022, Tamoghno Majumder, crop field.

Howrah, 8♂♂12♀♀, Amtala, Uluberia, 22°47'N 88°11'E, 1m, 24.vii.2022, Tamoghno Majumder, open field; Howrah, 13♂♂6♀♀, Baikhali, Uluberia, 22°47'N 88°11'E, 1m, 25.vii.2022, Tamoghno Majumder, crop field; Howrah, 11♂♂2♀♀, Jaynagar, Uluberia, 22°47'N 88°11'E, 1m, 26.vii.2022, Tamoghno Majumder, crop field. Hooghly, 1♂♂5♀♀, Amanmouri, Pandua, 23°07'N 88°27'E, 19m, 7.viii.2022, Tamoghno Majumder, roadside bushes; Hooghly, 11♂♂3♀♀, Goara, Pandua, 23°07'N 88°27'E, 19m, 8.viii.2022, Tamoghno Majumder, weed; Hooghly, 2♂♂7♀♀, Hatni, Pandua, 23°07'N 88°27'E, 19m, 11.viii.2022, Tamoghno Majumder, crop field; Hooghly, 5♂♂3♀♀, Kamtai, Pandua, 23°07'N 88°27'E, 19m, 12.viii.2022, Tamoghno Majumder, open field.

Hooghly, 2♂♂3♀♀, Jiara, Dhaniakhali, 23°96'N 88°10'E, 16m, 15.viii.2022, Tamoghno Majumder, crop field; Hooghly, 11♂♂3♀♀, Kak Gachi, Dhaniakhali, 23°96'N 88°10'E, 16m, 16.viii.2022, Tamoghno Majumder, crop field; Hooghly, 5♂♂2♀♀, Masuria, Dhaniakhali, 23°96'N 88°10'E, 16m, 17.viii.2022, Tamoghno Majumder, crop field; Hooghly, 10♂♂, Paschim Banpur, Dhaniakhali, 23°96'N 88°10'E, 16m, 20.viii.2022, Tamoghno Majumder, crop field; Hooghly, 7♂♂9♀♀, Sirijpur, Dhaniakhali, 23°96'N 88°10'E, 16m, 22.viii.2022, Tamoghno Majumder, crop field.

Description

The members of the species oval to subrounded (Fig. 2 a-d), body length 3.00–5.50 mm and width 3.00–4.40 mm. Dorsal side of the body convex, glabrous and shiny. Ground colour orange or yellowish orange. Ventral side of the body reddish-orange (Fig. 2 b). Pronotum with T shaped median marking (Fig. 3 a), sometimes discontinuous markings can be seen. Elytra had two zigzag black lines, a posterior subapical black spot and black suture line (Fig. 2 a, c, d). Elytral epipleura broad and thick (Fig. 3 i). On head, black transverse marking present on the posterior portion of frons (Fig. 3 b). Antennae of the specimens composed of 11 antennomeres; terminal antennomere U-shaped and slightly larger than its preceding two antennomeres (Fig. 3 c). Eyes approximately oval, moderately large, finely faceted, limitedly separated and interocular distance about 2-2.5x as wide as an eye (Fig. 2 c, 3 a, b). Mouthparts (labium, labrum, maxilla and mandible) as illustrated (Fig. 3 e-h). Abdominal postcoxal lines incomplete, reaching posterior margin of abdominal ventrite 1 and running along posterior margin, then almost touching lateral margin (Fig. 3 d). Prothorax as illustrated (Fig. 3 j). Leg as illustrated (Fig. 3 k). Male genitalia (Fig. 3 l-n) as illustrated, tegmen stout, penis guide in dorsal view (Fig. 3 l) moderately broader at base, gradually narrowed, guide nearly as long as parameres, parameres strongly curved on basal section with short sparse setae on the inner sides and distal end; penis guide

in lateral view (Fig. 3 m) broader at base, gradually narrowed, shorter than parameres. Penis (Fig. 3 n) moderately stout, curved with a penis capsule, penis capsule with short outer arm and curved inner arm. This species is ambiguous as there are several colour morphs and some colour morphs can be confused with *Micraspis discolor* (Fabr.) and *Chilocorus nigritus* (Fabr.). Five different clearly distinguishable elytral spot morphs of *C. sexmaculata* were observed and identified (Figs 4, 5). The morphs are categorized as follows:

M-1: Elytra with three zigzag black lines: Six black patterns consisting of two zigzag lines and a posterior black nearly round spot are present on the yellow-orange-coloured elytra. It has a black and moderately broad longitudinal spot along the medial suture line. A T-shaped black mark connecting the broad black band along the posterior margin of the pronotum is present. This was the most prevalent morph of *C. sexmaculata* in the Gangetic Alluvial Plains of West Bengal. This morph is commonly called the zig-zag ladybird and is found throughout the year. (Fig. 5 a).

M-2: Elytra with three zigzag black lines but the second lines are broken: Similar to the former one, but between two zigzag lines the second black lines are broken on each yellow-orange coloured elytron. It has a broad medial suture line. (Fig. 5 b).

M-3: Elytra with three zigzag black lines but the second black lines are fused with posterior spot: Three zig-zag black markings are very bold. The second black zig-zag lines are fused with subapical round posterior spot on each yellow-orange coloured elytron. Medial black suture line present. The pronotum is of same type, as present in the morph 1. (Fig. 5 c).

M-4: Elytra are completely black: It is a melanic type of morph. Foreground colour (i.e. base colour) of the elytron is completely black. The suture line is indistinct due to black colour of the entire elytra. The pronotum is of same type, as observed in the morph 1. (Fig. 5 d).

M-5: Elytra are transparent black except margins but basic zigzag pattern could be seen through the transparent area: Foreground colour is transparent black except the margins (orange coloured) of elytra. A zig-zag marking and a posterior sub-apical spot could be seen through the transparent black area. Medial black suture line visible. The pronotum bears marking typical of the zig-zag ladybird. (Fig. 5 e).

Harmonia octomaculata (Fabricius)

Material examined: Murshidabad, 5♂♂1♀, Aheripara, Sagardighi, 24°17'N 88°06'E, 32m, 05.ix.2022, Tamoghno Majumder, crop field; Murshidabad, 3♂♂4♀♀, Bajitpur, Sagardighi, 24°17'N 88°06'E, 32m, 05.ix.2022, Tamoghno Majumder, crop field; Murshidabad, 10♂♂2♀♀, Binodhati, Sagardighi, 24°17'N 88°06'E, 32m, 08.ix.2022, Tamoghno

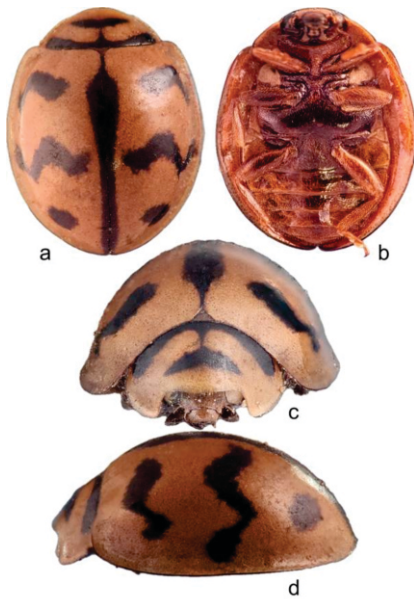


Fig. 2: *Cheilomenes sexmaculata* (Fabricius): (a-d). habitus: (a). dorsal view; (b). ventral view; (c). frontal view and (d). lateral view.

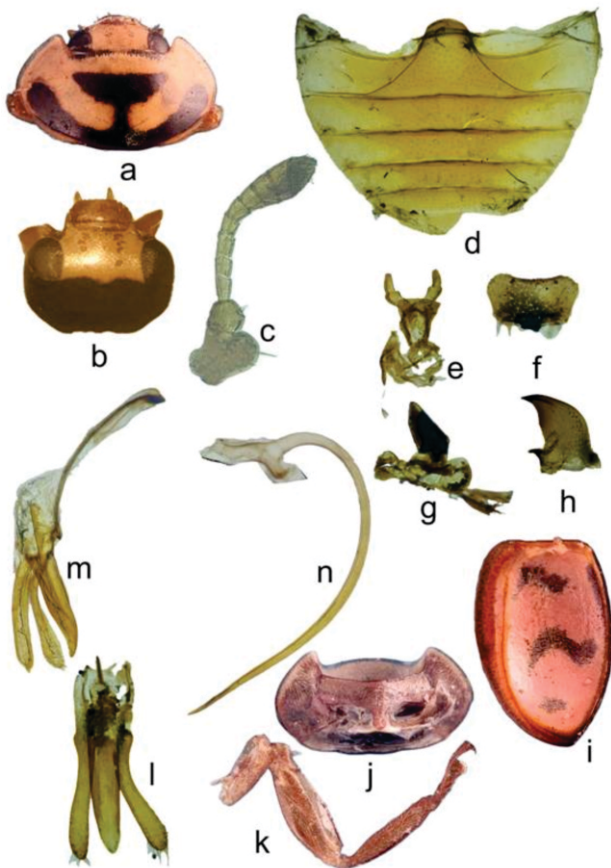


Fig. 3: *Cheilomenes sexmaculata* (Fabricius): (a). pronotum; (b). head, dorsal; (c). antenna; (d). abdomen; (e). labium; (f). labrum; (g). maxilla; (h). mandible; (i). elytral epipleuron; (j). prothorax, ventral; (k). leg; (l-n). male genitalia: (l). tegmen, dorsal; (m). tegmen, ventral; (n). penis.

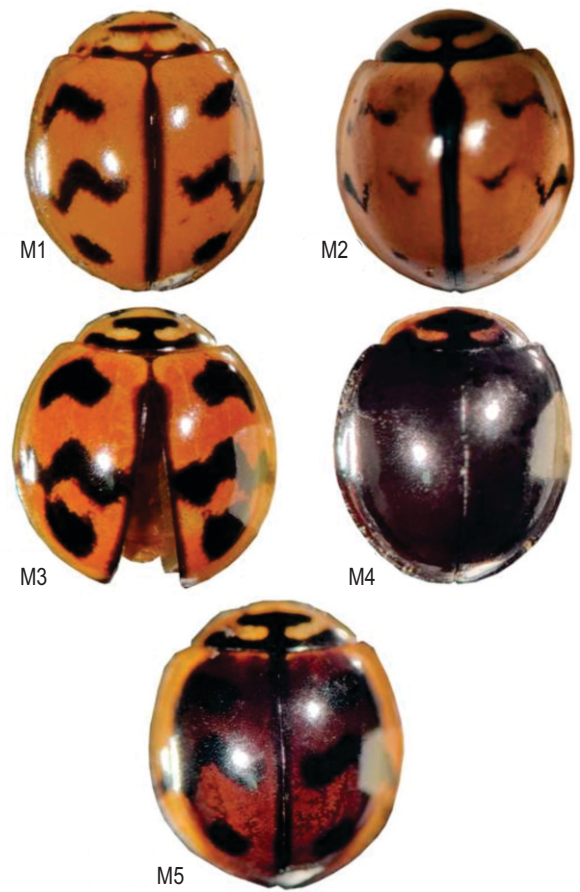


Fig. 4: Polymorphs of *Cheilomenes sexmaculata* (Fabricius): Coloured images.

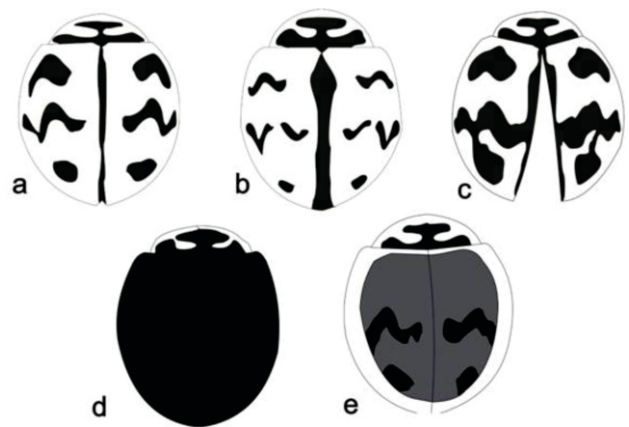


Fig. 5: Polymorphs of *Cheilomenes sexmaculata* (Fabricius): Vector drawings.

Majumder, crop field; Murshidabad, 2♂♂6♀♀, Dakshin Debagram, Sagardighi, 24°17'N 88°06'E, 32m, 10.ix.2022, Tamoghno Majumder, crop field; Murshidabad, 2♂♂, Chandanbati, Sagardighi, 24°17'N 88°06'E, 32m, 12.ix.2022, Tamoghno Majumder, crop field. Murshidabad, 6♂♂1♀, Anantpur, Nabagram, 24°04'N 88°03'E, 35m, 17.ix.2022, Tamoghno Majumder, crop field; Murshidabad, 7♂♂, Bagmara, Nabagram, 24°04'N 88°03'E, 35m, 18.ix.2022, Tamoghno Majumder, crop field. Murshidabad, 2♂♂7♀♀, Basudebkhal, Berhampore, 24°09'N 88°26'E, 18m, 21.ix.2022, Tamoghno Majumder, crop field; Murshidabad, 7♀♀, Banjetia, Berhampore, 24°09'N 88°26'E, 18m, 22.ix.2022, Tamoghno Majumder, crop field; Murshidabad, 2♂♂8♀♀, Bhatpara, Berhampore, 24°09'N 88°26'E, 18m, 22.ix.2022, Tamoghno Majumder, crop field; Murshidabad, 3♂♂1♀, Baikunthapur, Berhampore, 24°09'N 88°26'E, 18m, 24.ix.2022, Tamoghno Majumder, crop field; Murshidabad, 9♂♂1♀, Basabari, Berhampore, 24°09'N 88°26'E, 18m, 24.ix.2022, Tamoghno Majumder, crop field.

North 24 Parganas, 7♂♂, Chamta, Bongaon, 23°04'N 88°82'E, 7m, 04.x.2022, Tamoghno Majumder, crop field; North 24 Parganas, 3♂♂5♀♀, Belta, Bongaon, 23°04'N 88°82'E, 7m, 07.x.2022, Tamoghno Majumder, crop field; North 24 Parganas, 2♂♂1♀, Bhulat, Bongaon, 23°04'N 88°82'E, 7m, 11.x.2022, Tamoghno Majumder, crop field. North 24 Parganas, 8♂♂1♀, Amarkati, Basirhat, 22°72'N 88°47'E, 6m, 18.x.2022, Tamoghno Majumder, crop field; North 24 Parganas, 4♂♂, Ghosuri, Basirhat, 22°72'N 88°47'E, 6m, 20.x.2022, Tamoghno Majumder, crop field. North 24 Parganas, 11♂♂, Agarhati, Sandeshkhali, 22°36'N 88°87'E, 7m, 01.xi.2022, Tamoghno Majumder, crop field; North 24 Parganas, 5♂♂, Bayamari, Sandeshkhali, 22°36'N 88°87'E, 7m, 03.xi.2022, Tamoghno Majumder, crop field; North 24 Parganas, 19♂♂3♀♀, Ghatihara, Sandeshkhali, 22°36'N 88°87'E, 7m, 05.xi.2022, Tamoghno Majumder, crop field.

Nadia, 11♂♂, Bagadoba, Tehatta, 23°72'N 88°52'E, 13m, 17.xi.2022, Tamoghno Majumder, crop field; Nadia, 3♂♂2♀♀, Balarampur, Tehatta, 23°72'N 88°52'E, 13m, 17.xi.2022, Tamoghno Majumder, crop field; Nadia, 18♂♂, Betai, Tehatta, 23°72'N 88°52'E, 13m, 18.xi.2022, Tamoghno Majumder, crop field; Nadia, 3♂♂1♀, Kulgachi, Tehatta, 23°72'N 88°52'E, 13m, 19.xi.2022, Tamoghno Majumder, crop field. Nadia, 5♂♂4♀♀, Baharpur, Ranaghat, 23°17'N 88°56'E, 8m, 22.xi.2022, Tamoghno Majumder, crop field; Nadia, 9♂♂2♀♀, Beleati, Ranaghat, 23°17'N 88°56'E, 8m, 22.xi.2022, Tamoghno Majumder, open field; Nadia, 6♂♂8♀♀, Takshali, Ranaghat, 23°17'N 88°56'E, 8m, 25.xi.2022, Tamoghno Majumder, open field; Nadia, 3♂♂6♀♀, Suresh Nagar, Ranaghat, 23°17'N 88°56'E, 8m, 26.xi.2022, Tamoghno Majumder, crop field. Nadia, 1♂♂3♀♀, Deuli, Chakdah, 23°08'N 88°52'E, 11m, 07.xii.2022, Tamoghno Majumder, open field; Nadia, 8♂♂2♀♀, Kadamgachi, Chakdah, 23°08'N 88°52'E, 11m, 08.xii.2022, Tamoghno Majumder, open field; Nadia, 6♂♂7♀♀, Mathurapur, Chakdah, 23°08'N 88°52'E, 11m, 08.xii.2022, Tamoghno Majumder, crop field.

Nadia, 1♂♂1♀, Balindi, Haringhata, 22°96'N 88°56'E, 10m, 10.xii.2022, Tamoghno Majumder, open field; Nadia, 5♂♂, Hatikanda, Haringhata, 22°96'N 88°56'E, 10m, 11.xii.2022, Tamoghno Majumder, crop field; Nadia, 2♂♂, Dakshin Datta Para, Haringhata, 22°96'N 88°56'E, 10m, 11.xii.2022, Tamoghno Majumder, crop field; Nadia, 1♂, Mondouri, Haringhata, 22°96'N 88°56'E, 10m, 13.xii.2022, Tamoghno Majumder, crop field; Nadia, 2♂♂3♀♀, BCKV, Haringhata, 22°96'N 88°56'E, 10m, 14.xii.2022, Tamoghno Majumder, crop field. Howrah, 5♂♂, Begua, Amta, 22°57'N 88°01'E, 6m, 20.xii.2022, Tamoghno Majumder, crop field; Howrah, 1♂, Dadpur, Amta, 22°57'N 88°01'E, 6m, 21.xii.2022, Tamoghno Majumder, crop field; Howrah, 2♂♂, Habla, Amta, 22°57'N 88°01'E, 6m, 21.xii.2022, Tamoghno Majumder, open field. Howrah, 1♂2♀♀, Amtala, Uluberia, 22°47'N 88°11'E, 1m, 01.i.2023, Tamoghno Majumder, crop field; Howrah, 13♂♂6♀♀, Baikhali, Uluberia, 22°47'N 88°11'E, 1m, 01.i.2023, Tamoghno Majumder, crop field; Howrah, 11♂♂2♀♀, Jaynagar, Uluberia, 22°47'N 88°11'E, 1m, 03.i.2023, Tamoghno Majumder, crop field.

Hooghly, 1♀, Amanmouri, Pandua, 23°07'N 88°27'E, 19m, 08.i.2023, Tamoghno Majumder, crop field; Hooghly, 1♂2♀♀, Goara, Pandua, 23°07'N 88°27'E, 19m, 09.i.2023, Tamoghno Majumder, crop field; Hooghly, 2♂♂, Hatni, Pandua, 23°07'N 88°27'E, 19m, 11.i.2023, Tamoghno Majumder, crop field; Hooghly, 1♀, Kamtai, Pandua, 23°07'N 88°27'E, 19m, 11.i.2023, Tamoghno Majumder, crop field. Hooghly, 3♂♂1♀, Jiara, Dhaniakhali, 23°96'N 88°10'E, 16m, 17.i.2023, Tamoghno Majumder, open field; Hooghly, 1♂, Kak Gachi, Dhaniakhali, 23°96'N 88°10'E, 16m, 17.i.2023, Tamoghno Majumder, crop field; Hooghly, 9♂♂2♀♀, Masuria, Dhaniakhali, 23°96'N 88°10'E, 16m, 18.i.2023, Tamoghno Majumder, open field; Hooghly, 2♂♂1♀, Sirijpur, Dhaniakhali, 23°96'N 88°10'E, 16m, 23.i.2023, Tamoghno Majumder, crop field.

Description

The members of the species elongated oval (Fig. 6 a-d), body length 5.20 – 7.30 mm and width 4.00 – 5.40 mm. Dorsal side of the body slightly convex and glabrous. Ground colour vivid reddish orange to full orange. Mesoventrite and metaventrite black; ventrally five abdominal ventrites visible and distinctive black pattern was also present through all the ventrites (Fig. 6 b). Pronotum with variable black markings (Fig. 10 a-d). Elytra also had highly variable black maculae. Elytral epipleuron broad and thick with foveae (Fig. 7 j). On head, black transverse marking was present on the posterior portion and middle portion of frons (Fig. 7 a). Antennae composed of 11 antennomeres, terminal antennomere broad scalene trapezium shaped and larger than its preceding three antennomeres (Fig. 7 b, c). Eyes approximately oval, finely faceted, moderately large, moderately separated, interocular distance about 2x as wide as an eye (Fig. 6 c, 7 a). Mouthparts (labium, labrum maxilla and mandible) as illustrated (Fig. 7 e-h). Prothorax as illustrated (Fig. 7 i). Abdominal postcoxal lines incomplete with an associate line, curved, reaching towards upper edge (Fig. 7 d). Coxa and femur distinctive brownish orange to balck (Fig. 7 k). Male genitalia (Fig.



Fig. 6: *Harmonia octomaculata* (Fabricius): (a-d). habitus: (a). dorsal view; (b). ventral view; (c). frontal view and (d). lateral view.

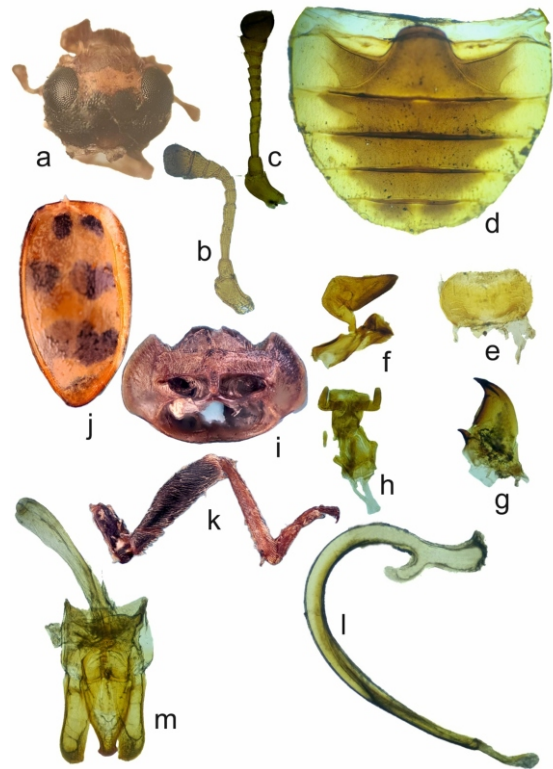


Fig. 7: *Harmonia octomaculata* (Fabricius): (a). head, dorsal; (b,c). antenna; (d). abdomen; (e). labrum; (f). maxilla; (g). mandible; (h). labium; (i). prothorax, ventral; (j). elytral epipleuron; (k). leg; (l-m). male genitalia: (l). penis and (m). tegmen, dorsal.

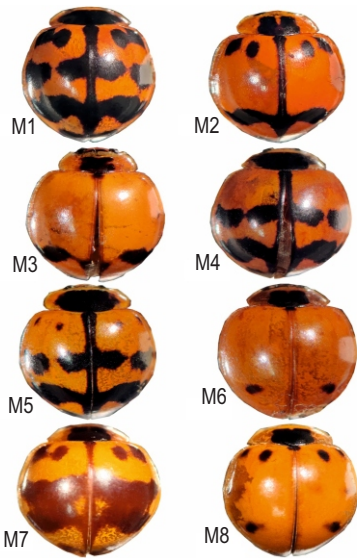


Fig. 8: Polymorphs of *Harmonia octomaculata* (Fabricius): Coloured images.

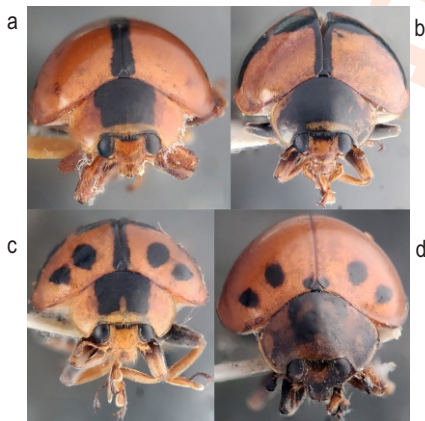


Fig. 10: Pronotal spot variations of *Harmonia octomaculata* (Fabricius).

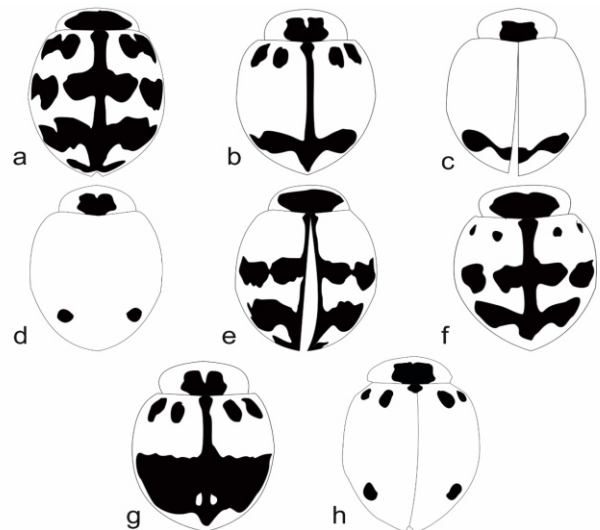


Fig. 9: Polymorphs of *Harmonia octomaculata* (Fabricius): Vector drawings.

7 l, m) as illustrated, tegmen (Fig. 7 m) stout, penis guide in dorsal view strikingly wider at base, gradually narrowed to a short stem, guide as long as parameres, Penis (Fig. 7 l) stout, greatly curved with a well-defined penis capsule, penis capsule with long outer arm and distinctly curved inner arm. *H. octomaculata* has a variety of morphs which vary only in size and number of spots on elytra which differed from each other. Eight different morphs of *H. octomaculata* were observed and identified (Figs. 8, 9). These morphs can be categorized as follows:

M-1: Elytra with three banded markings: Elytra have four black separated dots on forward portion and another four black separated dots on the central portion. It has a broad black medial suture line which is connected with the posterior markings on the apical portion of the yellowish-red coloured elytra. It is a very common morph. Pronotum mostly black. This morph is commonly called three-banded ladybird. (Fig. 9 a).

M-2: Elytra with four spots and a black band: Elytra only have four black spots on forward portion. There are no other black dots in this morph. Black medial suture line is connected with posterior band on the apical portion of the elytra. (Fig. 9 b).

M-3: Elytra with black posterior band: Elytra does not have any dots except at the posterior black band on the apical portion of the yellowish-red coloured elytra. It is not adorned with medial suture line. (Fig. 9 c).

M-4: Elytra with two black bands: There are no spots on forward portion of the elytra. On the central portion, four black spots are interconnected with each other and fused with black broad medial suture line. Suture line is also connected with posterior band on the rear portion of the yellowish-red coloured elytra. This morph is predominant in the month of February. (Fig. 9 e).

M-5: Elytra with two fused spots on central portion: This morph is almost same as the morph 1. In the morph 1 there are four separate spots respectively on forward portion and central portion of the elytra. But in this morph, two spots near the discal area are fused together on the central portion. (Fig. 9 f)

M-6: Elytra with two black dots: Two black round-shaped dots are found in the apical portion on each yellowish-red coloured elytron. These morph does not bear medial suture line. (Fig. 9 d).

M-7: Elytra with anchor-shaped pattern: Four black dots are found on forward portion of the elytra. Broad black medial suture line is connected with wide black anchor-shaped markings on the posterior part of elytra. Two teardrops-shaped dots are found in the wide anchor-shaped markings. (Fig. 9 g).

M-8: Elytra with six semicircular dots: Four black dots are found on forward portion of the elytra. Suture line is absent. Two semicircular black dots are found in the apical portion of the elytra. (Fig. 9 h).

Coccinella septempunctata Linnaeus

Material examined: Murshidabad, 11♂♂3♀♀, Aheripara, Sagardighi, 24°17'N 88°06'E, 32m, 05.ii.2023, Tamoghno Majumder, crop field; Murshidabad, 14♂♂, Bajitpur, Sagardighi, 24°17'N 88°06'E, 32m, 07.ii.2023, Tamoghno Majumder, crop field; Murshidabad, 11♂♂2♀♀, Binodhati, Sagardighi, 24°17'N 88°06'E, 32m, 07.ii.2023, Tamoghno Majumder, crop field; Murshidabad, 12♂♂4♀♀, Dakshin Debagram, Sagardighi, 24°17'N 88°06'E, 32m, 08.ii.2023, Tamoghno Majumder, crop field; Murshidabad, 13♂♂, Chandanbati, Sagardighi, 24°17'N 88°06'E, 32m, 09.ii.2023, Tamoghno Majumder, crop field. Murshidabad, 16♂♂4♀♀, Anantpur, Nabagram, 24°04'N 88°03'E, 35m, 11.ii.2023, Tamoghno Majumder, crop field; Murshidabad, 10♂♂3♀♀, Bagmara, Nabagram, 24°04'N 88°03'E, 35m, 12.ii.2023, Tamoghno Majumder, open field.

Murshidabad, 13♂♂1♀, Basudebkhali, Berhampore, 24°09'N 88°26'E, 18m, 15.ii.2023, Tamoghno Majumder, crop field; Murshidabad, 11♀♀, Banjetia, Berhampore, 24°09'N 88°26'E, 18m, 17.ii.2023, Tamoghno Majumder, open field; Murshidabad, 12♂♂5♀♀, Bhatpara, Berhampore, 24°09'N 88°26'E, 18m, 18.ii.2023, Tamoghno Majumder, crop field. North 24 Parganas, 16♂♂, Chamta, Bongaon, 23°04'N 88°82'E, 7m, 20.ii.2023, Tamoghno Majumder, crop field; North 24 Parganas, 15♂♂8♀♀, Belta, Bongaon, 23°04'N 88°82'E, 7m, 21.ii.2023, Tamoghno Majumder, open field; North 24 Parganas, 12♂♂, Bhulat, Bongaon, 23°04'N 88°82'E, 7m, 22.ii.2023, Tamoghno Majumder, crop field. North 24 Parganas, 22♂♂12♀♀, Amarkati, Basirhat, 22°72'N 88°47'E, 6m, 04.iii.2023, Tamoghno Majumder, crop field; North 24 Parganas, 10♂♂, Ghusuri, Basirhat, 22°72'N 88°47'E, 6m, 05.iii.2023, Tamoghno Majumder, open field. North 24 Parganas, 9♂♂, Agarhati, Sandeshkhali, 22°36'N 88°87'E, 7m, 08.iii.2023, Tamoghno Majumder, crop field; North 24 Parganas, 12♂♂, Bayamarii, Sandeshkhali, 22°36'N 88°87'E, 7m, 08.iii.2023, Tamoghno Majumder, crop field; North 24 Parganas, 11♂♂6♀♀, Ghatihara, Sandeshkhali, 22°36'N 88°87'E, 7m, 09.iii.2023, Tamoghno Majumder, crop field.

Nadia, 3♂♂, Bagadoba, Tehatta, 23°72'N 88°52'E, 13m, 14.iii.2023, Tamoghno Majumder, crop field; Nadia, 14♂♂5♀♀, Balarampur, Tehatta, 23°72'N 88°52'E, 13m, 16.iii.2023, Tamoghno Majumder, crop field; Nadia, 11♂♂, Betai, Tehatta, 23°72'N 88°52'E, 13m, 19.iii.2023, Tamoghno Majumder, crop field; Nadia, 12♂♂3♀♀, Kulgachi, Tehatta, 23°72'N 88°52'E, 13m, 20.iii.2023, Tamoghno Majumder, crop field. Nadia, 17♂♂, Baharpur, Ranaghat, 23°17'N 88°56'E, 8m, 07.iv.2023, Tamoghno Majumder, open field; Nadia, 1♂3♀♀, Beleati, Ranaghat, 23°17'N 88°56'E, 8m, 07.iv.2023, Tamoghno Majumder, crop field; Nadia, 21♂♂2♀♀, Takshali, Ranaghat, 23°17'N 88°56'E, 8m, 08.iv.2023, Tamoghno Majumder, crop field; Nadia, 1♂3♀♀, Suresh Nagar, Ranaghat, 23°17'N 88°56'E, 8m, 09.iv.2023, Tamoghno Majumder, open field.

Nadia, 9♂♂2♀♀, Deuli, Chakdah, 23°08'N 88°52'E, 11m, 12.iv.2023, Tamoghno Majumder, crop field; Nadia, 12♂♂, Kadamgachi, Chakdah, 23°08'N 88°52'E, 11m, 12.iv.2023, Tamoghno Majumder, open field; Nadia, 11♂♂1♀, Mathurapur, Chakdah, 23°08'N 88°52'E, 11m, 12.iv.2023, Tamoghno Majumder, crop field. Nadia, 11♂♂2♀♀, Balindi, Haringhata, 22°96'N 88°56'E, 10m, 14.iv.2023, Tamoghno Majumder, crop field; Nadia, 25♂♂, Hatikanda, Haringhata, 22°96'N 88°56'E, 10m, 16.iv.2023, Tamoghno Majumder, open field; Nadia, 21♂♂, Dakshin Datta Para, Haringhata, 22°96'N 88°56'E, 10m, 16.iv.2023, Tamoghno Majumder, crop field; Nadia, 7♂♂, Mondouri, Haringhata, 22°96'N 88°56'E, 10m, 17.iv.2023, Tamoghno Majumder, crop field; Nadia, 22♂♂7♀♀, BCKV, Haringhata, 22°96'N 88°56'E, 10m, 18.iv.2023, Tamoghno Majumder, open field. Howrah, 7♂♂2♀♀, Begua, Amta, 22°57'N 88°01'E, 6m, 10.v.2023, Tamoghno Majumder, crop field; Howrah, 14♂♂, Dadpur, Amta, 22°57'N 88°01'E, 6m, 10.v.2023, Tamoghno Majumder, crop field; Howrah, 3♂♂6♀♀, Habla, Amta, 22°57'N 88°01'E, 6m, 11.v.2023, Tamoghno Majumder, crop field. Howrah, 4♂♂, Amtala, Uluberia, 22°47'N 88°11'E, 1m, 15.v.2023, Tamoghno Majumder, crop field; Howrah, 1♀, Baikhali, Uluberia, 22°47'N 88°11'E, 1m, 16.v.2023, Tamoghno Majumder, crop field; Howrah, 12♂♂3♀♀, Jaynagar, Uluberia, 22°47'N 88°11'E, 1m, 17.v.2023, Tamoghno Majumder, open field.

Hooghly, 4♀♀, Amanmouri, Pandua, 23°07'N 88°27'E, 19m, 20.v.2023, Tamoghno Majumder, crop field; Hooghly, 20♂♂12♀♀, Goara, Pandua, 23°07'N 88°27'E, 19m, 20.v.2023, Tamoghno Majumder, crop field; Hooghly, 4♂♂, Hatni, Pandua, 23°07'N 88°27'E, 19m, 22.v.2023, Tamoghno Majumder, crop field; Hooghly, 9♀♀, Kamtai, Pandua, 23°07'N 88°27'E, 19m, 24.v.2023, Tamoghno Majumder, open field. Hooghly, 1♂, Jiara, Dhaniakhali, 23°96'N 88°10'E, 16m, 27.v.2023, Tamoghno Majumder, open field; Hooghly, 2♂♂, Kak Gachhi, Dhaniakhali, 23°96'N 88°10'E, 16m, 27.v.2023, Tamoghno Majumder, crop field; Hooghly, 1♂3♀♀, Masuria, Dhaniakhali, 23°96'N 88°10'E, 16m, 28.v.2023, Tamoghno Majumder, crop field; Hooghly, 6♂♂, Sirijpur, Dhaniakhali, 23°96'N 88°10'E, 16m, 28.v.2023, Tamoghno Majumder, crop field.

Description

The members of the species oval-shaped (Fig. 11 a-d), body length 5.00 – 8.10 mm and width 3.80 – 6.20 mm. Dorsal side of the body strongly convex. Ground colour vivid reddish orange to full orange. Ventral side of the body black and six abdominal ventrites visible (Fig. 11 b). Pronotum black with light orange anterolateral markings (Fig. 11 c). Elytra had highly variable black markings. Elytral epipleuron broad and thick with foveae for apices of mid and hind femur (Fig. 12 k). Head full black with two amber colour semicircular spots on interocular space (Fig 12 a). Antennae composed of 11 antennomeres, terminal antennomere scalene trapezium shaped and larger than its preceding three antennomeres (Fig. 12 b, c). Eyes were approximately oval, moderately small, finely faceted, quite separated, interocular

distance about 3x as wide as an eye (Fig. 11 c, 12 a). Mouthparts (labium, labrum maxilla and mandible) as illustrated (Fig. 12 g-j). Legs black (Fig. 12 l). Abdominal postcoxal lines incomplete with an associate line, curved, reaching towards upper edge (Fig. 12 d, e). Prothorax (Fig. 12 f) as illustrated. Male genitalia (Fig. 12 m, n) as illustrated, tegmen stout (Fig. 12 n), penis guide in dorsal view narrower at base, then gradually broaden up to basal half, then abruptly narrowed to apex and form a cone shape, penis guide longer than parameres, parameres with long dense setae on the inner sides and distal end. Penis (Fig. 12 m) stout, greatly curved with a well-defined broad penis capsule, penis capsule with short outer arm and distinctly curved elongate inner arm; penis apex modified. Six different elytral spot morphs of *C. septempunctata* were observed and identified (Figs 13, 14). These morphs can be categorized as follows:

M-1: Elytra with seven distinct spots: This morph is commonly known as the seven-spotted ladybird. It is found throughout the year. It does not bear medial suture line. A large macula is present on the scutellum. Each orange-coloured elytron has three spots, one lateral, one discal and one apical. (Fig. 14 a).

M-2: Elytra with hook like pattern: In this morph, all the three spots (lateral, discal and apical) are fused with each other through a band on each elytron forming a hook like pattern. It has a distinct scutellar spot. (Fig. 14 c).

M-3: Elytra with scutellar and discal spots fused together: In this morph, scutellar spot is fused with two discal spots through a thin bridge on each orange-coloured elytron forming a triangular pattern. There is no distinct medial suture line. It has two lateral and two apical spots. (Fig. 14b).

M-4: Elytra with boot like pattern: In this morph, discal spots and apical spots are fused together on each elytron forming a boot like pattern. It has a distinct scutellar spot and two lateral spots. It is a melanic morph. (Fig. 14 d).

M-5: Elytra with dumbbell-shaped pattern: In this morph, lateral spots and apical spots are connected through a bridge forming a dumbbell-shaped pattern on the elytra. It has a distinct scutellar spot and two discal spots in each elytron. (Fig. 14 e).

M-6: Elytra with all the spots conjoined: All the spots are fused with each other and forming an anchor-shaped pattern on the elytra. (Fig. 14 f).

Propylea dissecta (Mulsant)

Material examined: Murshidabad, 5♂♂1♀, Aheripara, Sagardighi, 24°17'N 88°06'E, 32m, 02.vii.2023, Tamoghno Majumder, crop field; Murshidabad, 11♂♂, Bajitpur, Sagardighi, 24°17'N 88°06'E, 32m, 03.vii.2023, Tamoghno Majumder, crop field; Murshidabad, 10♂♂6♀♀, Binodhati, Sagardighi, 24°17'N 88°06'E, 32m, 08.vii.2023, Tamoghno Majumder, crop field; Murshidabad, 4♂♂, Dakshin Debagram, Sagardighi, 24°17'N

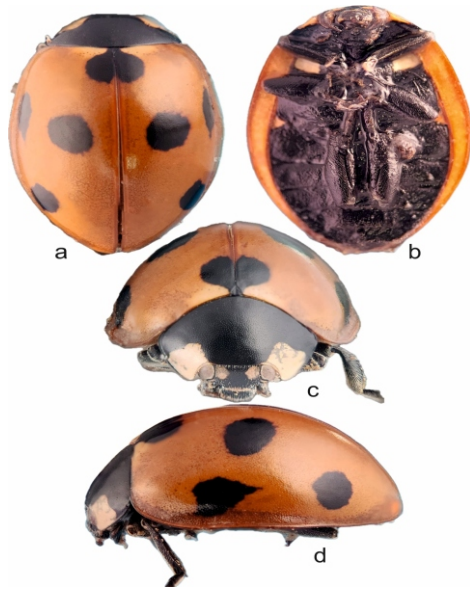


Fig. 11: *Coccinella septempunctata* (Linnaeus): (a-d). habitus: (a). dorsal view; (b). ventral view; (c). frontal view and (d). lateral view.



Fig. 12: *Coccinella septempunctata* (Linnaeus): (a). head, dorsal; (b,c). antenna; (d, e). abdomen; (f). prothorax, ventral; (g). mandible; (h). maxilla; (i). labrum; (j). labium; (k). elytral epipleuron; (l). leg; (m-n). male genitalia: (m). penis and (n). tegmen, dorsal.

88°06"E, 32m, 09.vii.2023, Tamoghno Majumder, crop field; Murshidabad, 2♂♂, Chandanbati, Sagardighi, 24°17'N 88°06'E, 32m, 11.vii.2023, Tamoghno Majumder, crop field.

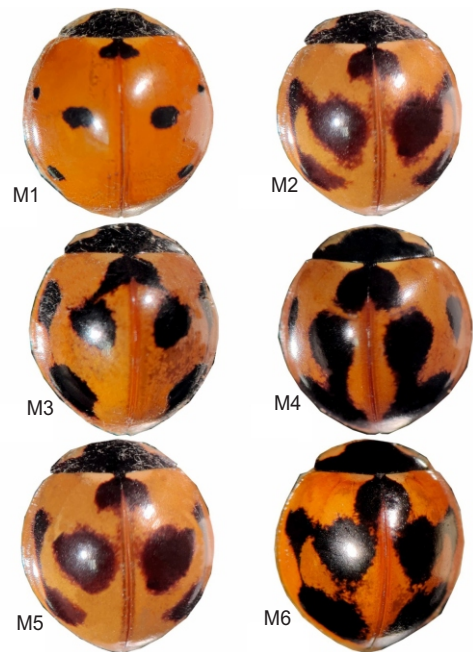


Fig. 13: Polymorphs of *Coccinella septempunctata* (Linnaeus): Coloured images.



Fig. 14: Polymorphs of *Coccinella septempunctata* (Linnaeus): Vector drawings.

Murshidabad, 1♂5♀♀, Anantpur, Nabagram, 24°04'N 88°03'E, 35m, 15.vii.2023, Tamoghno Majumder, crop field; Murshidabad, 3♂♂1♀, Bagmara, Nabagram, 24°04'N 88°03'E, 35m, 16.vii.2023, Tamoghno Majumder, crop field. Murshidabad, 5♂♂2♀♀, Basudebkhali, Berhampore, 24°09'N 88°26'E, 18m, 19.vii.2023, Tamoghno Majumder, crop field; Murshidabad, 2♀♀, Banjetia, Berhampore, 24°09'N 88°26'E, 18m, 20.vii.2023, Tamoghno Majumder, crop field; Murshidabad, 9♂♂2♀♀, Bhatpara, Berhampore, 24°09'N 88°26'E, 18m, 21.vii.2023, Tamoghno Majumder, crop field. North 24 Parganas, 6♂♂, Chamta, Bongaon, 23°04'N 88°82'E, 7m, 11.viii.2023, Tamoghno

Majumder, crop field; North 24 Parganas, 2♂♂, Belta, Bongaon, 23°04'N 88°82'E, 7m, 14.viii.2023, Tamoghno Majumder, crop field; North 24 Parganas, 7♂♂2♀♀, Bhulat, Bongaon, 23°04'N 88°82'E, 7m, 16.viii.2023, Tamoghno Majumder, crop field. North 24 Parganas, 11♂♂, Amarkati, Basirhat, 22°72'N 88°47'E, 6m, 20.viii.2023, Tamoghno Majumder, crop field; North 24 Parganas, 10♂♂4♀♀, Ghosuri, Basirhat, 22°72'N 88°47'E, 6m, 22.viii.2023, Tamoghno Majumder, crop field.

North 24 Parganas, 1♂1♀, Agarhati, Sandeshkhali, 22°36'N 88°87'E, 7m, 10.ix.2023, Tamoghno Majumder, crop field; North 24 Parganas, 2♂♂, Bayamarii, Sandeshkhali, 22°36'N 88°87'E, 7m, 11.ix.2023, Tamoghno Majumder, open field; North 24 Parganas, 1♂3♀♀, Ghatihara, Sandeshkhali, 22°36'N 88°87'E, 7m, 12.ix.2023, Tamoghno Majumder, crop field. Nadia, 10♂♂, Bagadoba, Tehatta, 23°72'N 88°52'E, 13m, 14.ix.2023, Tamoghno Majumder, crop field; Nadia, 2♂♂3♀♀, Balarampur, Tehatta, 23°72'N 88°52'E, 13m, 16.ix.2023, Tamoghno Majumder, crop field. Nadia, 7♂♂, Baharpur, Ranaghat, 23°17'N 88°56'E, 8m, 20.ix.2023, Tamoghno Majumder, crop field; Nadia, 2♂♂, Beleati, Ranaghat, 23°17'N 88°56'E, 8m, 20.ix.2023, Tamoghno Majumder, crop field. Nadia, 4♀♀, Deuli, Chakdah, 23°08'N 88°52'E, 11m, 25.ix.2023, Tamoghno Majumder, crop field; Nadia, 5♂♂1♀, Kadamgachi, Chakdah, 23°08'N 88°52'E, 11m, 26.ix.2023, Tamoghno Majumder, crop field; Nadia, 3♂♂, Mathurapur, Chakdah, 23°08'N 88°52'E, 11m, 27.ix.2023, Tamoghno Majumder, crop field. Nadia, 1♂3♀♀, Balindi, Haringhata, 22°96'N 88°56'E, 10m, 15.x.2023, Tamoghno Majumder, crop field; Nadia, 2♂♂, Hatikanda, Haringhata, 22°96'N 88°56'E, 10m, 17.x.2023, Tamoghno Majumder, crop field; Nadia, 10♂♂, Dakshin Datta Para, Haringhata, 22°96'N 88°56'E, 10m, 18.x.2023, Tamoghno Majumder, crop field; Nadia, 5♂♂6♀♀, Mondouri, Haringhata, 22°96'N 88°56'E, 10m, 19.x.2023, Tamoghno Majumder, crop field; Nadia, 11♂♂, BCKV, Haringhata, 22°96'N 88°56'E, 10m, 20.x.2023, Tamoghno Majumder, crop field. Howrah, 2♂♂6♀♀, Begua, Amta, 22°57'N 88°01'E, 6m, 26.x.2023, Tamoghno Majumder, crop field; Howrah, 5♂♂, Dadpur, Amta, 22°57'N 88°01'E, 6m, 27.x.2023, Tamoghno Majumder, open field; Howrah, 3♂♂1♀, Habla, Amta, 22°57'N 88°01'E, 6m, 29.x.2023, Tamoghno Majumder, open field.

Howrah, 1♂2♀♀, Amtala, Uluberia, 22°47'N 88°11'E, 1m, 05.xi.2023, Tamoghno Majumder, crop field; Howrah, 5♂♂3♀♀, Baikhali, Uluberia, 22°47'N 88°11'E, 1m, 07.xi.2023, Tamoghno Majumder, crop field. Hooghly, 4♀♀, Amanmouri, Pandua, 23°07'N 88°27'E, 19m, 14.xi.2023, Tamoghno Majumder, crop field; Hooghly, 2♂♂, Goara, Pandua, 23°07'N 88°27'E, 19m, 15.xi.2023, Tamoghno Majumder, crop field; Hooghly, 3♂♂, Hatni, Pandua, 23°07'N 88°27'E, 19m, 19.xi.2023, Tamoghno Majumder, crop field; Hooghly, 7♀♀, Kamtai, Pandua, 23°07'N 88°27'E, 19m, 21.xi.2023, Tamoghno Majumder, crop field. Hooghly, 2♂♂7♀♀, Jiara, Dhaniakhali, 23°96'N 88°10'E, 16m, 01.xii.2023, Tamoghno Majumder, open field; Hooghly, 10♂♂3♀♀, Kak Gachi, Dhaniakhali, 23°96'N 88°10'E, 16m, 03.xii.2023, Tamoghno Majumder, crop field;

Hooghly, 6♂♂2♀♀, Masuria, Dhaniakhali, 23°96'N 88°10'E, 16m, 05.xii.2023, Tamoghno Majumder, crop field; Hooghly, 6♂♂, Sirijpur, Dhaniakhali, 23°96'N 88°10'E, 16m, 08.xii.2023, Tamoghno Majumder, crop field.

Description

Form of the species semi-round to oval shaped (Fig. 15 a-d), body length 3.20 – 4.50 mm and width 2.70 – 3.40 mm. Dorsal side of the body slightly convex and glabrous. Ground colour orange. Mesoventrite and metaventrite black; ventrally six abdominal ventrites visible and distinctive black pattern also present through all the ventrites (Fig. 15 b). Pronotum black with light orange colour various anterolateral markings (Fig. 19 a, b). Elytra had a few variable black markings. Elytral epipleuron broad and thick without foveae (Fig. 16 i). Head black except the interocular space pale orange (Fig. 16 a). Antenna composed of 11 antennomeres, terminal antennomere U shaped and longer than preceding two antennomeres (Fig. 16 b). Eyes approximately oval, finely faceted, moderately large, limitedly separated, interocular distance about 2.5x as wide as an eye (Fig. 16 a) Mouthparts (labium, labrum maxilla and mandible) as illustrated (Fig. 16 e-h). Abdominal postcoxal lines incomplete, reaching posterior margin of abdominal ventrite 1 and running along posterior margin then gradually fade out (Fig. 16 c). Prothorax as illustrated (Fig. 16 d). Male genitalia (Fig. 16 k, l) as illustrated, tegmen (Fig. 16 l) thin, penis guide in dorsal view even to basal half then gradually narrowed to apex and form a slender leaf shape, penis guide shorter than parameres, parameres slightly curved at basal section with long dense setae on the inner sides and distal end. Penis (Fig. 16 k) slender, greatly curved with moderately lean penis capsule, penis capsule with short outer arm and slightly long curved inner arm; penis apex had modified thread like appearance. Leg (Fig. 6 j) as illustrated; femur deep brownish to black. Four different elytral spot morphs of *P. dissecta* were observed and identified (Fig. 17, 18). These morphs can be categorized as follows:

M-1 : Elytra with double anchor-shaped spots: Anchor-shaped black markings are present on each elytron, fused with each other on forward and posterior portion. Black suture line is present. Pronotum with large transverse black marking. (Fig. 18 a).

M-2: Elytra with two posterior spot and reduced anchor – shaped spots: Anchor-shaped black markings reduced on the forward portion of the elytra. Two semicircular spots are present on the posterior portion of the elytra. Black suture line is present. Pronotum has black wavy markings. (Fig. 18 b).

M-3: Elytra with only reduced anchor – shaped pattern: Similar to the former one. But it has no posterior spot on the elytra. Black suture line is present. Pronotum mostly black and has bulging appearance. (Fig. 18 c).

M-4: Elytra without any spot: Only the black suture line is visible. Pronotum mostly black and has bulging appearance. Most immaculate form, found throughout the year. (Fig. 18 d)

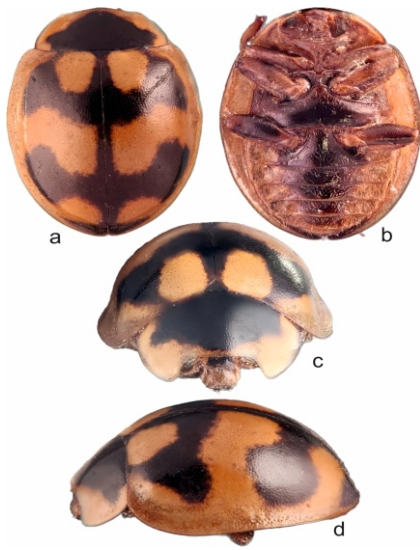


Fig. 15: *Propylea dissecta* (Mulsant): (a-d) habitus: (a) dorsal view; (b) ventral view; (c) frontal view and (d) lateral view.



Fig. 17: Polymorphs of *Propylea dissecta* (Mulsant): Coloured images.

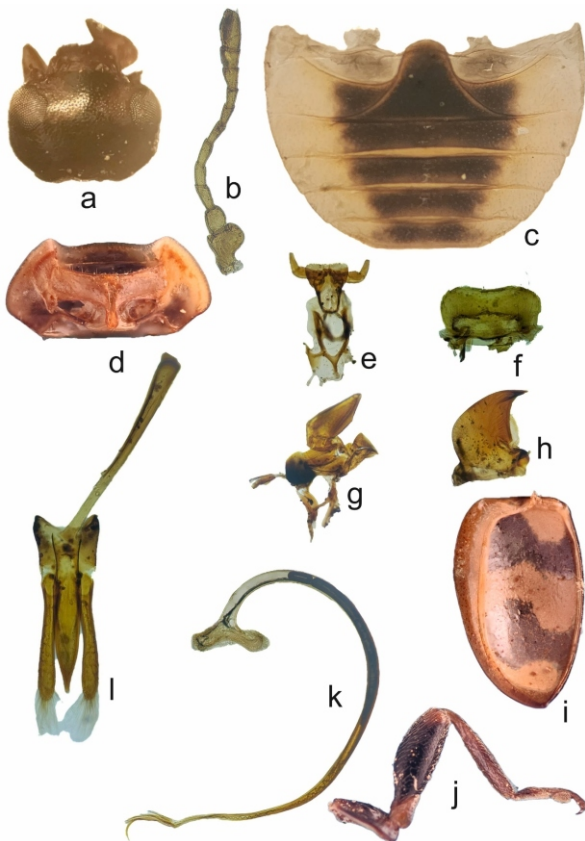


Fig. 16: *Propylea dissecta* (Mulsant): (a) head, dorsal; (b) antenna; (c) abdomen; (d) prothorax, ventral; (e) labium; (f) labrum; (g) maxilla; (h) mandible; (i) elytral epipleuron; (j) leg and (k-l) male genitalia: (k) penis; (l) tegmen, dorsal.

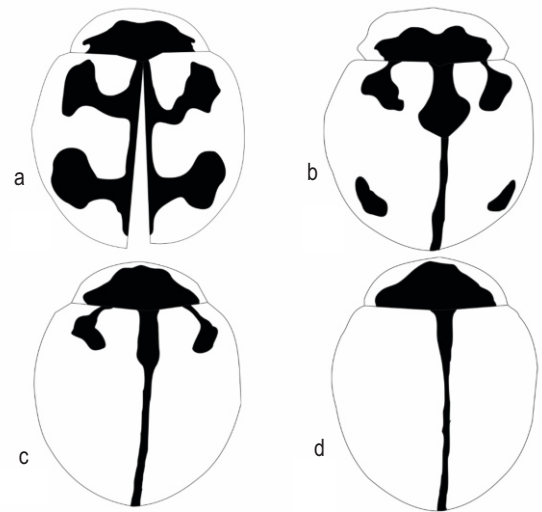


Fig. 18: Polymorphs of *Propylea dissecta* (Mulsant): Vector drawings.



Fig. 19: Pronotal spot variations of *Propylea dissecta* (Mulsant).

Research across the globe showed that the creation of polymorphs is merely a genetic function, which contradicts this association between temperature and morphology (Lamana and Miller, 1995). Along with body shape and size, mate desire is also related to polymorphism in ladybird beetles (Muggleton 1979; Majerus et al., 1982; Brakefield, 1984; O'Donald et al., 1984). The melanic forms, which absorb more sunlight in the winter, had higher mating success rates than the non-melanic forms, which accounts for the seasonal fluctuation in morph frequency (Ueno et al., 1998). Recently, Poorani (2023) documented different polymorphic variants of these four ladybird beetles from the Indian subcontinent.

The present study documents five morphs of *C. sexmaculata*, eight morphs of *H. octomaculata*, six morphs of *C. septempunctata* and four morphs of *P. dissecta* from Gangetic Alluvial Zone which will help to explore, identify and prepare inventory of ladybird beetle morphs in West Bengal. Study on male genitalia is vital for confirmation of the species because these variations could make it difficult to identify an individual based solely on elytral patterns or markings. The result of the study will undeniably steer the researchers to arrive at the accurate identity of the ladybird species which is considered as a benchmark in any study allied to biology. Regarding the pattern of their elytra, the four species of ladybird beetles exhibit substantial variations. Among the five different morphs of *C. sexmaculata*, M1 is the most prevalent and found throughout the year as the most dominant one in the studied area. Among the eight variants of *H. octomaculata*, M1 is the most common. Among six different morphs of *C. septempunctata*, M1 is the most widespread. In case of four different morphs of *P. dissecta*, M1 and M4 are the most widespread morphs. Although the findings of this study add to understanding of ladybird morphs only in the Gangetic Alluvial Zone, more research on the changes in coccinellid beetle pigmentation should be emphasised to cover all agro-climatic zones of West Bengal as well as Indian subcontinent.

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