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Cover Photo by Parixit Kafley of *Balinta octonotata*

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DESCRIPTION OF FURTHER INDIVIDUAL VARIATIONS OF THE CICADA *BALINTA OCTONOTATA* (INSECTA: HEMPIPTERA: CICADIDAE) AND EXTENSION OF ITS KNOWN DISTRIBUTION IN INDIA

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Reviewer: Sudhanya Ray Hajong

The cicada *Balinta octonotata* (Westwood, 1845) is known from Sikkim, Assam and Myanmar (Distant, 1906) as well as Bhutan and Nepal (Sanborn, 2014). Distant (1906) described three forms of the species: the typical form has four creamy spots on the tegmina, one sub basal, two distal and one subapical. The first variety lacks the basal spot to the tegmina and the second variety lacks the basal spot and has the two discal spots replaced by a narrow transverse fascia.

The species is common during April and May in the village forest of Gangmouthan village, district Biswanath, Assam and has been recorded in June from Uttarakhand, which record extends the known distribution of the species westwards from Nepal to Uttarakhand. During this period, a series of specimens was collected and the following undescribed variations noted:

Variety 3, with the basal and subcostal creamy spots obliterated, so that there are only two discal spots on the tegmina.

Variety 4, the subapical creamy spot is obliterated.

Variety 5, the tornal creamy spot is broken into two separate spots, making a series of three discal spots and a total of five creamy spots on the wing.

The length excluding tegmina is 25-27 mm for males and the expanse of the tegmina varies from 60-64 mm (Distant, 1903). Although it is not documented whether Distant (1903) measured the expanse of the tegmina in a straight line across the apices, below we have measured the expanse of a tegumen from the centre of the thorax to the apex and doubled the result, as described by Evans (1932) for measuring butterflies.

The data for the specimens examined is as follows:

Material examined: 13 specimens; length of body excluding tegmina 22-26 mm; expanse of tegmina 62 - 66 mm. 20.v.2019 Gangmouthan village, Biswanath district, Assam (90 m amsl). *Leg. et Coll*. Parixit Kafley; 1 male; 26.vi.2007; Ranibagh, district Nainital, Uttarakhand, India, 400 m elevation. *Leg. et Coll*. Peter Smetacek, Butterfly Research Centre, Bhimtal, Uttarakhand (Variety 4).

The present records add three undescribed forms to the known range of variation in this species and also add a major westward extension to the known distribution. In Uttarakhand, the cicada is found in forests of *Shorea robusta*, which is the larval host plant of the distasteful moth, *Lymantria semicincta* Walker, 1855 (Lepidoptera: Erebidae: Lymantrinae). The moth swarms in some years and is not rare at suitable seasons.

The similarity between the cicada and females of the moth is too remarkable to be a mere coincidence, with the range of variation in the creamy spots reflected in series of the moth. The palatability of the cicada is not known, but at least one member of the subfamily, *Sulphogaeana sulphurea* (Westwood, 1839) appears to be distasteful in the adult stage, for it is avoided by birds although it swarms during April and May in suitable localities in the western Himalaya. Dead and dying cicadas are common on the ground and are ignored by all insectivorous birds.

Acknowledgement

PS is grateful to the Rufford Small Grant Foundation, which funded work during 2007 when the above mentioned specimen was collected.

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Fig. 1 & 2: Typical form underside and upperside

Fig. 3 & 4: Variety 1 underside and upperside (*vide* Distant)


Fig. 5 & 6: Variety 3 underside and upperside (*new variety*)


Fig. 7 & 8: Variety 4 underside and upperside (*new variety*: Ranibagh, Uttarakhand 26.vi.2007)


Fig. 9 & 10: Variety 5 underside and upperside (*new variety*)


Fig. 11 & 12: *Lymantria semicincta* female underside and upperside: Jones Estate, Bhimtal, Uttarakhand, 1500 m. 27.vii.1988)

Fig. 13 & 14: *Balinta octonotata*

NEW DISTRIBUTION RECORDS OF ONE-SPOT GRASS YELLOW *EUREMA ANDERSONI JORDANI* CORBET & PENDLEBURY, 1932 (LEPIDOPTERA: PIERIDAE) IN NEPAL

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Reviewer: Peter Smetacek

Abstract

New distribution records of *Eurema andersoni jordani* Corbet & Pendlebury (Lepidoptera: Pieridae) from three locations in Nepal are presented.

Introduction

New distribution records of previously unknown species in the country or known species but with a limited known range of distribution is frequent in Nepal, where many nooks and crannies still remain unexplored. P. van der Poel (2020) reported *Eurema andersoni jordani* Corbet & Pendlebury, 1932 from Lakeside, Pokhara at 850 masl. He sighted 2 individuals at the same location in June and July and reported them to occur occasionally. This species was previously listed by Thapa (1998) without any distribution data. Consequently, Smith (2010) did not include this species and placed it under "redundant names". Later, photographs were taken in west Nepal, but they were not clear enough to be conclusive. It occurs from Uttarakhand to N.E. India (Varshney & Smetacek, 2015).

Like its common name suggests, *E. andersoni* Moore, 1886 bears only one cellspot on UnFW, however it might easily be confused with *E. hecabe* (Linnaeus, 1758), which typically has 2 UnFW cellspots but can also have single to no spot at all. That being said, *E. andersoni* differs in having a deeper yellow groundcolour, rounded HW margin which is more angled in *E. hecabe*. Along with one zigzag spot in UnFW cell, Evans (1932) also added that *E. andersoni* lacks scattered black scales or rusty spots on the underside *Eurema* typically bear. In addition, UnFW apex is marked brown at all instances (Evans, 1932) and UnHW postdiscal space 7 has a squiggle with its tail pointing to the spot in the cellend. Another similar *Eurema*, *E. blanda* (Boisduval, 1836) has 3 FW cellspots and sometimes 4.

Observations

Three individuals of *E. andersoni*, were recorded from 3 different locations that are quite distant from the original location (OL) from which it was reported, *i.e.* Lakeside, Kaski (van der Poel, 2020). One of the sightings was from Shaktikhor, Chitwan, Bagmati Province, 81.5 km South-East of OL (27°43'56.6"N 84°37'32.4"E at 525 masl) on October 8, 2020, the other was sighted at Balithum, Gulmi, Gandaki Province (28° 4' 5.592"N 83° 19'31.4256"E at 1350 masl), 65 km South-West of OL on November 29, 2020, by a paddy field and the most recent sighting was from Baglung Bazaar, Baglung, Gandaki Province (28°15'28.6"N 83°36'22.9"E at 950 masl), 37km West of OL on February 7, 2021, by Kaligandaki river. Note that the distances

given here are air distance taken from Google Maps, and not road distance. While Chitwan is essentially a terai district, the location in question lies in the transition zone between hills and terai, while Gulmi and Baglung are hilly districts in central Nepal. Both individuals from Chitwan and Gulmi were mud puddling alone and uninterruptedly, while the individual from Baglung was found perched on a leaf.

Conclusion

This finding suggests that *E. andersoni* is found both in the hilly and terai regions of Nepal and probably has a more extensive distribution throughout the country, albeit elusive.

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Fig. 1: *E. andersoni* individual sighted at Shaktikhor, Chitwan

Fig. 2: *E. andersoni* individual sighted at Balithum, Gulmi

Fig. 3: *E. andersoni* individual sighted at Baglung Bazaar, Baglung

OCCURRENCE OF KNOB-BILLED DUCK *SARKIDIORNIS MELANOTOS* (PENNANT, 1769) (ANATIDAE) FROM SOUTHERN KERALA

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Reviewer: Muhammad Akram Awan

Abstract

Sarkidiornis melanotos (Pennant) is a regular visitor in small numbers in Kerala. The earlier records of this species are from the Kole Wetlands of Kerala's North and central districts, i.e. Thrissur and Malappuram. Here we report the first record of *S. melanotos* from three locations of Southern Kerala: Polachira wetlands (Kollam district), Akkulam and Punchakari wetlands (both in Thiruvanthapuram district).

Keywords: *Sarkidiornis melanotos,* Anatidae, first record, South Kerala, a regular visitor.

Introduction

The Knob-billed Duck, *Sarkidiornis melanotos* (Pennant, 1769), is a resident, shifting locally with water conditions. The bird is rare in southern and eastern Sind and not found elsewhere in W. Pakistan. It is widespread practically throughout India, Bangladesh, Nepal's lowlands, and East Pakistan (Ali and Ripley, 1987; Grimett et al., 2011).

In Kerala, all the reported sightings are from the Kole Wetlands (Thrissur and Malappuram districts). Most of the sightings were made in Marancherry, Malappuram: four birds were spotted on 17th January 1993, three on 21st February 1993, two on December 1993, sixteen on 15th January 1995, four on 8th February 1995 and one on 1st January 1996 (Neelakantan et al., 1993; Ravindran, 1998). Two ducks were also spotted at Kunnamkulam in December 1993 (Ravindran and Susanth Kumar). One male was seen at Pazhanji on 25th January 2003. One male was spotted at Uppungal on the 8th January 2004 and four birds on 22nd February 2004 (Sasikumar et al., 2011). There are no published reports of Knob-billed Duck elsewhere in the state, particularly from the Southern districts of Kerala.

Material and Methods

The present reports of the species from Southern districts of Kerala are based on observations made during Annual Waterfowl Census, conducted by Warblers and Waders and Bird Watchers and Nature Lovers Forum, Thiruvananthapuram, Kerala during January 2017 at Polachira wetlands Kollam district, Kerala. An additional survey was conducted in the Punchakari wetlands adjoining the Vellayani Lake, Thiruvananthapuram, Kerala, on 22nd November 2020. The details of the new sighting of the species from various locations of South Kerala are given in Table 1 and Fig. 1.

Observations

On 22nd January 2017, during the Annual Waterfowl Census, a solitary male of *S. melanotos* was found along with a mixed flock of *Anas acuta, Anas crecca, Anas zonorhyncha, Anas querquedula,*

Maramaronetta angustirostris and *Dendrocygna javanica* in a waterlogged marshy place (Fig. 2). The bird was spotted after 12 years in Kerala; all earlier records were from Central Kerala (Sasikumar et al., 2011).

On 26th January 2017, during the Annual Waterfowl Census, two individuals of *S. melanotos* were sighted at Akkulam Lake (8°31′11.4″N; 76°33′57.9″E) in Thiruvananthapuram, the southernmost district of Kerala. The lake is part of the Akkulam-Veli Lake system, one of the southernmost lakes on the southwest coast of the Indian peninsula. Finally, three Knob-billed ducks were sighted and photographed (Fig. 2) from Akkulam Lake on 27th January 2017 (Smt. Resmi Varma, personal communication).

On 22nd November 2020, while conducting an avian study at the Punchakari wetlands adjoining the Vellayani Lake (8′26′44′N; 76°59′33′E), Thiruvananthapuram, Kerala, a flock of 11 individuals of *S. melanotos* were seen (Fig. 3). They were flying very low over the waterlogged areas of the wetlands, crossing over the marshy places. The flock circled over the wetlands for more than five minutes and landed in a west - south direction, out of the range of visibility. This is the highest count of *S. melanotos* recorded from southern Kerala.

Conclusion

The occurrence of Knob-billed Duck, *S. melanotos* from the wetlands of southern Kerala is noteworthy, given its habit of preferring central Kerala in earlier records (Sasikumar et al., 2011). The observation reported here is the first confirmed sighting and occurrence of Knob-billed Duck from Southern Kerala. The recent sightings point towards an increased preference of the species for wetlands in Southern Kerala. Anyhow coordinated and synchronised surveys across Kerala need to be conducted to ascertain the trend.

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Fig. 1: Map showing new sightings of *S. melanotos* from South Kerala.

Fig. 2: *S. melanotos*, male, sighted at Polachira wetlands, Kollam district, South Kerala.

Fig. 3: *S. melanotis*, male, sighted flying at Akkulam Lake, Thiruvananthapuram, from South Kerala.

Fig. 4. Flock of *S. melanotis*, sighted at Punchakari wetlands, Thiruvananthapuram, Kerala.

SHELTER BUILDING BEHAVIOUR OF *HASORA CHROMUS* (CRAMER, 1780) LARVAE (INSECTA: LEPIDOPTERA: HESPERIIDAE)

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Reviewer: Peter Smetacek

Abstract
Larvae of many lepidopterans, including those belonging to the family Hesperiidae, construct leaf shelters. It has been indicated that these shelters confer protection to larvae from predators and harsh environmental conditions. The repertoire of shelter architectures constructed by given genera or species of Hesperiidae is fairly predictable. Thus, shelter building behaviour can also be important from the perspective of evolution. The present study provides an insight into shelter building behaviour of larvae of Common Banded Awl, *Hasora chromus* (Cramer), including various designs of shelter that larvae can make, and the role of shelters protection from predators. *H. chromus* larvae were found to construct at least four broad architectural types of shelters by folding and tying leaves. The shelters function as a barrier for arthropod predators (including wasps and spiders), and also effective in protecting larvae from avian predators too.
Keywords: Common Banded Awl, *Hasora chromus*, Hesperiidae, Larva, Ecobiology, Shelter-building, Predation, Protection.

Introduction

Larvae of lepidopterans have devised several ways to protect themselves from predators as well as environmental conditions such as solar heat, dislodgement due to shaking or wind blow (Greeney et al., 2015). Their protective strategies include chemical, physiological, morphological, and behavioural defences association with other organisms and avoiding encounters with predators by constructing shelters (Greeney et al., 2015). The latter strategy, *i.e.* shelter making, is widely utilized by larvae of Hesperiidae (Greeney et al., 2003). The larvae of this butterfly family construct shelters with a diverse array of architecture through precisely executed actions, including cutting, rolling, folding and tying a portion or whole of a leaf or several leaves together (Greeney et al., 2003, 2015; Greeney 2009). Within Hesperiidae, the range of shelter architecture made by larvae of a species is largely predictable, and this may be important from the point of view of phylogeny of this group of butterflies (Greeney et al., 2003, 2010; Greeney 2009). However, studies on shelter building behaviour, architectural details of shelter and its protective values (protection from predators and harsh environment) for larvae have not received much attention, particularly for Indian hesperids. In the present communication, these aforementioned aspects have been reported for Common Banded Awl (*Hasora chromus* Cramer, 1780), a common hesperid butterfly found in most parts of India. *Hasora chromus* lays eggs singly or in groups of 2-3 eggs on nascent leaves of its host plant. There are five larval instars, live in self-constructed leaf shelters (Jenkinson, 2010; Devika Rani et al., 2020). In this observational study, the shelter building behaviour of *H. chromus* was

monitored in the natural conditions on the larval host plant *Millettia pinnata* (L.)- a tree planted along roads in many Indian cities.

Material and Methods

Eight *Millettia pinnata* trees growing along the roadsides and parks (in North-West Delhi, India) and infested with the larvae of Common Banded Awl (*Hasora chromus*) were monitored in the year 2020 from the second week of August to the first week of September. For observations related to predation and shelter building activities, the crown of two of these trees was accessed from the third and fourth floor (height of approximately 10-14 meters) of a residential building and observed for 12 days, i.e. the fourth week of August to the first week of September. During this period, the infested trees had the highest population of IVth and Vth instar larvae. Therefore, in the present study, observations on predation and shelter building activities pertain mainly to these two larval stages. Trees were observed between 9:00 a.m. to 5:00 p.m., cumulatively for 3.5-4 hours per day. Visible portions of the tree crown within 4 to 6 meters from the observer (covering about half of the crown area of trees) were chosen for making observations. The events were photographed and filmed using a Digital SLR camera (Nikon) fitted with an 80-400 mm zoom telephoto lens. The larval instars (Fig. 1) were identified based on their morphological features visible while they were engaged in feeding or constructing shelters (Devika Rani et al., 2020; Jenkinson, 2010).

Results and Discussion

Infestation of trees

M. pinnata is a middle-sized tree and a preferred larval host plant of *H. chromus* (Suryanarayana et al., 2015; Karmakar et al., 2018; Nitin, 2018; Devika Rani, 2020). In the study area, all the trees under observation had renewed their leaves and borne flowers in March-April. These trees had a second flush of new leaves and flowers during the rainy season, i.e. last week of July-September (in the same year). During this period (i.e. rainy season), the oviposition activity of *H. chromus* gradually increased with its peak during the second to fourth week of August (as determined by the numbers of egg-laying females). Eggs were laid on nascent buds of leaves (Fig. 1). The ovipositioning activity was higher in the morning and evening hours. During cloudy days, high ovipositioning was observed throughout the day. The maximum number of larvae (IVth and Vth instars) feed on leaves were observed during the fourth week of August to the first week of September.

Shelter architecture and feeding activity of larvae

During the fourth week of August to the first week of September, about 120 larval shelters were securitized. About 80 per cent of these were constructed /occupied by Vth Instar and most of the rest by IVth instar larvae. A few shelters, however, were occupied by IInd/IIIrd instars as well. Based on architecture, shelters could be classified as *a)* constructed from one leaflet and *b)* constructed by tying two leaflets together.

Three architectural subtypes were observed in shelters constructed from one leaflet:

i) Those in which the opposite margins of leaflets were brought together and tied with the help of silk (Figs. 2A, 2 B), *ii)* those in which a furrow was made by tying two sides of the blade in the middle of the leaflet (Fig. 2C), and *iii)* shelters in which a portion of the leaflet was cut from margin towards midrib and the resulting leaf flap was folded and glued (Fig. 2D). The 'ii' subtype was seen only on three occasions and was constructed by younger larval instars (II/ III instars). The subtypes 'i' and 'iii' observed in the present study may correspond respectively to the 'Type 2' and 'Type 6' shelters according to the classification of larval shelters given by Greeney et al. (2003). Accordingly, subtype 'ii' observed here may correspond to 'Type 2' shelter (Greeney et al., 2003).

In the shelters formed by two leaflets, the surfaces of two neighbouring or touching leaflets were brought together, and their margins were tied to each other (Figs. 2E-H). This architecture of shelter may correspond to 'Type 4' shelter of Greeney et al. (2003).

Larvae were found to spend most of the time inside the pockets of the shelters. They fed in bouts by chewing the margins of shelter leaflets or nearby leaflets by extending a part of their body out of the shelter (Figs. 2B, 2F-H, 3A-C). Only new leaves, i.e. those that emerged during the rainy season, were utilized for feeding or making shelters. Tough and mature leaves borne during March-April, however, remained unexploited. This might reflect the preference of larvae for tender leaves and the inability to fold or cut leaflets with hard leaf blades (Greeney *et al*., 2010).

The larvae abandoned their shelters once the shelter was consumed to the level that it could no more accommodate the body of larvae (Figs. 2E, 3D). To search for a suitable leaflet for the construction of a new shelter, larvae crawled on leaf petiole, rachis and twigs. The searching process sometimes took more than 5 minutes, exposing larvae to potential predators (Figure 3E-F). Since larvae can consume a shelter in less than a day's time, they require constructing several shelters during the larval stage (Jenkinson, 2010).

Shelter construction

About 20 shelter construction events were witnessed during the period of observation. The shelters were constructed with leaves that had emerged in the rainy season. Old and tough leaves offspring were not utilized. In a typical one leaf shelter, the process followed is 1) after settling to the new leaflet, the larvae swing a quarter to one-third portion of their anterior body in left and right repeatedly, 2) while swinging, the larvae touched their head on the one side of the leaf surface and then to the other side, 3) while the left and right movement of the body was under progress, there appeared a thin silken thread linking those two points of leaves which were repeatedly touched by head of the larvae, 4) larvae continued to swing their anterior part of the body to the left and right along the silk thread, which gradually thickened and shortened, 5) shortening of the thread was concurrent with the folding of the leaflet and brought the two sides of leaflet blade in close contact (or brought the surface of two leaflets in close contact if the shelter was being constructed from two neighbouring leaflets). The silken thread thus seemed to function as pulling rope and fastener. The process of fastening the leaf was performed at 3-4 points along the length of the leaflet to make a stable cavity. The cavity formed by the folding of the leaflet (or tying two leaflets) was also worked on from inside (as indicated by the rapid head movement of larvae while inside the cavity), possibly for proper sealing and to provide strength to the cavity. Figure 4 provides a sequential snapshot of various steps during the construction of a typical one leaf shelter by a V^{th} instar larva. The entire process of construction of a shelter may take over 30 minutes.

Larvae of lepidopterans are known to produce silk from their labial glands (Sehnal et al. 2008). Leaf shelter-building larvae generate the force required to pull or roll leaves by fixing several strands of overstretched silk to opposite points on a leaf (Fitzgerald et al., 1991, 1994, Greeney et al., 2010). The elastic properties (or contraction) of silk provide force to pull the two points and bring them together to make a leaf fold (Fitzgerald et al., 1991, 1994). Folding of the leaf by larvae might be constrained by certain properties of leaves such as structure, hardness and texture (Greeney et al., 2010), for instance, the force generated by silk may not be adequate to fold tough older leaves. Thus, in addition to chemical and nutritional characteristics, other leaf properties such as its toughness and structure may also affect preference for one

host plant over another by shelter making lepidopterans (Greeney et al., 2010).

Value of shelter as protection from predators

The potential functions of shelter are- protection of larvae from predators, dislodgement due to shaking of leaves by a sudden gush of wind, heavy rain, and cover from direct sunlight (Greeney et al., 2015; Loeffler 1996; Baer et al., 2020; Abarca et al., 2011, 2014). In the present study, observations related to the predation of IVth and Vth instar larvae by various predators were made. A list of predators frequently observed attacking or feeding on the larvae of *H. chromus* is provided in Table 1 and Fig. 5. A properly sealed leaf-shelter of *H. chromus* camouflages well with the background and functions as a protective shield around the larvae. Larvae were found to extend a part of their body outside the shelter to feed. Any sudden shake to the twig bearing shelter or sharp sound (such as clicking of the camera at about 1meter distance from the shelter) caused feeding larva to retract completely inside the shelter. However, on several occasions, feeding larvae did not retract even when a wasp or other insects landed or hovered within 2-3 inches from the shelter. Birds were found to be the most successful of all the predators in searching and extracting larvae from shelters (Fig. 5). Of all the birds given in Table 1, Jungle Babblers were found to be the most efficient in predation. About ten raiding events, each lasting for nearly 15 minutes by a flock of 4-5 Jungle Babblers, were witnessed. The flock could extract and consume about 10-15 larvae during each raiding event. Birds were found to feed on larvae as well as on pupae. The decline of raiding events by birds was found to be coincident with the decrease in the number of shelters (with larvae) in the first week of September.

Wasps, though not observed to extract larvae from the shelter, did make attempts to penetrate the shelter (Fig. 5K). Larvae looking for new leaflet for making a shelter or those in the process of making shelter were frequently found to be killed and consumed by wasps (Fig. 5J). Spiders were not found to kill or feed on larvae. However, on several occasions, spiders were found to follow movements of feeding or those larvae wandering in search of new leaflet for making shelter (Figs. 5H, I).

Whether shelters confer any protection to *H. chromus* larvae from predators?

1. There is an indication from the present study that shelter can act as a barrier to prevent arthropod predators from reaching larvae hiding inside the cavity of shelters. However, the protection conferred by the shelter may not be absolute. Similar observations have also been made by other workers (Abarca et al., 2014; Loeffler, 1996; Jones et al., 2002).

2. Though birds were found to the most successful predators, camouflaging of shelter with background could deceive birds, as in many cases, birds were unable to find shelters located within their close view. Also, on a few occasions, birds attacked empty shelters indicating that birds use leaf folds as visual cues to locate shelters (Murakami 1999).

Therefore, it may be concluded from the present study that- under natural conditions, shelter building behaviour can increase the chances of survival of IVth and Vth instar larvae of *H. chromus* larvae.

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Table 1. Predators observed attacking or searching into *Hasora chromus* shelters.

Birds	Arthropods
House Crow (*Corvus splendens*) Red-vented Bulbul (*Pycnonotus cafer*) Jungle Babbler (*Turdoides striata*) Common Myna (*Acridotheres tristis*) Oriental White-eye (*Zosterops palpebrosus*) Rufous Treepie (*Dendrocitta vagabunda*) Brown-headed Barbet (*Megalaima zeylanica*)	Yellow Paper Wasp (Genus: *Polistes*) Spiders (Order: Araneae)

Fig. 1: Larval stages

Fig. 2: Shelter architectures

Fig. 3: Feeding

Fig. 4: Shelter making

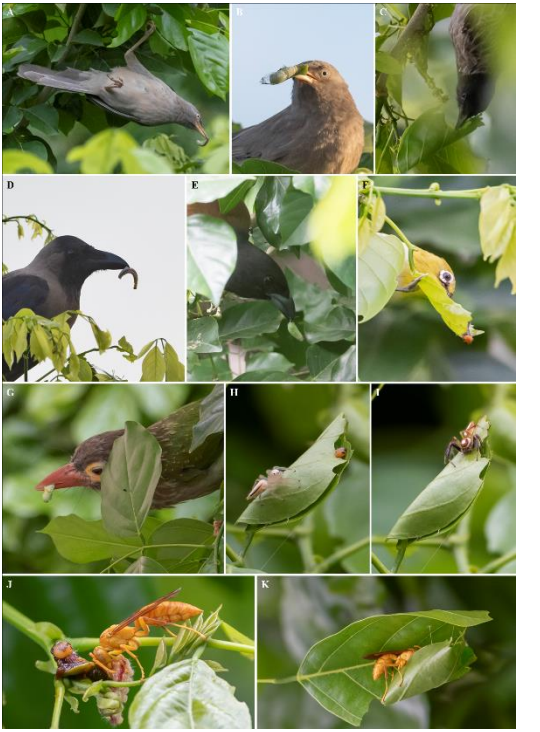

Fig. 5: Predators

COSTUS SPECIOSUS (ZINGIBERACEAE) AS NEW LARVAL HOST PLANT FOR THE GRASS DEMON BUTTERFLY, *UDASPES FOLUS* (CRAMER, [1775]) (INSECTA: LEPIDOPTERA)

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Abstract

Costus speciosus is reported as a new larval host plant for Grass Demon Butterfly, *Udaspes folus* (Cramer) (Insecta: Lepidoptera: Hesperiidae), based on the repeated sightings of caterpillars on the plant leaves and its rearing till eclosion of the adult butterfly.

Keywords: Butterfly, observations, host records, Maharashtra.

Introduction

The Grass Demon Butterfly, *Udaspes folus* (Cramer, [1775]) (Insecta: Lepidoptera: Hesperiidae) is commonly abundant in the forests of Sanjay Gandhi National Park and Bombay Natural History Society (BNHS) Nature Reserve, Mumbai, Maharashtra, India, during the monsoon. The reported larval host plants for *U. folus* are summarized by Robinson *et al.* (2001) and later by Nitin *et al.* (2018) as *Fagraea racemosa* (Loganiaceae), *Oryza* (Poaceae), Zingiberaceae, *Curcuma aromatica*, *Curcuma decipiens*, *Curcuma longa*, *Hedychium*, *Zingiber*, *Zingiber officinale*, *Zingiber zerumbet* (Zingiberaceae) and Liliaceae. In this paper, based on repeated sightings of caterpillars of *U. folus* on *Costus speciosus* leaves and its larval rearing, *C. speciosus* is reported as a new larval host plant for the butterfly.

Material and Methods

The Bombay Natural History Society (BNHS) Nature Reserve is a forested area spread over 33 acres and is nestled between Dadasaheb Phalke Chitra Nagari (aka Film City), and Sanjay Gandhi National Park in Mumbai City of Maharashtra, India. The reserve also has a small butterfly garden spread over around a quarter of an acre. *Costus speciosus* is a common plant found in the area. Observations were made on the feeding of *U. folus* caterpillars on the leaves of *C. speciosus* in the nature reserve.

Observations

On 20 September 2020, we found two caterpillars of *U. folus* on the leaves of *C. speciosus* (syn. *Cheilocostus speciosus*) (family Zingiberaceae) (Fig. 1). These larvae were resting inside cells, which they had made by folding the leaf margin with fine silk threads (Figs. 2, 3). We collected the caterpillars along with the leaves for rearing. Every day we added one fresh leaf of the *C. speciosus* to the container and cleaned the frass. However, both the caterpillars died on 24 September 2020.

On 19 October 2020, we again found three caterpillars of *U. folus* on the leaves of *C. speciosus* plants. We collected them and reared them on a diet of fresh leaves of *C. speciosus*. One caterpillar started pupating on the underside of the container lid on 31 October 2020 (Figs. 7, 8). The pupa was seen

on 1 November 2020. An adult Grass Demon eclosed on 29 January 2021 morning, i.e., after 89 days (three months) (Fig. 9). The remaining two started pupating on 2 November 2020. On 3 November 2020, one caterpillar was found dead in the container, and the other pupated on the underside of a leaf. From this pupa, an adult Grass Demon eclosed on the morning of 4 February 2021, i.e., after 92 days (three months).

We found one more caterpillar in the final instar on the *C. speciosus* on 1 November 2020. Unfortunately, it was found to be infested with some parasitoids that were visible inside the caterpillar body (see image). The caterpillar died on 3 November 2020.

Conclusion

The repeated sightings of caterpillars of *U. folus* on the *C. speciosus* plants and its rearing till eclosion of adult butterflies clearly indicates the regular use of the plant as a larval host. Looking at the list of larval host plants reported previously, this is clearly a new record of the larval host plant for the *U. folus*.

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Fig. 1. Grass Demon Caterpillar.

Fig. 2. Grass Demon Caterpillar Making Cell.

Fig. 3. Grass Demon Caterpillar, Resting in a Cell.

Fig. 4. An infested Grass Demon Caterpillar.

Fig. 5. Spiral costus plant showing two cells of Grass Demon on the upper side of the leaf.

Fig. 6. Grass Demon Pupating Caterpillar.

Fig. 7**.** Grass Demon Pupa on Spiral Costus Leaf.

Fig. 8**.** Grass Demon Pupa on the underside of the Container Lid.

Fig. 9**.** Freshly eclosed adult of Grass Demon.

FIRST RECORD OF *DIARRHEGMA MODESTUM* (FABRICIUS, 1805) (DIPTERA: TEPHRITIDAE) FROM ODISHA, INDIA

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Abstract
The paper reports *Diarrhegma modestum* (Fabricius) as a new state record for Odisha, India, based on photographic records.
Keywords: New record, fruitfly, *Moringa oleifera*.

Introduction

Fruit flies (Diptera: Tephritidae) represent one of the largest families of Diptera, with about 4,500 species in 500 genera under six subfamilies (Blepharoneurinae, Dacinae, Phytalmiinae, Tachiniscinae, Tephritinae and Trypetinae) known worldwide. The Indian fauna is represented by 243 species in 79 genera under four subfamilies, Dacinae, Phytalmiinae, Tephritinae and Trypetinae (David and Ramani, 2011). The genus *Diarrhegma* Bezzi, 1913, belongs to the tribe Acanthonevrini under the subfamily Phytalmiinae. The species under the tribe Acanthonevrini are mostly known to utilize decaying matter as larval hosts (Hancock and Drew, 1994).

Diarrhegma modestum (Fabricius, 1805) has been recorded to breed in decaying wood (Bezzi, 1913) and is widespread throughout the Oriental Region: India, Philippines, South East Asia and Indonesia (Hardy, 1986). Hancock and Drew (1994) reported this species, breeding on the pods of drumstick, but it was not known if the drumstick pods were fresh or decaying. The earlier records of this species are from West Bengal, Karnataka and Tamil Nadu in India (David and Ramani, 2011). Recently Masroor et al. (2019) have reported this species in mango and guava plantations from Bihar. Hossain and Khan (2013) also reported it from a field with cucurbits, viz. *Cucurbita maxima*, *Trichosanthus cucumerina* and *Luffa acutungula*, along with a considerable amount of drumstick (*Moringa oleifera*) in Bangladesh.

Material and Methods

The records of *D. modestum* were from a backyard garden in Cuttack District, Odisha (Location: 20°26'52.0"N 85°31'03.9"E) from December 2020 to January 2021. The photographs of previously damaged drumstick trunk, adult, maggots, puparium and ovipositing female are provided in Figs. 1a-e.

Observations

Diarrhegma modestum adults were found visiting a drumstick plant (*Moringa oleifera*). Although the plant was live, there was some damage to the decomposing trunk. On close observation, the adults of the fruit fly species were found ovipositing on the decomposing trunk. Maggots and pupae were also observed on the same decomposing region of the drumstick plant. Some puparium were collected, and adult flies were found to emerge at about three weeks from the date of collection. A video was also recorded on the ovipositing behaviour, which can be accessed by the link-

https://www.youtube.com/watch?v=V167SyRoyy8.

Conclusion

This observation is the first record of this fruit fly species from Odisha. This study will provide preliminary information for further studies on its biology, host range and larval habitat, which is not well known.

Acknowledgement

The author is thankful to Dr David KJ, Scientist (Entomology) at ICAR- National Bureau of Agricultural Insect Resources (NBAIR), for his help in the identification of the fruit fly species.

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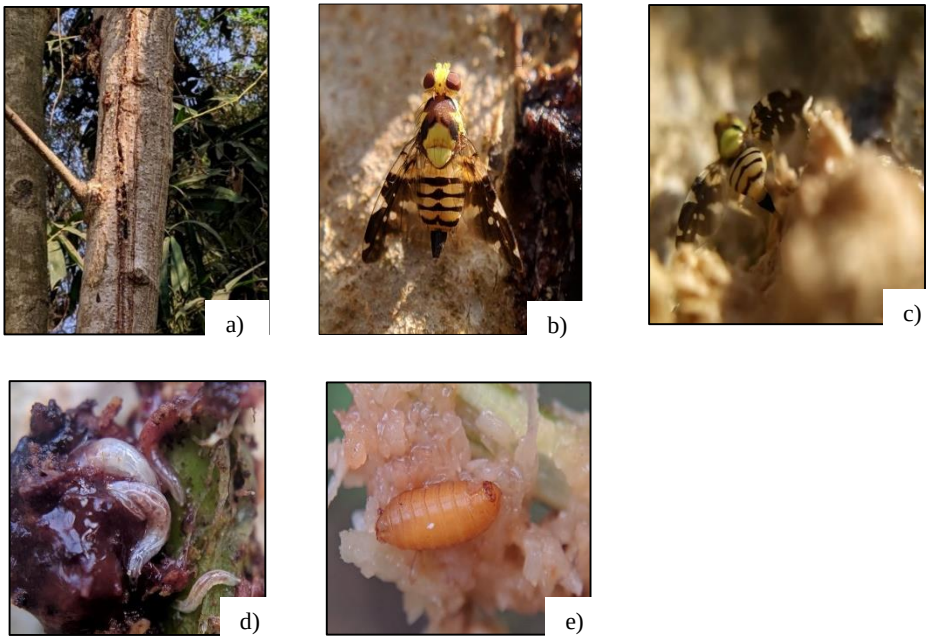

Fig. 1**.** *Diarrhegma modestum*: a) Previously damaged drumstick trunk b) Adult fruit fly c) Oviposting female d) Maggots e) Puparium.

RECENT SIGHTING OF *APPIAS GALBA* (WALLACE, 1867) (INSECTA: LEPIDOPTERA: PIERIDAE) FROM DHANSIRI RESERVE FOREST, KARBI ANGLONG, ASSAM, INDIA

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Reviewer: Peter Smetacek

Abstract: The present paper reports the first confirmed record *Appias galba* (Wallace) from the Karbi Anglong district of Assam.

Keywords: Indian Orange Albatross butterfly, new distribution record, Northeast India.

Introduction

The Indian Orange Albatross butterfly, *Appias galba* (Wallace, 1867), has its distribution range along Eastern Himalayas, Sikkim and Northeast India (Varshney & Smetacek, 2015; Sondhi & Kunte, 2018). In India's northeastern part, *A. galba* is known from Arunachal Pradesh, Assam, Nagaland and Manipur. The genus *Appias* Huebner (1819) represents 9 species from India (Varshney & Smetacek, 2015; Irungbam *et al*., 2020). Out of these 9 species, five species/subspecies are reported from Assam: *Appias lyncida eleonora* (Boisduval, 1836), *Appias albina darada* (C. & R. Felder, [1865]), *Appias galba* (Wallace, 1867), *Appias lalage lalage* (Doubleday, 1842), and *Appias indra indra* (Moore, 1857) (Norman, 1956; Gogoi, 2013; Mudoi et al., 2015; Singh, 2017). In Assam, *A. galba* was recorded from upper Assam by Norman in 1953. Gogoi *et al*. (2016) reported this species from Jeypore Reserve Forest in southern Assam.

Observations

Appias galba was sighted in Dhansiri Reserve Forest (26^{0}24′52.180″ N; 93^{0}39′51.219″ E) of Karbi Anglong district in Assam India during May 2016 (Figs. 1a, b). From 2016 to 2019 in the Karbi Anglong district, the species was recorded only once from Dhansiri Reserve Forest during the entire study period. Two individuals were recorded along the open forest area of the reserve forest from 10.00hrs to 11.00hrs, the temperature being 27^{0}C-29^{0}C.

Result and Discussion

Appias galba is bright orange with blackish veins. The butterfly is stated to be rare by Evans (1932). The species has also been reported to be rare by Sondhi & Kunte (2018) and Gogoi *et al*. (2016). In India, the species is legally protected under Schedule IV of the Wildlife Protection Act, 1972. Not much is known about the ecology of the species. The present finding confirms the presence of *A. galba* in Karbi Anglong district of Assam. It is the first record of *A. galba* from Karbi Anglong district of Assam and is an addition to the known distribution of the species.

Acknowledgement

We are grateful to the local guide for their assistance during the fieldwork. We sincerely thank the Forest Department, Assam, for their co-operation during the entire field study. Special thanks to Mr Monsoon Jyoti Gogoi for helping in the identification of the butterfly.

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Fig. 1 & 2**:** Adults of *Appias galba*, sighted at Dhansiri Reserve Forest of Karbi Anglong district in Assam

REPORT ON THE OCCURRENCE OF THE CICADAS *POMPONIA CINCTIMANUS* WALKER, 1850 AND *DUNDUBIA ANNANDALEI* BOULARD, 2007 FROM MIZORAM, INDIA

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Reviewer: Sudhanya Ray Hajong

The diversity and distribution of cicadas within the state of Mizoram has been poorly studied and this report adds new distribution records to the cicada fauna of the state as well as two species - *Dundubia hastata* Moulton, 1923 and *Tosena splendida* Distant, 1878., formerly reported by Marathe *et al*. (2021).

The occurrence of *Pomponia cinctimanus* Walker, 1850 and *Dundubia annandalei* Boulard, 2007 is reported for the first time from the state of Mizoram, India. *P. cinctimanus* are characterized by their greenish head, pronotum and mesonotum along with pale green coloration on the ventral head, sternum and operculum. Abdomen dark ochraceous and the tegmina and wings are pale hyaline in colour (Distant, 1892). Their distribution included Bangladesh (Marathe et al. 2021) along with Assam, India and Vietnam (Price *et al*. 2016). The occurrence of *D. annandalei* in India was recently established by Sarkar *et al* (2020). The species can be identified based on their entirely green body with pale reddish ocelli. The base of the legs are always yellow and the wings are completely transparent. The species has been reported from the states of Meghalaya, Assam and West Bengal (Sarkar *et al.* 2020).

The specimens were collected within the campus of Mizoram University (23°44'19.18"N, 92°39'44.62"E; 774 m asl. elevation) using light trap technique proposed by Sheikh *et al*. (2016) between April, 2020 and May, 2020 and were stored under dry preservation in the Departmental Museum of Zoology, Mizoram University. The specimen photographs were taken using Canon M6 mark ii digital camera with Tokina 100 mm (1:1) macro lens.

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Fig. 1: Dorsal and ventral views of *Pomponia cinctimanus* (A, B) and *Dundubia annandalei* (C, D) from Mizoram, India.

ROLE OF PUPAL RESPIRATORY HORN BEHIND EYE COLOUR DEVELOPMENT IN THE PHARATE ADULT OF *CHRYSOMYA MEGACEPHALA* (FABRICIUS) (INSECTA: DIPTERA)

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Abstract

Respiratory horns differ between fly species, implying that the trait is imperative for effective respiration. It establishes communication between atmospheric air and the pupal tracheal system. Also, it provides a potential function for the development of eye colour at the time of pupation. We observed the formation of respiratory horns in the intra–puparial development of the Latrine fly *Chrysomya megacephala* (Fabricius), which can lead to pigment screening in the eyes of the pupal stage.

Keywords: Colour development, respiratory horns, Diptera.

Introduction

Respiratory horns (RH) are a pair of prong-like structures found on the dorsal side of the cephalic half in various Diptera pupae. De Meijere (1902) was the first to attempt a systematic explanation of the structure of the RH in different Diptera families. The length of the RH varies between the flies: short ones are found in the large flies like blowflies, *Hypopygiopsis tumrasvini*, *Chrysomya megacephala*, *C. putoria* and *Lucilia cuprina* (Siriwattanarungsee *et al.*, 2005; Sukontason *et al.*, 2006b; Mendonca *et al.*, 2014); long ones in small dipterans like scuttle flies, *Megaselia scalaris* (Loew), *M. spiracularis* Schmitz, *M. rufipes* (Meigen) and *Diplonevra peregrina* (Wiedemann) (Sukontason *et al.*, 2006a; Disney & Aguiar, 2008; Feng & Liu, 2012a, 2012b). Phorid flies (*Pseudacteon* spp.) parasitize and pupates inside the empty head capsule of fire ants (*Solenopsis* sp.), from which two respiratory horns extend diagonally (Porter 1998)—implying that the longhorn trait is essential for effective respiration and that a larger number of thoracic horns and tracheal tubes allow for better oxygen supply (Rossaro *et al.*, 2007). In pupa of *Chrysomya megacephala* (Fabricius), Siriwattanarungsee *et al.* (2005) discovered a group of 38 globules at the end of the first abdominal segment. It was described using SEM photographs that pupal RH had slightly protruded from the centre of those globules in some older pupae. Several papillae were found on the RH, each with a longitudinal opening and a slightly convex base. The fifth segment of the puparium is pierced by paired pupal RH, which establishes communication between atmospheric air and the pupal tracheal system (Karandikar & Ranade, 1965). The function of RH in the puparial development of Latrine Fly, *Chrysomya megacephala* (Fabricius) was demonstrated in this study.

Material and Methods

The results obtained from this study was derived primarily from our previous study on intra–puparial development of Latrine fly *Chrysomya megacephala* (Sinha & Mahato, 2018), where the terminology and concepts to describe the processes of pupariation and pupation, as well as the puparium morphology, were adapted from Sinha & Mahato (2016). The larvae of *C. megacephala* were reared and observed in the captive chamber (temperature 22 ± 2°C, relative humidity 58±2%). The pupae were separated into developmental stages and placed in Carnoy's solution for 48 hours before being preserved in 70% alcohol for 6 hours. They were then treated with 5% formic acid for 48 hours before being preserved in 70% alcohol. The experiment involved dissecting 102 preserved pupae using dissecting instruments under a stereoscopic binocular microscope. The sequence of intra-puparial development of *C. megacephala* was observed, which includes cryptocephalic pupa, phenerocephalic pupa, pharate adult, imago, and head detail, was photographed with a camera (Nikon SLR Coolpix L820).

Observations

The paired respiratory horn (RH) was located at the end of the first abdominal segment of the Pharate adult stage (Fig. 1A). The cephalic capsule was relatively prominent in the Phenerocephalic pupal stage. Then there was the Pharate adult, which was the longest of the three stages that remained 120-122 hours when the successive development of the pupal eye colouration happened. RH was visible near the base of the cephalic structure on the dorso-lateral side (Fig. 1A). Yellow eyes began to turn red after 60 hours of pupal development. From the base of the respiratory horn, red pigmentation on both lateral parts of the cephalic region started to spread (Fig. 1B). Around 68 hours, the pigmentation had covered nearly half of the eye area, and the red-eye had become more prominent, turning carmine-red before finally turning burgundy.

Discussion

During intra-puparial development of *C. megacephala*, RH appeared first at about 56 hours of development and remained visible up to the fully developed Pharate adult stage at about 110 hours (Fig. 1C). With successive development of the cephalic region, the eyes become developed progressively to obtain their normal shape and its colour changes from transparent to yellow, then to carmine-red step by step (Fig. 1B). It was found that, at about 60 hours of pupal development, the red pigmentation on both lateral parts of the cephalic region (i.e. preliminary eye) started to spread from the base of RH. During 68 hours of development, pigmentation covered nearly half of an eye area. At about 74 hours, most of the eye area was pigmented with carmine red colour (Sinha & Mahato, 2018).

It was established that ommochromes are responsible for eye colouration in insects. Some of the ommochromes produced at the time of pupation contribute to the screening pigment in the eyes of adult Diptera. Ommochromes are a group of pigments derived from amino acid tryptophan via Kynurenine and 3-hydroxykynurenine. It was found that 3-hydroxykynurenine is transported to the eyes during metamorphosis in *Drosophila* sp., where theommochromes are found (Chapman, 2013). Ommochromes may be red dihydroxanthommatin and yellow xanthommatin. Xanthommatin is widely distributed in insects and is a screening pigment in the accessory cells of their eyes, usually in association with pterins which are abundantly found in pigment cells in compound eyes of insects and functions as a co-factor in ommochrome biosynthesis. Pterins are products of purine degradation, and their accumulation in the eyes of higher Diptera reflects the age (Shamim *et al.*, 2014). Ommochromes are produced by oxidative condensation of 3-hydroxykynurenine. It can be presumed that atmospheric oxygen enters

through the pupal RH helps in a condensation reaction to produce ommochromes.

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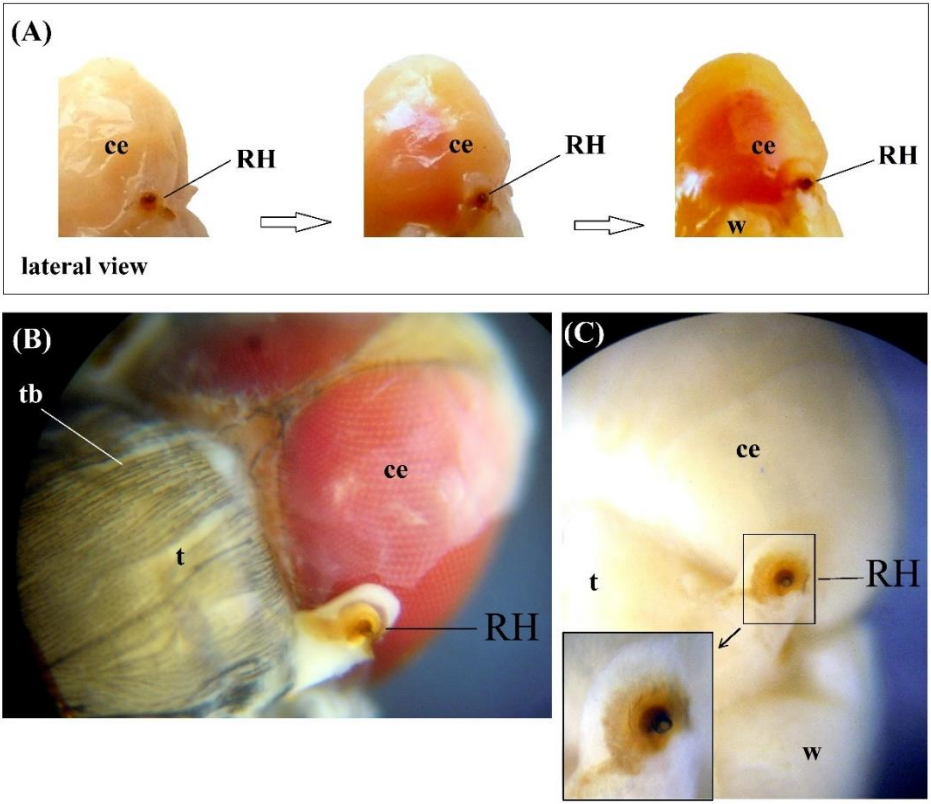

Fig. 1: (A), Spreading of pigmentation with gradual development towards adult; (B), Respiratory horn in fully developed Pharate adult; and (C), Showing knob-shaped respiratory horn (enlarged view inset) in early Pharate adult. Characteristics considered in this figure included the following: RH = respiratory horn, ce = compound eyes, t = thorax, tb = thoracic bristles and w = wing.

FIRST EVIDENCE OF *PAPILIO MACHAON* (LEPIDOPTERA: PAPILIONIDAE) FROM TERAI REGION OF NEPAL

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Reviewer: Piet van der Poel

Introduction

Nepal possesses diverse habitats, flora and fauna owing to its unique geographic position and variation in altitude and climate. 660 species of butterflies were reported by Smith (2010), but now the number has risen to 674 (Van der Poel & Smetacek, *in prep*.). To the North above 3000m, Palearctic butterfly species are found while to the south below 1500m, Oriental species are found. They surely do overlap to some extent but we also find a separate group of typically Himalayan species in the region of overlap (Smith, 2011). *Papilio machaon* Linnaeus, 1758 is basically a Palearctic species found throughout the Palearctic region, parts of North America, and Indo-Malayan region. Two subspecies of *P. machaon* fly in Nepal. In India, subspecies *asiatica* Menetries, 1855 flies from Jammu & Kashmir to Uttarakhand (Varshney & Smetacek, 2015).

While *P. machaon* was only reported in Nepal from elevations as low as 980 a.m.s.l (van der Poel & Smetacek, *in prep*.), lately several individuals were spotted in Terai region at elevations as low as 230m. This paper presents the new distribution record of *P. machaon* from lower elevations of Nepal. Surendra Pariyar, an expert on Nepal butterflies, has seen this butterfly in Terai before but lacks any evidence as proof (personal communication).

Observation

Two individuals of *P. machaon* were observed in a home garden located at an altitude of 230m (27°34′52.6″N, 84°40′45.1″E) in Rapti, Chitwan, sipping nectar from *Tagetes* sp. during the afternoon of 1st November, 2020. Three more individuals were observed on 23rd February, 4th March, and 11th March 2021 at the same location. However, photos of only the first and last observations were taken using a Samsung galaxy J5 smartphone.

Discussion

In the Himalaya and other mountain systems, it is normal for mid and high elevation butterflies to migrate to lower elevation, either in response to inclement weather at higher elevation or during winter. Cabbage Whites (*Pieris* spp.), Clouded Yellows (*Colias* spp.) and even Tortoiseshells (*Aglais* sp.) have been recorded on the Gangetic plain in winter.

Therefore, the record of *P. machaon* from relatively low elevation is not unusual and confirms the presence of this butterfly sporadically at low elevation during winter. Although the larval hostplants of the butterfly include cultivated umbellifers like dill, fennel, etc. there is so far no evidence to indicate that the specimens observed in the present study bred in the locality observed. Rather, it is likely that they descended to low elevation in response to cold weather.

Although several subspecies of *P. machaon* have been described in earlier works, we have

refrained from assigning subspecific status to the specimens we observed in this study in deference to the practice of not assigning subspecies status without specimens in hand.

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Fig.1: *P. machaon* 230m in Rapti, Chitwan, 1st November, 2020

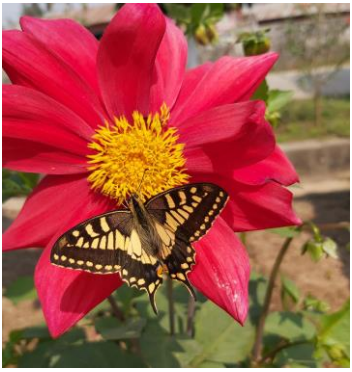

Fig.2: *P. machaon* 230m in Rapti, Chitwan, 11th March, 2021