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Cover Photo by Roshan Upadhaya of *Yamamotozephyrus kwangtungensis*.

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ADDITION OF A BUTTERFLY GENUS AND SPECIES TO THE INDIAN FAUNA

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Reviewer: Zdenek F. Fric

Introduction

The Striped Hairstreak *Yamamotozephyrus kwangtungensis* (Forster, 1942) was described on the basis of a series of specimens collected from Lungtao-shan (682 m) and Linping (700 – 1060 m) in Kwangtung province, Mantsi-shan (1160 m) in Hunan province and Kuatun (1000 – 1350 m) in Fukien province of eastern China. A second population was discovered on the island of Hainan, on Mt. Wuzhi-shan (1867 m) and described as *Ravenna kwangtungensis hainana* Koiwaya, 1993. Originally described in the *Zephyrus* Dalman, 1816 genus, *Z. kwangtungensis* was placed in a newly erected genus, *Yamamotozephyrus* Saigusa, 1993 and is the only member of the genus known so far. A third population was discovered in Kachin state of Myanmar and described as *Y. kwangtungensis mayhkaensis* Watanabe, 2000. The type series comprises a single male from Pannandin village (1000 m) (9.v.1999) and two males north of Putao (8.vi.1994). On the underside, it is easily distinguished from the nomino-typical subspecies and *Y. k. hainana* by the cell end bar on the forewing reaching the costa and the submarginal band of the hindwing, which is relatively narrower, especially in space 7.

Observation

On 10.v.2020, RU photographed a specimen of this species at Vijaynagar (27°19”33’ N; 97°00”61’) (1240m), Changlang district, Arunachal Pradesh. It was perched on a shrub near the ground. Since subspecies are usually assigned on the basis of specimens examined rather than photographs, yet it is possible to state that the specimen photographed is a male, judging by the tiny bit of forewing visible in the photograph (the female has a wider dark margin to the forewing) and the forewing cell-end bar reaches the costa, unlike *Y. k. kwangtungensis* and *Y. k. hainana*. The species appears to be univoltine throughout its distribution. The individual photographed in Vijaynagar confirms the presence of this distinctive species in India. Further work would clarify whether the Indian population is identical with the Myanmar population.

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Fig.1: *Yamamotozephyrus kwangtungensis*

FIRST ENCOUNTER OF INDIGENOUS PREDATORS ON NEW INVASIVE PEST OF GUAVA, WOOLLY WHITEFLY *ALEUROTHRIXUS FLOCCOSUS* (MASKELL) IN TAMIL NADU, INDIA

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Reviewer: Peter Smetacek

Introduction

Woolly whitefly, *Aleurothrixus floccosus* (Maskell) (Hemiptera: Aleyrodidae) was first described from Jamaica in 1896 (Martin & Mound, 2007) and later it was noticed in Florida in 1909. This whitefly is native to the Neotropical region but is now found throughout the warmer parts of the world, wherever citrus is grown (Malumphy *et al*., 2015). Recently, the highly polyphagous woolly whitefly, *Aleurothrixus floccosus* (Maskell) (Hemiptera: Aleyrodidae) was recorded in India on guava (*Psidium guajava* L.) (Sundararaj *et al*., 2019).This whitefly is an invasive species and it is reported to feed on more than 20 plant families and exhibits a strong preference for citrus species. But utill now there are no reports on the natural enemies of this invasive whitefly in India.

Methodology

Distribution and documentation of natural enemies of woolly whitefly (*A. floccosus*) was studied in a guava orchard (11°07'N, 76°59' E) in the Coimbatore district of Tamil Nadu. The woolly whitefly affected leaves were closely observed for the presence of natural enemies. The affected samples were collected from the guava orchard and kept under observation at the biological control laboratory for the emergence of parasitoids and predators. The process was then repeated to observe the further emergence of natural enemies. Insects collected from the different guava plants were transferred to 70% ethyl alcohol and identified in the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore.

Results

Earlier, scientists from different parts of the world were documented a few predators such as *Acletoxenus* sp. Malloch (Diptera: Drosophilidae) and *Scymnus (Pullus)* nr. *utilis* Hoang (Coleoptera: Coccinellidae) was found associated with *A. floccosus* colony under field conditions. Yu *et al*. (2011) recorded the predaceous drosophilid *Acletoxenus indicus* Malloch preying on larvae of *A. dispersus* Russell and *Aleurocanthus* Ashby sp. in South China. In woolly whitefly, nymphal stages were vulnerable and cause much damage to the guava leaves by sucking sap from undersurface. Woolly whitefly was segregating more honeydew in the leaves of guava comparing to the other whiteflies. The observation showed that there is nil parasitoid emergence from collected whitefly nymphs samples and fortunately we have documented three indigenous predators which are feeding on nymphal instars of woolly whitefly. Two of the predators belong to coccinellids, namely *Scymnus* sp. (Coleoptera: Coccinellidae) and *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae). The third one is from the order Neuroptera, *Mallada desjardinsi* (Navas) (Neuroptera: Chrysopidae). We documented different life

stages of these predators on woolly whitefly. The present study reported the first encounter of three indigenous predators on this new invasive woolly whitefly, *A. floccosus*.

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Fig.1: *Scymnus* sp grub feeding on woolly whitefly

Fig.2: *Cryptolaemus montrouzieri* grub feeding on woolly whitefly

Fig.3: *Mallada desjardinsi* grub feeding on woolly whitefly

Fig.4: Stalked eggs of *Mallada desjardinsi* on guava leaves (Under surface)

FURTHER ADDITIONS TO THE BUTTERFLY FAUNA OF CHHATTISGARH, INDIA

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Reviewer: Peter Smetacek

There are 159 species of butterflies reported from Chhattisgarh, India. Sisodia (2019) published a checklist with district-wise distribution of reported species from 13 out of 27 districts of Chhattisgarh. At present, there are 28 districts in Chhattisgarh. Jashpur lies in the north-eastern region of Chhattisgarh. It borders Jharkhand to the north and Odisha to the east. The northern side of the district is largely hilly and forested, demonstrating an affinity with the Chota Nagpur plateau, whereas the southern side is mostly lowlands, surrounded by Maikal ranges (Singh, 1971). Regionally, this is better understood as *Hetghat* and *Uparghat*, meaning lowland and highlands respectively (Brett, 1909). Jashpurnagar, the district headquarters, is situated on the steep hills of *Uparghat*. Previously, Sisodia *et al.* (2019) reported a total of 80 species from Jashpur based on previous published records and field surveys conducted in April-May, 2019. For continued monitoring of the area, an onsite capacity building workshop was conducted by A.S. to train potential local surveyors. Members of Jashpur Wildlife Welfare Foundation and N.K. from District Administration, Jashpur were trained on habitat sensing, observation techniques, field data collection techniques, basic identification, taxonomy of butterflies, data management, and ethics in data collection. As a result, three species of butterflies previously unreported from Chhattisgarh were photographed by N.K. subsequent to the last survey. The specimens were identified using Smetacek ([2016]) and Kehimkar (2008). Following is an annotated list of the three species:

Water Snow Flat *Tagiades litigiosa* Moeschler, 1878

Specimen Documented: 26.iv.2020, Collector's Bungalow, Jashpur Nagar (22° 52' 42.936" N 84° 8' 18.732" E), Chhattisgarh; N.K..

Known Distribution: Andaman & Nicobar Is.; Himachal Pradesh to North East India; Maharashtra to Andhra Pradesh and Kerala; Jharkhand (Varshney & Smetacek, 2015).

Remarks: It is a forest butterfly confined to hilly areas, rarely leaving the shade of the forests (Smetacek, [2016] & Wynter-Blyth, 1957). It was observed basking on a hedge in the garden of the bungalow. It was not observed subsequently, suggesting that there is no breeding population in the immediate vicinity of the site of observation.

Giant Redeye *Gangara thyrsis* (Fabricius, 1775)

Specimen Documented: 03.v.2020 Collector's Bungalow, Jashpur Nagar (22° 52' 42.936" N 84° 8' 18.732" E), N. K..

Known Distribution: Maharashtra to Kerala; Andhra Pradesh; Himachal Pradesh to North East India; Andaman & Nicobar Is.

Remarks: It was found sitting on the ground in the parking area during the day. Normally active at dusk and dawn. The present record helps connect the known distribution of this species, linking the peninsular Indian population, recorded from as far north as

Andhra Pradesh and Gujarat with the Himalayan population.

Brown Onyx *Horaga viola* Moore, 1882

Specimen Documented: 5.v.2020 Collector's Bungalow, Jashpur Nagar (22° 52' 42.936" N 84° 8' 18.732" E), N.K..

Known Distribution: South India, Himachal Pradesh to North East India (Varshney & Smetacek, 2015).

Remarks: It was recorded in the evening basking in the sun. The species is rare throughout its distribution. A possible record of this was observed at the same location during the earlier survey, but since there was no photographic confirmation, it was not included in the list at the time. However, this means that there is a resident population in or in the vicinity of the Collector's Bungalow.

Discussion

The new records reported above are not unusual, since known populations exist both south and north of Chhattisgarh. What is interesting is that populations of these and several other species of butterflies, which were previously known to occur in two disjunct zones, are proved to be actually connected, sometimes tenuously, through the Eastern Ghats. Secondly, it appears that the populations linking the Himalayan and southern Indian communities of butterflies are island populations, since species like the Brown Onyx have not been found in other parts of the state so far. On the basis of these and other findings, it might be possible in the future to get a better idea of what the forests of Chhattisgarh should contain, before over-grazing by cattle, lopping for fodder, exploitation of forest resources, and forest fires changed the composition of the forest community. It would be important to understand the original forest community structure of the state so that suitable habitats can be conserved. The tenuous link represented by the Eastern Ghats between Himalayan and southern Indian populations of birds, reptiles, insects and plants should not broken, for then the populations would be entirely isolated. Even the present island populations of Chhattisgarh can become isolated if the distances between the islands becomes too great. This would result in the stopping of gene flow between southern India and the Himalaya.

Acknowledgement

We thank Peter Smetacek, Butterfly Research Centre, Bhimtal, Uttarakhand for his help in writing this note and Shrikrishna Jadhav (I.F.S), Divisional Forest Officer, Jashpur, Chhattisgarh for his constant support in conducting surveys of the region.

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Fig.1: *Gangara thyrsis*

Fig.2: *Tagiades litigiosa*

Fig.3: *Horaga viola*

CONFIRMATION OF *GRAPHIUM DOSON ELEIUS* (INSECTA: LEPIDOPTERA: PAPILIONIDAE) IN DELHI, INDIA

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Reviewer: Peter Smetacek

Introduction

Two subspecies of the Common Jay butterfly (*Graphium doson* (C. & R. Felder, 1864)) are known from India , *G. d. eleius* (Fruhstorfer, 1907) from southern India to West Bengal and *G.d. axion* (C. & R. Felder, 1864) from Jammu & Kashmir along the Himalaya to north east India and ? Delhi (Varshney & Smetacek, 2015). They are distinguished primarily by the dark sub-basal bar on the hind wing *recto* which is nearly obsolete in *G. d. axion* but well developed *G. d. eleius*. Sharma *et al*. (2019) reported *G. d. eleius* from Jammu and Kanpur; Smetacek (2009) reported the presence of *G.doson* in Delhi but the subspecies was not known because no specimens were examined. G. *doson* feeds on *Polyalthia longifolia* in Delhi and is now well established species with several annual generations.

Observation

On 24.ix.2019, several caterpillars of *G. doson* were observed on a *Polyalthia* tree in west Delhi. These were bred and on 7.xi.2019, an imago emerged. This was sent to the Butterfly Research Centre, Bhimtal, Uttarakhand for identification. It was confirmed to be a specimen of *G. d. eleius* the typically southern Indian subspecies. The specimen is in the collection of the Butterfly Research Centre, Bhimtal.

Discussion

This record confirms that *G. d. eleius* has extended its distribution in recent years from southern India to Kanpur, Delhi, Punjab, Jammu in India and Punjab in Pakistan. The reason for the range extension is not only the widespread plantation of *Polyathia longifolia* as an ornamental tree throughout northern India but perhaps some favorable climatic change, since *P. longifolia* has been cultivated throughout northern India for over 150 years (Brandis, 1874), 140 years before *G. doson* was first recorded in the area.

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I would like to thank my wife, Varsha, for supporting me and Sohail Madan and his team at the Butterfly Park of the Asola Bhatti Wildlife Sanctuary for inspiratioin.

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Fig.1: *Graphium doson,* 7. xi.2019, Delhi

NEW RECORD OF *PSEUDONEOPONERA RUFIPES* (INSECTA: HYMENOPTERA: FORMICIDAE) FROM JHARKHAND, INDIA

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Reviewer: Peter Smetacek

The Indian subcontinent is well known for its high biodiversity, varied environment and habitats, and interesting geological history. However, much work remains to document and catalogue the species of India and their geographic distribution, especially for invertebrate groups. Ants constitute an important part of the animal biomass in terrestrial ecosystems and respond to stress on a much finer scale compared to vertebrates (Hölldobler & Wilson, 1990; Andersen, 1997). They are widely used to assess landscape disturbance and species diversity (Paknia & Pfeiffer, 2011). They perform major ecological functions (predators, scavengers, pollinators, nutrient cyclers, soil turners) and are also responsible for numerous plant species dispersal at almost all levels of terrestrial food webs (Lach *et al*., 2010; Del Toro *et al*., 2012; Guénard, 2013; Pfeiffer *et al*., 2013). In this context, knowledge about their diversity and distribution may add to our understanding of their ecological functions, biogeographic patterns and global affinities.

Two years ago, 13,379 species of ants were listed globally and about 30,000 undescribed species still needed to be catalogued, according to estimates by many myrmecologists (myrmologicalnews, 2018). At present, the diversity is assessed to be 16,301 valid species and subspecies around the world (AntWeb, 2020). In India 828 species and subspecies were listed, representing 100 genera grouped into 10 subfamilies (Bharti, 2016). Subfamily Ponerinae of Formicidae has 2 species of *Pseudoneoponera* i.e., *Pseudoneoponera rufipes* (Jerdon, 1851) and *Pseudoneoponera bispinosa* (Smith, 1858) across India. The genus *Pseudoneoponera* occurs from India through Southeast Asia to Australia, where it reaches its greatest species diversity. *Pseudoneoponera* have unusual reproductive and social strategies. The queen caste has, apparently, been, found in only a few species, while gamergates have been found in several species (Monnin & Peeters, 2008). An unusual characteristic of this genus is that the workers produce a foamy thread-like defensive excretion from their venom glands. The foaming is produced by atrophication of Dufour's gland and the resulting mixing of venom gland proteins with the air (Buschinger & Maschwitz, 1984).

Some ant specimens were collected from a grassland area (23.444599 N, 85.316906 E) inside the Birsa Agricultural University campus on October 19, 2019 and kept in Faculty of Forestry. The specimens were collected and preserved in 70% ethanol, photographed and the latter sent to myrmecologists for identification. The ant was found to be *P. rufipes*, which is a new record for the state of Jharkhand, India. *Pseudoneoponera rufipes* is known to occur in Andaman and Nicobar Islands, Arunachal Pradesh, Assam, Goa, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Sikkim, Tamil

Nadu, Tripura, Uttarakhand and West Bengal (Bharti, 2016).

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I am deeply in debt to Brian L Fisher, Department of Entomology, California Academy of Sciences for his valuable time to identify the genus. I would also like to thank Pronoy Baidya, Centre for Ecological Sciences, Indian Institute of Science, Bangalore for identification upto species level.

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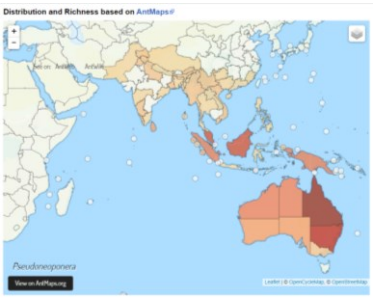

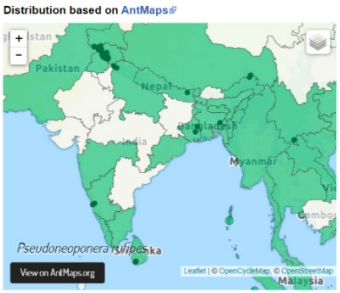

Figs. 1 & 2: Showing distribution of genus *Pseudoneoponera* and *P. rufipes* (Antwiki.org, 2020).

Fig.3

Fig.4

Fig.5

Fig.6

Figs.3-6: Showing *Pseudoneoponera rufipes*

SAPINDUS LAURIFOLIUS VAHL, 1794 AS A NEW HOST PLANT FOR THE COMMON GUAVA BLUE BUTTERFLY *VIRACHOLA ISOCRATES* IN GUJARAT, INDIA

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Abstract

The Indian Soap-nut tree *Sapindus laurifolius* is traditionally used as a shampoo and detergent in India. The Common Guava Blue *Virachola isocrates* is a pest to a variety of floral species, especially *Psidium guajava*. In this study, we have documented its complete life cycle on *S. laurifolius.*

Introduction

The Common Guava Blue *V. isocrates* (Fabricius, 1793) (Lycaenidae: Theclinae: Deudorigini) is a widely distributed species occurring throughout India (Varshney & Smetacek, 2015). Caterpillars are mostly fruit borers and feed on a variety of floral species. Known host plants for *V. isocrates* in India are reviewed by Nitin *et al*. (2018). *S. laurifolius* and *S. emarginatus* are the two species of genus *Sapindus* which have been reported from Gujarat. In *S. laurifolius*, flowering is observed during October-January and fruiting during February-April whereas in *S. emarginatus*, flowering occurs during October-February and fruiting during January-April (Patel, 1971). Variya (2018) observed a female *V. isocrates* laying eggs on *Sapindus laurifolius* (Fig. 1a & 2) at the Post Graduate Department of Biosciences, UGC-Centre of Advanced Study, Anand. Looking at the characters given by Patel (1971) the tree species was confirmed as *S. laurifolius.* The female laid a single, white, spherical egg (Bhakare & Ogale, 2018). on the underside of the leaf (Fig. 1a & 1b) and fruit as well (Fig. 2). Later, both eggs were collected for further study. Rao (1992) has reported larval stages of *V. isocrates* feeding on *Sapindus* sp. but does not clarify any particular species of *Sapindus*. Other than *V. isocrates,* early-stages of *Deudorix epijarbas* and *Rapala varuna* from India (Varshney, 2018) and *Acytolepis puspa* from Sri Lanka (Jayasinghe, 2014) have been reported feeding on *S. laurifolius*.

Materials and Methods

The life cycle was studied under laboratory conditions at room temperature between 29th January - 11th March, 2018 at the Post Graduate Department of Biosciences, UGC-Centre of Advanced Study, Sardar Patel University, Anand, Gujarat. Collected eggs were placed in a sterile plastic container closed with breathable cloth cover. After the eggs hatched, fresh leaves and fruits of *S. laurifolius* were provided to the larvae (Fig. 3). They preferred to feed on the fruit and they made a hole and started feeding on the soft internal mass (Fig. 4 & 5). Once a larva finishes the fruit from inside, leaving only the outer covering intact, it travels to another fruit (Fig. 6). Till pupation, fresh green soap-nuts were fed as the main food source of larval stages.

Result and Discussion

Rao (1992) noted that *V. isocrates* larvae have been found feeding on *Sapindus* sp. and our study supports that observation. Along with laboratory observations, field observations

were also carried out and wild larvae of *V. isocrates* were found inside the fruits of *S. laurifolius* (Fig. 7). We documented the early stages of *V. isocrates* starting from egg-laying till pupation on *S. laurifolius*. Before pupation, the leftover of soap-nuts was removed and larvae pupated at the bottom of the container (Fig. 8). It took a total of 41 days to become an adult starting from the egg stage. An enclosed adult male was released in the wild (Fig. 9).

As *Virachola isocrates* causes economic damage to many trees, its life cycle on *Sapindus laurifolius* is a noteworthy addition. *S. laurifolius* occurs commonly in India and perhaps plays an important role in sustaining the wild populations of *V. isocrates* along with other host plants as mentioned above. For the confirmation of *S. laurifolius* as a new host plant, the cited literature (Bell, 1920; Wynter-Blyth, 1957; Atwal, 1976; Varshney, 1997; Kalesh & Prakash, 2007; Kalesh & Prakash, 2015; Khan, 2016) has been cross checked. However, in India, a few other species of *Sapindus* occur which support the early stages of many insect species (Rao, 1992). Also, there is a likelihood that *V. isocrates* utilizes/infests other species of *Sapindus* found on the Indian Subcontinent during the larval stage.

Acknowledgments

I would like to thank Dr. A. S. Reddy, Post Graduate Department of Biosciences, Sardar Patel University and Ms. Richa Chauhan for helping with the identification of genus *Sapindus*. Many thanks to the Nature Club, Surat and Voluntary Nature Conservancy for their constant support.

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Fig.1a: Female laying egg on leaves

Fig.1b: Egg

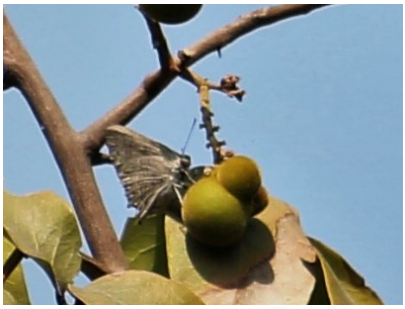

Fig.2: Female laying egg on fruits

Fig.3: Caterpillar on fruit

Fig.4: Punctures the fruit from the lateral side

Fig.5: Feeds on the inner mass of fruit

Fig.6: After consuming one fruit, travels to another fruit

Fig.7: Larvae observed in wild

Fig.8: Pupa just before eclosing

Fig.9: Adult

CHECKLIST OF BUTTERFLIES (INSECTA: LEPIDOPTERA) FROM MUKUNDARA HILLS TIGER RESERVE, RAJASTHAN

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Introduction

Butterflies are an ideal subject for ecological studies of landscapes (Thomas & Malorie, 1985). Further, butterflies are good biological indicators of habitat quality as well as general health of the environment (Larsen, 1988; Kocher & Williams, 2000; Sawchik *et al*., 2005). The following study is the first checklist of the butterflies of Mukundara Hills Tiger Reserve, Rajasthan comprising a total of 45 species belonging to 5 families (Papilionidae, Hesperiidae, Pieridae, Lycaenidae and Nymphalidae).

Materials & Methods

Study Area

Mukundara Hills Tiger Reserve (MHTR) (24°47' N, 76° 0' E) is situated at a distance of 56 km from the city of Kota in Rajasthan. It consists of three wildlife sanctuaries, namely, Darrah National Park, Chambal Wildlife Sanctuary and Jaswant Sagar Wildlife Sanctuary. It is located on the eastern bank of the Chambal river. The name is derived from the mountain Mukundara. Earlier, the entire area was known as Darrah Wildlife Sanctuary, which was a hunting preserve for the royal family of Kota. It is spread across four districts-Kota, Bundi, Chittorgarh and Jhalawar-covering an area of 759 sq. km. It consists of a core area of 417 sq. km and a buffer zone covering 342.82 sq. km. MHTR has dry deciduous forest (Champion & Seth, 1968) and is dominated by *Anogeissus pendula, A. latifolia, Acacia catechu, Acacia leucofloea, Zizyphus mauratiana* and *Flacourtia indica*. Mammals recorded in the area include leopard, Indian wolf, sloth bear, hyena, jungle cat, Indian fox, desert cat, ratel, pangolin, chital, sambar, nilgai and chinkara (Jhala *et al.*, 2015) along with many species of birds and reptiles.

Methods

The survey was done randomly while studying the status of tigers, co-predators and prey in India during the month of November & December, 2014. The observations were taken throughout the day along with the ongoing project work. The majority of observations were done on the forest road passing through Darrah National Park, at various water holes and near the base camp in Jaswant Sagar Wildlife Sanctuary. Photo documentation of the butterflies was done during the study period. No specimen was collected for this study.

Data Analysis

The photographs were identified using available literature. This is the first study of the butterfly fauna of the area. Thus, it provides base line information for further studies. To ascertain the identity of butterflies photographs were taken and species identified with the keys provided by Kehimkar (2008, 2016), Wynter-Blyth (1957) and *Butterflies of India, v. 2.74*, (2020). All butterflies were identified based on photographs. For nomenclature, we followed the latest catalogue by Varshney & Smetacek (eds.) (2015). Since *Pelopidas* (Hesperiidae) and *Tarucus* (Lycaenidae) require dissection for confirming identity to species level, we have only reported the genera of both in the following list. Butterflies were classified

according to their abundance in five categories: (Kasambe *et al.*, 2018)

A – Abundant: Seen 80 - 90% of the time in most habitats.

C – Common: Seen 60 - 80 % of the time in most habitats.

U – Uncommon: Seen 40 - 60 % of the time in most habitats.

R – Rare: Seen 20 - 40 % of the time in most habitats.

VR – Very rare: Seen less than 20% of the time in most habitats.

Results & Discussion

Kulshrestha & Jain (2016) have recorded 20 species of butterflies belonging to 4 families (Pieridae, Papilionidae, Lycaenidae and Nymphalidae) at Jhalawar, (Rajasthan). Palot & Soniya (2000) reported 34 species of butterflies from Keoladeo National Park, Bharatpur, Rajasthan. A total of 45 species belonging to 5 families are reported with Nymphalidae and Pieridae being the dominant families among all the reported families.

A total of 45 species were found in during the survey. The family wise abundance was Nymphalidae: 17 species (37.78%); family Pieridae: 15 species (33.33%); family Lycaenidae: 6 species (13.34%); family Papilionidae: 5 species (11.11%) and family Hesperiidae: 2 species (4.44%). The butterfly abundance was as follows: Abundant: 8 species; Common: 8 species; Uncommon: 12 species; Rare: 11 species and Very Rare: 6 species.

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I would like to thank Director, Wildlife Institute of India, National Tiger Conservation Authority for granting permission. I would also like to thank the Rajasthan Forest Department for their support throughout the study. Finally, I am also thankful to Mr. Mandar Sawant for helping me. Sincere thanks to the Director BNHS, Dr. Deepak Apte who has always encouraged me.

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Table 1

S N	Family	Common Name	Scientific Name	Abundance
1	Papilionidae	Common Rose	*Pachliopta aristolochiae* (Fabricius, 1775)	U
2	Papilionidae	Common Mormon	*Papilio polytes romulus* Cramer, [1775]	C
3	Papilionidae	Lime Butterfly	*Papilio demoleus* Linnaeus, 1758	U
4	Papilionidae	Tailed Jay	*Graphium agamemnon* (Linnaeus, 1758)	C
5	Papilionidae	Spot Swordtail	*Graphium nomius* (Esper, 1799)	U
6	Hesperiidae	Swift	*Pelopidas* Fabricius, 1798 species	VR
7	Hesperiidae	Indian Palm Bob	*Suastus gremius* (Fabricius, 1798)	U
8	Pieridae	Mottled Emigrant	*Catopsilia pyranthe* (Linnaeus, 1758)	R
9	Pieridae	Common Emigrant	*Catopsilia pomona* (Fabricius, 1775)	A
10	Pieridae	Common Grass Yellow	*Eurema hecabe* (Linnaeus, 1758)	A
11	Pieridae	Spotless Grass Yellow	*Eurema laeta* (Boisduval, 1836)	A
12	Pieridae	Psyche	*Leptosia nina* (Fabricius, 1793)	C
13	Pieridae	White Orange-tip	*Ixias marianne* (Cramer, [1779])	C
14	Pieridae	Yellow Orange-tip	*Ixias pyrene* (Linnaeus, 1764)	R
15	Pieridae	White Arab	*Colotis phisadia vestalis* (Butler, 1876)	R

16	Pieridae	Little Orange-tip	*Colotis etrida* (Boisduval, 1836)	A
17	Pieridae	Crimson-tip	*Colotis danae* (Fabricius, 1775)	C
18	Pieridae	Small Salmon Arab	*Colotis amata* (Fabricius, 1775)	R
19	Pieridae	Common Albatross	*Appias albina* (Boisduval, 1836)	R
20	Pieridae	Pioneer	*Belenois aurota* (Fabricius, 1793)	VR
21	Pieridae	Common Gull	*Cepora nerissa* (Fabricius, 1775)	R
22	Pieridae	Great Orange-tip	*Hebomoia glaucippe* (Linnaeus, 1758)	VR
23	Lycaenidae	Common Silverline	*Spindasis vulcanus* (Fabricius, 1775)	U
24	Lycaenidae	Peablue	*Lampides boeticus* (Linnaeus, 1767)	VR
25	Lycaenidae	Zebra Blue	*Leptotes plinius* (Fabricius, 1793)	R
26	Lycaenidae	Common Pierrot	*Castalius rosimon* (Fabricius, 1775)	R
27	Lycaenidae	Pierrot	*Tarucus* Butler, 1886 sp.	VR
28	Lycaenidae	Gram Blue	*Euchrysops cnejus* (Fabricius, 1798)	R
29	Nymphalidae	Plain Tiger	*Danaus chrysippus* (Linnaeus, 1758)	A
30	Nymphalidae	Common Tiger	*Danaus genutia* (Cramer, 1779)	A
31	Nymphalidae	Glassy Tiger	*Parantica aglea* (Stoll, [1782])	A
32	Nymphalidae	Common Crow	*Euploea core* (Cramer, [1780])	C
33	Nymphalidae	Common Evening Brown	*Melanitis leda* (Linnaeus, 1758)	A
34	Nymphalidae	Dark-branded Bushbrown	*Mycalesis mineus polydecta* (Cramer, [1777])	VR
35	Nymphalidae	Common Sailer	*Neptis hylas varmona* Moore, 1872	U
36	Nymphalidae	Common Leopard	*Phalanta phalantha* (Drury, [1773])	U
37	Nymphalidae	Angled Castor	*Ariadne ariadne indica* (Moore, 1884)	U
38	Nymphalidae	Yellow Pansy	*Junonia hierta*	R

			(Fabricius, 1798)	
39	Nymphalidae	Lemon Pansy	*Junonia lemonias* (Linnaeus, 1758)	U
40	Nymphalidae	Grey Pansy	*Junonia atlites* (Linnaeus, 1763)	C
41	Nymphalidae	Peacock Pansy	*Junonia almona* (Linnaeus, 1758)	U
42	Nymphalidae	Blue Pansy	*Junonia orithya* (Linnaeus, 1758)	R
43	Nymphalidae	Danaid Eggfly	*Hypolimnas misippus* (Linnaeus, 1764)	C
44	Nymphalidae	Great Eggfly	*Hypolimnas bolina* (Linnaeus, 1758)	U
45	Nymphalidae	Tawny Coster	*Acraea violae* (Fabricius, 1793)	U

Fig.1: *Parentica aglea*

Fig.2: *Hebomoia glaucippe*

Fig.3: *Tarucus* sp.

Fig.4: *Pelopidas* sp.

A PRELIMINARY REPORT ON COLEOPTERA FAUNA OF KALYANI (A SUBURBAN CITY), WEST BENGAL, INDIA

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Introduction

Among insects, order Coleoptera, commonly known as beetles, are the most diverse group of organisms on earth. These beetles form an important component of our ecosystems. Many of them are serious pests of agriculture and forestry while some are extremely beneficial as nutrient recyclers and pollinators. From India, approximately 15,500 beetle species were reported till date (Ramkrishna & Alfred, 2007). Though several faunistic and taxonomic works on larger families of Coleoptera have been carried out regionally from different parts of West Bengal, Kalyani city has never been assessed for its beetle fauna. In addition to the State Fauna Series and the Records of the Zoological Survey of India, some of the notable works on Coleoptera fauna of West Bengal are of Banerjee (2014), Mitra (2014), Mitra *et al*. (2015, 2016, 2018), Sarkar *et al*. (2012, 2014, 2015, 2016a, 2016b, 2017, 2019), Basu *et al*. (2017), Ghosh *et al*. (2017), Saha & Raychaudhuri (2017) and Kharel *et al*. (2020). Based on this background, several surveys were conducted from March, 2019 to February, 2020 to document the Coleoptera fauna of Kalyani city. The city has an area of 29.14 km^2 and is located in the Nadia district of West Bengal, India (22.9747° N, 88.4337° E). The city displays characteristic features of both rural and urban environment. It is surrounded by agricultural fields and pastures.

Materials and methods

Beetle specimens were collected using sweep nets, hand picking, pit fall traps and ultra violet light traps. The collected specimens were identified by examining the characters under stereozoom trinocular microscope (OLYMPUS SZX7) using the keys and descriptions available in Fauna of British India volumes on different families of Coleoptera, State Fauna series and Occasional Papers of the Zoological Survey of India, as well as other relevant and current literature. The current status of each species was checked in various databases like Catalogue of Life, GBIF, Coccinellidae of India etc. The collected specimens were deposited in the Entomology Laboratory of the Department of Zoology, University of Kalyani for further studies. The distribution records for each species were compiled from literature published till date.

Results and Discussion

The surveys resulted in the recognition of 34 species distributed over 29 genera and 10 families of Coleoptera. The maximum species representation was from the family Scarabaeidae (13), followed by Coccinellidae (07) and Chrysomelidae (03) respectively. The families Cerambycidae, Elateridae and Tenebrionidae were recorded with two species each, whereas the families Curculionidae, Hydrophilidae and Meloidae were recorded each with only one species. All the species presented here are reported for the first time from Kalyani city.

Systematic account

Order: Coleoptera Linnaeus, 1758

Suborder: Adephaga Schellenberg, 1806

Family: Carabidae Latreille, 1802
Subfamily: Harpalinae Bonelli, 1810
Genus *Chlaenius* Bonelli, 1810
Subgenus *Pachydinodes* Kuntzen, 1919
1.*Chlaenius*(*Pachydinodes*) *hamifer* Chaudoir, 1856
Specimens recorded: 3 exs.: 2 exs. Chandmari, Kalyani (22.9839° N, 88.4546° E), West Bengal, India, 14.ix.2019, coll. B.P. Kharel. 1 ex. Lake Park, Kalyani (22.9683° N, 88.4436° E), West Bengal, India, 04.x.2019, coll. S.K.Sarkar.
Indian distribution: Haryana and West Bengal.
Global distribution: Australia, Bhutan, China, Iran, Japan, North Korea, South Korea, Myanmar, Nepal, New Guinea, Pakistan, Sri Lanka, Thailand and United Arab Emirates.
Remarks: Commonly found in leaf litter, under tree bark, under logs, and rocks and sands by the edges of pond and river.

Subfamily: Scaritinae Bonelli, 1810
Genus *Scarites* Fabricius, 1775
Subgenus *Parallelomorphus* Motschulsky, 1849
2. *Scarites* (*Parallelomorphus*) *indus* Olivier, 1795
Specimens recorded: 1 ex. Silpanchal, Kalyani (22.9813° N, 88.4392° E), West Bengal, India, 15.xii.2019, coll. B.P. Kharel.
Indian distribution: Arunachal Pradesh, Assam, Karnataka, Kashmir, Sikkim, Uttar Pradesh, and West Bengal.
Global distribution: Afghanistan, Nepal, Pakistan, Sri Lanka, Vietnam.
Remarks: Commonly found in leaf litter, under tree bark and logs, and soil surface.

Suborder: Polyphaga Emery, 1886
Family Cerambycidae Latreille, 1802
Subfamily Cerambycinae Latreille, 1802
Genus *Xystrocera* Audinet-Serville, 1834
3. *Xystrocera globosa* (Olivier, 1795)
Specimens recorded: 2 exs.:1 ex. Dakshin Goshpara, Kalyani (22.9897° N, 88.4372° E), West Bengal, India, 11.vi.2019, coll. B.P. Kharel, 1 ex. Kathaltala, Kalyani (22.9902° N, 88.4436° E), West Bengal, India, 16.iii.2019, coll. B.P. Kharel.
Indian distribution: Andaman Island, Assam, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.
Global distribution: Arabia, Australia, Bangladesh, China, Egypt, Hawaii Island, Indonesia, Israel, Japan, Korea, Madagascar, Malaysia, Myanmar, Philippines, Pakistan, Sri Lanka, Taiwan, Thailand and Vietnam.
Remarks: Commonly found in roots, stumps and branches of cutch, gum, and many species of *Albizia* trees. It is a pest of *Albizia* species.

Subfamily Lamiinae Latreille, 1825
Genus *Batocera* Castelnau, 1840
4. *Batocera rufomaculata* De Geer, 1775
Specimens recorded: 2 exs. Lake Park, Kalyani (22.9683° N, 88.4436° E), West Bengal, India, 04.x.2019, coll. B.P. Kharel.
Indian distribution: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.
Global distribution: China, Comoros, Egypt, Iran, Israel, Lebanon, Madagascar, Mascarene, Mauritius, Nepal, Oman, Pakistan, Syria, Turkey and Yemen.
Remarks: Commonly found in roots, stumps, and branches of fig, papaya, mango and Sal trees. It is a pest of mango and fig.

Family Chrysomelidae Latreille, 1802
Subfamily Cassidinae Gyllenhal, 1813
Genus *Aspidimorpha* Hope, 1840
Subgenus *Aspidomorpha* Berg, 1899
5. *Aspidimorpha* (*Aspidimorpha*) *miliaris* (Fabricius, 1775)
Specimens recorded: 1ex. Birpara, Kalyani 22.9961° N, 88.4352° E), West Bengal, India, 05.vii.2019, coll. B.P. Kharel.

Indian distribution: Assam, Bihar, Karnataka, Meghalaya, Orissa, Tamil Nadu and West Bengal.
Global distribution: Australia, China, Philippines and Sri Lanka.
Remarks: Commonly found in leaves & flowers of Cucurbitaceae plants.

Genus *Dicladispa* Gestro, 1897
Subgenus *Dicladispa* Gestro, 1897
6. *Dicladispa* (*Dicladispa*) *armigera* (Olivier, 1808)
Specimens recorded: 2 exs. Taltala, Kalyani (22.9908° N, 88.4191° E), West Bengal, India, 21.i.2020, coll. B.P. Kharel.
Indian distribution: Andhra Pradesh, Assam, Bihar, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.
Global distribution: Bangladesh, Bhutan, Cambodia, China, Indonesia, Iran, Korea, Malaysia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Taiwan, Thailand and Vietnam.
Remarks: Commonly found in paddy plants.

Subfamily Galerucinae Latreille, 1802
Genus *Aulacophora* Dejean, 1835
7. *Aulacophora foveicollis* (Lucas, 1849)
Specimens recorded: 3 exs.: 2 exs. Muratipur, Kalyani (22.9969° N, 88.4472° E), West Bengal, India, 13.x.2019, coll. S.K. Sarkar, 1 ex. Birpara, Kalyani 22.9961° N, 88.4352° E), West Bengal, India, 05.vii.2019, coll. B.P. Kharel.
Indian distribution: Arunachal Pradesh, Assam, Bihar, Gujarat, Kerala, Maharashtra, Meghalaya, Orissa, Punjab, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.
Global distribution: Bangladesh, Myanmar, Pakistan, Sri Lanka.
Remarks: Commonly found on leaves & flowers of *Cucumis melo* and other Cucurbitaceae plants.

Family Coccinellidae Latreille, 1807
Subfamily Chilocorinae Mulsant, 1846
Genus *Brumoides* Chapin, 1965
8. *Brumoides suturalis* (Fabricius, 1798)
Specimens recorded: 2exs. Kathaltala, Kalyani (22.9902° N, 88.4436° E), West Bengal, India, 16.iii.2019, coll. B.P. Kharel.
Indian distribution: Haryana, Himachal Pradesh, Manipur, Maharashtra, Punjab, Rajasthan, Tamil Nadu and West Bengal.
Global distribution: Bangladesh, Bhutan, Indonesia, Nepal, Pakistan and Papua New Guinea.
Remarks: Commonly found in stems & leaves of paddy and mulberry plants.
Genus *Curinus* Mulsant, 1850
9. *Curinus coeruleus* (Mulsant, 1850)
Specimens recorded: 2exs. Block D, Kalyani (22.9847° N, 88.2627° E), West Bengal, India, 17.x.2019, coll. B.P. Kharel.
Indian distribution: Andhra Pradesh, Kerala, Tamil Nadu and West Bengal.
Global distribution: Nepal, Philippines and Thailand.
Remarks: Commonly found in stems, leaves, and roots of sugarcane and flowers of marigold and rose.

Subfamily Coccinellinae Latreille, 1807
Genus *Cheilomenes* Chevrolat, 1837.
10. *Cheilomenes sexmaculata* (Fabricius, 1781)
Specimens recorded: 1ex. Bidhanpally, Kalyani (22.9644° N, 88.4675° E), West Bengal, India, 04.iv.2019, coll. B.P. Kharel.
Indian distribution: Andhra Pradesh, Assam, Bihar, Maharashtra, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Manipur, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

Global distribution: Australia, Bangladesh, China, Indonesia, Japan, Malaysia, Pakistan and Philippines.
Remarks: Commonly found in stems, leaves, flowers & fruits of brinjal, maize and cotton plants.

Genus *Coccinella* Linnaeus, 1758
11. *Coccinella transversalis* Fabricius, 1781
Specimens recorded: 5 exs.: 2exs. Block A9, Kalyani (22.9661° N, 88.4650° E), West Bengal, India, 29.v.2019, coll. B.P.Kharel, 3exs. Chandmari, Kalyani (22.9839° N, 88.4546° E), West Bengal, India, 14.ix.2019, coll. S.K.Sarkar.
Indian distribution: Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Kerala, Manipur, Meghalaya, Odisha, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.
Global distribution: Australia, Bangladesh, China, Indonesia, Japan, Malaysia, Philippines, Sri Lanka and Vietnam.
Remarks: Commonly found in stems of maize, wheat & rice plants.

12. *Coccinella undecimpunctata* Linnaeus, 1758
Specimens recorded: 4 exs.: 3exs. Muratipur, Kalyani (22.9980° N, 88.4533° E), West Bengal, India, 14.ii.2020, coll. B.P. Kharel, 1ex. Dakshin Goshpara, Kalyani (22.9897° N, 88.4372° E), West Bengal, India, 11.vi.2019, coll. B.P. Kharel.
Indian distribution: Jammu and Kashmir, Punjab, Uttar Pradesh and West Bengal.
Global distribution: Afghanistan, Canada, China, Egypt, Greece, Iraq, Libya, Mongolia, New Zealand, Pakistan, Poland, Saudi Arabia, Tajikistan and Turkmenistan.
Remarks: Commonly found in dead grass, rotting bark, stems, leaves and flowers of rose, china-rose and leaves of Solanaceae plants.

Genus *Oenopia* Mulsant, 1850
13. *Oenopia billieti* (Mulsant, 1853)
Specimens recorded: 1ex. Block B3, Kalyani (22.9713° N, 88.4344° E), West Bengal, India, 10.vi.2019, coll. S.K. Sarkar.
Indian distribution: Assam, Himachal Pradesh, Jammu & Kashmir, Kerala, Punjab, Sikkim, Uttar Pradesh and West Bengal.
Global distribution: Nepal.
Remarks: Commonly found in stems, leaves and flowers of brinjal, okra and tomato plants.

Subfamily Epilachninae Mulsant, 1846
Genus *Henosepilachna* Li & Cook, 1961
14. *Henosepilachna vigintioctopunctata* (Fabricius, 1775)
Specimens recorded: 1ex. Block B8, Kalyani (22.9783° N, 88.4347° E), West Bengal, India, 14.ix.2019, coll. B.P. Kharel.
Indian distribution: Haryana, Himachal Pradesh, Kerala, Madhya Pradesh, Manipur, Meghalaya, Punjab, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.
Global distribution: Australia, Bhutan, China, Japan, Korea, Philippines, Russia.
Remarks: Commonly found in stems and leaves of Cucurbitaceae plants, leaves of bitter gourd and flowers of Ashwagandha *Withania somnifera*.

Family Curculionidae Latreille, 1802
Subfamily Entiminae Schönherr, 1826
Genus *Blosyrus* Schönherr, 1826
15. *Blosyrus oniscus* (Olivier, 1807)
Specimens recorded: 1ex. Buddha Park, Kalyani (22.9850° N, 88.4180° E), West Bengal, India, 12.vii.2019, coll. B.P. Kharel.
Indian distribution: Assam, Meghalaya, Nagaland and West Bengal.
Global distribution: Bangladesh and Myanmar.
Remark: Commonly found in air-filled stems of aquatic plants.

Family Elateridae Leach, 1815
Subfamily Agrypninae Candèze, 1857
Genus *Lanelater* Arnett, 1952
16. *Lanelater fuscipes* (Fabricius, 1775)

Specimens recorded: 1ex. Buddha Park, Kalyani (22.9850° N, 88.4180° E), West Bengal, India, 12.vii.2019, coll. B.P. Kharel.
Indian distribution: Karnataka, New Delhi, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.
Global distribution: Indonesia, Madagascar and Sri Lanka.
Remarks: Commonly found in potato leaves, stems and tubers.

Subfamily Melanotinae Candèze, 1859
Genus *Melanotus* Eschscholtz, 1829
17. *Melanotus fuscus* (Fabricius, 1801)
Specimens recorded: 1ex. Block B2, Kalyani (22.9766° N, 88.4252° E), West Bengal, India, 24.ix.2019, coll. S.K. Sarkar
Indian distribution: Sikkim, Tripura and West Bengal.
Global distribution: China, Indonesia, Laos, Myanmar, Sri Lanka and Thailand.
Remarks: Commonly found in stems, tubers and leaves of onion and potato.

Family Hydrophilidae Latreille, 1802
Subfamily Hydrophilinae Latreille, 1802
Genus *Hydrophilus* Geoffroy, 1762
18. *Hydrophilus olivaceous* Fabricius, 1781
Specimens recorded: 2 exs. Chandmari, Kalyani (22.9839° N, 88.4546° E), West Bengal, India, 14.ix.2019, coll. S.K.Sarkar.
Indian distribution: Andhra Pradesh, Haryana, Madhya Pradesh, Maharashtra, Manipur, Odisha and West Bengal.
Global distribution: No record found.
Remarks: Commonly found in ponds, dams and stagnant water bodies.

Family Meloidae Gyllenhal, 1810
Subfamily Meloinae Gyllenhal, 1810
Genus *Mylabris* Fabricius, 1775
19. *Mylabris phalerata* (Pallas, 1781)
Specimens recorded: 2 exs. Chandmari, Kalyani (22.9839° N, 88.4546° E), West Bengal, India, 14.ix.2019, coll. S.K. Sarkar
Indian distribution: Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Odisha, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal.
Global distribution: China and Sri Lanka.
Remarks: Commonly found in flowers of china-rose & and on rotting wood.

Family Scarabaeidae Latreille, 1802
Subfamily Dynastinae Macleay, 1819
Genus *Alissonotum* Arrow, 1908
20. *Alissonotum piceum* (Fabricius, 1775)
Specimens recorded: 4 exs. Dakshin Goshpara, Kalyani (22.9897° N, 88.4372° E), West Bengal, India, 11.vi.2019, coll. B.P. Kharel.
Indian distribution: Himachal Pradesh, Kerala, Madhya Pradesh, Odisha, Sikkim, Uttarakhand and West Bengal.
Global distribution: Bangladesh, China, Indonesia, Malaysia, Myanmar, Pakistan and Sri Lanka.
Remarks: Commonly found in rotting stems and leaves of various shrubs, rotting bark and grass.

Genus *Clyster* Arrow, 1908
21. *Clyster retusus* Arrow, 1908
Specimens recorded: 1 ex. Block B8, Kalyani (22.9783° N, 88.4347° E), West Bengal, India, 14.ix.2019, coll. B.P. Kharel.
Indian distribution: Andaman and Nicobar islands, West Bengal.
Global distribution: Indonesia and Myanmar.
Remarks: Commonly found in rotting bark and flowers of rose, marigold and china-rose.

Subfamily RUTELINAE Macleay, 1819
Genus *Anomala* Samouelle, 1819
22. *Anomala bengalensis* (Blanchard, 1851)
Specimens recorded: 5 exs.: 3exs. Block B2, Kalyani (22.9766° N, 88.4252° E), West Bengal, India, 24.ix.2019, coll. B.P. Kharel. 2exs. Muratipur, Kalyani (22.9980° N, 88.4533° E), West Bengal, India, 14.ii.2020, coll. B.P. Kharel.

Indian distribution: Andhra Pradesh, Bihar, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttarakhand and West Bengal.
Global distribution: Bangladesh, Bhutan, Myanmar and Nepal.
Remarks: Commonly found in stems, leaves & roots of maize, wheat, barley, jowar, bajra, oil seed crops like groundnut, sesame, sunflower, soyabean, vegetable crops like brinjal, cucurbit, okra and other commercial crops like sugarcane, cotton, tobacco etc.

23. *Anomala rugosa* Arrow, 1899
Specimens recorded: 2 exs. Block A7, Kalyani (22.9997° N, 88.4277° E), West Bengal, India, 04.i.2020, coll. B.P. Kharel.
Indian distribution: Assam, Bihar, Chhattisgarh, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Sikkim, Tamil Nadu, Uttarakhand and West Bengal.
Global distribution: Bhutan, Nepal and Pakistan.
Remarks: Commonly found on leaves, stems and flowers of potato, tomato and brinjal plants.

24. *Anomala varicolor* (Gyllenhal, 1877)
Specimens recorded: 4 exs. Buddha Park, Kalyani (22.9850° N, 88.4180° E), West Bengal, India, 12.vii.2019, coll. B.P. Kharel.
Indian distribution: Assam, Bihar, Chhattisgarh, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh, Himachal Pradesh, Sikkim, Uttarakhand and West Bengal.
Global distribution: Bhutan, China, Nepal, Sri Lanka and Taiwan.
Remarks: Commonly found in stems of Leguminosae plants like *Acacia*, pea and bean.

Subfamily Scarabaeinae Latreille, 1802
Genus *Catharsius* Hope, 1837
25. *Catharsius birmanensis* Lansberge, 1874
Specimens recorded: 1 ex. Birpara, Kalyani 22.9961° N, 88.4352° E), West Bengal, India, 05.vii.2019, coll. B.P. Kharel.
Indian distribution: Haryana, Punjab, Rajasthan, Sikkim, Uttar Pradesh and West Bengal.
Global distribution: Bhutan, Myanmar and Thailand.
Habitat: Commonly found in cow and buffalo dung.

Genus *Liatongus* Reitter, 1893
26. *Liatongus affinis* (Arrow, 1908)
Specimens recorded: 1 ex. Muratipur, Kalyani (22.9969° N, 88.4472° E), West Bengal, India, 13.x.2019, coll. B.P. Kharel.
Indian distribution: Manipur and West Bengal.
Global distribution: China, Myanmar and Thailand.
Remarks: Commonly found in cow and buffalo dung.

Genus Onitis Fabricius, 1798
27. *Onitis philemon* Fabricius, 1801
Specimens recorded: 1 ex. Block D, Kalyani (22.9847° N, 88.2627° E), West Bengal, India, 17.x.2019, coll. S.K. Sarkar.
Indian distribution: Arunachal Pradesh, Bihar, Chandigarh Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal.
Global distribution: China, Nepal, Pakistan, Sri Lanka, Taiwan and Vietnam.
Remarks: Commonly found in cow and buffalo dung.

Genus Onthophagus Latreille, 1802
28. *Onthophagus andrewesi* Arrow, 1931
Specimens recorded: 4 exs.: 3 exs. Muratipur, Kalyani (22.9980° N, 88.4533° E), West Bengal, India, 14.ii.2020, coll. B.P. Kharel. 1ex. Muratipur, Kalyani (22.9969° N,

88.4472° E), West Bengal, India, 13.x.2019, coll. S.K. Sarkar.
Indian distribution: Karnataka, Kerala, Maharashtra, Tamil Nadu and West Bengal.
Global distribution: No record found.
Remarks: Commonly found in cow, buffalo and goat dung.

29. *Onthophagus ceylonicus* Harold, 1859
Specimens recorded: 2 exs. Block A9, Kalyani (22.9661° N, 88.4650° E), West Bengal, India, 29.v.2019, coll. B.P. Kharel.
Indian distribution: Karnataka, Rajasthan and West Bengal.
Global distribution: Sri Lanka.
Remarks: Commonly found in cow dung.

30. *Onthophagus* (*Colobonthophagus*) *dama* (Fabricius, 1798)
Specimens recorded: 16 exs.: 8 exs. Bidhanpally, Kalyani (22.9644° N, 88.4675° E), West Bengal, India, 04.iv.2019, colls. B.P. Kharel. 6 exs. Kathaltala, Kalyani (22.9902° N, 88.4436° E), West Bengal, India, 16.iii.2019, coll. B.P. Kharel. 2 exs. Birpara, Kalyani 22.9961° N, 88.4352° E), West Bengal, India, 05.vii.2019, coll. S.K. Sarkar.
Indian distribution: Arunachal Pradesh, Bihar, Chhattisgarh, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.
Global distribution: Bhutan, China, Nepal and Sri Lanka.
Remarks: Commonly found in cow, buffalo and goat dung.

Genus *Sisyphus* Latreille, 1807
31. *Sisyphus longipes* (Olivier, 1789)
Specimens recorded: 6ex. Kathaltala, Kalyani (22.9902° N, 88.4436° E), West Bengal, India, 16.iii.2019, coll. B.P. Kharel.
Indian distribution: Andhra Pradesh, Chhattisgarh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu and West Bengal.
Global distribution: Myanmar, Pakistan, Sri Lanka and Thailand.
Remarks: Commonly found in cow and buffalo dung.

Genus *Tiniocellus* Péringuey, 1901
32. *Tiniocellus imbellis* (Bates, 1891)
Specimens recorded: 8 exs.: 5ex. Taltala, Kalyani (22.9908° N, 88.4191° E), West Bengal, India, 21.i.2020, coll. B.P. Kharel. 3ex. Dakshin Goshpara, Kalyani (22.9897° N, 88.4372° E), West Bengal, India, 11.vi.2019, coll. B.P. Kharel.
Indian distribution: Bihar, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.
Global distribution: Nepal and Pakistan.
Remarks: Commonly found in cow, buffalo and goat dung.

Family Tenebrionidae Latreille, 1802
Subfamily Tenebrioninae Latreille, 1802
Genus *Alphitobius* Stephens, 1829
33. *Alphitobius diaperinus* (Panzer, 1797)
Specimens recorded: 2 exs. Kathaltala, Kalyani (22.9902° N, 88.4436° E), West Bengal, India, 16.iii.2019, coll. B.P. Kharel.
Indian distribution: Assam, Uttarakhand and West Bengal.
Global distribution: No record found.
Remarks: Commonly found in caves, rotting leaves, sticks and grasses.

Genus *Gonocephalum* Chevrolat, 1849
34. *Gonocephalum depressum* (Fabricius, 1801)
Specimens recorded: 2 exs. Kathaltala, Kalyani (22.9902° N, 88.4436° E), West Bengal, India, 16.iii.2019, coll. B.P. Kharel.
Indian distribution: Arunachal Pradesh, Assam, Himachal Pradesh, Kashmir, Manipur, Meghalaya, Sikkim and West Bengal.
Global distribution: Afghanistan, Bhutan, China, Indonesia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka and Taiwan.

Remarks: Commonly found in rotting wood, bark and leaf litter.

The outcome of the study indicates that Kalyani city, though facing rapid urbanization activities, still harbours a good number of insects, particularly beetles. The longhorn beetles (Cerambycidae) and dung beetles (Scarabaeidae) listed in our work are very common and found in many urban cities of India. For e.g., *Batocera rufomaculata* is a pest of mango, papaya, fig etc. and *Xystrocera globosa* is a pest of many species of *Albizia* and cutch trees. These trees are quite common in many cities of India. The dung beetles listed are found in dung of various mammals like cow, buffalo, goat etc. Most of the ladybird (Coccinellidae), leaf (Chrysomelidae), ground (Carabidae) and darkling (Tenebrionidae) beetles listed here can be spotted in many suburban cities of the country.

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Fig.1: *Alphitobius diaperinus*

Fig.2: *Anomala bengalensis*

Fig.3: *Aspidimorpha miliaris*

Fig.4: *Batocera rufomaculata*

Fig.5: *Coccinella transversalis*

Fig.6: *Chlaenius hamifer*

Fig.7: *Cheilomenes sexmaculata*

Fig.8: *Brumoides suturalis*

Fig.9: *Dicladispa armigera*

Fig.10: *Hydrophilus olivaceous*

Fig.11: *Lanelater fuscipes*

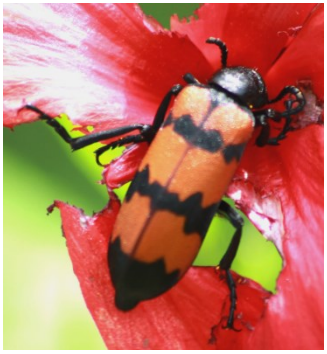

Fig.12: *Mylabris phalerata*

SEVEN TYPICALLY FRUIT AND SAP FEEDING NYMPHALID BUTTERFLIES RECORDED AT FLOWERS IN THE KUMAON HIMALAYA, INDIA

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Reviewer: Piet van der Poel

Introduction

Based on feeding habits, butterflies can broadly be divided into those that visit flowers for nectar and those that do not. Bhuyan *et al*. (2014) recorded two species of typically fruit and sap feeding butterflies, i.e. *Sephisa dichroa* (Kollar, [1844]) and *Charaxes solon* (Fabricius, 1793), visiting flowers of *Prunus cerasoides* D. Don and *Lantana camara* L. respectively in India. This is seen as a major shift in behavior triggered by the lack of wild fruit, sap, dung and carrion during appropriate seasons in the area inhabited by these butterflies. As might be expected, such a shift would not be restricted to one or two species. In the present paper, we report further records of typically fruit and sap feeding butterflies feeding on flower nectar, thus confirming that the previous observations were not isolated events.

Observations were undertaken irregularly from March, 2014 to April, 2019 at the Butterfly Research Centre, Jones Estate, Bhimtal in Uttarakhand, India, mainly on several bushes of *Buddleia asiatica* Lour. growing together to form a spinney. The spinney was planted during the 1970s. Some butterflies were also recorded at flowers of *Ageratina adenophora* (Spreng) R.M. King & H. Rob., an invasive species which is a surprisingly popular plant for insect flower visitors.

Although the forest around the study site is relatively good, having been well protected over the last 70 years, yet forest and over grazing have decimated the herbs, shrubs and bushes that originally covered the area and perhaps offered a variety of options for butterflies. Tree sap usually oozed from wounds made by birds and beetle larvae in healthy trees. Perhaps there are fewer of these and therefore correspondingly fewer points where sap is available for butterflies.

Almost all the butterflies that do not normally visit flowers belong to the Nymphalidae and Lycaenidae. In the present study, we report several Nymphalidae that now often visit flowers. So far, we have not recorded any of the non-nectar feeding Lycaenidae at flowers.

Observations

Buddleia asiatica, which is also known as the Butterfly Bush, is a native plant that flowers from February to April in the Western Himalaya. Although it is a very popular plant with butterflies and moths, seeds do not form, indicating that the insect visits are nectar gathering events that do not lead to the production of fertile seeds. Care was taken to include only those species where it was possible to photograph the butterfly with its proboscis inserted into the flower. The identity of specimens of *Mycalesis mineus* were verified by examining the distinctive brands on their wings. Usually, the species listed below visited the flowers on more occasions

than listed, but only the photographed specimens are treated to reduce the possibility of misidentified species being included in the list.

On 4.iv.2014, a Banded Treebrown (*Lethe confusa* Aurivillius, 1898) was observed feeding on flowers of *Eupatorium adenophora* on three consecutive days, spending up to 20 minutes at each session during the morning hours.

On 4.iv.2014, a Dark Brand Bushbrown (*Mycalesis mineus* (Linnaeus, 1758)) was observed feeding on flowers of *Eupatorium adenophora* for up to 5 minutes at a session.

On 23.ii.2017, a Blue Admiral (*Kaniska canace* (Linnaeus, 1763)) was observed feeding on flowers in the buddleia spinney for over 20 minutes.

On 5.iii.2017, a male Gaudy Baron (*Euthalia lubentina* (Cramer, [1777])) was observed feeding on different sprays of buddleia blossoms for more than 30 minutes.

On 5.iii.2017, a Blue Admiral (*K. canace*) was observed feeding on the same bush for over 15 minutes.

On 16.iii.2017, a Common Evening Brown (*Melanitis leda* (Linnaeus, 1758)) was observed feeding on buddleia for 10 minutes.

On 21.iii.2017, a Dark Evening Brown (*Melanitis phedima* (Cramer, [1780])) was observed feeding on buddleia blossoms for 10 minutes.

On 28.iii.2017, a Banded Treebrown (*L. confusa*) was recorded at buddleia blossoms, where it fed for over 20 minutes.

On 2.iv.2017, a Dark Brand Bushbrown (*Mycalesis mineus*) was recorded at the buddleia blossoms, where it fed for over 20 minutes.

On 14.iii.2019 a Blue Admiral (*K. canace*) spent more than ten minutes on Buddleia flowers.

On 5.iv.2019, a male Siren *Hestina persimilis* (Westwood, [1850]) spent fifteen minutes probing Buddleia flowers.

On 6.iv.2019, a female Siren (*H. persimilis*) spent more than ten minutes on the flowers of Buddleia.

Discussion

Butterflies are attracted to plants whose nectar contains between 10 to 30% sugar, since the viscosity of thicker solutions will reduce the efficiency of the proboscis (Kingsolver, 1985). Butterflies that inhabit shady areas, such as the Morphinae and Satyrinae, tend to obtain their nutrition in the adult stage from tree sap and over ripe fruit, while butterflies with thick thoraxes housing powerful flight muscles, especially the Charaxini and Apaturinae, prefer odorous substances like carrion and animal droppings in addition to overripe fruit and tree sap (de Niceville, 1886, Wynter-Blyth, 1957). However, there are exceptions within the Apaturinae, such as *Hestinalis nama* (Doubleday, 1844), which visits flowers regularly, in addition to tree sap, over ripe fruit and rotting substances (*pers. obs*.). The Nymphalinae are usually sun loving flower feeders, but *Kaniska canace* never visits flowers while *Nymphalis xanthomelas* (Esper, 1781) visits both flowers and tree sap. Agnihotri *et al*. (2020) reported *K. canace* on flowers of *Rhododendron arboreum* in the Kumaon Himalaya. In the Limenitidinae, the *Euthalia* Huebner, [1819] genus usually avoids flowers and feeds on tree sap and fallen fruit. The appearance of *E. lubentina* on buddleia is certainly unusual. Among the Satyrinae, the visits of three genera to flowers is unusual, for *Mycalesis* Huebner, 1818, *Melanitis* Fabricius, 1807 and the white striped *Lethe* Huebner, [1819] species (*L. rohria* (Fabricius, 1787), *L. europa* (Fabricius, 1775), *L. confusa*, *L. isana* (Kollar, [1844]), *L. verma* (Kollar, [1844])) never visit flowers but prefer tree sap and over ripe fruit. The Apaturinae usually do not visit flowers, with the exception of species like *Hestinalis nama*. Bhuyan *et al*. (2014) added *Sephisa dichroa* to this list. The present paper shows both sexes of *H. persimilis* visiting flowers. It is noteworthy

that these butterflies have not been found at flowers at other times of the year. In the western Himalaya, there are no trees or bushes that would produce fruit in February, March and the first half of April (Osmaston, 1927). They might have obtained their nutrition from tree sap in earlier years, but now they appear to have shifted to flower nectar.

Conclusion

The shift of energy sourcing in the adult stage of some Nymphalid butterfly species in the western Himalaya suggests that their traditional sources of energy, vis., tree sap and over ripe fruit, are not available any more in the first quarter of the year. In the present study, the butterflies have been reported on *Buddleia asiatica*, a native plant, and *Eupatorium adenophora*, an exotic plant. Efforts to re-establish forests on degraded lands should take into consideration the requirements of all parts of the native community, so that native plants that supplied nutrients to spring species are discovered and re-introduced.

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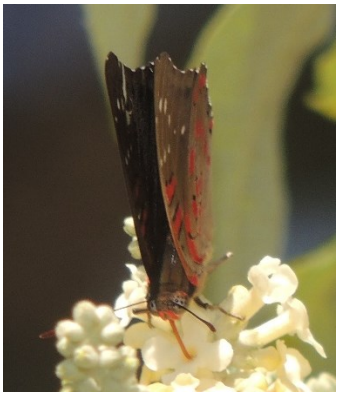

Fig.1: *Euthalia lubentina*

Fig.2. *Kaniska canace*

Fig.3. *Hestina persimilis female*

Fig.4. *Hestina persimilis male*

Fig.5. *Lethe confusa*

Fig.6. *Melanitis leda*

Fig.7. *Melanitis phedima*

Fig.8. *Mycalesis mineus*

MODIFICATIONS TO THE KNOWN EXPANSE OF INDIAN BUTTERFLIES

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Introduction

The only measurement used in the study of Lepidoptera is the wingspan. Although it is a rather simple concept, there are various interpretations of the term. The intention is to obtain an idea of the expanse of the creature. In a few cases, identification becomes easier if one has an idea of the size. However, there is no universal definition of the term, wingspan. Some older authors measured a straight line between the forewing apices of pinned specimens. This, of course, was controversial, since the same butterfly could have different wingspans, depending on the position of its forewings in relation to each other. A more reliable method was followed by Evans (1932). In this, the butterfly is measured from the centre of the thorax to the tip of the forewing apex and the result doubled. Evans (1932) provided wingspans of all butterfly species then known from the Indian subcontinent and the book is still the standard work on the subject.

Piet van der Poel (*pers. comm*.) noted that in his measurement of Colin Smith's butterfly collection at the Natural History Museum, Pokhara, Nepal, the measure between the forewing apices gives a value between 75% and 98% of the measure used by Evans (1932). Some subsequent authors did not follow Evans' (1932) method and interpreted the wingspan to mean the direct distance between the forewing apices of set specimens (Kunte, 2000); others defined it in the following terms, "a straight distance between the two apices of the forewing of a preserved specimen that has the dorsum of the forewings at right angles to the body." (Kehimkar, 2008) again others suggested that the wingspan was obtained by measuring a forewing from the base to the apex and doubling the result (Sondhi et al., 2013). Unfortunately, all these authors proceeded to use Evans' (1932) figures in their species descriptions, thereby creating confusion, since Evans' (1932) figures were obtained by a different measure.

Some recent authors interpreted the wingspan to mean the direct distance between the forewing apices (Kunte, 2000); others defined it more precisely in the following terms, "a straight distance between the two apices of the forewing of a preserved specimen that has the dorsum of the forewings at right angles to the body." (Kehimkar, 2008) or else as the sum resulting from doubling the forewing length (Sondhi, Kunte, *et al*., 2013) while using Evans' (1932) figures. This, naturally, was misleading. If one considers that the centre of the thorax as the apex of an inverted triangle, the distance from the centre of the thorax to the apices of the forewings as the sides of the triangle and the distance between the apices as the base of the triangle, the above authors all define the wingspan as the base of the triangle, while presenting measurements for the two sides.

Material and Methods

Specimens in the private collection of the authors at Jones Estate, Bhimtal, Uttarakhand, India were measured. Two species, *Troides aeacus* and *Delias pasithoe*, were measured in the Wankhar Butterfly Museum, Shillong, Meghalaya. Unfortunately, the specimens examined in the Wankhar Museum do not have data labels, so all that can be assumed is that they were collected somewhere in India. Nevertheless, they add information to the known expanse of the species, regardless of where they were collected. The collection at Jones Estate was started in 1947 by Fred Smetacek Sr. and most of the specimens collected before 1980 can be attributed to him. It comprises not only a reference collection of specimens of Indian moths and butterflies, but dwarf specimens, aberrations and cripples. Specimens were measured and compared with measurements for the species in Evans (1932). If larger or smaller, these specimens are figured here and the new record for the wingspan of the species is given in Table 1.

Discussion

It is not clear which collections were examined by Evans (1932) in order to arrive at the figure presented for each species. We may assume that he examined material in his own collection, as well as those in the Natural History Museum, London. Beyond this, it would be merely speculation, for although Evans is known to have visited various collectors in different parts of India and Europe, whether he measured their specimens or not is not known. The largest Indian butterfly, on the basis of Evans' measurements, is an unknown individual of the Southern Birdwing (*Troides minos* (Cramer, [1779])) which scaled 190 mm. In the present paper, we have a specimen of the Golden Birdwing (*Troides aeacus*) measuring 194 mm, which is therefore the largest butterfly in India and the mantle for the largest species therefore passes from *Troides minos* to *Troides aeacus*. The largest individual of the Common Grass Yellow (*Eurema hecabe*) is also mentioned in the following table. It was recorded in Uttarakhand. The remaining species mentioned in the present paper have new records for the least known size. This size is of interest, since it tells us how small a species can be before metamorphosis is aborted and the larva starves to death. Usually, the smallest sized individuals are in the spring brood, presumably because the larvae did not find enough food during the winter months. However, this has not been experimentally proved. What is known is that when larvae are bred, the resulting adult specimens are often smaller than wild ones. Species like *Papilio bianor* and *P. protenor* are known to have spring broods that are much smaller in size than the summer or post-Monsoon broods. In other cases, such as *Graphium sarpedon* and *G. cloanthus*, a few individuals in the spring brood can be quite small, whereas summer individuals are usually large. In yet other cases, such as *Cyrestis thyodamas* Boisduval, 1846, *Stibochiona nicea* (Gray, 1846), *Sephia dichroa* (Kollar, [1844]), dwarf specimens have never been recorded. A specimen of the Common Yellow Swallowtail (*Papilio machaon* Linnaeus, 1758) is also included in figure 2. It is probably the smallest specimen of the species known, but due to an unfortunate accident, the forewing apices were torn off and the specimen cannot be measured. It is depicted for record's sake.

Acknowledgements

We are grateful to Rosalyna Moore Wankhar for permission to measure and mention specimens of *Triodes aeacus* and *Delias pasithoe* in the collection of Wankhar Memorial Butterfly Museum, Shilong.

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Table 1. Showing the New Record for the Wingspan of the Species

SN	Species	Collection data	Wingspan (mm)	Forewing length (mm)	Evans' (1932) figures (mm)
1	*Troides aeacus* (C. & R. Felder, 1860) Golden Birdwing female	Didihat, Uttarakhand, 1900 m 21.v.2012	194	90	150-170
	Troides aeacus (C. & R. Felder, 1860) Golden Birdwing male	Wankhar Butterfly Museum, Shillong, Meghalaya. No data label.	106	49	150-170
2	*Byasa polyeuctes* (Doubleday, 1842) Common Windmill	Near Gagar, 2100m, Uttarakhand, 2.v.2014	98	46	110-140
3	*Byasa dasarada* (Moore, 1858) Great Windmill	Near Gagar, 2100m, Uttarakhand 29.v.1994	96	45	100-140
4	*Papilio bianor* Cramer, [1777] Common Peacock	Jones Estate, Bhimtal, 1500m Uttarakhand 10.iii.1971	78	37	90-130
5	*Papilio protenor* Cramer, [1775] Spangle	Jones Estate, Bhimtal, 1500m Uttarakhand 17.iii.1974	86	40	100-140
6	*Papilio polytes* Linnaeus, 1758 Common Mormon	Jones Estate, Bhimtal, 1500m Uttarakhand 26.i.1970	52	25	90-100
7	*Papilio clytia* Linnaeus, 1758 Common Mime	Jones Estate, Bhimtal, 1500m Uttarakhand 13.vi.1966	78	37	90-130
8	*Graphium sarpedon* (Linnaeus, 1758) Common Bluebottle	Jones Estate, Bhimtal, 1500m Uttarakhand 20.iii.1982	68	32	80-90
9	*Graphium cloanthus* (Westwood, 1841)Glassy Bluebottle	Jones Estate, Bhimtal, 1500m Uttarakhand 14.iii.1994	64	30	85-95
10	*Catopsilia pomona* (Fabricius, 1775) Common Emigrant	Jones Estate, Bhimtal, 1500m Uttarakhand 5.v.1960	46	21	55-80

11	*Eurema hecabe* (Linnaeus, 1758) Common Grass Yellow	Jones Estate, Bhimtal, 1500m Uttarakhand 8.ix.2017	54	25	40-50
12	*Colias erate* (Esper, 1805) Pale Clouded Yellow	Ranikhet, Uttarakhand, 1500m 16-31.iii.2015	42	19	45-55
13	*Colias nilagiriensis* C. & R. Felder, 1859 Nilgiri Clouded Yellow	Kodaikanal, Tamil Nadu, 2100m 21.iii.1992	40	19	45-50
14	*Pieris canidia* (Linnaeus, 1768) Indian Cabbage White	Jones Estate, Bhimtal, 1500m Uttarakhand 8.iv.2016	42	20	45-60
15	*Pontia daplidice* (Linnaeus, 1758) Bath White	Jones Estate, Bhimtal, 1500m Uttarakhand 10.vi.1990	42	20	45-50
16	*Ixias pyrene* (Linnaeus, 1764) Yellow Orange Tip	North eastern India, no data label.	44	21	50-70
17	*Appias lyncida* (Cramer, [1777])	North eastern India, no data label.	52	25	55-70
18	*Delias eucharis* (Drury, 1773) Common Jezabel	Jones Estate, Bhimtal, 1500m Uttarakhand 27.iii.1981	58	28	70-80
19	*Delias belladonna* (Fabricius, 1793) Hill Jezabel	Jones Estate, Bhimtal, 1500m Uttarakhand 2.iv.1982	66	32	70-85
20	*Delias pasithoe* (Linnaeus, 1767) Redbase Jezabel	Wankhar Butterfly Museum, Shillong, Meghalaya. No data label.	46	21	70-85
21	*Pareronia hippia* (Fabricius, 1787) Common Wanderer	Jones Estate, Bhimtal, 1500m Uttarakhand 20.xi.2014	56	26	65-80
22	*Danaus chrysippus* (Linnaeus, 1758) Plain Tiger	Jones Estate, Bhimtal, 1500m Uttarakhand 20.v.2010	54	25	70-80
23	*Parantica melaneus* (Cramer, [1775]) Chocolate Tiger	North Eastern India, no data label.	72	35	85-95
24	*Athyma opalina* (Kollar, [1844]) Himalayan Sergeant	Jones Estate, Bhimtal, 1500m Uttarakhand 21.iii.1994	46	21	60-70
25	*Neopithecops zalmora* (Butler, [1870]) Quaker	Rudrapur, Uttarakhand, 400m, 1.iii.1994	18	8	20-30

Fig.1: *Triodes aeacus*

Fig.2: *Byasa polyeuctes*

Fig.3: *Byasa dasarada*

Fig.4: *Papilio bianor*

Fig.5: *Papilio protenor*

Fig.6: *Papilio polytes*

Fig.7: *Papilio clytia*

Fig.8: *Graphium sarpedon*

Fig.9: *Grahium cloanthus*

Fig.10: *Papilio machaon*

Fig.11: *Catopsilia pomona*

Fig.12: *Eurema hecabe*

Fig.13: *Colias erate*

Fig.14: *Pieris canidia*

Fig.15: *Colias nilagirensis*

Fig.16. *Appias lyncida*

Fig.17: *Ixias pyrene*

Fig.18: *Pontia daplidice*

Fig.19: *Delias eucaris*

Fig.20: *Danaus chrysippus*

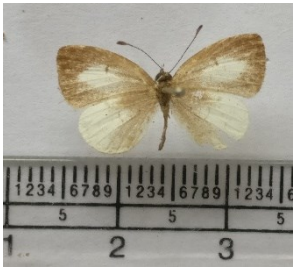

Fig.21: *Neopithecops zalmora*

Fig.22: *Pareronia hippia*

Fig.23: *Athyma opalina*

Fig.24: *Parantica melaneus*

FIRST RECORD OF BANDED ROYAL BUTTERFLY *RACHANA JALINDRA* (INSECTA: LEPIDOPTERA: LYCAENIDAE) FROM JHARKHAND, INDIA

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Introduction

The Banded Royal *Rachana jalindra* (Horsfield, 1829) (Lycaenidae) is a butterfly that is not often encountered. On the Indian subcontinent, it has so far been reported from the Western Ghats, Maharashtra, Odisha, Sikkim, Arunachal, the North Eastern states and West Bengal in India, as well as from Bangladesh, Nepal, Bhutan and Myanmar (Kehimkar, 2016). Within India, there are three subspecies, *R. j. tarpina* (Hewitson, 1878) from the Andaman Is.; *R. jalindra indra* (Moore, [1884]) from Odisha; Sikkim to N. E. India and *R. j. macanita* Fruhstorfer, 1912 from Goa to Kerala (Varshney & Smetacek, 2015). On the underside, *R. j. indra* is distinguished from *R. j. macanita* by the discal band being chocolate in *indra* rather than dark brown as in *macanita* (= *macarita* in err.); hindwing tornal green scales more prominent and the white diffused areas beyond discal band more extensive in *indra* (Evans, 1932).

Observation

An individual of *R. jalindra* was observed on 29.i.2019 feeding on marigold (*Tagetes*) flowers in the Biodiversity Park, Ranchi, Jharkhand (23.2547 N, 85. 3469 E). The Biodiversity Park is a part of natural sal (*Shorea robusta*) forest native to the area on the outskirts of Ranchi city. The butterfly fed on the flowers for a few minutes while it was being photographed.On subsequent days, it was not observed in the area.

Discussion

The butterfly photographed was indisputably identified as belonging to *R. jalindra* despite only underside views being available. In addition, on the basis of its extensive white diffused area beyond the discal line, it can be placed in the subspecies *indra*, which is known from neighbouring Odisha (Varshney & Smetacek, 2015). This is the first record of this species from Jharkhand. It is not a common species throughout its distribution, so it is not surprising that it escaped observation earlier. The species feeds in the larval stage on *Helicanthes elasticus* (*Loranthus elasticus*) (Sevastopulo, 1973), which is plentiful in the area. Like other members of the group, the species is never found in numbers (P. Smetacek, *pers. comm*.).

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Fig.1: *Rachana jalindra*

TWO NEW LYCANIDAE SPECIES FOR BHUTAN: *BOTHRINIA CHENNELLII* (DE NICÉVILLE, [1884]) AND *UNA USTA* DISTANT, 1886

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Abstract
Two unusual *Lycanidae* species were photographed in 2016 in the Lingmethang area of Mongar Dzongkhag in Bhutan. They were observed during weekly butterfly surveys from late May to early September 2016. Among the almost 200 species recorded were the following two that have not been reported for Bhutan before.

Introduction

Bothrinia chennellii (de Nicéville, [1884]), Hedge Cupid has two subspecies, *B. c. chennelli* and *B. c. celastroides* Shirôzu & Saigusa, 1962. Evans (1932) reports it from Assam to the Karens. Website Butterflies in Indo-China by Yutaka Inayoshi gives locations in north Thailand and north Laos for *B. c. celastroides*. The subspecies in Bhutan and India is *B. c. chennelli*. The type locality for the species is Shillong in Megalaya, India. Varshney & Smetacek (2015) list it for Assam. It differs from similar Hedge Blues (*Celastrina* Tutt, 1906) by the Underside Forewing discal spots in spaces 1b-5 being in line and the spot in space 6 only slightly shifted in, the Underside Hindwing discal spots in spaces 1b-1c-2 being almost in line, and not having any androconia (Evans, 1932).

Observations

On 20 May 2016 and 3 June 2016 between 10:00 and 14:00 hours, some 5 individuals were observed in 3 different locations near Lingmethang in Saleng Gewog, Mongar Dzongkhag, Bhutan. Some were on the sandy river bank near the confluence of the Lingmethang and Kuri Rivers at about 560 m elevation. Others were found on wet sand a bit upstream at 610 m elevation in the Mountain Hazelnut Project area near Lingmethang town. The latter area is forested and includes the hazelnut nursery as well as some buildings of the project. The confluence area consists of stones and sand deposits of the Lingmethang River, which are covered with shrubs and a few small trees. Most *Bothrinia* Chapman, 1909 were mudpuddling with other blues including *Leptotes plinius* (Fabricius, 1793) (Zebra Blue), *Prosotas nora* (Felder, 1860) (Common Lineblue), *Megisba malaya* (Horsfield, [1828]) (Malayan) and Hedge Blues. The species was listed in a report on the butterfly species of Lingmethang (Van der Poel, 2016), but the identification was only recently confirmed by Motoki Saito. The figures show one male and one female.

Una usta Distant, 1886, Una (also known as Singleton), has three subspecies: *usta* Distant, 1886, *unipunctata* Toxopeus, 1932 from Java and *philippensis* Schroder & Treadaway, 1986 from the Philippines. The type locality for *Una usta* is the Malay Peninsula, Malaysia. Evans (1932) reports it from Assam to S. Burma. Varshney & Smetacek (2015) list it from Assam. The underside is pale ochreous brown with a small double spot in the Underside Forewing cell and no spot in the Underside Hindwing cell and the two costal spots of the Underside Hindwing being more prominent than the other spots (Evans, 1932). The latter is not quite the case for my individual.

On 12 August 2016, one single *Una usta usta* was observed mudpuddling together with *Prosotas nora* (Common Lineblue) and Hedge Blues, on the muddy roadside near a bridge in Masangdaza, Saleng Gewog, Mongar Dzongkhag, at 860 m elevation. The location is in a valley with broadleaved forest, upstream from the monastery, houses and agricultural fields of Masangdaza village. Several kilometers downstream, the creek joins the Lingmethang river just west of Lingmethang town.

The reported observations extends the known range of *Bothrinia chenelli* further west and north into the foothills of the Himalaya.

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Fig.1: *Bothrinia chennellii* female

Fig.2: *Bothrinia chennellii male*

Fig.3: *Una usta*

THE ELUSIVE PRINCE *ROHANA TONKINIANA* IN ARUNACHAL PRADESH: AN ADDITION TO THE BUTTERFLY FAUNA OF INDIA

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Reviewer: Motoki Saito

The genus *Rohana* Moore, [1880] is represented in India by two species. These are *R. parisatis* (Westwood, 1850) and *R. parvata* (Moore, 1857). Both occur sympatrically in the eastern Himalaya while *R. parisatis* is also found in Southern India (Varshney & Smetacek, 2015). Males of *R. parisatis* were considered singular on the Indian subcontinent for being entirely black on the upper side. On a visit to Bhutan in September, 2019, AG and SD observed and photographed several *R. parisatis* males. Among these, there appeared to be a second species, *Rohana tonkiniana* Fruhstorfer, 1906, distinguished in the field on the basis of its somewhat larger size. Besides size, the shape of the forewing margin is relatively straight in males of *R. tonkiniana* compared to males of *R. parisatis*. In addition, the inner margin of the hindwing is pale in males of *R. tonkiniana* and dark in males of *R. parisatis*. It was photographed on 22.ix.2019 at Tingtibi (Zhemgang district) (400 m). A series of *Rohana* males were collected at Miao, Arunachal Pradesh, India in October, 2019. These were sent to the Butterfly Research Centre, Bhimtal, Uttarakhand for identification. The specimens were dissected and genitalia examined. The genitalia was compared with illustrations in Jiang *et al*. (2019). A single specimen of *R. tonkiniana* was discovered, confirming its presence in the eastern Himalaya.

Specimen examined: 1 ex.: Forewing length 19mm: expanse 42 mm. Miao, Changlang district. Arunchal Pradesh, India (27.4923 North 96. 2268 East: Elevation: 250 metres). 25 x. 2019. *Leg*. M. Pertin. *Det*. P. Smetacek. *Coll*. Butterfly Research Centre, Bhimtal. The type locality of *R. tonkiniana* is Than – Moi, Tonkin, North Vietnam. The subspecies *R. t. siamensis* (Fruhstohfer 1913) was described from Hinlap (Siam), [Thailand] Jiang *et al*. (2019) reported the subspecies from several locations in Yunnan, China. Their specimens were collected in May, August and November, suggesting the species has three annual generations in the area. The specimen reported in the present paper was collected in October. If we treat the specimen photographed by AG in Bhutan as *R. tonkiniana*, then the species

was photographed in September. Due to the remarkably similar facies of *R. parisatis* and *R. tonkiniana*, the present report only confirms the presence of *R. tonkiniana* in Arunachal Pradesh, India and suggests that the species probably also occurs in Bhutan on the basis of photographs of free ranging individuals. However, confirmation of the latter would require confirmation by dissection of male genitalia of specimens from that country.

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Fig.1: *Rohana parisatis* male, Meghalaya

Fig.2: *Rohana tonkiniana* male, Miao, Arunachal Pradesh

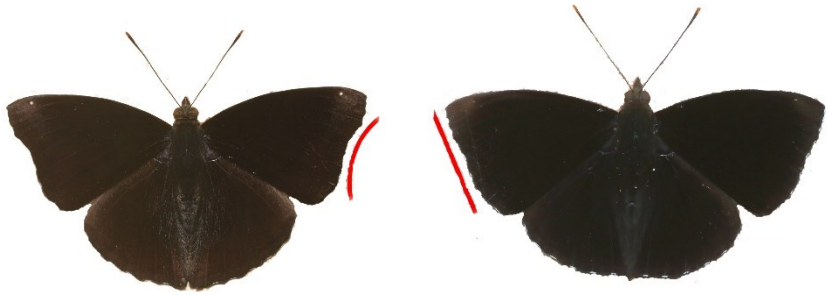

Fig.3: Left *Rohana parisatis* and Right *Rohana tonkiana*

INDIVIDUAL ABERRATIONS OF THE COMMON BLUEBOTTLE BUTTERFLY *GRAPHIUM SARPEDON SARPEDON* (INSECTA: LEPIDOPTERA: PAPILIONIDAE) IN INDIA

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Reviewer: Zdenek F. Fric

Introduction

Graphium sarpedon (Linnaeus, 1758) is a widespread butterfly, that occurs from Pakistan, along the southern face of the Himalaya to China and Japan, southwards through Thailand and Malaysia to the Philippines and parts of Indonesia (Page & Treadaway, 2013). The facies vary seasonally and geographically and there are several described subspecies along its range. On the Indian subcontinent, the subspecies *G. s. sarpedon* occurs from northern Pakistan, along the Himalaya to N.E. India. Page & Treadaway (2013) proposed a new subspecies, *G. s. sircari*, with a distribution from Meghalaya and Assam in India to Yunnan in China and northern Myanmar, but Tschikolovets & Pages (2016) treated the Himalayan subspecies as *G. s. sarpedon*, apparently ignoring Page & Treadaway (2013). In addition, Page & Treadaway (2013) described a new subspecies of *Graphium adonarensis* (Rothschild, 1896), namely, *G. a. septentrionicolus* Page & Treadaway, 2013 from the Khasi Hills of Meghalaya. Rosseau-Decelle (1947) described two individual forms or aberrations of *G. sarpedon* from India, namely *cellamaculosa* and *punctata* from the Khasi hills (Meghalaya) and Magok, northern West Bengal respectively, based on a single specimen each in his collection. The form *cellamaculosa* is distinguished by having a small pale blue spot on both surfaces of the wing at the lower angle of the forewing cell, while *punctata* bears, in addition to the cell spot characteristic of *cellamaculosa*, a small pale line in space 8 on both surfaces of the forewing. Recently, the form *cellamaculosa* has been recorded from the Bhimtal valley in Uttarakhand, India. In addition, a form similar to *punctata* but with a much larger cell spot has also been recorded from Assam and Uttarakhand. This is treated under *punctata* in this report. A third, intermediate, form has also been recorded, as described below. The question arose, that since *G. adonarensis septentrionicolus* and *G. sarpedon* f. *cellamaculosa* are both so far only known from the Khasi hills, the possibility that *cellamaculosa* is a form of *G. adonariensis* rather than of *G. sarpedon* cannot be ruled out. To confirm this, two male specimens of both named forms described below were dissected and compared with genitalia of *sarpedon* and *adonarensis* illustrated by Page & Treadaway (2013). Both specimens matched *sarpedon* and not *adonarensis*, confirming that the aberrations described by Rosseau-Decelle

(1947) are correctly placed under *sarpedon*, assuming that *adonarensis* does not have identical aberrations. Although butterflies have been monitored continuously at what is now the Butterfly Research Centre in the Bhimtal valley for around 70 years, the aberrant forms are not among the older material present in the collection. The aberrations only came to notice during the last eight years. They are all from the spring brood, although the butterfly is on the wing from March to October, according to the personal records of PS. This might be because the spring brood is attracted in numbers to buddleia flowers, whereas the summer and autumn broods are found at thistles (*Cirsium* sp.) and occasionally on other flowers, but rarely in numbers. Males gather at wet mud, but, so far, only one individual of *cellamaculosa* has been observed mudpuddling. This is the record from Assam in the present paper. The current records suggest that these aberrations occurs throughout the Indian distribution of the species, from the western Himalaya to N.E. India, which is the type locality for both forms described by Rosseau-Decelle (1947).

Material Examined

G. sarpedon sarpedon forma indiv. *cellamaculosa*: 2 exs.: 21.iii. 2012 male; 1.iv.2017 male. Both from Butterfly Research Centre, Bhimtal, Uttarakhand, India. Coll. Butterfly Research Centre, Bhimtal, Uttarakhand, India. *G sarpedon sarpedon* forma indiv. *punctata*: 2 exs.: 24.ii.2016, Gangmouthan village, Biswanath district, Assam, Coll. Parixit Kafley, Gangmouthan, Assam; 9. iii.2016, male, Butterfly Research Centre, Bhimtal, Uttarakhand, India, Coll. Butterfly Research Centre, Bhimtal, Uttarakhand, India. A third undescribed form occurs at the Butterfly Research Centre, Bhimtal. This is described below.

This form bears a small pale spot on both surfaces of the forewing in space 8, in the same location as the spot that distinguishes *punctata* from *cellamaculosa*. It differs from both *punctata* and *cellamaculosa* in lacking the pale blue spot at the lower angle of the forewing cell.

The new form confirms that the two extra spots that distinguish all three forms from typical *sarpedon* are independent of each other, so that *cellamaculosa* bears the spot in the forewing cell, the new form bears the spot in space 8 on the forewing, while *punctata* combines both features and has a spot in the forewing cell as well as in space 8 of the forewing.

The size of the spots is variable, ranging from a thin line in the specimen from 21. Iii. 2012 (top right in the plate), to a rather larger cell-spot (1.iv.2017) (right middle in the plate) to a large, prominent cell spot in both specimens of *punctata* (9. Iii.2016) and 24.ii.2016) examined in this study, although Rosseau-Decelle (1947) noted that the spots in both his type specimen are small, *punctata* bearing only a pale line in space 8.

It is interesting that the closely related taxon *Graphium isander isander* (Godman & Salvin, 1888) also bears the pale spot in space 8 of the forewing.

Acknowledgment

We are highly obliged to Yutaka Inayoshi and Adam M. Cotton for guidance and literature.

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Fig.1: Top right: *G. sarpedon* forma *cellamaculosa* 21.iii.2012; centre right: *G. sarpedon* forma *cellamaculosa* 1.iv.2017; bottom right: *G. sarpedon* forma *punctata* 9.iii.2016; bottom left: *G. sarpedon* typical wet season form female 17.ix.2016; centre left: *G. sarpedon* undescribed form 19.iii.2019; top left *G. sarpedon* undescribed form 26.iii.2019.

Fig.2: *Graphium sarpedon* f. *punctata,*
Gangmouthan, Assam

TWO INDIAN BILATERAL GYNANDROMORPH BUTTERFLY SPECIMENS

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Reviewer: Peter Smetacek

Although bilateral gynandromorphs have been reported in almost all families of butterflies, no examples have so far been reported from India. Evans (1932) mentions that, "Gynandromorphs, i.e. butterflies partly male and partly female, are very rarely to be found." No further mention of this phenomenon is made nor are any Indian examples noted. The present report is based on two specimens in the collection of the Wankhar Memorial Museum of Entomology at the above address. Both specimens are without labels and therefore it is not possible to know where or when they were recorded. One indisputable bilateral gynandromorph is a specimen of the Yellow Orange Tip *Ixias pyrene* (Linnaeus, 1764). The left pair of wings are of a male and the right side of a female. It is likely that the specimen was collected in north eastern India, since peninsular Indian females of this species are not as dark on the forewing as the north eastern ones (Peter Smetacek, *pers. comm*.). The male forewing measures 33 mm and the female forewing measures 32 mm. A second indisputable bilateral gynandromorph is a specimen of the Colour Sergeant *Athyma nefte inara* (Westwood, 1850). In this specimen, the right pair of wings is of a male and the left side is of a female. The female wings are rather larger than the male, as is normal in the species, except that in this case the result is that the butterfly is not symmetrical, with the left forewing measuring 38 mm and the right forewing measuring 33 mm. These two specimens appear to be the first gynandromorph butterflies reported from India, although the phenomenon is not unknown in other parts of the world. Indeed, the phenomenon would go unnoticed in those species that do not exhibit sexual dimorphism.

Reference

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Fig.1: *Ixias pyrene*

Fig.2: *Athyma nefte inara*

LESTES PATRICIA TAAMRPATTI SSP. NOVA (INSECTA: ODONATA: LESTIDAE) FROM MAHARASHTRA, INDIA

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Key words: Odonata; Zygoptera; *Lestidae*; damselfly; new subspecies; Western Ghats

Introduction

Lestes Leach, 1815, consists of 8 known species in the Western Ghats of India. *Lestes patricia* Fraser, 1924 is endemic to the Western Ghats and so far known only from Virajpet, Coorg (Virrajendrapet, Kodagu, Karnataka). A single male specimen of *L. patricia* was collected on 24.vi.1923 and described the following year. The female is still unknown and no further male specimens were ever collected. It is immediately distinguished from other members of the genus by the broad black dorsal band on the synthorax. Kosterin (2019) amended the keys for *Lestes* comparing pterostigma, markings on synthorax, colour of the occiput and structure of the anal appendages.

Urmodi dam on the Urmodi River, which is a small tributary of the Krishna is in Satara District of Maharashtra, is situated in the foothills of the northern Western Ghats. The vegetation in the area is Western subtropical hill forest.

Observations

During the course of a photographic survey of insects by the authors at the above location, a colony of damselflies were observed in a grassy patch above a fallow field bordered with dense forest. The grassy patch was a few meters away from a small stream with a rocky bed. The colony was provisionally identified as *L. patricia* on the basis of the photographs. Further investigations were carried out by the authors in the same locality over the next few days. [Image 1]. Individuals were hanging vertically on dry sticks about 1 metre above the ground in sunlit patches [image 2, 3]. Mating pairs were observed on grass blades close to the ground [image 4]. No individuals were observed outside a radius of 200 meters of the grassy patch.

Discussion

The members of the colony discovered in Satara closely match the single known male of *L. patricia*. However, there are stable differences between the material examined in the present study and the description of *L. patricia*. The likelihood that the newly discovered population is, in fact, a distinct species cannot be ruled out, but cannot be confirmed until further, fresh specimens of *L. patricia* are made available from the type-locality in Kodagu. Since the stable features observed in the newly discovered population preclude it from being indisputably placed under *L. patricia*, yet given the lack of comparative material it is not possible to place it as a new species with certainty, so the newly discovered population from Maharashtra is tentatively placed as a subspecies of *L. patricia*, pending a comparison with fresh specimens of *L. patricia* from the type

locality. While it is normally inappropriate to propose a new taxon when there is little comparative material, but given the importance of this discovery, it is of conservation value to give a name to this newly discovered population. It cannot be treated under the nominotypical form, because the differences described below are consistent throughout the material examined, as well as in individuals photographed on the first day, which might be different individuals from the material collected. Given that of the eleven specimens known of *L. patricia*, ten specimens from Maharashtra are nearly identical to each other in all points that distinguish the ten from the single specimen known from Kodagu, and the fact that the Kodagu specimen and the Maharashtra specimens were collected within a week of each other nearly a century apart, any differences between the Kodagu and Maharashtra specimens cannot be attributed to seasonal morphs. The specimen described as *L. patrica* by Fraser was less than a year old at the time of it's description and therefore unlikely to have esperienced much colour change due to the passage of time. In the following account, we refrain from noting the exact location of the colony to help protect the colony from potential exploitation. Authorities will be alerted to the presence of this highly local taxon and appropriate measures put in place to ensure the conservation of the colony.

Lestes patricia taamrpatti **ssp. nova**

Material Examined

6 males, 4 females.18.vi.2020. 750 m. Backwaters of Urmodi Dam, Satara district, Maharashtra, India. Collectors: Shriram Dinkar Bhakare, Sunil Hanmant Bhoite and Pratima Ashok Pawar.

Depository: Holotype: male: BNHS 306. Reference collection of the Bombay Natural History Society (BNHS), Fort, Mumbai. Paratypes: 1 male BNHS 307; 2 females BNHS 308; BNHS 309. Reference collection of the Bombay Natural History Society (BNHS), Fort, Mumbai. Remainder will be deposited in other recognized type depositories in India.

Description

Holotype: male: abdomen: 35 mm; hindwing: 23 mm

Head: [image 5] Eyes bright blue above and pale blue beneath. Vertex, occiput, postclypeus and frons black. Anteclypeus black with some bright blue patches. Labrum bright blue. Antennae black with two blue bands at the base and upper half reddish.

Prothorax: [Image 6] bluish on the sides, matt black above.

Synthorax: [images 6, 7, 8] Bluish green above and on sides. A distinctive middorsal coppery red brown uniform band bordered with black, extending on each side to about half way to the humeral suture. Humeral stripe darker near prothorax. A dark spot at mesepimeron-metepisternum junction. Ventrum pale greenish with large white areas and 2 pairs of black spots.

Legs: Pale brown and outwardly bluish. Spines on femora short and tibiae long. 11 black spines on femora of hindlegs.

Wings: [image 9, 10] hyaline. Discoidal cells equal on both wings. Pterostigma reddish brown in life, nearly 4 times as long as broad. 10 postnodal crossveins on forewings, 9 on the hindwing. 2 antenodals. Anal Crossing (Ac) midway between the antenodals.

Abdomen: [images 11, 12, 13] Segments 1 to 7 bluish green with a broad black dorsal stripe. Single prominent elongate black mark on the lower lateral aspect of segment one. Single black dot on lateral aspect of segment two above secondary genitalia. A brown patch at the lower end of segments 3,4,5,6 laterally. Lower 25% of segment 7 and entire segment 8 black. Segment 9 white with triangular central black area on dorsal and ventral aspect.

Segment 10 ventrally black, laterally and dorsally white.

Anal appendages: [images 14, 15, 16] Black with powdery white mottling dorsally. Cerci in lateral view longer than broad and deeply bifid. Inner dilatation of cerci has a robust tooth at base. Apical ends turned in at nearly a right angle, with some small obscure spines on the outer border. Apices black, naked and rounded. Paraprocts short, broad. Paraprocts not extending to the end of expanded part of cerci.

Paratypes

Males: 5 exs.: same data as holotype.

Abdomen: 34-36 mm; hindwing: 22-24 mm.

Variation from holotype: the white suffusion on segment 10 of the abdomen is variable. Individuals have 9 to 12 postnodal crossveins on forewings, and a similar variation in postnodal crossveins on the hindwings. The brown patch at the lower end of segments 3,4,5,6 laterally is variable in size.

Females: Abdomen: 31-34 mm Hindwing: 22-24 mm

Head: [Image 17] Eyes upper half greenish blue with lower half much paler. Occiput, vertex and frons reddish brown. Postclypeus, anteclypeus and labrum pale greenish blue.

Prothorax: pale yellow on the sides, reddish brown above.

Synthorax: [Images 18, 19, 20] pale yellow above and on sides. A distinctive middorsal coppery red-brown uniform band bordered with black, extending on each side to about half way to the black humeral suture. Ventrum pale yellow with white areas and dark brown spots.

Legs bluish outwardly, dark brown on flexor and extensor surfaces. Spines on femora short, on tibia long [14 spines on hindleg femora].

Wings: [images 21, 22] Hyaline. Pterostigma dark brown, nearly four times as long as broad; 10-12 postnodal crossveins on forewing, 10-12 on the hindwing. Discoidal cells of both wings equal, Anal Crossing (Ac) midway between the antenodals.

Abdomen: [images 23, 24, 25] bluish green. All segments with a broad dorsal dark brown stripe. Segment 7 distal end dark brown. Segment 8 dark brown with small greenish white ventral spot. Segment 9 dark brown with dorsal pale white patch on lower half. Segment 10 white. Stylus outer surface pale brown. Inner surface dark black. Ovipositor and basal plate brown. Ovipositor reaching as far as anal appendages.

Anal appendages: [images 26, 27] Cerci pale grey, deeply bifid with both arms bluntly protruding to about the same length. Cerci protruding beyond paraprocts. Paraprocts short, dark brown.

Etymology: Taamrpatti (Taamr = copper; band = patti) refers to the distinctive middorsal coppery red-brown band on synthorax of both sexes.

Comparison with other *Lestes* species

The differences observed in all the male individuals of *Lestes* examined in the present study versus the original description of *L. patrica* by Fraser (1924) as well as the revised key of *Lestes* by Kosterin (2019) are as follows - Frons black (azure blue *vide* Fraser (1924)). A distinctive middorsal coppery red-brown uniform band bordered with black (matt black stripe *vide* Fraser (1924)). Both wings postnodal crossvein count is variable (Forewing 14, Hindwing 10 *vide* Fraser (1924)). Variable brown patch at the lower end of abdominal segments 3,4,5,6 laterally (not mentioned by Fraser (1924)). Abdominal segment 9 is white with triangular central black area on dorsal and ventral aspect. Segment 10 black ventrally but white on the dorsum and lateral aspect (segments 8 to 10 entirely black, segments 9 and 10 pruinosed white on the dorsum *vide* Fraser (1924)). Paraprocts very short, not extending to the end

of expanded part of cerci (extending nearly to the end of expanded part *vide* Fraser (1924)).

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Fig.1: Habitat of *Lestes patricia taamrpatti*

Fig.2: Male of *Lestes patricia taamrpatti* in habitat

Fig.3: Female of *Lestes patricia taamrpatti* in habitat

Fig.4: Mating

Fig.5: Male Head

Fig.6: Male Prothorax & Synthorax dorsal view

Fig.7: Male Synthorax lateral view

Fig.8: Male Synthorax ventral view

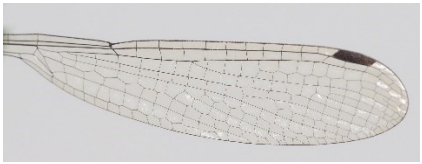

Fig.9: Male Forewing

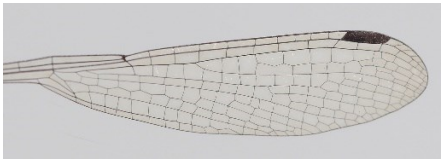

Fig.10: Male Hindwing

Fig.11: Male Abdomen dorsal view

Fig.12: Male Abdomen lateral view

Fig.13: Male Abdomen ventral view

Fig.14: Male Appendage ventral view

Fig.15: Male Appendage lateral view

Fig.16: Male Appendage dorsal view

Fig.17: Female Head

Fig.18: Female Synthorax dorsal view

Fig.19: Female Synthorax lateral view

Fig.20: Female Synthorax ventral view

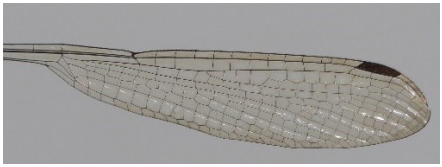

Fig.21: Female forewing

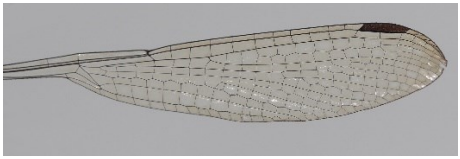

Fig.22: Female hindwing

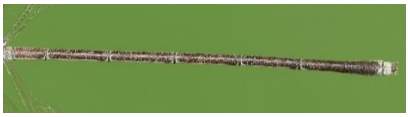

Fig.23: Female abdomen dorsal view

Fig.24: Female abdomen lateral view

Fig.25: Female abdomen ventral view

Fig.26: Female appendages lateral view

Fig.27: Female appendages

DISTRIBUTIONAL RANGE EXTENSION OF THE MOTHS *SOMATINA ROSACEA* (SWINHOE), *PTEROGONIA AURIGUTTA* (WALKER) AND *CARRIOLA FENESTRATA* (HAMPSON) (INSECTA: LEPIDOPTERA) TO THE EASTERN GHATS OF ODISHA

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Reviewer: Peter Smetacek

Introduction

Field surveys for moths in Mayurbhanj district of Odisha during February, 2020 recorded three moth species belonging to the Nolidae, Erebidae and Geometridae tht were previously unknown from eastern India. They were attracted to the light of a mercury vapour lamp reflected off a white screen. The lamp was kept lit from dusk till midnight. The survey was carried out at low elevation in an overgrown field of the village with teak plantation and mixed deciduous forest in the vicinity.

Material examined

Somatina rosacea (Swinhoe, 1894) (Geometridae: Sterrhinae) 2 ♂♂: 19.ii.2020, Village Upara Taldiha (133 m), Mayurbhanj district, Odisha (21˚40'28"N; 86˚28'41"E). *Leg. et Coll.* Sandeep Mishra, Biodiversity Education and Research Centre, Bhubaneswar, Odisha.

The species was first described from the Khasis (present day East and West Khasi Hills districts of the Indian state Meghalaya) with Cherra Punji (Sohra) as type locality. Apart from the type locality, this species has been reported from Taiwan (Prout, 1914), Western Ghats of Kerala (Devikulam, Ponmudi and Pandimotta) and Karnataka (Madikeri) in India (Kirti *et al*., 2012; Sondhi *et al*., 2018). Two individuals of *Somatina* Guenee, 1857 were collected during the survey. The specimens were identified as *S. rosacea* based on the descriptions by Swinhoe (1893) and Hampson (1895). *Pterogonia aurigutta* (Walker, 1858) (Nolidae: Cloephorinae); 1♂: 21.ii.2020, locality data as for *S. rosacea*.

Pterogonia aurigutta was originally described as *Thalatta aurigutta* by Walker (1858) from Singapore. A dimorphic species, the female was described as a separate species *Pterogonia striatura* Moore, 1887 (Yoshimoto, 1994). Later it was synonymised with *P. aurigutta* by Kobes (1997). Thus far the species has been recorded from Sundaland, Thailand and Sri Lanka besides the type locality (Holloway, 2003). In India, this moth is known from the Andaman Islands and Khasi hills, Indian state of Meghalaya. A male specimen of *P. aurigutta* was collected during this survey. Identification of the species was

done based on the description given by Walker (1858). *Carriola fenestrata* (Hampson, 1893) (Erebidae: Lymantriinae); 2♂♂: 24.ii.2020, locality data as for *S. rosacea*.

This moth was first described as *Leucoma fenestrata* by Hampson (1892) from Sri Lanka. The current combination was proposed by Swinhoe (1922). During the survey, two male specimens of *C. fenestrata* were collected. This species was previously known from N.E. India, Sri Lanka and by Gupta (1992) from Nagarhole, Karnataka. The present report is the first record of this species from eastern India.

All the collected specimens were identified, labelled and deposited in the repository of Biodiversity Education and Research Centre, Bhubaneswar, Odisha. The survey area is a biodiversity rich zone in the northern end of Eastern Ghats adjacent to the east coast of India. The present report affirms the extension of distributional range of these three species which were previously known only from N.E. India and, in the case of *S. rosacea*, the Western Ghats.

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Fig.1: *Somatina rosacea*

Fig.2: *Pterogonia aurigutta*

Fig.3: *Carriola fenestrata*

A PLAIN TIGER BUTTERFLY *DANAUS CHRYSIPPUS* (INSECTA: NYMPHALIDAE) WITH DYSFUNCTIONAL PROBOSCIS IN CAPTIVITY

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Abstract

A male of the Plain Tiger butterfly *Danaus chrysippus* (Linnaeus, 1758) (Lepidoptera: Nymphalidae) emerged from its pupa in captivity with its proboscis separated. Unlike other individuals, the separate halves of the proboscis were not appropriately assembled during its lifetime. The specimen survived for 10 days under controlled conditions. During these 10 days it was observed to be probing in an attempt to feed with both the separated halves of the disjointed proboscis on sugar solution.

Introduction

Adults of the Order Lepidoptera eclose with the two halves of the proboscis separated. These are appropriately assembled together soon after eclosion. There are observations on butterflies where the proboscis, which was split long after eclosion, was appropriately connected by the specimen independently (Pometto, 2014). However, in the specimen in question, reared by S. K. at his home at the above address, it was observed that not only did the two parts of the proboscis not join together, but the specimen tried using both the parts independently to feed on the offered sugar solution. Lehnert *et al*. (2014) noted that butterflies with previously split proboscides can retain the ability to feed. In the same study, they also observed that butterflies might be able to partly reassemble their proboscis when split. In the specimen under observation, the proboscis was never assembled during its lifetime.

Method

In a batch of *D. chrysippus* larvae being bred, one specimen eclosed with a damaged/weak left forewing and a split proboscis. Despite normal efforts by the butterfly, it was not able to appropriately assemble the proboscis. This butterfly was kept under observation by S. K. for 10 days until it died a natural death. The observations are tabulated in table 1. The specimen was kept in a large cage with diagonally placed twigs to enable it to walk about and hang from at night.

Remarks

When attempting to feed, the butterfly would excitedly probe the sugar solution with the tip of half a proboscis. Apparently, it was unable to ingest any of the sugar, since on day 4 it collapsed during the night and weakened from then until its death on day 10. Given that *D. chrysippus* is a migratory insect, the active adult life of a healthy individual can be expected to be for several weeks at least. The observation in the table suggest that the male of *D. chrysippus* contains enough energy in the form of body fat carried over from the larval stage to fuel it actively for at least three days and thereafter, it can survive for seven days. Given that the butterfly observed was relatively inactive and therefore used less energy, it is likely that in an open environment, a healthy individual would feel the need to ingest food energy from an external source by

the third day after eclosion. Failing this, it would weaken until it died. It was also noted that the wings appeared to grow duller as the condition of the butterfly deteriorated. However, since this was not expected, the observation is subjective. This observation suggests that having a source of food available is important for adult butterflies to live longer and thrive.

Results

On all days the butterfly was found feeding on the sugar solution on the ear bud, by using both parts of the proboscis separately.

Discussion

Since we have not done a dye test to establish feeding, we are not able to conclude about the actual feeding. However by observation, the butterfly did all the actions for feeding using either parts of its proboscis. The total life of the butterfly specimen was 10 days. It was informed by Mr Peter Smetacek (*pers comm*.) that the life span without food for a nymphalid is also around 10 days.

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Table 1: Observation Summary

Date	Day	Observations				
2020/06/		General	Wings	Proboscis	Remarks	Notes if any
01	1	Lethargic	Fresh and bright ground colour. Left forewing not fully expanded.	Separated	Not very active but attempted to feed.	Offered a cotton earbud soaked in 30% jaggery and sugar solution. Avoided use of proboscis. Instead, it climbed on the ear bud and stood on the part containing sugar solution.
02	2	Active	same as day 1	Separated	Active but did not attempt to feed as often as on day 1.	Placed a bowl of wet soil with some salt for mud puddling but it avoided that and started probing the sugary ear bud with its proboscis.
03	3	Active	Groundcolour became little duller.	Separated	Active, spent more time attempting to feed than on the previous day.	Same as day 1 and 2.

04	4	Active	same as day 3	Separated	Active, and attempted to feed for longer than on day 2.	Found in a weak condition at the bottom of its cage, lying upside down in the morning
05	5	Active	Dull wings	Separated	Active but spent less time attempting to feed.	Found at the bottom of its cage lying upside down in the morning.
06	6	Lethargic	Dull wings	Separated	Weak and spent more time attempting to feed than on day 2	Found at the bottom of the cage, lying upside down in the morning.
07	7	Active	Dull wings	Separated	Active and attempted to feed for longer than on day 2	Was settled on the twig in its cage in the morning, like a healthy butterfly. Avoided the sunny side of its cage.
08	8	Active	Dull wings	Separated	Active and spent longer attempting to feed than on day 2	Was settled on the twig in its cage in the morning, like a healthy butterfly. Avoided the sunny side of its cage.
09	9	Active	Dull wings	Separated	Active and spent longer attempting to feed than on day 2	Found at the bottom of the cage, lying upside down in the morning.
10	10	Active	Shrunken abdomen	Separated	Active in the morning, died in the afternoon.	Found at the bottom of the cage, lying upside down in the morning.

Fig.1: *Danaus chrysippus* proboscis separated

CURRENT STATUS OF THE CHINESE PANGOLIN IN SOME COMMUNITY FORESTS OF ARUNACHAL PRADESH, INDIA

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Introduction

North-eastern India is one of the 25 mega-biodiversity hotspot regions of the world (Myers *et al*., 2000). Arunachal Pradesh lies in the north-easternmost part of India and comprises a major portion of the biological hot spot region of the Eastern Himalaya, with vegetation ranging from tropical to alpine. Generally, pangolins are nocturnal, elusive, non-aggressive, solitary, insectivorous, and burrowing animals (Gaubert, 2011). They play a role in maintaining ant and termite populations in various ecosystems (Roberts, 1997). In India, two species of pangolins are found, Indian pangolin (*Manis crassicaudata*) and Chinese pangolin (*Manis pentadactyla*). So far, only the Chinese pangolin has been reported from the state. The Chinese pangolin represents the intermediate form between Malayan and Indian pangolins (Pocock, 1924). They occur in the Himalayan foothills in eastern Nepal, Bhutan, India, Bangladesh, Myanmar, Vietnam, Thailand, China and Taiwan (Shrestha, 2003; Duckworth *et al*., 2008). The pangolins are also hunted for medicinal purpose by the Nishi and Galo tribes of Arunachal Pradesh (Chakravorty *et al*., 2011). Indigenous communities as well as poachers in the region continue to hunt it due to a high demand on the international market as well as for local consumption. The lack of information and awareness regarding this species among local residents has resulted in an increase in hunting and poaching as well as extensive habitat degradation in areas where they were previously common. To better understand the present situation, a survey was undertaken in villages where pangolins are known to occur. Direct and indirect evidence of pangolins were recorded with the help of local people to determine the presence or absence of the species.

Result and Discussion

An extensive survey for signs of pangolin presence like burrows, fecal matter, claw marks, etc. was undertaken in three community forests, namely the Renuk community forest of Changlang district; the Mebo and Mariyang community forest of East Siang district and the Parsi-Parlo circle of Kurung Kumey district. Indirect evidence like occupied burrows and fecal matter was found in the Renuk community forest. High counts of burrows were also recorded from Mebo and Mariyang community forest and Parsi-Parlo circle. A total of 63 burrows were located. There were 28 burrows in the Renuk community forest; 17 burrows in the Parsi-Parlo circle; 10 burrows in Mebo and 8 burrows in the Mariyang community forest. These burrows were within 1 km radius of the village in Renuk; 2 km radius in the Parsi-

Parlo circle, 2 km radius in the Mebo and 7 km radius in the Mariyang community forest. Most of the burrows were in vicinity of bamboo groves. A relatively higher number of burrows were recorded in bamboo groves with more than 50% canopy cover.

In Arunachal Pradesh current market demands are rapidly increasing local pressure on hunting of rare and endangered animals in some regions, which include pangolins. It is essential to protect the remaining population of the species through *in-situ* conservation in the wild with community participation in the region. The lack of information, awareness and unchecked hunting among the local residents with reference to this species and increased habitat degradation in the area has increased threats to pangolins. Data on human perspective, traditional knowledge and social belief in relation to pangolin should be documented which will help to streamline future conservation strategy.

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Fig.1: Claw mark of pangolin at the mouth of an occupied burrow

Fig 2. Fecal matter of Pangolin with undigested termites

Fig 3. Burrow of pangolin from East Siang

Fig 4. Burrow of pangolin from Changlang

BUTTERFLY VISITORS TO TWO INVASIVE PLANTS IN THE INDIAN AND BHUTANESE HIMALAYA

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Reviewer: M. Ackram Awan

Introduction

During the last century, several invasive plants colonized parts of the Indian sub-continent. These include *Parthenium hysterophorous* L., *Ageratum conyzoides* L. and *Lantana camara* L. (Aigbedion Atalor *et al*., 2019; Evans, 1997; Kohli *et al*., 2006; Negi *et al*., 2019). These plants spread rapidly and have colonized parts of the Himalaya.

In the present study, we have documented lepidopteran visitors to the flowers of *Choromlaena odorata* L. and *Ageratina adenophora* Spreng. at two locations, one in Uttarakhand, India and the second in Bhutan. Although information is available on germination, seeds, toxicity and other aspects of these plants (Zheng *et al*., 2015), no information appears to have been published about the variety of insects that visit them. Since they belong to Asteraceae and Verbanaceae, which are insect pollinated, it appears that a part of their success in colonizing can be attributed to the fact that they are popular nectaring plants for insects.

Methodology

Butterflies visiting the flowers were photographed between March, 2014 and April, 2020 at the Butterfly Research Centre (1500 m), Bhimtal, Uttarakhand, India and between October, 2017 and November, 2019 at Mendrelgeng (2100 m), Tsirang block, Bhutan. The study site in Bhimtal has been colonized by *A. adenophora* while the study site in Bhutan has been colonized by *C. odorata*. Butterflies were photographed at the flowers in India by DSS, AA, PS and in Bhutan by Gyeltshen. Since several insects merely perch on flowers or leaves, only those species have been included in the following list where it was possible to obtain photographs of individuals with the proboscis inserted in the flowers.

Remarks

There is no doubt that these flowers are very popular among insects. Many individuals of the species were observed at the flowers over the years. Few native plants are known to attract such a variety of species from all the different families. True, the flowers are not popular with Papilionidae and Pieridae, for several species belonging to these families that are on the wing during the flowering season are conspicuous by their absence, although they visit other flowers in the vicinity. The butterflies that have not been recorded visiting *A. adenophora* despite being present in the area include *Graphium sarpedon* (Linnaeus, 1758), *G. cloanthus* (Westwood, 1841), *P. polytes* Linnaeus, 1758, *P. bianor* Cramer, [1777], *P. protenor* Cramer, [1775], *Catopsilia pomona* (Fabricius, 1775), *C. pyranthe* (Linnaeus, 1758), *Gonepteryx*

nepalensis Doubleday, 1847, etc. The present list does not purport to be a list of pollinators of these plants but a list of butterflies that visit these flowers, insert their proboscis and presumably suck their nectar.

Acknowledgement

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Table 1

S.N	Scientific names	Remarks
	PAPILIONIDAE	
1.	*Pachliopta aristolochiae* (Fabricius, 1775)	Rarely visited and then only briefly. The main flowering of the plant does not coincide with the emergence of the main brood of this species, so the individuals that emerged late get to feed on the early flowers of the plant.
2.	*Papilio agestor* Gray, 1831	This species also visits the flowers occasionally, for the same reason as outlined above.
	HESPERIIDAE	
3	*Tagiades menaka* (Moore, [1866])	A regular and frequent visitor to the flowers.
4	*Pseudocoladenia dan* (Fabricius, 1787)	As for *T. menaka*.
	PIERIDAE	
5	*Pieris brassicae* (Linnaeus, 1758)	A regular visitor to the flowers.
6	*Pieris canidia* (Linnaeus, 1768)	This is a commoner species than *P. brassicae* in the Indian study area and is a frequent visitor to the flowers.
7	*Ixias pyrene* (Linnaeus, 1764)	This has been recorded at *C. odorata* in Bhutan. The species is an occasional straggler in the Uttarakhand study area.
8	*Delias descombesi* (Boisduval, 1836)	Recorded at *C. odorata* flowers. The species does not occur in the western Himalaya.

9	*Delias pasithoe* (Linnaeus, 1767)	As for *D. descombesi.*
	LYCAENIDAE	
10	*Remelana jangala* (Horsfield, [1829])	As for *D. descombesi.*
11	*Chliaria kina* (Hewitson, 1865)	A single individual was photographed on the flowers on 4. iv. 2014. It was observed again on the flowers in 2018. The individuals observed spent over ten minutes skipping from flower to flower.
12	*Deudorix epijarbas* (Moore, 1857)	Several individuals visit the flowers each year, spending over 5 minutes among the flowers.
13	*Rapala maena* (Hewitson, 1863)	An uncommon visitor to the flowers, since it is not usually on the wing so early in the year. Individuals that do visit spend many minutes on the flowers.
14	*Rapala pheretima* (Hewiston, 1863)	Frequent visitor to the flowers of *C. odorata* in Bhutan; not recorded at *A. adenophora* flowers in Uttarakhand.
15	*Rapala nissa* (Kollar, [1844])	A regular visitor to the flowers every year, since it is common in the Indian study area and on the wing when this plant is in flower. Individuals spend up to 15 minutes on the flowers.
16	*Rapala varuna (Horsfield, [1829])*	Individuals occasionally recorded in Bhimtal
17	*Celastrina gigas* (Hemming, 1928)	Individuals spend three to five minutes on the flowers. A regular visitor in the Indian study area.
18	*Celastrina huegelii* (Moore, 1882)	As for the previous species. This species occurs in larger numbers than *C. gigas*.
19	*Megisba malaya* (Horsfield, [1828])	Not a common visitor to the flowers, since there are few individuals on the wing so early in the year. Those that do visit the flowers spend more than three minutes there.
20	*Udara dilecta* (Moore, 1879)	As for *C. gigas*.
	NYMPHALIDAE	
21	*Danaus chrysippus* (Linnaeus, 1758)	Occurs singly in both the study areas. Individuals visiting the flowers spend a minute or two and fly away. They do not stay long in an area.
22	*Danaus genutia* (Cramer, [1779])	As for *D. chrysippus*.
23	*Parantica aglea* (Stoll, [1782])	Males are territorial, and visit the flowers in their territory throughout the day, in brief visits. The remaining time is spent patrolling the territory.
24	*Tirumala septentrionis* (Butler, 1874)	Not a common butterfly in the study areas, usually one individual at a time flying by. Individuals attracted to the flowers spend five to ten minutes fluttering from flower to flower. A regular visitor year after year.
25	*Euploea core* (Cramer, [1780])	In some years, a male will take up a beat in the study area and visit the flowers repeatedly through the day, spending three to five minutes at each session.
26	*Euploea mulciber (Cramer,*[1777])	An occasional visitor to the flowers.

27	*Lethe confusa* Aurivillius, 1890	An unusual visitor to any flower, two individuals of this species were recorded day after day spending over five minutes at a time at the flowers on 7.iv.2014 and the following four days at the Indian study site.
28	*Mycalesis mineus* (Linnaeus, 1758)	Again, a very unusual record at flowers. An individual visited the flowers for three days starting 4.iv.2014 at the Indian study site.
29	*Callerebia annada* (Moore, [1858])	A frequent visitor to the flowers. Individuals spend three to ten minutes on each visit.
30	*Ypthima baldus* (Fabricius, 1775)	A regular visitor to the flowers, but individuals do not spend long at each visit, usually a minute or two before moving on.
31	*Neptis clinia* Moore, 1872	All members of the genus in the area are frequent visitors to the flowers and each individual spends two to twenty minutes investigating the flowers.
32	*Neptis nata* Moore, [1858]	See under *N. clinia*.
33	*Neptis sappho* (Pallas, 1771)	See under *N. clinia*.
34	*Neptis soma* Moore, 1858	See under *N. clinia*.
35	*Athyma cama* Moore, [1858]	An occasional visitor to the flowers that stays for around three to five minutes, during which time it keeps moving from flower to flower.
36	*Athyma opalina* (Kollar, [1844])	As for *A. cama*.
37	*Athyma selenophora* (Kollar, [1844])	As for *A. cama*.
38	*Argynnis hyperbius* (Linnaeus, 1763*)*	Not recorded in Uttarakhand at flowers of *A. adenophora*, but visits *C. odorata* in Bhutan.
39	*Vagrans egista* (Cramer, [1780])	An occasional visitor, but a few visit the flowers every year. They are habitually very nervous and do not sit for long anywhere. Flower visits are usually less than 30 seconds per flower, while an individual might settle on and probe ten or more flowers during a single visit.
40	*Cirrochroa aoris* Doubleday, [1847]	A female was recorded at *C. odorata* flowers in Bhutan. Males are also frequent visitors.
41	*Hestinalis nama* (Doubleday, 1844)	A regular visitor to the flowers. Individuals visit singly, and spend five minutes or more visiting flowers.
42	*Cyrestis thyodamas* Boisduval, 1846	A regular visitor to the flowers, where several individuals may spend hours among the flowers on a sunny day.
43	*Symbrenthia lilaea* (Hewitson, 1864)	Several individuals can spend half an hour or more each on the flowers, taking up to three minutes on each flower before moving on.
44	*Aglais caschmirensis* (Kollar, [1844])	Not all individuals of this species in an area visit the flowers. Those that do, spend up to four minutes at the flowers per visit.

45	*Vanessa cardui* (Linnaeus, 1758)	A regular visitor to the flowers, where each individual can spend up to ten or more minutes. Each flower is thoroughly explored before moving on to the next.
46	*Vanessa indica* (Herbst, 1794)	As for *Vanessa cardui*.
47	*Junonia lemonias* (Linnaeus, 1758)	Not all individuals in the area visit the flowers and those that do do not spend much time there, around half a minute per flower head. They do not flit from flower head to nearby flower head, but dash about after taking wing before returning to a distant flower of the same species.
48	*Junonia iphita* (Cramer, [1779])	Several individuals at a time can spend more than half an hour each at a time investigating the flowers.
49	*Cethosia cyane (Drury,*[1773]	Regular visitor to *C. odorata* flowers in Bhutan.
50	*Libythea myrrha* Godart, 1819	A regular visitor. Both sexes visit the flowers and spend up to half an hour at a time, visiting different flowers. They are not wary and seem to have implicit faith in the effectiveness of their underside camouflage, which resembles a dead leaf.

Fig.1: *Tagiades menaka*

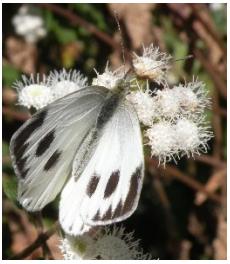

Fig.2: *Pieris canidia*

Fig.3: *Delias pasithoe*

Fig.4: *Chliaria kina*

Fig.5: *Rapala nissa*

Fig.6: *Rapala pheretima*

Fig.7: *Deudorix epijarbas*

Fig.8: *Megisba malaya*

Fig.9: *Hypolycaena erylus*

Fig.10: *Remelana jangala*

Fig.11: *Hestinalis nama*

Fig.12: *Cirrochroa aoris*

Fig.13: *Tirumala septentrionis*

Fig.14: *Lethe confusa*

Fig.15: *Mycalesis mineus*

Fig.16: *Neptis nata*

Fig.17: *Neptis sappho*

Fig.18: *Neptis soma*

Fig.19: *Athyma cama*

Fig.20: *Athyma selenophora*

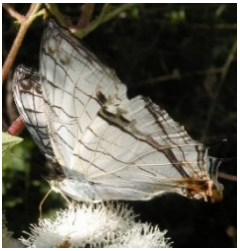

Fig.21: *Cyrestis thyodamas*

Fig.22: *Argynnis hyperbus*

Fig.23: *Junonia iphita*

Fig.24: *Callerebia annada*

Fig.25: *Libythea myrrha*

Fig.26: *Vagrans egista*