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On Any Aspect Related with Life Forms

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Cover Photo of founder of BIONOTES *Late* Dr. R.K. Varshney

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OBITUARY: OUR FOUNDER, DR. RAJENDRA KUMAR VARSHNEY

ASHUTOSH VARSHNEY AND ANURAG VARSHNEY
Raj Bhawan, Manik Chowk, Aligarh, Uttar Pradesh

Dr. Rajendra Kumar Varshney was born in Aligarh on 10th October 1939 into an established business family. His father, Shri Jyoti Prasad, was a prominent businessman and social worker who was instrumental in building Dharamshalas in Aligarh. His mother, Chameli Devi, was a very religious woman.

Dr. Varshney did his early education in Aligarh in various colleges like Hiralal Barahsaini Inter College, DAV Inter College and Arya Samaj Inter College. He did his B Sc. and M Sc. in Zoology from Aligarh Muslim University in 1960. While working at the Zoological Survey of India, he did his PhD in 1972 and was awarded a D. Sc. by Patna University in 1996. He learnt German from Max Mueller Bhawan, Kolkata. Apart from that, he was also well versed in Bengali and Urdu. He was an avid philatelist and had a lot of rare stamps in his collection.

Socially, Dr. Varshney was always active in the Varshney community. From 1952, he was involved in various Varshney publications (Barahsaini, Varshney Patrika, Jhankaar etc.) as an editor. He also held various posts in the community groups. His poetry collection "Phool Ek Sau Pankhuria" was published in 1957. Many of his short stories were broadcasted from Aakashwani All India Radio from 1962 to 1964 and then from 1984 to 1995.

He was employed in the Indian Lac Research Institute at Ranchi and then joined Zoological Survey of India, with stints at its Kolkata, Patna, Shillong and Jodhpur offices. He retired from ZSI in 1997 while serving as Additional Director.

Dr. Varshney was a Fellow of the Royal Entomological Society of London, Entomological Society of India, Academy of Zoology, and Indian Association of Systematic Zoologists; and a member/office bearer of the National Geographic Society, Washington; Academy of Entomology, Chennai; Indian Society of Salinity Research Scientists, Jodhpur; the International Symposia on the Scale Insect Studies; etc.

Dr. Varshney had published over 150 research papers, including more than 30 on Lepidopteran insects. His works on Indian butterflies have been cited by several workers in India and abroad. He wrote the first Hindi book on Indian butterflies and was senior editor for the first catalogue of Indian butterflies, which established that there were 1318 species known from India at the time.

He has served on the Editorial boards of Oriental Insects, USA; Zoos' Print Journal, Coimbatore, Indian Journal of Biodiversity, Bangalore, Prani Jagat, Kolkata, Biosystematica, Kozhikode; etc. He was the founder-editor of Bionotes, a quarterly periodical on Life Sciences.

Other entomologists have named the following taxa in his honour: Genus *Varshneyia (*Thysanoptera), Genus *Varshneococcus* (Homoptera), *Microstylum varshneyi* (Diptera), *Hemiptarsenus varshneyi* (Hymenoptera) and *Neptis miah varshneyi* (Lepidoptera).

He was also an interviewer for M Phil and PhD courses for Aligarh Muslim University.

Dr. Varshney got married in 1963 to Mithilesh Kumari Varshney in Aligarh. He was a doting father to 3 children, Nidhi Krishna, a doctor based in Patna, Ashutosh Varshney and Anurag Varshney who are working in the

management layer in multinationals in NCR area.

Dr. Varshney left us all for his heavenly abode on 28th April 2021. His memories remain with all of us in the form of his work for his community, his scientific work and his writings – prose and poetry which will always remain with us.

PORTRAIT OF A GENTLEMAN

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I first came in contact with Dr. R.K. Varshney when I received a politely worded letter asking for a contribution to the inaugural issue of a small quarterly newsletter, to be called Bionotes. I knew of Dr. Varshney from his publications on butterflies. He was forever trying to catalogue and straighten out the names of Indian butterflies.

Bionotes, be explained, was aimed at the student community, so that small findings could be published rapidly, usually within three months, so that they could be useful to the student. Normal journals at the time took anywhere from a year to five years to publish a paper, by which time the student had completed studies and moved on.

He shared with me the trouble he had trying to get registration as a periodical. He had no help, not even a computer. Working traditionally with hard copy and editor's pencil, he put out the journal regularly for the next 19 years.

It was his life work after retirement from the post of Additional Director at the Zoological Survey of India. All the irritations were left behind and he was doing what he liked to do and he did it well. The sort of things that irritated him was exemplified in an anecdote from his Zoological Survey of India days in Calcutta.

In those days, the most recent book on Indian butterflies was by M.A. Wynter-Blyth, published in 1957, but mostly following the nomenclature used by W.H. Evans in 1932. A book that still serves to identify lesser known Indian butterflies not covered in other works. Things had moved forward, but in scattered publications and we in India had little means of keeping abreast of developments in the matter. Dr. Varshney therefore published an updated nomenclature for Wynter-Blyth's book, which incorporated valid updates and enabled those who possessed the book to pencil in the changes where appropriate.

It was not long before this caught the eye of others who were in a position to solve the problem and Dr. Varshney was approached to do an updated version of Wynter-Blyth's book, to be published by the Bombay Natural History Society. He agreed, but pointed out that, since he was a government employee, he needed permission to undertake the project. So he applied for permission of the Director of the Zoological Survey of India and in due course, it was granted. Now the fun started. He communicated by letter to the B.N.H.S. that the project could go forth and must have been in a high state of excitement, until he was called into the Director's office and told that, since the Director had taken the trouble to give permission, his name was to be included as a co-author.

Somewhat crestfallen, since he was an ethical man, Dr. Varshney agreed. Four days later, he was called into the Deputy Director's office. There were four of his seniors there, and all four told him to include their names too! That was the end for him. He threw up his hands in resignation and the book was never done, since the faineants themselves had neither the knowledge nor ability to write such a book. Thus, India was denied a decent book on butterflies for the next twenty years. I have tried to discover the names of these blots on the name of Indian science, who fed on public money like parasites and did no work in return.

Subscription to Bionotes was kept low, starting at a hundred rupees in 1999 and reaching 150 rupees annually in 2019. This

obtained for the subscriber four issues of the journal a year, in a brown paper wrapping with handwritten address by Dr. Varshney.

In 2014, he approached me with the idea of putting out a catalogue of Indian butterflies, since almost 70 years after Independence, we did not know how many species of butterflies occurred in our country.

At the time, getting the expertise together was a marathon task, but finally, with the help of 12 international experts from Russia, Singapore, Denmark, France, Japan, Belgium, Britain, Czechia, Malaysia and Nepal, we managed to get a reasonably accurate figure of 1318 species of butterflies. More importantly, the catalogue stabilized the names of Indian butterflies. Besides national media, it made the BBC world news, a fact that made Dr Varshney rather proud. It is probably his crowning achievement, with almost 24,000 views on Researchgate, where it was the most downloaded Biology paper globally for a few weeks. Mrs Varshney and he graced a Butterfly Meet here in Bhimtal as Chief Guests in 2015. Although it was an informal gathering, he insisted on protocol and decided to have an ice-breaking session. Since there was no ice, literal or figurative, we gave him a hammer and duly introduced ourselves.

In 2019, I got a phone call from him in which he asked me to take over the publication of Bionotes. It seemed that the baggage of Impact Factors, Citation Indices and other rankings had proven too much for him and brought the journal to a point where no one was contributing anything to it. I was relatively unaware of the red-taping of journals in progress at the time, and said a hesitant "yes", mainly to keep up his flagging spirits.

The first issue was a challenge, because there were three months to prepare and no contributions. Shristee Panthee, who naturally filled the role of Assistant Editor thrust upon her, and I managed to get the March, 2019 issue out with only a few contributions from people to whom rankings did not matter. Then some kindly soul got us registered on the UGC list again and contributions began to flow in. However, most of the contributions are from people who are not formally trained in science. For many, this is the first scientific publication of their lives. Some have gone on to publish more of their findings not only in Bionotes but other journals as well, thus going beyond the vision of Dr Varshney when he founded this!

As editor, I have tried to keep the papers anecdotal and full of natural history, so that an average person can read and understand any of the notes published. I am grateful to the referees, who understand the goals of the journal and often stay up late at night to edit and debate changes to the paper under consideration. Shristee, despite her enormously busy schedule, stays up late to format the papers and make sense of the jumbles of manuscripts and photos she gets. Dr Ramamurthy, meanwhile, takes things forward and makes sure the issue is uploaded on the website of the Indian Entomological Society.

The current issue is the April to September issue instead of the July to September one. We are unable to put the June 2021 issue. I apologise for that. I had a rather debilitating attack of covid during the period and was unable to do anything. Dr. Varshney had also left us two months before, so he was not on hand to take things forward.

So this issue mourns the loss of a gentleman who lived life ethically at an unprincipled time, who never did the wrong thing if he could help it and who strove to improve society and make our country a better place to live in: indeed, a model for all of us!

Late. Dr. R.K. Varshney with Peter Smetacek, Bhimtal, June 2016

PUBLICATIONS OF DR. R.K. VARSHNEY

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Reviewer: Peter Smetacek

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CITY IF NOT FOREST: NEW HABITAT RECORD OF *MACROMIA CINGULATA* RAMBUR,1842 (ODONATA, MACROMIIDAE)

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Abstract
The habitat preferred by Rambur's Torrent Hawk dragonfly (*Macromia cingulata* Rambur,1842) was previously known to be interior forest streams and submontane forests. This study reports a new habitat preference of the species i.e. urban residential area within the busy city limits from Thiruvananthapuram, Kerala. The Probable causes for the habitat shift and need for future surveys are discussed.
Keywords: Rambur's Torrent Hawk, dragonfly, new habitat, submontane forest, streams, urban residential area, city limits, Kerala, habitat shift, survey

Introduction

Odonates are excellent models to study the health of aquatic and wet land ecosystems. They act as bioindicators for understanding ecological integrity of the river corridor as the taxon provides information about their aquatic breeding sites, and the surrounding terrestrial habitat (Golfieri, 2016). India has 488 species and 27 subspecies in 154 genera and 18 families of odonata out of which the family Libellulidae is the richest (Subramanian & Babu, 2017). The Libellulid genus *Macromia* Rambur includes large sized dragonflies, coloured dark metallic green or blue vividly marked with citron-yellow; the sexes closely similar in colour and markings; head very large, eyes globular, very broadly contiguous: vesicle simple in both sexes; prothorax small, thorax large and robust, naked; legs very long and spidery (Fraser 1936). As far as Indian species are concerned they breed in sub montane streams at altitudes of 2,000 to 4,000 feet (Fraser 1936). They are commonly known as Torrent Hawks/River Cruisers from their habit of hawking/cruising long distances along river banks.

The genus includes 14 species (Subramanian & Babu, 2017). *Macromia cingulata* Rambur is a species distributed in submontain habitat of peninsular India (Fraser 1936). Later it was reported from West Bengal (Dwari et al 2018). The species can be identified by the following characters: Male-head labium bright yellow, borders of lateral lobes and the middle lobe black; labrum bright citron-yellow, heavily bordered with black; anteclypeus black; postclypeus and frons pale citron-yellow, the latter with a broad T-shaped mark formed by confluence of a broad spot on front of frons and thick line in the floor of sulcus above; vesicle steely blue-black; occiput black; eyes blue during life, glossy black and unmarked behind. Prothorax dark brown, two small lobes and anterior and bright yellow; thorax a beautiful metallic bluish-violet, marked with bright citron-yellow. Legs black, wings hyaline. Abdomen black, ringed with pale citron-yellow almost creamy-white in some specimens. Anal appendages black, as long as

segment 9: superiors tapering to a point. Female closely resembles the male but more robust. The abdomen markedly compressed (Fraser 1936). Its small delicate build, black colour with strongly contrasted yellow markings, lips broadly bordered with black, and face bright yellow barred with black will easily distinguished it from other Indian Macromiae (Fraser 1936). It is purely a riverine species, and is usually found hawking over shallow, rippling water flowing over clean, gravelly bottoms. Being a submontane species most of its habitat records are from hilly forested area (Fraser 1936, Dwari et al 2018, Dawn and Chandra 2014). This study presents a new habitat record of the species.

Materials and Methods

Opportunistic surveys were conducted in a residential area (Indira Nagar, Peroorkada, 8.53472 50°N 76.972765°E) in Thiruvananthapuram city limits, capital of Kerala from May 2020 to June 2021. The study site is situated in suburb in Municipal Corporation of Thiruvananthapuram, Kerala and has an altitude of just 18m MSL. The area is devoid of forest patches or riverine and is fairly populated with close neighbour hoods and residential buildings which are close to the vehicular city road. The habitat of the study site is an urban area with few some trees and a small marshy area with a natural spring 700m away. The water from the spring flows through small residential drainage canal passing through plots with sparse trees, shrubs, plantains and kitchen gardens joining the main drainage canal. Field photographs were captured using Canon 6D Mark II DSLR camera with 100-400 mm Canon zoom lens. The species identity was determined by comparing the detailed photographs (all angles) with descriptions furnished by Fraser (1924, 1936).

Results and Discussion

During the one year survey period the *M. cingulata* Rambur,1842 was spotted in eight occasion. In the initial sighting a single individual was found hanging vertically from an electric line above a tarred road. The height of the perch was 20 feet (approximate) from the ground level. After the initial sighting, we could sight the species perching on the same electric line six more instances from 13th August 2020 to 30th October 2020, four times male (fig.1), one time female (fig.2) and once a mating pair (fig.3). After seven months on 31st May 2021 we could also sight a male on the same electric cable (Table 1).

The individuals we observed were hanging vertically from an electric cable above the tarred vehicular road most of the time with occasional hawking over the road for hunting small insects. Average perching time/duration was 20 to 25 minutes. A mating pair was seen clinging on the same electric cable for a duration of 90 minutes. The individuals were not seen disturbed by the noise or movement of any vehicle but the movement of pedestrians disturbed them. On such disturbances they flew away from the perch and settled back in a new perch a bit away from the earlier perch.

The habitat of the individuals sighted in the study is entirely different from previously described habitat of the species. *M. cingulata* Rambur is purely a riverine species, and is usually found hawking over shallow, rippling water flowing over clear, gravelly bottoms (Fraser 1936). Hilly tracts with forest vegetation and proximity of streams are usually preferred by the species. Dwari et al (2018) had reported it from vegetated hilly area of West Bengal. The study reveals a new habitat preference of the submontane species i.e. low altitude urban city residential. Due to its submontane habitat preference the earliest records of the species are mostly from medium to high elevation hilly areas (Fraser 1936, Dwari et al 2018, Dawan and Chandra 2014). The authors have previously spotted the species from Ponmudi Hills (8°45′37"N, 77°07′00"E) at an altitude of 1200 m MSL & valleys of Athirumala (8°37′N 77°15′E) part of

Peppara Wildlife Sanctuary at an altitude of 1400m MSL (Unpublished observation). The present urban habitat has an elevation of just 18 MSL. The continuous sighting (in seven occasion) over a period of almost one year and the sighting of a mating pair suggests a confirmed preference of the new urban habitat by the species. The study area has no nearby riverine or forest patch except a spring which is about 700m away which waters the drainage canals passing through the plots in the residential area. Whether such a drainage channels could support the breeding of *M. cingulata* Rambur,1842 needs to be investigated. The sighting of mating pairs suggest breeding attempts.

The adaptation of such submontane riverine species to urban habitat is noteworthy in the backdrop of habitat degradation and climate change. Distribution patterns of Odonata are strongly associated with both natural changes along the river system and management impacts (Hoffman and Mason 20005). Whether such effects in the original riverine habitat of *M. cingulata* Rambur,1842 had favoured this new urban habitat preference is to be further investigated by surveys in the nearby hill riverine systems. Further the effect local factors like reduced human disturbances due to the present COVID related restrictions which could probably help the species to find new corridors for habitat exploration also needs to be factored for future detailed surveys.

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Table 1. Observations on *Macromia cingulata* Rambur from the residential area

Sl.No	Date of observation	Number of species observed and sex	Activities observed and time duration
01.	13th August 2020	1 male	Perching and then flew off (10 minutes)

02.	20th August 2020	1 male	Perching and occasionally hawking (13 minutes)
03.	23rd August 2020	1 male	Perching and occasionally hawking (20 minutes)
04.	26th August 2020	1mating pair	Perching and then flew off (90 minutes)
05.	3rd September 2020	1 male	Perching and then flew off (20 minutes)
06.	5th September 2020	1 female	Perching and hawking occasionally (30 minutes)
07.	30th October 2020	1 male	Perching and then flew off (20 minutes)
08.	31st May 2021	1 male	Perching and then flew off (25 minutes)

Fig.1: *Macromia cingulata* Rambur male

Fig.2: *Macromia cingulata* Rambur female

Fig.3: *Macromia cingulata* Rambur mating pair

Fig.4: New urban habitat of *Macromia cingulata* Rambur

*DIOSCOREA ESCULENTA (*LOUR.) BURKILL AS A LARVAL HOST PLANT OF *TAGIADES JAPETUS* (STOLL, [1781]) (INSECTA: LEPIDOPTERA: HESPERIIDAE)

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Abstract

Dioscorea esculenta (Lour.) Burkill is observed as a new larval host plant of *Tagiades japetus*.

Keywords: Larval host plant, immature stages, Hesperiidae, Assam, India.

Introduction

Egg laying choices in herbivorous insects have consequences for offspring growth (Gripenberg *et al*., 2010), defense (Denno *et al*., 1990) and competition (Anderson *et al*., 2010). Bell (1909-1927), Wynter-Blyth (1957), Sevastopulo (1973), Kunte (2000; 2006), Kiruba *et al*. (2008); Kalesh & Prakash (2007, 2015), Smetacek & Smetacek (2011), Tiple *et al*. (2011), Sengupta *et al*. (2014), Ghosh & Saha, (2016), Nitin *et al*. (2018), Karmakar *et al*. (2018), Kafley (2019), Naik & Mustak (2020) and Dey (2020) have reported the larval host plants of butterflies in India.

Materials and Methods

An opportunistic field survey was carried out at SB's backyard garden at Bongal Gaon (26.678° N and 93.979° E, 92 m above asl) near Dergaon town, situated beside Dergaon-Golaghat Road in Assam in India. The place is overgrown with different grasses and other plant such as *Dioscorea alata, Dioscorea esculenta, Citrus* spp., *Litchi chinensis, Cocos nucifera, Areca catechu, Curcuma* spp., etc.

On 29.iv.2020, a female *Tagiades japetus* was sighted ovipositing on the upper surface of a leaf of *Dioscorea esculenta* (Lour.) Burkill. After 5 days, the orange-brownish egg successfully hatched into a pale yellowish 1st instar larva *in situ* and started to feed on the plant. SB regularly observed it during that period and collected the yellowish-brown, bilobed headed 2nd instar larva and put it into a clay pot along with the same plant. SB noted the feeding and shelter pattern of all early stages. The caterpillar continued its life cycle by feeding on the *D. esculenta* leaves provided. The life history of this species for India has already been illustrated in detail (Bhakare & Ogale, 2018). The eclosed butterfly was identified using Kehimkar (2016). Additionally, immature stages were also observed in the natural environment.

Dioscorea esculenta is a climber plant which stem twigging to the left, all leaves are simple, capsules broader than longer, round seeds winged leaves pubescent, reniform or orbicular-cordate with sharp stipular thorns and numerous tubers (Prain, 1903). The Plant List (2013) is followed for the updated scientific name of the host plant.

Result

Tagiades japetus has been recorded from India to Myanmar, Thailand, Laos, Cambodia and Vietnam (Inayoshi, 2021). *Dioscorea alata, Dioscorea wallichii and Dioscorea oppostifolia* were earlier reported as larval host plants for this species (Sevastopulo, 1973; Robinson *et al*., 2010). The successful rearing and emergence of *Tagiades japetus* on

Dioscorea esculenta confirms the latter as a hitherto unreported larval host plant.

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Fig: (1). Cultivated plant (edible) of *Dioscorea esculenta* (2). *Tagiades japetus* laying egg (3). Larva making leaf shelters (4). 5th instar larva (5). Pupa (6). Freshly eclosed adult.

RECORD OF *STUENINGERIA NEPALENSIS* LEHMANN, 2019 (INSECTA: LEPIDOPTERA: METARBELIDAE) IN BHUTAN

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Abstract
The present paper reports and confirms the easternmost known range of the newly described species *Stueningeria nepalensis* from Bhutan. The species was previously only known from Central Nepal and the Kumaon Himalaya.
Key words: Metarbelidae, Cossoidea, new record, range extension, *Stueningeria nepalensis.*

Introduction

The genus *Stueningeria* Lehman, 2019 (Metarbelidae) was recently erected with *Stueningeria nepalensis* as the type species (Nepal, Kathmandu Valley, Godavari) (Lehman, 2019). The genus currently includes nine species (Table 1) distributed along the southern slopes of the Himalaya in India and Nepal and throughout Indochina (Myanmar, Thailand, and Vietnam) and southern China (Yunnan Province) (Yakovlev & Zolotuhin, 2021).

In this note, we report the sighting of *S. nepalensis* from Mendrelgang, Bhutan. Mendrelgang (26.950°N & 90.114°E, 1247 m elevation) is a block in Tsirang district, Bhutan. The region has a temperate climate with the annual temperature ranging between 20°C and 35°C. The winter season extends from October to March, followed by summer season from April to June and rainy season from June to September (NSB, 2010). The region is covered with subtropical broadleaf forest in the lower valley and mixed Chir Pine (*Pinus roxburghii* Sarg.) forest at higher altitude. The area is disturbed due to anthropogenic activities such as seasonal cultivation and grazing by domesticated animals.

During observation of moths in Mendrelgang, an individual of a moth belonging to Metarbelidae was collected on the night of 16 July 2013. The moth was attracted to the fluorescent lamp fitted on the science laboratory building of Mendrelgang Central School, Tsirang. The specimen was collected, mounted on a pin and photographed (Figure 1). The photograph was shared to many researchers and online portals for identification confirmation but remained unidentified until recently, when Dr. Roman V. Yakovlev, professor of Ecology Department at Altai State University, Russia identified it as *Stueningeria nepalensis* in an email communication (dated 9 June 2021).

The adult of the species can be identified based on the characters provided by Lehmann (2019). The head is with rough-scaled, light grey with brown tips on scales, light grey with black patches on the eyes, bipectinated antennae. Forewing with a pure white ground color, towards termen light grey, not glossy, coastal margin with brown patches, termen with brown lunules, a rectangular brown patch at the end of discal cell, below discal cell and above 1A+2A some pure white very long scales,

rectangular grey patches forming almost a slightly oblique subterminal band that continues below 1A+2A, not distinctly marked is CuA2; ciliae short, alternating brown and light grey, glossy. Underside of forewing light grey, glossy, costal margin with brown patches. Hindwing grey, glossy; underside as in forewing. Abdomen dark brown with a short abdominal tuft.

S. nepalensis is known from the Sub-Himalaya in the Central and Eastern regions of Nepal and Bhimtal (Uttarakhand) of Kumaon Himalaya (Yakovlev & Zolotuhin, 2021). The present record is the first confirmed record of the species from Bhutan and marks the easternmost known range of the species. In Nepal, the species is associated with "Subtropical broadleaved evergreen forest" (Below an elevation of ca. 1600 m) and "Lower temperate mixed broad-leaved forest" (Above ca. 1800 m) sensu Stainton (1972) (Lehman, 2019). In contrast, the specimen collected from India (Bhimtal (Uttarakhand), ca. 1500 m) and Bhutan (Mendrelgang, 1247 m) is associated with "Sub tropical broad-leaved evergreen forest" or the "Sub tropical belt" (> 1000m–2000m) sensu Dobremez (1972).

The larval foodplant of the species is unknown but like some other Metarbelidae species, probably on the bark and/or in the wood of conifers (Lehman, 2019).

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Appendix 1. Checklist of Genus *Stueningeria* Lehmann, 2019 (* recently recorded from Bhutan)

Sr No.	Species	Distribution
1	*S. nepalensis* Lehmann, 2019*	Nepal, India (Uttarakhand), Bhutan (Mendrelgang)
2	*S. campbelli* (Hampson, 1910)	India (Andhra Pradesh)
3	*S. phaga* (Swinhoe, 1894)	India (Meghalaya and Assam)
4	*S. htetae* Yakovlev & Zolotuhin, 2021	Northern Myanmar (Kachin State)
5	*S. csovarii* Yakovlev & Zolotuhin, 2021	Thailand (Nan Province)
6	*S. loeffleri* Yakovlev & Zolotuhin, 2021	Thailand (Sakhon Nakhon Province)
7	*S. ihlei* Yakovlev & Zolotuhin, 2021	Vietnam (Thua-Thien-Hue Province)
8	*S. murzini* Yakovlev & Zolotuhin, 2021	China (Yunnan Province, south-western part)
9	*S. pinratanai* Yakovlev & Zolotuhin, 2021	Thailand (Chiangmai Province)

Fig 1. Adult of *Stueningeria nepalensis* Lehmann, 2019

FIRST RECORDS FOR NEPAL OF *ALBULINA ARCASEIA* AND *ALBULINA PHARIS* (LYCAENIDAE) FROM THE HREBLAY COLLECTION

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Máron Hreblay (1963 – 2000) was a Hungarian lepidopterist who worked extensively on Owlet moths (Noctuidae) between 1993 and 2000. He produced 52 scientific publications and proposed 604 species-level and 28 genus-level names for the Noctuidae. He had an extensive private collection of nearly 150,000 specimens, which is now housed in the Hungarian Natural History Museum (HNHM). In 2014, a detailed description of Hreblay's scientific work and collection of Owlet moths was published by the HNHM (Bálint *et al*., 2014). Apart from moths, Hreblay's collection also comprised a large number of butterflies, including many from the Himalaya. He made 11 collection trips to Nepal between 1993 and 2000.

Early in 2021, the authors came into contact and exchanged lists of species, those known from Nepal, based on an unpublished 2021 draft catalogue of butterfly species of Nepal, and those from Nepal present in the Hreblay collection. When the lists were crosschecked, there were several possible new species records for Nepal. After checking the provisional identifications, two new species records for Nepal were identified.

For first identification, Fruhstorfer (1916), Evans (1932), d'Abrera (1993), and Smith (1994, 2011) were used. The second author carried out significant research on Polyommatini species, including *Albulina* (Bálint & Johnson, 1997). He also prepared the genitalia of both species, confirming the generic placement of the two species. Information from the Hreblay collection and from other sources about the occurrence of these species in and near Nepal is presented here.

Albulina arcaseia (Fruhstorfer, 1916) Kamba Mountain Blue.

Fruhstorfer (1916) described the species as *Lycaena pheretes arcaseia* from Kambajong in Tibet, 15 km from the Sikkim border. Bollow (1930) repeated the information given in the original description. D'Abrera (1993) documented the species from "Sikkim" and from "Sikkim, Tungu, Teesta Valley, 13,000-14,000 ft.", showing the male and the female phenotypes. Huang (2001) indicates that *A. arcaseia* is sympatric with *A. orbitulus tibetana, A. lehana asiatica* (= *A. asiatica*) and *A. pharis* in the border area of Sikkim and Tibet. This species is not listed for India in Varshney & Smetacek (2015). Van Gasse (2018) lists it as apparently rare in North Sikkim at about 4000 m elevation, based on pictures on the website of the Indian Foundation of Butterflies (Kunte *et al*., 2021). Talavera *et al*. (2012) list this species in the combination of *Agriades arcaseia*, after merging *Agriades* s.s., *Albulina (orbitulus)* and *Vacciniina* s.s. Funet (2021) and Van Gasse (2018) follow Talavera *et al*. (2012).

Fruhstorfer (1916) describes the male to have lighter blue upper wings compared with *L. pheretes* (= *A. orbitulus*) and *L. asiatica* Elwes and to be slightly less shiny and slightly more

greenish compared with *L. hylas* Esper (= *Polyommatus dorylas*); the under side of the forewing has a white-ringed black end cell spot and three white roundish spots between cell end and apex. However, these traits are rather variable in Polyommatini and subject to environmental variables (Piszter *et al*., 2019). Fruhstorfer (1916) also stated that the valves of *arcaseia* were much wider and dorsally straighter than those of *pheretes* (= *orbitulus*) and *lehana*, while the uncus differed considerably and was more robust, but did not present any documentation for comparison. Indeed, the valval shape of *A. arcasiea* is broader in the apical region and the aedeagus is blunt compared to congeners [see figures in Stempffer (1937-1938), Higgins (1975) and Fernandez-Rubio (1976)].

Three specimens were collected in June 1998 by Márton Hreblay and Balázs Benedek near Lhonak in the Kanchenjunga area in East Nepal (roughly 27° 47' N and 88° 02' E), some 65 km SW of Kambajong in Tibet. Pictures of a male *A. arcaseia* upper and undersides are presented here together with pictures of its genitalia capsula and the aedaegus. This is the first record of *A. arcaseia* for Nepal and it represents a small extension westward of its known distribution area. The common English name indicated above is proposed here, as the name used by the Indian Foundation of Butterflies (Eastern Mountain Blue) appears not correct for a species, which on the Indian subcontinent is only found in Sikkim and NE Nepal.

Albulina pharis (Fawcett, 1904) Fawcett's Mountain Blue.

Fawcett described the species as *Lycaena pheretes pharis* and recorded it in July from "Khamba Jong, Thibet, at 15,000 ft (4,600 m) elevation. Seitz (1923) just mentions "*Lycaena pheretes pharis*" (*pheretes* is now a synonym for *orbitulus)* and illustrates the underside of the male wings, but Bollow (1930) described it in detail referring the illustration presented in Seitz (1923). Most probably based on the mentioned sources, Evans (1932) also listed it as a ssp. of *Polyommatus pheretes* from Sikkim, Chumbi". D'Abrera (1993) documented "*Albulina pharis*" from the "Chumbi Valley" and Sikkim" showing the male and the female phenotypes. Huang (2001) stated that *A. pharis* is sympatric with *A. orbitulus tibetana*, *A. lehana asiatica* (= *A. asiatica*) and *A. arcaseia* in S Central Tibet and nearly sympatric with *A. lehana lehana* in SW Tibet. This species is listed from Sikkim in Varshney & Smetacek (2015). However, Van Gasse (2018) only mentions it from Khambajong in Tibet, and as one possible species for a specimen from Mishmi Hills (Arunachal Pradesh), which was identified as *Lycaena pheretes* by South in 1913, but requires re-examination. Van Gasse (*pers. comm*.), states that Evans' information is solely based on the record of Fawcett and there may not be any evidence of *A. pharis* in India. Talavera *et al*. (2012) do not list *pharis*, but based on their merging of *Agriades* s.s., *Albulina (orbitulus)* and *Vacciniina* s.s., they would probably name it *Agridades pharis*, as done on the Funet website (2021).

Fawcett (1904) stated that the male of *A. pharis* has a dark purple-blue upper side with black marginal lines, broader on hindwing, especially at apex and costa. The underside of the forewing is purple-grey, paler at apex with a white-ringed black end cell spot and usually four small white-ringed black discal spots; the hindwing is pale brownish, with a pale ochreous spot in and extending beyond the cell, six more such spots beyond it and an indistinct one near the base. The genitalia structures show commonplace *Albulina* shapes.

Four specimens were collected in July 1996 by Lenga Sherpa on the Dhaulagiri slopes, NW of Marpha in Lower Mustang (roughly 28° 47' N and 83◦ 39' E) at about 4000m elevation. Pictures of the male *A. pharis* upper and underside are presented here together with pictures of the genitalia capsula and the aedaegus. This is the first record of *A. pharis* from Nepal and represents a small SW

extension into Nepal of its known distribution area.

Discussion

Talavera *et al*. (2012) proposed to merge species of three genera into an enlarged *Agriades* genus, including three monophyletic lineages that may be considered as subgenera: *Albulina* (*orbitulus*), *Vacciniina* s.s. (*optilete*) and *Agriades* s.s. (*glandon*, *pheretiades*, *podarce* and *pyrenaicus*). Bálint disagrees with the authors as the newly created *Agriades* genus is impossible to identify in real conditions as it is based on empirical molecular data, ignoring evidence-based morphology traits. Talavera *et al*. (2012) did not include specimens of the two species of this article in their study, but list *Agriades arcaseia.* The Funet website and others follow Talavera *et al*. (2012), but this discussion is not yet finished and we maintain the two new species for Nepal in the genus *Albulina*.

Finding these two species in Nepal is not unexpected as they are known to fly not far from the Nepal border in Tibet and Sikkim. These two new records bring the total number of recognized butterfly species in Nepal to 679. Recently, there has been an increase in the number of first records of species in Nepal, mainly by students and naturalists. Many more new species for Nepal may be found in the near future. Reaching 750 butterfly species for Nepal appears to be a reasonable goal for the next decades.

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Fig.1*: Albulina arcaseia*, Kamba Mountain Blue, UP

Fig.2: *Albulina arcaseia*, Kamba Mountain Blue, UN

Fig.3: *Albulina arcaseia,* genitalia capsula

Fig.4: *Albulina arcaseia*, aedaegus

Fig.5: *Albulina pharis,* Fawcett's Mountain Blue, ♂ UP

Fig.6: *Albulina pharis,* Fawcett's Mountain Blue, ♂ UN

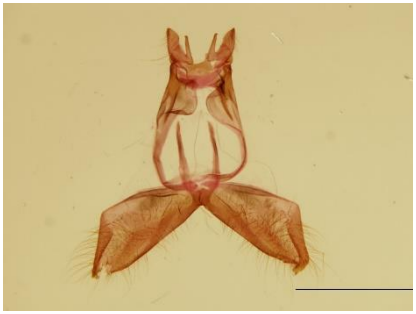

Fig.7: *Albulina pharis,* genitalia capsula

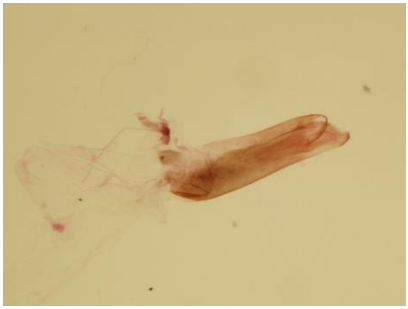

Fig.8: *Albulina pharis,* aedaegus

SIGHTING OF PLAIN TIGER (*DANAUS CHRYSIPPUS* LINN., 1758) FORM *DORIPPUS* IN NEW DELHI, INDIA

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Four forms of *Danaus chrysippus* are known from India, viz. *chrysippus*, *alcippoides*, *amplifascia* and *dorippus* (Smetacek, 2001). The first form is the most common in the country whereas sighting of the other three forms are rare (Smetacek, 2001). The form *dorippus*, known to be a common form in Africa, is sighted only rarely in India (Smith *et al*., 1997; Smetacek, 2001). This form is differentiated from the other forms by lack of a white band on the forewing (Smetacek, 2016). It has been observed only on few occasions in several states – Uttarakhand (foothills), Bengal, Bihar, Rajasthan and Maharashtra (Smetacek, 2001) and Andhra Pradesh (M. Yuvaraj & Smetacek, 2019). It was recorded by Ashton in the year 1972 from Delhi (Ashton, 1972).

Here, I report sighting of *Danaus chrysippus* form *dorippus* from Rohini area of Northwest Delhi, India in the afternoon of March 14, 2021. The butterfly was found to be gliding over flowers on the lawns of a residential society. It was observed for 10 minutes, and photographed using a digital camera (Fig. 1).

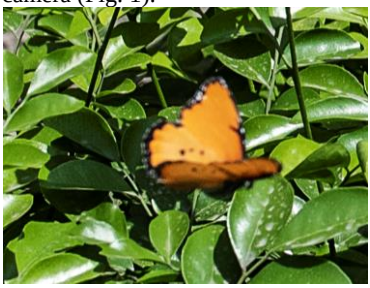

Fig.1**:** Image of *Danaus chrysippus* form *dorippus* as observed in Rohini area of Northwest Delhi, India.

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FIRST RECORD OF COMMON CILIATE BLUE BUTTERFLY *ANTHENE EMOLUS* (INSECTA: LEPIDOPTERA: LYCAENIDAE) FROM UTTAR PRADESH, INDIA

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Abstract

Common Ciliate Blue *Anthene emolus* is reported for the first time from Uttar Pradesh.

Introduction

The Common Ciliate Blue, *A. emolus* (Godart 1824) is found from India to Southeast Asia. On the Indian subcontinent, the known distribution of *A. lycaenina* is from Uttarakhand (Sondhi, 2017) through Nepal eastwards to Arunachal Pradesh, the hills of north-eastern India and Bangladesh. The species is also known to occur in Orissa, Jharkhand, Bihar, Goa and from Southern Maharashtra to Kerala (Evans, 1932; Wynter-Blyth, 1957; Cantile, 1963; Smith, 1994; van Gasse, 2013, Varshney & Smetacek, 2015; Kehimkar, 2016).

Methodology

After a fine monsoon, on 30.ix.2020, the first author, Sushmita, photographed two worn individuals of this species with her mobile phone camera (Realme Note 5 Pro), feeding on flowers in the Butterfly Park of Lucknow Zoo (26º 50' 35.9" N 80º 57' 04.5" E; 121m above mean sea level), Hazratganj, District Lucknow, Uttar Pradesh, India. A third individual, apparently freshly emerged, was photographed by Babita Sharma at the same location with her cell phone camera (Redmi Note 9 Pro, Xiaomi) on 27.x.2020. Peter Smetacek identified and confirmed these photographs as *Anthene emolus* (Common Ciliate Blue).

Discussion

This is the first record of *Anthene emolus* from Lucknow district as well as from Uttar Pradesh. The butterfly park of Lucknow is situated in Nawab Wajid Ali Shah Zoological Garden (Lucknow Zoo). The climate of Lucknow is mild and generally warm and temperate (climate-data.org). *A. emolus* is essentially a forest species, which inhabits moist, dense forests at low elevations. They are active in open areas, at the edges of the forests and forests clearings (Bhakare & Ogale, 2018).

The records of the species at the same location a month apart suggest that there is a breeding colony of this species established in the Lucknow Zoo.

Conclusion

There is no record of *A. emolus* from Uttar Pradesh, India. Since it has been recorded from Bihar (Varshney & Smetacek, 2015), so it was expected from the neighboring state, Uttar Pradesh and the present report is a confirmatory record rather than a notable range extension.

Acknowledgement

We would like thank Mr. R.K. Singh, Director and Dr. Utkarsh Shukla, Deputy Director and Senior Veterinarian of Nawab Wajid Ali Shah Zoological Garden (Lucknow Zoo), Lucknow for giving us necessary permission to work in Butterfly Park of Lucknow Zoo. We also

express our sincere gratitude to Mr. Daya Shanker Sharma for his generous help during the surveys. The authors are very grateful to the reviewers for their valuable suggestions and information.

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Fig.1 & 2: Common Ciliate Blue in Lucknow

ARECA PALM *DYPSIS LUTESCENS* (ARECACEAE) AS NEW LARVAL HOST PLANT FOR THE GIANT REDEYE BUTTERFLY *GANGARA THYRSIS* (INSECTA: LEPIDOPTERA: HESPERIIDAE)

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Keywords: *Gangara thyrsis, Dypsis lutescens,* Arecaceae

The Giant Redeye *Gangara thyrsis* (Fabricius, 1775) (Insecta: Lepidoptera: Hesperiidae) is found in Mumbai city of Maharashtra. Within the city, it has been reported from urban habitats and urban gardens more often than from the forested areas of Sanjay Gandhi National Park.

The species is known to occur from Maharashtra to Kerala, in Andhra Pradesh; Himachal Pradesh to Northeast India and Andaman & Nicobar Islands (Varshney & Smetacek, 2015). It has been reported to occur in South India and has been photographed in the Western Ghats from Mumbai southwards to Kerala (Bhakare *et al.*, 2020). It was recently reported from BNHS Nature Reserve in Mumbai, Maharashtra (Kasambe, 2018).

Since September 2020, the author has been rearing caterpillars of butterflies in Mumbai area and especially in the Bombay Natural History Society (BNHS) Nature Reserve, which is a forested area spread over 33 acres nestled between Dadasaheb Phalke Chitra Nagari (aka Film City) and Sanjay Gandhi National Park in Mumbai City of Maharashtra, India. The Reserve also has a small butterfly garden spread over an area of around quarter of an acre.

In 2019, the author had seen one adult *G. thyrsis* in this Reserve nectaring on the flowers of Crepe Ginger or Spiral Ginger *Costus speciosus*. On 6.iii.2020, a crushed specimen was found on the road leading to the Reserve.

On 9.xi.2020 morning and on 6.xii.2020 evening, the author found adult butterflies nectaring on the white flowers of the Pinwheel Flower *Tabernaemontana divaricata* in urban habitat in Goregaon suburb of Mumbai.

On the same day he found a large caterpillar and two eggs of the species on roadside Areca Palm *Dypsis lutescens* (Family Arecaceae). The author bought a potted *D. lutescens* and released the caterpillar on it and kept the eggs on it. The caterpillar soon made a cell for itself and was seen feeding. Frass was seen under the plant. On 19.xi.2020 it started pupating by making a roll by sewing few leaves of the palm using its own saliva. An adult butterfly was seen flying in the apartment on 20.xii.2020.

The two eggs hatched on 14.xi.2020. The newborn caterpillars ate half of the egg shells and started folding leaf edges and made cells by sewing the edge with silk threads. For this they cut the leaves including the midrib. The caterpillars were observed feeding and growing on the plant itself. Next day, both shifted their locations, sewed three leaves together and made a pocket like cell in there. On 26.xi.2020, one fell down from the plant twice and was put back on the plant. The third

time it was found on ground, it was shifted (along with the second one) to a transparent rearing container and kept with some leaves for feeding. But both were found dead on 27.xi.2020.

A 5th instar caterpillar was found on leaves of *Dypsis lutescens* on 01.i.2021 early in the morning at 05.10am. It was brought and released on the potted *D. lutescens* plant in the author's apartment. It was seen feeding for the next three days and frass was observed under the plant. However, on 4.i.2021, the caterpillar disappeared. Presumably it had wandered and rolled up leaves of the palm for pupation and the pupa could not be located. A freshly eclosed butterfly was seen in the apartment on 6.ii.2021. It flew after few hours.

From 26.xi.2020 to 01.iii.2021, a total of 15 eggs and 8 caterpillars were found on different *D. lutescens* plants in BNHS Nature Reserve, Mumbai (only two eggs) and the Goregaon urban area (remaining).

Following is the complete list of larval host plants reported till date for *Gangara thyrsis*: Arecaceae, *Borassus flabellifer*, *Calamus*, *Calamus pseudofeanus*, *Calamus rotang*, *Calamus thwaitesii*, *Calamus viminalis*, *Caryota urens*, *Chamaerops humilis*, *Cocos nucifera*, *Corypha umbraculifera*, *Licuala grandis*, *Licuala chinensis*, *Phoenix acaulis*, *Phoenix loureiroi* (Arecaceae) (Robinson *et al.* 2021, Nitin *et al.*, 2018.). *Zingiber officinale* (Zingiberaceae) has also been recorded once (Kalesh & Prakash, 2007). *Saccharum officinarum* (Poaceae) is recorded but this is doubtful and needs confirmation (Nitin *et al.*, 2018).

Conclusion

The repeated sightings of eggs and caterpillars of *Gangara thyrsis* on the *Dypsis lutescens* (Family Arecaceae) plants and its rearing till eclosion of adult butterflies clearly indicates the regular use of the plant as a larval host. Looking at the list of larval host plants reported previously, this is clearly a new record of the larval host plant for the *G. thyrsis*. Also, the plantation of this plant as ornamental plant in cities like Mumbai could be helping it spread there.

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Fig.1: Egg on Dypsis letescens plant

Fig.2: Caterpillar First Instar making cell

Fig.3: Caterpillar in cell

Fig.4: Caterpillar 4 instar

Fig.5: Caterpillar 5 Instar

Fig.6: Pupation

Fig.7: Freshly eclosed butterfly

Fig.8: Areca Palm *Dypsis lutescens* in Goregaon, Mumbai

REPORT OF A LIVE RECORD OF *NEPTIS ASPASIA* (SYN: *PHAEDYMA ASPASIA*), LEECH, 1890, (LEPIDOPTERA: NYMPHALIDAE: LIMENITIDINAE: NEPTINI) FROM INDIA AFTER 68 YEARS

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Abstract
Phaedyma aspasia falda (Eliot, 1969) was described on the basis of a type series collected from Bhutan in 1933 and Assam in 1947 (Eliot, 1969). Since then, this subspecies has not been recorded from India. Dhungel & Wahlberg (2018) returned the taxon *aspasia* to genus *Neptis* Fabricius, 1807, based on molecular phylogeny. Consequently, the original combination, *Neptis aspasia*, has been revived. We have photographed a live specimen of *Neptis aspasia falda* from Pange, Talle valley W.L.S, North Subansiri District, Arunachal Pradesh, in August, 2015. This is 68 years after the last Indian specimens were collected in 1947.

Key words: Neptini, Rediscovery, Pange, Talle valley, Apatani, Arunachal Pradesh, Conservation.

Introduction

J.N. Eliot (1969) listed 10 species under *Phaedyma* Felder, 1861 including a new species, *Phaedyma chinga* Eliot, 1969. He also described a new subspecies *falda*, for *Phaedyma aspasia* based on specimens collected from Assam (Dafla Hills, Apotani-15.viii.1947) and Bhutan (Wan du Potrang, 01.vii.1933 (*F. Ludlow & G. Sheriff*). No subsequent records of this species have been reported from India till a live specimen was photographed by us in 2015 from Pange, Talle Valley, Arunachal Pradesh. Another subspecies, *P. a. kathmandia* (Fujioka, 1970) was described from Godavari, Central Nepal.

Materials and Methods

During a field survey in August 2015, VKC photographed a moderate sized *Neptis* in Pange, Talle Valley Wildlife Sanctuary, North Subansiri District, Arunachal Pradesh. The location was near the iron bridge in the vicinity of Forest Range Office, Pange (1500m amsl.). The individual sighted had landed on the path, from a nearby *Dalbergia horrida* plant. It was photographed at once, using a Canon 7D SLR with a Tamaron 180 mm Macro lens, and the individual flew away before a second photograph could be taken. The image was subsequently reviewed and identified as *Neptis aspasia* by Purnendu Roy and the subspecies identity was suggested by Peter Smetacek.

Observations

The individual sighted was old in appearance, and a piece from the right forewing termen near the tornus and another from the right hind wing apex plus termen were missing from a putative predator attack, but the markings on the left wings were intact and clear enough for identification. The *Dalbergia horrida* plant from which the butterfly flew was examined and two early instar caterpillars, similar to typical *Neptis* caterpillars, were found.

Discussion

The species was identified based on the morphology of wing pattern. The forewing discal spots in spaces 2 and 3 join with the cell streak forming a distinctive pattern which has been described as a hockeystick. In India *N. nycteus* de Nicéville, 1890, *N. nemorum* Oberthür, 1906 and *N. manasa* Moore, [1858] all have this arrangement. However, in all those species the spot in 2 is relatively broad in relation to the spot above in space 3 and the hindwing discal band is also broader than *N. aspasia*. We also compared it with images of *Neptis aspasia* from Vietnam (Yutaka Inayoshi, 2021) and Myanmar (Shizuya *et al*., 2011) with which it matched well. From the white markings which show some traces of yellow in places, and the locality of sighting, this individual appears to match with Eliot's description of the sub species *falda*, specially with the albescent individual collected from the Dafla Hills, Apotani, 1947 (Eliot, 1969), almost the same territory of our record. Eliot's specimen from the Dafla Hills was almost certainly collected by Frederick Betts, who collected in the Apa Tani valley (= Apotani), today known as the Ziro valley, barely 20 km from the Talle Wildlife Sanctuary. Although Betts (1950) did not mention this species in his list of butterflies of the area, that was probably because he appears to have listed only those species whose identity he was certain of, and deposited the unidentified specimens of his collection in the Natural History Museum, London (Catriona Child, *pers. comm.*), where J.N. Eliot found his type series. This species is very rare and there are no studies available about its preferred habitat and elevation. It is clearly a montane species, inhabiting broadleaf forests above 1600 m elevation.

Acknowledgement

We are thankful to Peter Smetacek, for his support and guidance. VKC, BV, VV, AND GD are grateful to Punyo Chada from Ngunu Ziro for field support. We are also grateful to the Forest Department of Arunachal Pradesh for facilitating our visit.

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Fig.1. *Neptis aspasia falda* recorded from Talle Valley Wildlife Sanctuary

Fig.2. *Location Map, Neptis aspasia falda sighting*

AVIAN DIVERSITY IN URBAN AREAS OF LAKE TOWN, KOLKATA, WEST BENGAL

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Reviewer: Peter Smetacek

In the present note, the diversity of birds has been recorded at three localities of Lake Town under South Dum Dum Municipality, Kolkata, West Bengal, *viz*. campus of East Calcutta Girls' College, campus of Lake Town Government sponsored Girls' School and Lake with park area (Third Lake) during the period of July 2017 to September 2019. The areas studied are urban, with one large and one small water body, very little grassland and some orchards along with roadside vegetation. The small water body supports various aquatic plants rooted, floating and marginal whereas the large water body has only marginal plant life and is mainly used for aquaculture. Observations were carried out in the morning between 6.00 am to 9.30 am and in the evening between 4.00 pm and 6.00 pm. A binocular (Nikon Action EX 10X50 CF) and Fieldscope (Nikon Prostaff SEP 25) were used to spot the birds. Identification of birds has been done with reference to Ali (2002) and Grimmett *et al*. (2011).

A total of 35 species of birds belonging to 22 families were recorded during the entire study period (Table 1). Based on the frequency of observation, birds are classified as abundant (observed more than 75%), regular (30% to <75%) and rare (< 30%).

In Table 1, it may be noted that raptors are rare (Black Kite and Barn Owl) while other groups such as waders, insectivores and frugivores are still present in healthy numbers. The careless use of chemical pesticides or ill-conceived 'developmental' activities could rapidly change this happy state of affairs.

It was observed that the quantity and diversity of birds was reducing throughout the study period. It may be due to the constantly increasing anthropogenic activity, pollution or reduction in trees, or else a combination of these and other factors. From the present study, it can be conclude that diverse vegetation supports greater avian diversity. But rapid and constant urbanization in this area leads to habitat destruction which has an adverse impact on avian diversity.

This note is intended to serve as base line data for what was present during this period in a rapidly changing landscape.

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Table 1. Avian diversity at Lake Town, South Dum Dum Municipality, Kolkata.

S. N.	Common Name	Scientific Name	Family	Habitat	Remarks

1.	House Crow	*Corvus splendens*	Corvidae	Human habitation, Grassland	Abundant
2.	Jungle Crow	*Corvus macrorhynchos*	Corvidae	Human habitation, Orchard	Rare
3.	Indian Tree-pie	*Dendrocitta vagabunda*	Corvidae	Orchard	Regular
4.	Common Myna	*Acridotheres tristis*	Sturnidae	Human habitation, Orchard, Grassland	Abundant
5.	Pied Myna	*Gracupica contra*	Sturnidae	Human habitation, Grassland	Abundant
6.	Indian Pond Heron	*Ardeola grayii*	Ardeidae	Water body	Abundant
7.	Cattle Egret	*Bubulcus ibis*	Ardeidae	Grassland	Abundant
8.	Little Egret	*Egretta garzetta*	Ardeidae	Water body	Regular
9.	Lesser Goldenbacked Woodpecker	*Dinopium benghalense*	Picidae	Orchard	Abundant
10.	White-breasted kingfisher	*Halcyon smyrnensis*	Alcedinidae	Water body	Abundant
11.	Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	Human habitation, Orchard	Abundant
12.	Asian Koel	*Eudynamys scolopacea*	Cuculidae	Orchard	Regular
13.	Greater Coucal	*Centropus sinensis*	Cuculidae	Orchard	Regular
14.	Small Bee-eater	*Merops orientalis*	Meropidae	Orchard	Abundant
15.	Rose- ringed Parakeet	*Psittacula krameri*	Psittacidae	Orchard	Regular
16.	House Sparrow	*Passer domesticus*	Ploceidae	Human habitation, Orchard	Rare
17.	Baya, Weaver Bird	*Ploceus philippinus*	Ploceidae	Orchard	Rare
18.	Black Drongo	*Dicrurus macrocercus*	Dicruridae	Human habitation, Orchard	Regular
19.	Common Tailorbird	*Orthotomus sutorius*	Muscicapidae	Orchard	Regular
20.	Oriental Magpie Robin	*Copsychus saularis*	Muscicapidae	Human habitation, Orchard	Regular
21.	Jungle Babbler	*Turdoides striatus*	Muscicapidae	Orchard	Regular
22.	Spotted Dove	*Streptopelia chinensis*	Columbidae	Human habitation, Orchard, Grassland	Abundant
23.	Blue rock Pigeon	*Columba livia*	Columbidae	Human habitation, Grassland	Abundant
24.	Bengal Green Pigeon	*Treron phonicoptera phonicoptera*	Columbidae	Orchard	Rare

25.	Coppersmith Barbet	*Megalaima haemacephala*	Capitonidae	Orchard	Rare
26.	Blue Throated Barbet	*Megalaima asiatica*	Capitonidae	Orchard	Rare
27.	Brown Shrike	*Lanius cristatus*	Laniidae	Orchard	Rare
28.	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	Water body	Regular
29.	Black Kite	*Milvus migrans*	Accipitridae	Human habitation	Rare
30.	Purple Sunbird	*Nectarinia asiatica*	Nectariniidae	Orchard	Rare
31.	Black-headed Oriole	*Oriolus xanthornus*	Oriolidae	Orchard	Regular
32.	White wagtail	*Motacilla alba*	Motacillidae	Grassland	Rare
33.	Yellow wagtail	*Motacilla flava*	Motacillidae	Grassland	Rare
34.	Little cormorant	*Phalacrocorax niger*	Phalacrocoracidae	Water body	Regular
35.	Barn Owl	*Tyto alba*	Tytonidae	Human habitation	Rare

FIRST REPORT OF GENUS *PADENIA* MOORE, 1882 (LEPIDOPTERA: EREBIDAE: ARCTIINAE: LITHOSIINI) FROM ASSAM, INDIA

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Abstract: The present study reports genus *Padenia* Moore, 1882 and *P. acutifascia* de Joanis, 1928 from Assam, for the first time.

Keywords: Moth, *Padenia*, new distribution, Assam

Introduction

The moths of genus *Padenia* are mainly characterised by a dull fore wing with dark transverse bands. This genus is distributed from the Indian mainland to the Bismarck Islands in the East (Kirti & Singh, 2015). Worldwide, the genus is known to have 11 species, out of which four species are reported from India. Hampson (1894) reported *P. transversa* (Walker, 1854) from Odisha (Ganjam), Tamil Nadu (Nilgiris) and the Andaman Islands. Kirti & Singh (2015) reported *P. duplicana* (Walker, 1863) from Arunachal Pradesh. Kirti *et al.* (2020) provided the world checklist of *Padenia*, and added two more species from India, *P. acutifascia* de Joannis, 1928 from Arunachal Pradesh, Mizoram & Meghalaya, and *P. obliquifascia* Rothschild, 1920 from North Andaman Islands. They also included new distributional records for *P. duplicana* from Meghalaya and *P. transversa* from Karnataka, Kerala & Andhra Pradesh. The present study forms the first record for genus *Padenia* from Assam and constitutes a range extension for *P. acutifascia*.

Result

The present study was carried out at Gauhati University campus, Assam (25°53" N, 91°28" E). A single individual was observed on 11.ii.2021 at 13:26 hours. It was identified as *Padenia* referring Hampson (1894) and further identified to species level as *P. acutifascia* on the basis of features mentioned in Kriti *et al*. (2020).

Discussion

The present study forms the first record for genus *Padenia* from Assam. *P. acutifascia* was earlier reported from Arunachal Pradesh, Meghalaya and Mizoram and the present record confirms its presence in Assam.

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Fig.1. *Padenia acutifascia* in Guwahati, Assam

MURRAYA KOENIGII (RUTACEAE), A NEW LARVAL HOST PLANT OF *ANTHENE LYCAENINA* (INSECTA: LEPIDOPTERA: LYCAENIDAE)

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Abstract
Murraya koenigii, curry leaf plant is newly recorded as a larval host plant of *Anthene lycaenina*, pointed ciliate blue butterfly from Panihati (22.6994°N, 88.3702°E), North 24 Parganas district, West Bengal, India.

Introduction

Anthene lycaenina (Felder, 1868), commonly known as pointed ciliate blue, is a species of butterfly, belongs to family Lycaenidae, found in India, Nepal, Bhutan, Bangladesh, Myanmar, and Sri Lanka (Kehimkar, 2016). In India, it is found from Sikkim to north-east India, Gujarat southwards to Kerala, eastwards to Odisha and West Bengal (Varshney & Smetacek, 2015). It also occurs in Andaman islands (Kehimkar, 2016). Previously reported larval host plants of *Anthene lycaenina* are *Buchanania axillaris* (Anacardiaceae), *Buchanania cochinchinensis* (Anacardiaceae), *Bridelia retusa* (Phyllanthaceae), *Putranjiva roxburghii* (Putranjivaceae), *Leucaena leucocephala* (Fabaceae), *Acacia nilotica* (Fabaceae), *Acacia pennata* (Fabaceae), *Dalbergia latifolia* (Fabaceae), *Moullava spicata* (Fabaceae), *Pithecellobium dulce* (Fabaceae), *Caesalpinia bonduc* (Fabaceae), *Ventilago denticulata* (Rhamnaceae), *Allophylus cobbe* (Sapindaceae) (Wynter-Blyth, 1957; Robinson *et al*., 2010; Nitin *et al*., 2018). Nayanathara & Narayana (2020) reported mango (Anacardiaceae) as a larval host plant of *Anthene lycaenina*. The curry leaf tree *Murraya koenigii* (L.) Spreng (Rutaceae) is a small tree with compound leaves, and small flowers, produced in clusters, native to tropical parts of Asia (Sachdeva & Tongbram, 2017). Flowers are white and 10 to 12 millimetres across (Krishen, 2013). Lepidopteran insects that are known to use *Murraya koenigii* as larval host plant are *Phyllocnistis citrella* (Gracillariidae), *Psorosticha zizyphi* (Oecophoridae), *Tinthia cymbalistis* (Sesiidae), *Papilio polytes* (Papilionidae), *Papilio demoleus* (Papilionidae), *Papilio polymnestor* (Papilionidae) and *Papilio nephelus* (Papilionidae) (Robinson *et al*., 2010; Karmakar *et al*., 2018). Previously, *Anthene lycaenina* was not known to feed on *Murraya koenigii* in the larval stage. In the present study, *Murraya koenigii* is reported as a new larval host plant of *Anthene lycaenina* from Panihati (22.6994°N, 88.3702°E), North 24 Parganas district, West Bengal, India.

Materials and Methods

Study Area

Panihati (22.6994°N, 88.3702°E) is an urban locality in North 24 Parganas district of West Bengal state, India and is a part of Gangetic plains biogeographic zone. Panihati is located beside the Ganga river. Average elevation of Panihati above mean sea level is 13 metres.

Methodology

Visual observation and rearing of *Anthene lycaenina* was carried out during the study. Rearing was done in a clean, aerated plastic container. Study period was from 07.iii.2021 to 15.iii.2021. The season of the study period

was spring. Adult *Anthene lycaenina* was identified using Wynter-Blyth (1957) and Kehimkar (2016). *Murraya koenigii* was identified using Krishen (2013) and Sachdeva & Tongbram (2017). Photographs of observations were taken using a Lenovo K33a42 smart phone.

Results and Discussion

On 07.iii.2021, at 4:50 p.m., one small lepidopteran larva was observed on an inflorescence of an about 4 feet tall flowering *Murraya koenigii* plant, on the roof-top garden of the author's residence. The height of the roof was about 11 feet from the ground. The larva was feeding on a flower bud, on the inflorescence. This larva was then collected for rearing. It was reared in a clean, aerated plastic container, provided with the same inflorescence along with the leafy branch, on which it was observed. The inflorescence contained some flower buds and some open flowers. At 5:34 p.m., the larva was observed to feed on a flower bud. It was feeding from one side of the bud and made a hole in it, laterally. After that, at about 6:17 p.m., the larva was observed to feed on petals and stamens of an open flower from the inflorescence. It was defecating on the container's surface during feeding. Faecal matter was removed carefully from the container. On 08.iii.2021, at 11:31 a.m., the larva was seen on a *Murraya koenigii* leaf's dorsal surface, having oriented itself to align with the midrib of the leaf. The larva was dark green at that time. It remained in the same position, on the leaf, for the rest of the day and was not feeding. On 09.iii.2021, at 1:51 p.m., it was observed that, the larva had pupated on the same leaf surface. The pupa was green and was about 9 millimetres in length. From the date of pupation (09.iii.2021), it remained in the pupal stage for 6 days. On 15.iii.2021, at about 7:25 a.m., it was found that, an adult *Anthene lycaenina* had eclosed from the pupa. The adult individual was then released and it flew away.

In the present study, *Anthene lycaenina* larva was observed to feed on a white open flower and flower buds of *Murraya koenigii*, and then pupation and adult eclosion took place. Hence, *Murraya koenigii* (Rutaceae) is a larval host plant of *Anthene lycaenina*. This is a new record of larval host plant for this butterfly.

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Fig.1. *Anthene lycaenina* larva feeding on a flower bud of *Murraya koenigii*. 07.iii.2021

Fig.2. *Anthene lycaenina* larva feeding on a flower bud of the inflorescence of *Murraya koenigii*. 07.iii.2021.

Fig.3. Hole made on lateral side of a flower bud of *Murraya koenigii* by *Anthene lycaenina* larva.

Fig.4. *Anthene lycaenina* larva feeding on an open flower of *Murraya koenigii*. 07.iii.2021

Fig.5. *Anthene lycaenina* larva (dorsal view) on leaf of *Murraya koenigii*. 08.iii.2021

Fig.6. *Anthene lycaenina* larva (lateral view) on leaf of *Murraya koenigii*. 08.iii.2021.

Fig.7. Pupa of *Anthene lycaenina* on *Murraya koenigii* leaf. 09.iii.202108.iii.2021.

Fig.8. Eclosed adult *Anthene lycaenina*. 15.iii.2021.

EGG CANNIBALISM BY CATERPILLARS OF THE TAWNY COSTER BUTTERFLY, *ACRAEA TERPSICORE* (LEPIDOPTERA: NYMPHALIDAE) IN INDIA

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The first author (RR) has developed a small butterfly garden on his private land in Khar area in Mumbai, Maharashtra. Here he has planted many larval host plants and nectar plants of butterflies. There are a few Passion Flower vines also (*Passiflora* spp.) which is a known larval host plant of Tawny Coster *Acraea terpsicore* (Linnaeus, 1758).

On 30.vii.2020 a Tawny Coster was seen laying a batch of eggs on the underside of a Passion Flower vine leaf. Further observations revealed that there were already two batches of eggs on the same leaf. These eggs started hatching during the ensuing days.

After feeding on the egg shells, the newly hatched caterpillars (more than 50) started feeding on the leaves by skimming the leaf surface. After some time, these caterpillars crawled around and found a batch of more than 70 freshly laid eggs. Surprisingly, they started feeding on these fresh eggs. After a few hours, it was seen that the entire batch of freshly laid eggs was finished by the already hatched caterpillars.

On 25.x.2021, RK found two batches of eggs on one leaf of Passion Flower at the butterfly garden in BNHS Nature Reserve, which is nestled between the Film City and Sanjay Gandhi National Park, in Goregaon, Mumbai. The two batches were on the upper and under sides of one single leaf. The eggs from one batch (of more than 70 eggs) started hatching at around 11 a.m. and started feeding on the shells of eggs from which they had emerged. As the emergence and feeding on the upper surface of the leaf was being observed and video recorded, it was discovered that there was another batch of eggs on the underside of the same leaf. After finishing the egg shells, the caterpillars started crawling around and reached these eggs. As RK was aware of the above incident, he watched the behaviour of these caterpillars. However, although they discovered the eggs, they did not eat them and moved on to feeding on leaves of the larval host plant. Observations were discontinued as most of the caterpillars dispersed to nearby leaves, leaving the egg unharmed. Also on 29.x.2021, RK observed another batch of more than 70 eggs hatching. The caterpillars did not eat each other, at least on that day. In that case, there was no other batch of unhatched eggs.

It has been reported for many lepidopteran caterpillars that they exhibited cannibalism as caterpillars feeding on caterpillars (de Niceville, 1901; Moore, 1912; Brues,1920; Dethier, V. G., 1937) or even as caterpillars feeding on eggs of the species as reported in two species of *Pieris* butterflies, viz., *Pieris rapae* and *P. melete* (Watanabe & Yamaguchi, 1993).

In a recent research paper, Orrock *et al*. (2017) proposed that induced defenses in plants (the plant making itself low quality or toxic) reduce herbivory by increasing cannibalism among the caterpillars.

We could not find any reference of egg cannibalism in any butterfly species from India. Hence the report assumes importance.

Acknowledgements

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Fig.1: Leaf of Passion Flower showing hatching and fresh eggs of Tawny Coster

Fig.2: Tawny Coster caterpillars feeding on fresh eggs

Fig.3: Tawny Coster caterpillars feeding on fresh eggs

Fig.4: Tawny Coster caterpillar feeding egg shells

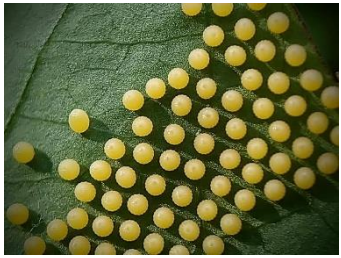

Fig.5: Tawny Coster fresh eggs

NEW RECORD OF FREAK *CALINAGA* (INSECTA: LEPIDOPTERA: NYMPHALIDAE) FROM EASTERN HIMALAYA, NEPAL

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Abstract

This paper presents the first record of a Freak, *Calinaga* Moore, 1857 from Taplejung district of Eastern Nepal. Three individuals were recorded from a forest edge alongside Cardamom plantation. The confirmation was made from a photograph of an individual perching on an epiphyte growing on a branch of *Ficus* spp.

Keywords: *Calinaga*, Eastern Nepal, New Record

Introduction

Calinaga is placed in the monobasic nymphalid subfamily Calinaginae. The genus occurs in South Asia and China. There is considerable confusion over the taxa in this genus. Some authors recognize 11 species, of which 4 were believed to occur on the Indian subcontinent (Beccaloni *et al*., 2003; Savela, 2015). However, Todisco *et al*. (2017) found that for six taxa of this genus they studied, only four were valid. Since only one of these, *C. aborica* Tytler, 1915 was an Indian taxon, we have treated the remaining taxa, i.e. *buddha* Moore, 1857, *brahma* Butler, 1885 and *gautama* Moore, 1901 as subspecies of *C. buddha*, following Varshney & Smetacek (2015) until reliable work is carried out on the Indian taxa.

Although the genus was known from both east as well as west of Nepal, i.e. from Himachal Pradesh to Uttarakhand (*buddha*) and from Sikkim to Arunachal Pradesh and Myanmar (*gautama*, *brahma* and *aborica*) (Evans, 1932), there was no report of this genus from Nepal, although it was assumed that one or the other taxon occurred here.

Material and Method

A study was carried out on butterfly diversity of the Eastern Himalaya, Nepal in 2018 where three individuals of *Calinaga* were recorded from Taplejung district, Province 1, Nepal. The individuals were recorded from Tamor river basin, one of the main tributaries of Koshi river at an altitude of 1286 m a.m.s.l (27.4911836 E; 87.746465 N). The individuals were seen fluttering along the edges of hill forests bordering cardamom plantation. The individuals were found perching on an epiphyte growing in the branch of a *Ficus* tree. Though in flight it resembled *Parantica* spp., a careful examination of the photograph (Fig 1) confirmed the species to be a *Calinaga.* We tentatively place the individuals observed by us under *C. b. gautama*, since the presence of pale brown underside hind wing and more elongated forewing separates it from *C. b. brahma* (Kehimkar, 2016). The markings of

the species along with the orange-red thorax are similar to *C. b. buddha* but the ground color is darker brown, especially on the underside. The forewings are a bit more elongated and produced and the hind wings are narrower and more angular compared to *C. buddha* (Moore, 1902; Evans, 1932).

Results and Discussions

This is the first record of the genus and sub-family Calinaginae from Nepal. As Todisco, 2017 noted, evolutionary history of this *Calinaga* species is still uncertain and therefore we are not assigning a species level name to it. This species is most likely to be *gautama*, known from Sikkim, which adjoins the current study area. However, the status of the taxon g*autama* is not certain. It was recorded in May, which coincides with its short flying period from March to May (Kehimkar, 2016). Though the study was conducted extensively, this species was recorded only from the specific forest-agriculture edge. The species was found perching on the epiphyte for more than two hours around noon which might provide some basis for further research in ecology of the species. Lack of research coverage and localised habitat of the species might be the reason for the lack of evidential data of the species in Nepal.

At the recorded site, continual agricultural land extensions were observed. However, traditional agroforestry was practiced in the area, which makes its impact difficult to predict on the status of the species. Also, the lack of evidential data of the larval host plant of the species makes difficult to recommend specific conservation measures. Other members of the genus feed on *Morus* species in the larval stage and this species might feed on *Ficus*. This study confirms the presence of a small local population of the species in Nepal but further research is essential to assess its overall distribution.

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Fig 1: *Calinaga* sp. perching on an orchid

FOUR ADDITIONS TO THE LANTERNFLY (INSECTA: FULGOROIDEA: FULGORIDAE) FAUNA OF NEPAL

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Abstract
Four species are added to the known Fulgoridae fauna of Nepal. One species, *Polydictya tricolor* (Westwood, 1845) was recorded from Sundarbazar, Lamjung in June 2017, while the other three, *Aphaena (Aphaena) submaculata* (Duncan, 1843), *Lycorma imperialis* White, 1846 and *Penthicodes (Ereosoma) atomaria* (Weber, 1801) were reported from a single location at Bhedetar, Dhankuta, all in August 2021. With this, there are altogether eight species of Fulgoridae recorded from Nepal.
Keywords: Fulgoridae, lanternflies, lantern bugs, planthopper, Nepal

Introduction
The members of Fulgoridae are commonly known as lantern bugs or lanternflies. Bourgoin (2021) lists 774 species of Fulgoridae under 142 genera around the world. These insects are mostly found in the tropics while some genera are also found in temperate regions. About 300 species are found in the Oriental Region alone, which represents about 40% of all known Fulgorids (Constant & Pham, 2019).

The Fulgoridae fauna of Nepal is not well known. Thapa (2000) mentions only four species in this family viz. *Fulgora oculata* Westwood, 1841 (now *Pyrops oculatus* (Westwood, 1838)), *F. pyrorhyncha* Donovan, 1800 (now*Pyrops pyrorhynchus* (Donovan, 1800), *Pyrops punctata* Walker, 1851 (now *Zanna affinis* (Westwood, 1838)) and *Saiva cardinalis* (Butler, 1874). *Zanna affinis* was also listed for Nepal by Constant *et al.* (2016). Thus, so far, only four species have been reported from Nepal.

Methods and Methodology
The findings are based on opportunistic surveys carried out by the first author across random districts of Nepal, specifically looking for butterflies. The insects were photographed using Canon 7D MarkII camera coupled with 100mm f/2.8L Macro IS USM lens. The GPS location along with altitudes are stored in the camera itself. For identification purpose, Distant (1906) was used. The photographs were sent to Mr. Jerome Constant (Belgium) for further confirmation who identified the specimens based on the photographic evidence.

Observation
List of Species

Suborder Auchenorrhyncha Duméril, 1806
Infraorder Fulgoromorpha Evans, 1946
Family Fulgoridae Latreille, 1807

Genus *Aphaena* Guérin-Méneville, 1834

1. *Aphaena (Aphaena) submaculata* (Duncan, 1843)

A single individual of *A. submaculata* was seen in Bhedetar, Dhankuta on 12.viii.2021, at 750 masl. The individual was feeding on tree sap inside a forest along with many

individuals of *Lycorma imperialis* White, 1846.
Distribution: Sikkim, Darjiling. (Distant, 1906)
This genus is in need of revision (Constant *et al.*, 2016).

Genus *Penthicodes* Blanchard, 1845

2. *Penthicodes (Ereosoma) atomaria* (Weber, 1801)
One individual of *P. atomaria* was seen in Bhedetar, Dhankuta on 12.viii.2021 at 700 masl. The individual was perched on a leaf along a forest trail.
Distribution: India, Bhutan, China, Cambodia, Indonesia, Malaysia, Laos, Thailand, Vietnam. (Constant, 2010; Jiaranaisakul *et al.*, 2018)

Genus *Lycorma* Stal, 1863

3. *Lycorma imperialis* (White, 1846)
Several individuals of *L. imperialis* were seen in Bhedetar, Dhankuta from 11 to 21.viii.2021 at 640-750 masl. Most of the individuals were seen in a group feeding on the sap of an unknown tree, while some were found on forest trails.
Distribution: Sikkim, Assam, Darjiling. (Distant, 1906)

Genus *Polydictya* Guérin-Méneville, 1844

4. *Polydictya tricolor* (Westwood, 1845)
An individual of *P. tricolor* was found in Sundarbazar, Lamjung on 6.vi.2017 at 610 masl by the first author.
Distribution: Assam, Darjiling (Distant, 1906); India, Assam and Vietnam (Nagain & Porion, 1996).

Updated Checklist for Nepal

1. *Aphaena (Aphaena) submaculata* (Duncan, 1843)*
2. *Pyrops pyrorhynchus* (Donovan, 1800) = *Fulgora pyrorhyncha* Donovan, 1800
3. *Pyrops oculatus* (Westwood, 1838) = *Fulgora oculata* Westwood, 1841
4. *Lycorma imperialis* (White, 1846)*
5. *Penthicodes (Ereosoma) atomaria* (Weber, 1801)*
6. *Polydictya tricolor* (Westwood, 1845)*
7. *Saiva cardinalis* (Butler, 1874)
8. *Zanna affinis* (Westwood, 1838)

*Additions for Nepal

Discussion

The Fulgoridae of Nepal have not been well studied. There are very meager records in the literature and practically no preserved specimens. The location of Nepal makes it one of the best places for Fulgoridae, especially in the middle ranges in the east of the country. In the central hills though, we have never come across many of them. A thorough review and much field work on this group is required to come up with a more complete checklist for Nepal. With these four records, and the previous four, only eight species of this group are recorded from Nepal so far.

Acknowledgement

The authors are grateful to Mr. Jerome Constant (Royal Belgian Institute of Natural Sciences, Belgium) for verifying the identifications, and Nepal Agricultural Research Council (NARC), Khumaltar, Lalitpur for supporting the research.

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Fig1: *Aphaena submaculata* (Duncan, 1843)

Fig.2: *Aphaena submaculata* (Duncan, 1843)

Fig.3: *Lycorma imperialis* White, 1846

Fig.4: *Penthicodes atomaria* (Weber, 1801)

Fig.5: *Polydictya tricolor* (Westwood, 1845), Dorsum

Fig.6: *Polydictya tricolor* (Westwood, 1845), Venter

Fig.7: *Polydictya tricolor* hind tibia showing the distinctive four spines, the one near the base smallest (Distant, 1906)

GENERA OF ANTS ASSOCIATED WITH LARVAE OF PLAINS CUPID (*CHILADES PANDAVA*, HORSFIELD, 1829) (INSECTA: LEPIDOPTERA: LYCAENIDAE) INFESTING *CYCAS*, IN DELHI, INDIA, AND AN INSIGHT INTO THE NATURE OF THEIR INTERACTION

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Abstract

Larvae of many species of Lycaenid butterflies are known to associate with ants. With respect to larvae, the association can be facultative or obligatory. Also, larvae of some species of Lycaenids maintain a parasitic, and many others a mutualistic relationship with ants. Larvae of *Chilades pandava* (Lepidoptera:Lycaenid:Polyommatini) -a butterfly that has recently extended its range along with the artificial introduction of its larval host plants, several species of *Cycas*, is known to associate with more than one genera/species of ants. We sampled ornamental *Cycas* plants in urban Delhi infested with *C. pandava* for the genera of ants that associate with the larvae of this butterfly. Results compiled from sampling studies in Delhi, and various reports from literature indicated that at least 13 genera of ants can associate with larvae of *C. pandava*. In the present communication, these results have been discussed in light of the nature of association between *C. pandava* and ants.

Keywords Lycaenid-ant Association, Mutualism

Introduction

The larvae of many Lycaenid butterflies are known to associate with ants- 'myrmecophily' (Pierce *et al*., 2002). The relationship between larvae and ants can be parasitic, commensal or mutualistic (Baylis *et al*., 1993; Fiedler, 2012). The latter type of relationship i.e. mutualism, occurs most frequently (Fiedler, 2006a; 2012). In mutualism, the butterfly larvae provide nutritious secretion-'larval nectar' (rich in sugars and amino acids) from Dorsal Nectary Organs (DNO, located in 7th abdominal segment of larvae) to ants. In return, the larvae are exempted from attack by ants and additionally, ants aggressively safeguard larvae from other predators (Pierce *et al*., 2002; Hojo *et al*., 2015; Malicky *et al*., 2005). Larvae also possess a pair of eversible Tentacle Organs (TO), on the 8th abdominal segment which are known to secrete volatile substances, and Pore Cupola Organs (PCO) distributed on abdomen (Pierce *et al*., 2002; Ekka *et al*., 2020). The function of substances secreted from TO is similar to the ant alarm pheromone; it alerts ants when larvae are alarmed, and can communicate the message of need for protection to several species of ants (Pierce *et al*., 2002; Ekka *et al*., 2020). Gnatzy *et al*. (2017) suggested that TO are mechanosensors. PCO is known to secrete substances to appease ants which otherwise may attack soft bodied larvae. Thus, the three organs, i.e. DNO, TO and PCO are important for mutualistic larvae–ant association (Pierce *et al*., 2002; Fiedler, 1991; 1996).

It has been shown that the seemingly mutualistic relationship between Lycaenids

and ants is actually of the host-parasite type. Larvae, through certain chemicals in their secretion, can manipulate the behaviour of ants and enforce a cooperative behaviour such as partner fidelity and aggressive defence (Hojo *et al*., 2015; Hughes, 2015).

The association between Lycaenid larvae and ants can be facultative or obligatory (Pierce *et al*., 2002, Fiedler *et al*., 1996; Fiedler, 2012). In the facultative association, larvae do not require or tended by several genera or species of ants, and; larvae are attended by ants only intermittently. In the obligatory association, larvae are invariably associated with a particular genus or species of ants and the survival of larvae is not possible without ants due to high risk of predation or other reasons (Fiedler *et al*., 1996; Pierce *et al*., 2002). In most cases, facultative associations are said to be mutualistic (Pierce *et al*., 2002).

Field data collated for larvae of 435 species of Lycaenids revealed that worldwide, about 53 genera of ants associate with larvae of this group of butterflies (Fiedler, 2001). All the genera of ants reported in the study were also known to forage on honeydew, plant nectar or other liquid sources of carbohydrates. The same study also reported that in India, 21 genera of ants associate with the larvae of 109 species of Lycaenids, with most frequently associated genera of ants being: *Crematogaster* (Lund, 1831), *Camponotus* (Mayr, 1861), *Polyrhachis* (Smith, 1857), *Oecophylla* (Smith, 1860), *Anoplolepis* (Santschi, 1914), *Tapinoma* (Forster, 1850), *Pheidole* (Westwood, 1839), *Paratrechina* (Motschoulsky, 1863) and *Technomyrmex* (Mayr, 1872) (Fiedler, 2001),

Chilades pandava is an invasive butterfly and a serious pest of *Cycas* sp. in some parts of the world (Wu *et al*., 2009;Tennent, 2014;Marler *et al*., 2012; Liu, 2018). It is known to use about 85 species of *Cycas* as host plants including *Cycas revoluta*- the common ornamental Cycad species in gardens (Marler *et al*. 2012). The butterfly lays eggs on nascent fronds of *Cycas* on which the emerging larvae feed. This severely affects the growth of the plant. The larvae of *C. pandava* have been observed to be associated with more than one genus of ants and the association is considered of the mutualistic type (Fiedler, 1991). In the present communication, the ant associations of *C. pandava* have been further studied. Observations made on the *Cycas* plants in urban Delhi (Northern India) revealed association of larvae of *C. pandava* with many more genera of ants. The list of ant genera that can associate with larvae of *C. pandava* has been further augmented by previous reports from various other geographical locations. The results so obtained are discussed in view of the nature of association between *C. pandava* and ants.

Materials and Methods

Observations related to larva-ant association

Thirteen ornamental *Cycas* plants at five different locations (parks and lawns) in urban Delhi (L1-L5, Table 1) were observed for the genera of ants that associate with the larvae of *C. pandava.* All the plants were examined for about 10-15 minutes from top and underside. Ants which were seen in physical contact with larvae were photographed with any of the three mentioned instruments: 1) digital SLR camera (model Nikon-D500), attached with macro lens (AF-S VR Micro-Nikkor 105 mm) or wide angle lens (18-55) with extension tubes; 2) Panasonic GH5 attached with 35 mm lens; and 3) Canon A3200 with 5X zoom. Short duration video clips of ants in physical contact with larva were also made using the above mentioned instruments. The identity of the ants up to the genus level was ascertained through photographs. The information on the numbers of genera of ants associated with larva of *C. pandava* so obtained is given in Table 1.

Literature search

The information on the numbers of genera of ants than can associate with larva of *C. pandava* was augmented by online literature search. The information so obtained is given in Table 2.

Observations related to life cycle of *C. pandava*

Three plants at location L1 (Table 1) were observed for egg laying, larval stage, pupation and eclosion. One breeding cycle of *C. pandava* on each of the three plants was monitored. Observations were commenced from appearance of new fronds till their damage by feeding activity of the larvae and slowing down or culmination of breeding activity of butterflies on the plants. Various stages of *C. pandava* life cycle were photographed (Figure 1).

Results

Breeding activity

Adult *C. pandava* laid eggs on nascent fronds of *Cycas* sp. The discoid eggs of *C. pandava* were greenish-white or pale bluish-white (Figure 1b and c). The majority of eggs hatched within 5-8 days after the fronds were heavily laden with eggs by adults. When the larval population was at its maximum, all the instars could be seen on the plant, possibly due to the asynchronous hatching of eggs of different ages. The emerging larvae fed by boring into the young fleshy fronds as well as on the surface of fronds. On the basis of body colour, larvae could be differentiated into three colour types; pale-green, reddish-purple, and a third form, with an intermediate colour (Figure 1d). Ants were seen in physical contact usually with older larvae. Pupae were observed at the base of leaves after 7 or more days of hatching of the eggs under observation (Figure 1e and f). The breeding activity (egg laying) of *C. pandava* on a plant slowed down and finally stopped after damage to all or most of the nascent fronds by the feeding activity of larvae (Figure 1g).

Observations related to larvae-ant interaction

A total of 6 different genera of ants belonging to 3 subfamilies of Formicidae, i.e. Myrmicinae, Formicinae and Dolichoderinae were found to associate with larvae of *C. pandava* on 13 *Cycas* plants at 5 different locations (L1-L5) in urban Delhi (Table 1 and Figure 2). Ants were observed to make physical contact with the larvae which were about the length of 1 cm or more (older larvae). Ants moved or ran on the dorsal side of larvae with characteristic antennal movements and intermittently paused near DNO (Figure 2) to collect larval nectar. Literature search provided 7 additional genera of ants that associated with larvae at other geographical locations (Table 2).

Further observations made in the present study include: a) on a given *Cycas* plant, not all the larvae seen were in contact with ants during the time span of observation, b) in all but two cases, only a single genus of ants was observed to associate with larvae on a given plant, c) on two occasions, more than one genus of ants were observed to be associated with nearby larvae on the same plant (sharing food site), and d) at location L2 with cluster of 5-6 infested *Cycas* plants, different genera of ants were observed to associate with larvae on different plants at a given time.

Discussion

C. pandava is native to Southern Asia and has invaded many other regions of the world (Wu *et al*., 2009;Tennent, 2014;Liu, 2018;Fric *et al*., 2014: Abu-Shall, 2014;Williams, 2006). It is a serious pest in some parts of the world, threatening various endemic species of *Cycas*, as well as ornamental *Cycas* in gardens (Marler *et al*., 2012; Liu *et al*., 2018). In Delhi, the butterfly profusely lays eggs on budding fronds of *Cycas* from March to November. Extensive damage to the plant is caused by the larvae which feed exclusively on tender fronds.

The larvae of *C. pandava*, particularly the older instars (3^{rd}-4^{th}) are intermittently attended (or tended) by ants (Figures 1 and 2).

The 3rd and 4th instar larvae of butterflies belonging to the tribe Polyommatini are known to possess PCO, DNO and TOs (Fig. 2 g and h) and myrmecophily occurs universally in this tribe (Fielder, 1991; Pierce *et al*., 2002; Ekka *et al*., 2020). The association is of mutualistic type as larvae secrete nectar from DNO in the presence of ants on which the latter feed. And, in response to this food provisioning service, larvae are not only exempted from attack by ants, but are also protected from other predators by the latter (Fielder, 1996; Pierce *et al*., 2002). A total of 13 genera of ants have been found to associate with *C. pandava* larvae (Tables 1 and 2). This includes 6 genera observed in urban parts of Delhi in the present study, and 7 genera from other geographical locations as reported in the literature (Table 1 and 2). Of the 6 genera of ants which we have reported from Delhi, *Meranoplus* have not been reported previously to associate with larvae of *C. pandava*. According to the state-wise checklist of ants in India, Delhi is known to have 19 genera of ants (Bharti *et al*., 2016), and the present study shows that at least 10 of these (6 genera from Table 1 + 4 genera given in bold letters in Table 2) can associate with larvae of *C. pandava*. It is however possible that many more genera of ants that can associate with larvae of *C. pandava* will be discovered if more extensive sampling is done. Since the larvae of *C. pandava* can be tended by several species of ants, and only intermittently, also, larvae can transform into adults even in the absence of any contact with the ants (results not shown), indicates a facultative association between larvae and ants (Fielder, 1991; 1996; Pierce *et al*., 2002) as mentioned by Fielder (2006b).

All the genera of ants that associate with larvae of *C. pandava*, belong to only three subfamilies-Myrmicinae, Formicinae and Dolichoderinae (Table 1 and 2). This observation is in agreement with the previous studies on ant-Lycaenid association (Fielder, 2001; 2006a). The genera of ants that associate with larvae of Lycaenids are known to practice 'trophobiosis'- a phenomenon which requires a complex set of morphological and behavioural traits (Fielder, 2001; 2006a; 2012). Furthermore, in facultative larvae-ant association, ant genera which are ecologically dominant in their habitat or defend territories and monopolize resources, are most likely to be the partner (Fielder, 2001, 2006a; 2012).

It therefore strengthens the view (Fielder, 2006b) that association of larva of *C. pandava* with ants is of mutualistic- facultative type. Furthermore, it is possible that the ability of *C. pandava* larvae to maintain healthy relations with several genera of ecologically dominant and aggressive ants patrolling on *Cycas* plant, and employ these ants as guards against other predators could be a positive feature for the invasive potential of this butterfly. However, to emphasize this notion conclusively, further in-depth studies are required.

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Table 1. Genera of ants found to associate with larvae of *C. pandava* at different locations in Delhi, India**.**

Location	**Plant**	**Genera of ants found to be associate with larvae on different *Cycas* plants sampled**	**Family of ants**	**Total number of ant genera associated with larvae**
L1	P1.1	*Camponotus*	Formicinae	*Camponotus* *Tetramorium* *Meranoplus* *Pheidole* *Crematogaster* *Tapinoma* (Total = 6)
	P1.1	*Tetramorium*	Myrmicinae	
	P1.2	*Camponotus*	Formicinae	
	P1.3	*Camponotus*	Formicinae	
L2	P2.1	*Meranoplus*	Myrmicinae	
	P2.2	*Pheidole*	Myrmicinae	
	P2.3	*Crematogaster*	Myrmicinae	
	P2.4	*Meranoplus*	Myrmicinae	
	P2.5	*Pheidole*	Myrmicinae	
L3	P3.1	*Tapinoma*	Dolichoderinae	
L4	P4.1	*Tapinoma*	Dolichoderinae	
	P4.2	*Tapinoma*	Dolichoderinae	
L5	L5.1	*Camponotus*	Formicinae	

Table 2. Genera of ants associated with larvae of C. pandava at different geographical locations as reported in literature. *The column includes those genera of ants from column 2, not observed in sampling in Delhi. Genera in bold letters in right most column are also found in Delhi India (Bharti et al. 2016)

Location	**Genera of ants reported to be associated with larvae of *C. pandava***	**Family of ants**	**Total number of ant genera associated with larvae at different geographical locations***
Calcutta, India (Bingham, 1907)	Monomorium	Myrmicinae	Monomorium Prenolepis Anoplolepis Iridomyrmex Paratrechina Oecophylla Technomyrmex (Total = 7)
	Crematogaster	Myrmicinae	
	Prenolepis	Formicinae	
Guam (Anonymous 1, and Anonymous 2)	Anoplolepis	Formicinae	
	Tetramorium	Myrmicinae	
	Tapinoma	Dolichoderinae	
	Iridomyrmex	Dolichoderinae	
	Monomorium	Myrmicinae	
	Paratrechina	Formicinae	
	Pheidole	Myrmicinae	
Sabah, Malaysia (Chung 2012)	Oecophylla	Formicinae	
	Anoplolepis	Formicinae	
	Paratrechina	Formicinae	
Unknown (Fiedler 2006b)	Technomyrmex	Dolichoderinae	
Varanasi (Ekka et al. 2020)	Camponotus	Formicinae	

Fig.1*:* Various stages in the life cycle of *C. pandava* as observed on *Cycas* sp. at location L1. a) Mating adults, b) nascent leaf dotted with *C. pandava* eggs, c) close up of eggs, d) larvae on infested frond e) final larval instar at the site of pupation, f) final larval instar and pupa, g) *Cycas* plant with fronds damaged by *C. pandava* infestation.

Fig.*2*: Various ant genera associated with the larvae of *C. pandava* in Delhi, India. a) *Tapinoma*, b) *Tetramorium*, c) *Camponotus* d) *Pheidole* e) *Meranoplus*, and f) *Crematogaster*, g) showing response of *C. pandava* larva after interaction with ant (*Camponotus* sp.); encircled portion showing Dorsal Nectary Organ (DNO) with oozing drop of liquid, and eversible pair of Tentacle Organs (TO), h) close up of DNO and TO shown by arrows '1' and '2' respectively.

CHECKLIST OF BUTTERFLIES (INSECTTA: LEPIDOPTERA) FROM FOUR DISTRICTS OF CHHATTISGARH, INDIA WITH THREE ADDITIONS TO THE STATE FAUNA OF BUTTERFLIES OF CHHATTISGARH

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Reviewer: A.S. Sisodia

Abstract
A checklist of 83 species of butterflies from Dhamtari, Gariaband, Raipur & Baloda Bazar districts of Chhattisgarh state is presented based on surveys from October, 2018 to December, 2020. Three species out of 83 here reported are new records to the state butterfly fauna of Chhattisgarh.

Introduction

Biogeographically, Chhattisgarh comes under the Deccan Plateau (Rodgers *et al.*, 2002), and geologically, the Central Indian Plateau of Madhya Pradesh and Chhattisgarh is a part of the Gondwana Plateau (Chandra & Singh, 2004). The climate of the state is tropical, hot and humid due to its proximity to the Tropic of Cancer.

Sisodia (2019) reviewed 142 species from the previously published records (Chandra *et al*., 2014 & Dubey *et al*., 2015) and further added 19 species to the state fauna of butterflies, while removing two misidentified species from the list, taking the tally to 159. Subsequently, Sisodia & Kshirsagar (2020) made further additions of three species, Tandan *et al*. (2020) added two more and Nihlani *et al*. (2021) added one species which resulted in 165 species of butterflies from Chhattisgarh. This study reports three additions to the butterfly fauna of Chhattisgarh, taking the count of reported butterflies from Chhattisgarh to 168.

Materials and Methods

For the present study, we selected four districts of central Chhattisgarh and carried out a random survey there for two years, from October, 2018 to December, 2020. Sites of the study were selected as Kurud (20.8304°N, 81.7084°E) and Nagri (20.3484°N, 81.9593°E) blocks in Dhamtari district, Deobhog (19.9137°N, 82.6432°E) block in Gariaband district, Kasdol (21.2514°N, 81.6296°E) block in Baloda Bazar, Abhanpur (21.0529°N, 81.7441°E) & Raipur (Dharsinwa) (21.2514° N, 81.6296°E) blocks in Raipur district.

The observation of butterflies at various sites were made by H. N. Tandan, Gulab Chand, Swati Tandan and Tanuja at Kurud, Gulshan Kumar Sahu at Nagri, Ravi Naidu and Ramanand Agrawal at Deobhog and H. N. Tandan at Kasdol. Butterflies were photographed using a Canon 1300D DSLR camera and mobile cameras (iPhone 6S, Redmi note 5, redmi note 6 pro & Samsung

galaxy M11). Field identification was made with the help of Evans (1932); Wynter Blyth (1957); Haribal (1992) & Smetacek (2017).

Observations

The three additions to the butterfly fauna of Chhattisgarh state, two of them belonging to Lycaenidae, one to the Nymphalidae, are as follows:

Family: Lycaenidae

Sub Family: Polyommatinae

Freyeria putli (Kollar, [1844] – Lesser Grass Jewel (Figs. 1, 2)

Specimens Photographed: 01.vii.2020, 29.x.2020

Known Distribution: South India; Himalaya from Uttarakhand to N.E. India. (Varshney & Smetacek, 2015).

Remarks: The specimen was photographed on 24.xi.2017 during a field visit conducted by Department of Zoology, Government College, Deobhog. Subsequently it was observed by Gulab Chand and H. N. Tandan in P.G. College Campus, Kurud & Bhatagaon Nursery on 01.vii.2020 & 29.x.2020. The observations were made by Ramanand Agrawal from Deobhog, by Gulshan Kumar Sahu from Nagri, by Ravi Naidu from Bastar and other parts of Chhattisgarh. Sometimes it was observed in plenty, flying about grasslands during October and November.

Sub Family: Theclinae

Spindasis ictis (Hewitson, 1865) – Common Shot Silverline (Figs. 3, 4)

Specimens Photographed: 29.ix.2020, 10.x.2020 & 2.xii.2020

Known Distribution: Rajasthan northwards to Himachal Pradesh, eastwards to W. Bengal and southwards to Kerala (Varshney & Smetacek, 2015).

Remarks: The specimen was photographed on 29.ix.2020 by Ramanand Agrawal at his home backyard in Deobhog. Subsequently it was also observed by Ravi Naidu on 2.xii.2020 at Deobhog. The species was observed in the urban areas as well as dense forest of Tatamari forest range in the Keshkal forest division by H. N. Tandan on 10.x.2020. *Spindasis ictis* is known from central India, recorded from Sidhi (Chandra *et al*., 2000) and Umaria (Choudhary & Khan, 2002).

Family: Nymphalidae

Sub Family: Danainae

Euploea klugii Moore, [1858] – King Crow (Figs. 5, 6)

Specimen Photographed: 21.viii.2020

Known Distribution: Northern Bihar; Sikkim to N.E. India. (Varshney & Smetacek, 2015).

Remarks: The specimen was photographed on 21.viii.2020, by Ramanand Agrawal at his home backyard in Deobhog. *Euploea klugii* is a very widely distributed species, recorded for the first time from Madhya Pradesh (Flora *et al*., 2020) in central India. The state of Chhattisgarh was established in 2000 and the specimen of King Crow is reported here as a new record for the state fauna of Chhattisgarh.

Discussion and Conclusion

During the study, a total of 83 species of butterflies belonging to 18 subfamilies placed under five families were observed and photographed from four districts of Chhattisgarh state (Table 1). Family Lycaenidae dominates with 31 species in 24 genera, followed by Nymphalidae with 26 species in 18 genera, Hesperiidae 10 species in 9 genera, Pieridae 9 species in 6 genera, and Papilionidae with 7 species in 3 genera. The present study results in three species unrecorded earlier from Chhattisgarh. Therefore, they have been added here new to the known butterfly fauna of the state.

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Table1: List of the butterflies recorded from Dhamtari, Gariaband, Raipur & Baloda Bazar Districts of Central Chhattisgarh, India. (# indicate new record to the state Chhattisgarh)

S. N.	Common Name	Scientific Name	Oct.2018 to Dec. 2020, Recorded from	Distribution in India (Varshney & Smetacek (2015))			
			Dhamtari	Raipur	Gariaband	Baloda Bazar	
Family: Papilionoidae							

Sub family: Papilioninae							
1	Blue Mormon	*Papilio polymnestor* Cramer, 1775	+	+	+	+	Peninsular India as far north as W. Bengal and Bangladesh, to Madhya Pradesh and Gujarat.
02.	Lime Swallowtail	*Papilio demoleus* (Linnaeus, 1758)	+	+	+	_	Throughout India below 2000 m elevation
03.	Common Mormon	*Papilio polytes* (Linnaeus, 1758)	+	+	+	+	Throughout India below 2000 m elevation
04.	Common Banded Peacock	*Papilio crino* Fabricius, 1793	+	_	+	_	Peninsular India as far north as W Bengal.
05.	Tailed Jay	*Graphium agamemnon* (Linnaeus, 1758)	+	+	+	_	Uttarakhand to N.E. India; peninsular India.
06.	Common Jay	*Graphium doson* (C. & R. Felder, 1864)	+	+	+	+	J. & K. to N.E. India, Delhi, South India to W. Bengal
07.	Common Rose	*Pachliopta aristolochiae* (Fabricius, 1775)	+	_	_	_	Throughout India
Family: Hesperiidae							
Sub Family: Coeliadinae							
08.	Common Banded Awl	*Hasora chromus* (Cramer, 1780)	+	+	+	_	Throughout India and Andaman & Nicobar Islands
Sub Family: Hesperiinae							
09.	Dark Palm-Dart	*Telicota bambusae* (Moore, 1878)	+	_	_	_	Throughout India except Rajasthan.
10.	Pale Palm-Dart	*Telicota colon* (Fabricius, 1775)	+	_	_	_	Gujarat to W. Bengal and southwards to Kerala; Delhi to Uttar Pradesh; Uttarakhand to Sikkim.
11.	Grass Demon	*Udaspes folus* (Cramer, [1775])	+	_	+	_	Gujarat to West Bengal and south to Kerala; Himachal Pradesh to N. E. India

12.	Restricted Demon	*Notocrypta curvifascia* (C. & R. Felder, 1862)	+	_	+	_	Andaman & Nicobar Is. (Andamans); Maharashtra to Kerala; Uttarakhand to N.E. India.
13.	Indian Palm Bob	*Suastus gremius* (Fabricius, 1798)	_	_	+	_	Throughout India.
14.	Rice Swift	*Borbo cinnara* (Wallace, 1866)	+	_	+	_	Throughout India except Jammu & Kashmir.
15.	Giant Redeye	*Gangara thyrsis* (Fabricius, 1775)	_	_	+	_	Maharashtra to Kerala; Andhra Pradesh; Himachal Pradesh to N.E. India; Andaman & Nicobar Is..
Sub Family: Pyrginae							
16.	Golden Angle	*Caprona ransonnettii* (R. Felder, 1868)	+	_	_	_	Gujarat east to Jharkhand and south to Kerala.
17.	Indian Skipper	*Spialia galba* (Fabricius, 1793)	+	+	+	_	Throughout India.
Family: Pieridae							
Sub Family: Coliadinae							
18.	Common Emigrant	*Catopsilia pomona* (Fabricius, 1775)	+	+	+	+	Throughout India
19.	Mottled Emigrant	*Catopsilia pyranthe* (Linnaeus, 1758)	+	+	+	+	Throughout India
20.	Common Grass Yellow	*Eurema hecabe* (Linnaeus, 1758)	+	+	+	+	Throughout India including Andaman & Nicobar Islands
21.	Small Grass Yellow	*Eurema brigitta* (Stoll, [1780])	+	_	_	_	Throughout India including the Andaman and Nicobar Is..
Sub Family: Pierinae							
22.	Pioneer	*Belenois aurota* (Fabricius, 1793)	+	_	_	_	Throughout India except N.E. States

23.	Indian Jezabel	*Delias eucharis* (Drury, 1773	+	-	+	-	Throughout India.
24.	Painted Jezabel	*Delias hyparete* (Linnaeus, 1758)	_	_	+	_	Sikkim to N.E. India; Odisha, Andhra Pradesh.
25.	Indian Wanderer	*Pareronia hippia* (Fabricius, 1787)	+	_	+	_	Throughout India except Jammu & Kashmir, Punjab and Rajasthan.
26.	Psyche	*Leptosia nina* (Fabricius, 1793)	+	_	+	_	Throughout India east of Punjab, including the Andaman Is..
Family: Lycaenidae							
Sub family : Curetinae							
27.	Indian Sunbeam	*Curetis thetis* (Drury, [1773])	+	_	_	_	Andaman & Nicobar Is. (Kondula Island, Great and Little Nicobar). Peninsular India.
Sub family : Miletinae							
28.	Apefly	*Spalgis epius* (Westwood, [1851])	+	_	+	_	Uttarakhand to N.E. India; Gujarat to Kerala and east to W. Bengal.
Sub Family: Theclinae							
29.	Large Oakblue	*Arhopala amantes* (Hewitson, 1862)	+	_	_	_	Gujarat to Andhra Pradesh and southwards to Kerala, Uttarakhand to Arunachal to Manipur.
30.	Indian Oakblue	*Arhopala atrax* (Hewitson, 1862)	+	_	_	_	Peninsular India; Jammu & Kashmir to N.E. India.
31. #	Common Shot Silverline	*Spindasis ictis* (Hewitson, 1865)	_	_	+	_	Rajasthan northwards to Himachal Pradesh, eastwards to W. Bengal and southwards to Kerala.
32.	Common Silverline	*Spindasis vulcanus* (Fabricius, 1775)	+	_	+	_	Throughout India.
33.	Purple Leaf Blue	*Amblypodia anita* Hewitson, 1862	+	_	_	_	Andaman & Nicobar Is. (Andamans). Peninsular India,
34.	Common Guava Blue	*Virachola isocrates* (Fabricius, 1793)	+	_	+	_	Throughout India

35.	Common Red Flash	*Rapala iarbus* (Fabricius, 1787)	+	_	_	_	Sikkim to N.E. India.
36.	Yamfly	*Loxura atymnus* (Stoll, 1780)	_	_	+	_	Maharashtra and Madhya Pradesh to Kerala; Uttarakhand to West Bengal & N.E. India.
Sub Family: Polyommatinae							
37.	Pointed Ciliate Blue	*Anthene lycaenina* (R. Felder, 1868)	+	_	_	_	Gujarat southwards to Kerala and eastwards to Odisha and W. Bengal; Uttarakhand to NE India.
38.	Common Lineblue	*Prosotas nora* (C. Felder, 1860)	+	_	_	_	Andaman & Nicobar Islands, throughout India except arid regions
39.	Tailless Lineblue	*Prosotas dubiosa* (Semper, [1879])	+	_	_	_	India including Andaman & Nicobar Is. (Andamans).
40.	Dark Cerulean	*Jamides bochus* (Stoll, [1782])	+	+	+	_	Throughout India including Andaman & Nicobar Islands
41.	Common cerulean	*Jamides celeno* (Cramer, [1775])	+	_	+	_	Gujarat south to Kerala and eastward to West Bengal; Uttarakhand to N.E. India.
42.	Forget-me-not	*Catochrysops strabo* (Fabricius, 1793)	+	+	+	_	Throughout India including Andaman & Nicobar Is..
43.	Common Pierrot	*Castalius rosimon* (Fabricius, 1775)	+	+	+	+	Throughout India including Andaman and Nicobar Islands.
44.	Angled Pierrot	*Caleta decidia* (Hewitson, 1876)	_	_	+	_	Peninsular India; Sikkim to N.E. India.
45.	Small Cupid	*Chilades parrhasius* (Fabricius, 1793)	+	_	+	_	Rajasthan to Kerala; Uttar Pradesh; Himachal Pradesh and Uttarakhand.
46.	Plains Cupid	*Chilades pandava* (Horsfield, [1829])	_	+	_	_	Throughout India
47.	Lime Blue	*Chilades lajus* (Stoll, [1780])	+	+	+	+	Throughout India
48.	Indian Cupid	*Everes lacturnus* (Godart, [1824])	+	_	_	_	Himachal to N.E. India, Uttar Pradesh and Bihar, Andaman & Nicobar Islands, Gujarat

							southwards to Andhra Pradesh and Kerala
49.	Pea Blue	*Lampides boeticus* (Linnaeus, 1767)	+	_	_	_	Throughout India including Andaman & Nicobar Is..
50.	Grass Jewel	*Freyeria trochylus* (Freyer, 1845)	+	+	+	_	South India, North India from Punjab to N.E. India
51. #	Lesser Grass Jewel	*Freyeria putli* (Kollar, [1844])	+	+	+	_	Throughout India
52.	Lesser Grass Blue	*Zizina otis* (Fabricius, 1787)	+	+	+	+	Throughout India, W. Bengal and Sikkim to N.E. India, Andaman & Nicobar Islands
53.	Dark Grass Blue	*Zizeeria karsandra* (Moore, 1865)	+	+	+	+	Throughout India, Andaman & Nicobar Islands
54.	Tiny Grass Blue	*Zizula hylax* (Fabricius, 1775)	+	_	+	_	Throughout India; Andaman and Nicobar Is..
55.	Gram Blue	*Euchrysops cnejus* (Fabricius, 1798)	+	+	+	+	Throughout India.
56.	Pale Grass Blue	*Pseudozizeeria maha* (Kollar, [1844])	+	_	_	_	Throughout India.
57.	Zebra Blue	*Leptotes plinius* (Fabricius, 1793)	+	+	+	_	Throughout India except Jammu & Kashmir
Family: Nymphalidae							
Sub Family: Danainae							
58.	Plain Tiger	*Danaus chrysippus* (Linnaeus, 1758)	+	+	+	+	Throughout India
59.	Common Tiger	*Danaus genutia* (Cramer, [1779])	+	+	+	+	Throughout India
60.	Blue Tiger	*Tirumala limniace* (Cramer, [1775])	+	+	+	+	Throughout India including Andaman & Nicobar Island and Lakshadweep

61. #	King Crow	*Euploea klugii* Moore, [1858]	_	_	+	_	Uttar Pradesh; Northern Bihar; Sikkim to N.E. India. Odisha to Kerala.
62.	Common Crow	*Euploea core* (Cramer, [1780])	+	+	+	+	Throughout India, Andaman & Nicobar Islands
63.	Double-branded Crow	*Euploea sylvester* (Fabricius, 1793)	+	_	_	_	Peninsular India to N.E. India.
Sub Family: Satyrinae							
64.	Common Evening Brown	*Melanitis leda* (Linnaeus, 1758)	+	+	+	+	Throughout India
65.	Common Bushbrown	*Mycalesis perseus* (Fabricius, 1775)	+	_	_	_	Himachal Pradesh to N.E. India.
66.	Common Palmfly	*Elymnias hypermnestra* (Linnaeus, 1763)	+	_	+	_	Maharashtra to Kerala; Punjab to Odisha and N.E. India.
Sub Family: Limenitidinae							
67.	Common Sailer	*Neptis hylas* (Linnaeus, 1758)	+	+	+	+	Andaman Island, Uttarakhand to N.E. India, Southern Nicobar Island, Gujarat, Madhya Pradesh and Jharkhand southwards to Kerala
68.	Short-banded Sailer	*Phaedyma columella* (Cramer, [1780])	+	_	_	_	Gujarat eastwards to W. Bengal and southwards to Kerala. Uttarakhand to N.E. India.
69.	Common Baron	*Euthalia aconthea* (Cramer, [1777])	+	+	+	+	Maharashtra to Odisha; Himachal Pradesh to Uttarakhand and Uttar .Pradesh.
70.	Baronet	*Symphaedra nais* (Forster, 1771)	+	+	+	+	Tamil Nadu to Gujarat and Rajasthan, eastwards to W. Bengal.
71.	Commander	*Moduza procris* (Cramer, [1777])	+	_	+	+	Uttarakhand to N.E. India. Peninsular India.
72.	Grey Count	*Tanaecia lepidea* (Butler, 1868)	+	_	_	_	Maharashtra eastwards to Odisha and southwards to Kerala. Uttarakhand to N.E. India.
Sub Family: Nymphalinae							
73.	Peacock Pansy	*Junonia almana*	+	+	+	+	Throughout India

		(Linnaeus,1758)					
74.	Grey Pansy	*Junonia atlites* (Linnaeus, 1763)	+	+	+	+	Throughout India
75.	Lemon Pansy	*Junonia lemonias* (Linnaeus, 1758))	+	+	+	+	Sikkim to N.E. India, J&K to Uttarakhand, Rajasthan to Kerala and eastwards to Jharkhand
76.	Blue Pansy	*Junonia orithya* (Linnaeus, 1758)	+	+	+	+	Sikkim to N.E. India, Nicobar Islands, J. & K. to Kerala and W. Bengal
77.	Chocolate Pansy	*Junonia iphita* (Cramer, [1779])	+	+	+	+	Jammu & Kashmir to N.E. India.
78.	Great Eggfly	*Hypolimnas bolina* (Linnaeus, 1758)	+	+	+	+	Throughout India except very arid regions
79.	Danaid Eggfly	*Hypolimnas misippus* (Linnaeus, 1764)	+	_	+	_	Throughout India
Sub Family: Biblidinae							
80.	Common Castor	*Ariadne merione* (Cramer, [1777])	+	_	+	_	Gujarat to Kerala and Andhra Pradesh.
Sub Family: Charaxinae							
81.	Plain Tawny Rajah	*Charaxes psaphon* Westwood, 1847	+	_	+	_	Peninsular India as far north as Gujarat; Madhya Pradesh; Odisha to N.E. India.
Sub Family: Heliconiinae							
82.	Common Leopard	*Phalanta phalantha* (Drury, [1773])	+	_	_	_	Throughout India.
Sub Family: Acraeinae							
83.	Tawny Coster	*Acraea violae* (Fabricius, 1793)	+	+	+	+	Throughout India

Fig.1: *Freyeria putli* upperside

Fig.2: *Freyeria putli* underside

Fig.3: *Spindasis ictis* underside

Fig.4: *Spindasis ictis* underside

Fig.5: *Euploea klugii* underside

Fig.6: *Euploea klugii* upperside

OBSERVATION OF *OROLESTES SELYSI* (INSECTA: ODONATA: LESTIDAE) FROM ASSAM, INDIA

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Introduction

Orolestes McLachlan, 1895 (Lestidae) is a genus of damselflies. It has five species distributed mostly in Southeast Asia (Paulson & Schorr, 2021). Two species, *O. selysi* McLachlan, 1895 and *O. durga* Lahiri, 1987 have been recorded from India (Kalkman *et al*., 2020). Of these two species, *O. selysi* is known to occur in Darjeeling (India), Vietnam, Lao People's Democratic Republic and parts of China (Dow & Subramanian, 2010), while *O. durga* is known only from the type series collected from Arunachal Pradesh. Fraser (1933) opines that *O. selysi* is either very rare or local and can be easily distinguished from all other Indian Lestids by its coloured wings.

Observations

Four large individual Lestids were seen and photographed at 1030 hrs on 21.ii.2021 from Dehing-Patkai National Park, Assam (27.316124° N; 95.476927° E). Three of the individuals were male, of which two were similar to each other. The similar individuals had green eyes, olivaceous green thorax and wings that were coloured blackish brown between hyaline base and apex. The apical border of this fascia had a milky white border. The dorsum of their abdomen was black, but segments 3 and 4 had median bluish areas ringed with black at both the ends. Segments 8, 9 and 10 were sky blue with black apical rings and segment 10 was slightly notched. The superior anal appendages were long, slender, regularly curved and forcipate.

The third male had completely hyaline wings which revealed long pterostigma covering about 5 cells. It was similar to the other two males in all other respects. The lone female observed was shorter, more robust, had yellowish green eyes and completely hyaline wings.

Discussion

The two similar males were identified positively as *Orolestes selysi*. We believe this is the first photographic record of this species from the wild in India and it is definitely a first record for the state of Assam. The dissimilar male is probably a hitherto unreported aberration of the same species, as the only species of the genus in India with unmarked and transparent wings is *O. durga*, which is considerably smaller and has abdominal segments 8 to 10 black instead of sky blue (Lahiri, 1987). The female of *O. selysi* remains to be formally described.

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Fig. 1: *Orolestes selysi* adult male

Fig. 2: *Orolestes* cf *selysi* male with uncoloured wings

Fig. 3: *Orolestes* cf *selysi* female

SOME IMPORTANT RECORDS OF BUTTERFLIES FROM DHANKUTA AND SUNSARI, NEPAL

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Reviewer: P. van der Poel

Nepal is home to 660 species of butterflies in 263 genera (Smith, 2010). Van der Poel (2020) reported this number to be 665, after the addition and deletion of several species. However, in the draft of an updated species list for Nepal (Van der Poel & Smetacek, *in prep*.), it is reported that the number of butterfly species is 674. This number is likely to go up as many species that have been recorded from Sikkim and/or Uttarakhand may also occur in Nepal.

Province Number 1 of Nepal has 14 districts, out of which Dhankuta is a mid-hill district while Sunsari is essentially a Terai district. Dhankuta stretches over an area of 891 km^2. The altitude varies from around 300 m to 2500 m. The vegetation ranges from sub-tropical Sal forest along the Arun and Tamor rivers, to cooler temperate vegetation at the higher elevation. Bhedetar is a small hill station at the border of Dhankuta and Sunsari districts, 16 km from Dharan, Sunsari.

Sunsari district covers an area of 1,257 km^2. Dharan is a sub-metropolitan city in Sunsari, situated at an elevation of 349 m in the foothills of the Mahabharat Range in the north. The southern part of Dharan borders the Terai region.

Some areas of Bhedetar, Dhankuta (26°52'30"N 87°19'55"E) and Dharan, Sunsari (26°50'10"N 87°18'09"E) were explored in March of 2021. Bhedetar of Dhankuta was visited on 8-10.iii.2021 while Dharan of Sunsari was visited on 11.iii.2021.

March is one of the best months to observe butterflies in Nepal in Terai and mid-hill regions (Smith, 2011). During the survey, several common species were recorded which occur all across Nepal, while species which are typical to the east of Nepal were evident as well. Moreover, on 8-9.iii.2021, some extremely rare species appeared at one point.

This paper deals with some significant records, which are either new to Nepal or new to east Nepal or species with very few records or not recorded for a very long time. References for existing records have been taken from Van der Poel & Smetacek, (*in prep*.). Identification keys from Evans (1927; 1932; 1949) have been followed.

Family: Hesperiidae

Scobura isota Swinhoe, 1893 – Swinhoe's Forest Bob

Several individuals were seen at Bhedetar, Dhankuta flying around a forest stream there at 630-650 masl. The recorded individuals were all DSF as the base color of UnHW was all yellow (Evans, 1949). *S. isota* differs from *S. cephala* (Hewitson, 1876) in that it bears only 2 spots on UnHW (in spaces 2 and 4+5) while *S. cephala* has an extra rectangular spot in space 1c. Sometimes though in *isota*, an insignificant spot (or sometimes even significant) could be present in space 1c and if so, a corresponding spot is "always" present in space 6 (connected to inner margin of spot 5). On UpFW, *S. cephala* is always (possibly with some exceptions) known to bear a spot in sp. 4 apart from 2 and 3 while *S. isota* mostly lacks it (Evans, 1949). Swinhoe, 1893 describes *S. isota* as having only 2 FW subapical spots instead of three (also true for the present

individuals), but this character is clearly variable comparing with references from Yutaka Inayoshi (online resource).

Smith (2010; 2011) listed *Scobura cephala* (Hewitson, 1876) as the only species under *Scobura* Elwes & Edwards, 1897 found in Nepal and recorded it from central and eastern Nepal. Consequently, Van der Poel & Smetacek (*in prep*.) also list *Scobura cephala* (Hewitson, 1876) with a distribution in the East Terai (which includes part of Smith's (2011) central Terai) and East Nepal, reporting it as very seldom and local. Smith (2011) only shows an image of the upperside which, however contains a spot in FW space 4 as well. This feature is also sometimes shared by *S. isota*.

Although Fan *et al*. (2010) list a characteristic very similar to that specified by Evans (1949) to distinguish between *Scobura cephala* (conspicuous rectangular white spot in space 1c [=CuA2]), and *S. isota* (no such spot), they indicate that *S. isota* is very similar to *S. cephala* from Vietnam (although without the rectangular spot in 1c), requiring examination of the male genitalia to ensure conclusive identification. However, in the present case, more than 10 individuals were observed and not a single one had any character remotely resembling *S. cephala*.

Thus, it would be safe to say that the individuals were all *S. isota* and constitute the first record for Nepal. The identification was further confirmed by Dr T.L. Seow (Singapore, *pers. comm*.), and Mr. Monsoon Jyoti Gogoi (*pers. comm*.), both being certain that all the individuals photographed in the present study were typical *S. isota*. Monsoon Jyoti Gogoi (*pers. comm*.) also added that "*S. cephala* will never have small UnHW spots like the present individuals".

Hasora anura anura de Nicéville, 1889 – Himalayan Slate Awl

Reported only once from Pokhara, central Nepal, in 1970, this species was seen for the second time at Bhedetar, Dhankuta at dusk (4:26 PM) around a forest stream on 9.iii.2021, at 630 masl.

Halpe zema zema (Hewitson, 1877) – Banded Ace

Prior to the present report, this species was recorded only from Illam. An individual was seen along a forest trail in the morning (9:22 AM) at Bhedetar, Dhankuta on 9.iii.2021, at 630 masl. This record represents a small westward extension to its known range by about 60 km.

Matapa sasivarna (Moore, [1866]) – Black-veined Redeye.

Recorded only from central Nepal before, at least 2 individuals were seen along a forest stream at Bhedetar, Dhankuta on 9.iii.2021 at 630-640 masl.

Caltoris kumara moorei (Evans, 1926) – Blank Swift

This species was spotted only in the western Terai and central Nepal before. An individual was seen along a forest stream at Bhedetar, Dhankuta perched on a rock, on 10.iii.2021, at 630 masl.

Caltoris tulsi tulsi (de Nicéville, [1884]) – Purple Swift

Before, this species was recorded only from Pokhara and Kathmandu valley, central Nepal. An individual was perched on a rock along a forest stream on 8.iii.2021, at 640 masl.

Telicota ohara jix Evans, 1949– Narrow-branded Palm Dart

Recorded only from central Nepal and east Terai, several individuals were seen at Bhedetar, Dhankuta along a forest stream for three days, at 630-650 masl.

The identification was confirmed by Dr T.L. Seow on the basis of the position of the male brand and the hindwing band.

Family: Lycaenidae

Allotinus drumila drumila (Moore, [1866]) – Great Darkie

This is the third record of this species in Nepal. It was recorded only twice earlier, both before 1988 and from Sankhuwasabha (north of Dhankuta). A female was flying around a

banana stump by the side of a river at Bhedatar, Dhankuta at 3:30 p.m. on 8.iii.2021, at 630 masl. The sun had set and the stump was full of aphids and ants.

Family: Nymphalidae

Charaxes solon solon (Fabricius, 1793) – Black Rajah

Fourth record for Nepal, an individual was seen circling around, near a river at Bhedetar, Dhankuta midday on 9.iii.2021, at 650 masl. Two individuals were recorded in east Nepal in 1979, and one in west Nepal in Kanchanpur in 2019.

Pantoporia sandaka davidsoni Eliot, 1969 – Extra Lascar

Reported only from central Nepal and eastern Terai (Chitwan) before, several individuals were found at Bhedetar, Dhankuta every day of the survey, at 630-650 masl.

Family: Papilionidae

Graphium macareus indicus (Rothschild, 1895) – Lesser Zebra

This butterfly is considered very rare and local in Nepal and was only recorded from Ilam earlier, in April and May. At least 2 individuals were recorded on 9.iii.2021, at 630-650 masl. One was perched on a leaf early in the morning and one was flying around a *Lantana* bush. Some others were noticed flying around on other days too, but they could easily have been *Papilio clytia clytia* Linnaeus, 1758, which was fairly common there.

Papilio polymnestor polymnestor Cramer, 1775 – Blue Mormon

Recorded only from Pokhara (central Nepal) and Ilam (east) before, an individual was seen for three days in a row flying and never settling near a river at Bhedetar, Dhankuta, at 630-650 masl.

Papilio memnon agenor Linnaeus, 1758 form *primigenius* – Great Mormon

This form of great Mormon is new to Nepal. It has weak blue patches on its hindwings and forewings. Two or three such individuals were seen in Dharan, Sunsari on 11.iii.2021.

Papilio memnon agenor Linnaeus, 1758 form *polymnesteroides*– Great Mormon

This form of Great Mormon is new to Nepal. It appears very much like *Papilio polymnestor* except for the lack of dense blue patches on the UnHW. Moreover, the blue is deeper blue unlike in *Papilio polymnestor polymnestor* which looks more greyish blue. It should be noted that these two forms of *Papilio memnon agenor* were very abundant, at least in Dharan (11.iii.2021) at 590-640 masl while there are no reports of them anywhere in central Nepal, although the species occurs there.

Family Pieridae

Eurema andersonii jordani Corbet & Pendlebury, 1932 – One-spot Grass Yellow

Reported only from central Nepal before (van der Poel, 2020), an individual was seen at Bhedetar, Dhankuta flying among the flowers of *Lantana camara* on 10.iii.2021, at 585 masl.

Discussion

These findings of rare species and new records signify the vast diversity of butterflies in unexplored parts of the country. The importance of thorough surveys in such areas is always a necessity to expand the existing documentation of butterfly fauna in Nepal.

Acknowledgements

I am grateful to Ms. Anisha Sapkota (AFU, Chitwan), Mr. Piet van der Poel (Netherlands) and Mr. Surendra Pariyar (ANHM, Pokhara) for helping me in my research. I also appreciate the staff of Annapurna Natural History Museum, Pokhara, who permitted me to work on and refer to material in the collection.

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Fig.1: *Scobura isota* Swinhoe, 1893 –Swinhoe's Forest Bob (No spot in FW sp. 4)

Fig.2: *Scobura isota* Swinhoe, 1893 – Swinhoe's Forest Bob (Typical DSF with small spots)

Fig.3: Scobura isota Swinhoe, 1893 – Swinhoe's Forest Bob (Individual with small spot in UnHW sp. 1c and corresponding small spot in sp. 6)

Fig.4: *Hasora anura anura* - de Nicéville, 1889 –Slate Awl

Fig.5: *Halpe zema zema (Hewitson, 1877)* – Banded Ace

Fig.6: *Matapa sasivarna* (Moore, [1866]) – Black-veined Redeye Ace

Fig.7: *Caltoris kumara moorei* (Evans, 1926) – Blank Swift

Fig.8: *Caltoris kumara moorei* (Evans, 1926) – Blank Swift

Fig.9: *Caltoris tulsi tulsi* (de Nicéville, [1884]) – Purple Swift

Fig.10: *Telicota ohara jix* – Narrow-branded Palm Dart Swift

Fig.11: *Telicota ohara jix* – Narrow-branded Palm Dart Swift

Fig.12: *Allotinus drumila drumila* (Moore, [1866]) – Great Darkie

Fig.13: *Allotinus drumila drumila* (Moore, [1866]) – Great Darkie

Fig.14: *Charaxes solon solon* (Fabricius, 1793) – Black Rajah

Fig.15: *Pantoporia sandaka davidsoni* Eliot, 1969 – Extra -

Fig.16: *Graphium macareus indicus* (Rothschild, 1895) – Lesser Zebra

Fig.17*: Papilio polymnestor polymnestor* Cramer, 1775 – Blue Mormon

Fig.18: *Papilio polymnestor polymnestor* Cramer, 1775 – Blue Mormon

Fig.19: *Papilio memnon agenor* form *primigenius* Linnaeus, 1758 – Great

Fig.20: *Papilio memnon agenor* form *polymnestoroides* Linnaeus, 1758 – Great

Fig.21: *Papilio memnon agenor* form *polymnestoroides* Linnaeus, 1758 – Great

NEW RECORDS OF *PSEUDANAPHES SIKKIMIANUS* (INSECTA: CHALCIDOIDEA: MYMARIDAE) FROM MEGHALAYA, INDIA

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Abstract
Pseudanaphes sikkimianus is reported for the first time in Meghalaya, which is the second north-eastern Indian state from which this species has been recorded.
Keywords: Mymaridae, new record, Meghalaya

Introduction

Pseudanaphes Noyes & Valentine, 1989 belongs to the *Anaphes* Haliday, 1833 group, with a total of five species (Noyes & Valentine, 1989) described globally represented by *P. hirtus* Noyes and Valentine, 1987 described from New Zealand (Noyes & Valentine, 1989), *P. zhaoi* Lin, 1997 from China (Lin, 1997), two species *P. lincolni* (Girault, 1913) and *P. particoxae* (Girault, 1938) from Australia (Lin *et al.*, 2007) and *P. sikkimianus* Rehmat & Anis, 2011 from India (Rehmat & Anis, 2011). *Pseudanaphes* resembles some species of *Anaphes* but is distinguished by the long marginal vein and an evenly rounded forewing apex. From India, just one described species was recorded from Sikkim. In the present study, *P. sikkimianus* is reported from Meghalaya, which is the second state distribution record from India and an extension to the known distribution of the species.

Materials and Methods

The specimens were collected using yellow pan trap and later were preserved in 70% alcohol. Preparation of slides specimens followed a methodology described by Noyes (1982). Taxonomic keys given by Lin *et al*. (2007), Noyes & Valentine (1989) were used for morphological identification.

Measurements were taken using a compound microscope with graticule from slide-mounted and preserved specimens given in millimeters (mm) viewed under 40X (one division = 0.025 mm). All collected specimens (slides and preserved) were deposited in the Entomology Laboratory, Department of Zoology, North Eastern Hill University, Shillong, Meghalaya, India.

Results and Discussion

***Pseudoanaphes* Noyes & Valentine, 1989**

Pseudanaphes Noyes & Valentine, 1989: 47. Type species: *Pseudanaphes hirtus* Noyes & Valentine, by original designation.

***P. sikkimianus* Rehmat & Anis, 2011**

Material examined: 3 ♀ India, North East, Meghalaya, Ingkyrsa, 1214m, 25°14'30.28"N and 91°27'40.90"E. 20.x.2016, (Yellow Pan Trap). Coll. B. Kharbisnop.

Distribution: Sikkim (Rehmat & Anis, 2011) and Meghalaya (new record).

Description: Body metallic dark-colour approximately measured 0.55 mm in length. Head strongly sculptured with an appropriate length - 0.08 mm, bearing large and globular eyes (0.05 mm). Scape very long (0.13 mm) with globular pedicel (0.03 mm). Female funicle 6-segmented; f1, f5-f6 equally measured with 0.02 mm each, f2 longest - measuring 0.04 mm whereas f3-f4 each measures 0.03 mm respectively; clava entire

with 0.12 mm in length. Metasoma measures 0.27 mm as long as wide than mesosoma (0.17 mm). Forewing and hindwing narrow as well as elongated, almost equally measured - 0.53 mm and 0.50 mm respectively bearing elongated cilium. Fore-leg and mid-leg almost subequal in length (0.41 mm and 0.49 mm respectively); hind-leg longer compared to the two, roughly 0.60 mm in length. Ovipositor 0.14 mm.

Pseudoanaphes sikkimianus was described in 2011. So far the species was considered to be confined to Sikkim. The present paper extends the known distribution of *P. sikkimianus* to Meghalaya.

Acknowledgement

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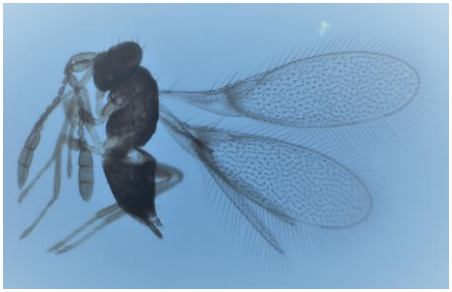

Fig 1 & 2: *Pseudanaphes sikkimianus* (40X)

EXTENSION OF THE KNOWN FLOWERING PERIOD OF *RHODODENDRON ARBOREUM* TO JUNE IN NAINITAL DISTRICT, UTTARAKHAND, INDIA

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Introduction

The community of flora and fauna that make up a forest ecosystem is directly affected by climate. Changes in the typical annual cycle of a plant reflect the changing climate and other factors. Budding, flowering, fruiting, leaf shedding and seed dispersal are regulated by the seasons. Changes in the timing of these phenomena affect not only the plant but the fauna dependent upon that plant for food.

The changes in temperature and moisture regimes affect the phenology of flora, which has a direct effect on the fauna of a forest. One such species is *Rhododendron arboreum* Smith, a medium sized tree that occurs in the Himalaya from 1200 m to 3350 m (Osmaston, 1927; Polunin & Stainton, 1984). It is the state tree of Uttarakhand. The conspicuous red. pink or white flowers are borne between January and May (Osmaston, 1927).

Although Osmaston (1927) noted that the tree flowers in June, studies in the outer ranges of the Himalaya show that flowering ends by late May (Gaira *et al*., 2014; Mittal *et al*., 2016). It therefore appears that the tree flowers in June at the upper limit of its distribution in the main Himalayan range in June, where Osmaston (1927) noted the pale flowered varieties occur. In the western Himalaya, field observations in Nainital district, Uttarakhand (2009– 2011) showed *R. arboreum* to have a peak flowering period from February to March (Gaira *et al*., 2014). *Rhododendron* was reported to start flowering in the first week of February, flowering peaked in the first week of April and was completed by May (Mittal *et al*., 2016).

Singh (2014) cryptically stated that *R. arboreum* flowered "first early June", although the data he was interpreting ended on 31 May. Dr. N. Singh, the author, was contacted regarding this statement and he clarified (*pers. comm*.) that he meant "before early June", the typographical error being caused by the fact that the Hindi word *pahle* translates into *first* or *before* in English.

Methodology

Maheshkhan Reserve Forest (29°24'16"N 79°33'50"E) was visited during 2020 and 2021from time to time for various studies. It is located at an altitude of 1800 – 2200 m. The forest is composed of *Querus leucotrichophora*, *Pinus roxburghii*, *Myrica esculenta*, *Lyonia ovalifolia*, *Viburnum cotinifolium*, *Viburnum mulaha*, *Rhododendron arboreum*, etc. and has rain fed streams. A motor road runs across the south facing hillside and is the main access to the forest, with game paths running above and below the road.

In 2021, the climatic conditions were unpredictable as there was no winter rain in January and February followed by heavy, unseasonal rain in the months of May and June.

Observations

The present observations were carried out while walking along a 3 km stretch of the motor road in Maheshkhan Reserve Forest from the entrance gate towards the Forest Rest House. On 17.vi.2021, 7 trees of *Rhododendron arboreum* were observed, each

with 2- 6 flowers. The flowers were normal, with some buds, some in full bloom and some with wilted petals on the same flower-head (Figures 1-6).

Discussion

Supplementary observations of the flowering of *R. arboreum* in Nainital district during 2021 are noted below, to show that flowering was on the whole normal during early 2021, until the unusual rains in May and June appear to have affected the process. All four locations where observations were carried out are situated on the southern face of the Gagar range, which is the outermost range of the Himalayan mountain system in Nainital district. The highest point is Cheena Peak (2600 m) above Nainital.

The first flowering observation was made on 21.i.2021with 12 flowers blooming on a tree at the Forest Rest House, Bhowali Range (29°23'17.2"N 79°30' 40.1"E; 1800 m), Bhowali. In Manora range near Takula (29°21'27.0"N 79°27'25.1"E; 1700 m), one tree was observed with 15 flowers and the second tree with 2 flowers on 29.i.2021. In Nainital, at Tanki bend on the southern slope of Cheena Peak (Naina range) (29°24'03.3"N 79°26'59.6"E; 2330 m), one tree had 2 flowers and another tree had 5 flowers on 1.iii.2021. Further observations were interrupted by the lockdown.

On 17.vi.2021, along the same range, *Rhododendron arboreum* flowers were observed blooming at Maheshkhan as mentioned above. A total of 7 trees were observed which had 2- 6 flowers each and out of them one was a short 1,5 m tall bush. The flowering trees had a girth from 10 cm and 1.5 m height to mature trees with a girth of 2 m and an estimated height of 6 m. The current observations thus extend the known flowering time of *Rhododendron arboreum* in the outer ranges of the western Himalaya from the end of May (Singh, 2014) to the third week of June. It is not a regular phenomenon but one clearly brought about by the unusual weather pattern in the area during the first half of the year.

Acknowledgement

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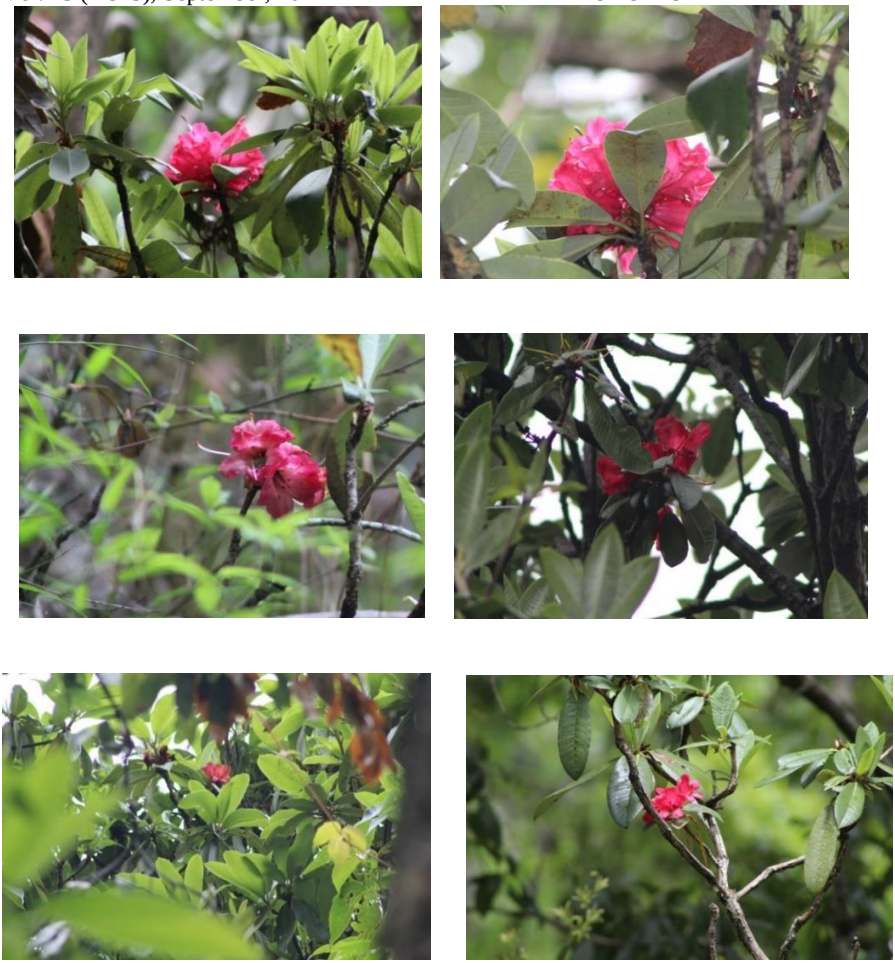

Figures 1-6 showing *Rhododendron arboreum* flowers in Maheshkhan Reserve Forest on 17.vi.2021

A NEW SPECIES OF *LEMAIREIA* NÄSSIG & HOLLOWAY (LEPIDOPTERA: SATURNIIDAE, SATURNIINAE) FROM NORTH-EASTERN INDIA

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Abstract

A new species of the genus *Lemaireia* Nässig & Holloway, 1987 is described from the north-eastern Indian state of Arunachal Pradesh; it is compared with *L. luteopeplus* Nässig & Holloway, 1988. For both taxa, males and their genital structures are figured. Females and preimaginal instars remain unknown at present.

Keywords: Himalaya, Arunachal Pradesh, Meghalaya, Mizoram, *Lemaireia*, new species

Introduction

The genus *Lemaireia* was established by Nässig & Holloway with *Antheraea loepoides* Butler, 1880 being its type species. At the time of the generic description only four taxa were known, two of them described in a second parallel publication by Nässig & Holloway (1988), which was planned originally to contain also the generic description but then eventually was published a little later than Holloway (1987) which now contains the original diagnosis. In the last 25 years, the number of described taxa in *Lemaireia* increased to 11, with the latest description of *L. daparo* Jiang *et al*., 2021 from Sichuan and Yunnan, PR China. Those authors gave an overview about published taxa and literature about the genus and figured the known Chinese species. The genus is known from the north-eastern parts of India via Myanmar, Laos, Thailand to China, Vietnam, West Malaysia and from the islands of Sumatra, Java, Borneo, and Mindanao.

Records for the genus are completely missing in publications exclusively on the Indian fauna, such as Hampson (1893), Arora & Gupta (1979) and Chandra *et al*. (2019), which shows that the records of *Lemaireia* specimens in India are rare. The only report besides the original description of *L. luteopeplus* is by Sondhi *et al*. (2021) who mention one specimen record from Arunachal Pradesh. Although tentatively identified as *L. luteopeplus luteopeplus* in image 463 in their paper,the authors note that further research is necessary.

Following is a description of the twelfth species in the genus:

***Lemaireia himalayana* n. sp.**

Holotype (Fig. 1a, recto; Fig. 1b, verso): Male, India (NE), C. Arunachal Pradesh, Apatani area, Ziro valley 1800 m, vi.1990, leg. local collector; GP 2600/19 SNB; barcode SNB 6315. – A red holotype label will be added accordingly. The holotype will be deposited within the Rainer Seegers Foundation in the collections of Museum für Naturkunde, Berlin, Germany.

Etymology: *L. himalayana* n. sp. is the only Himalayan species of the genus and named for its origin.

Description

Male (Figs. 1a, dorsal view, & b, ventral view).

Length of forewing, measured from base to apex: 37 mm.

Wing expanse, measured from forewing apex to centre of thorax and doubled: 88 mm.

Head, thorax, abdomen and ground colour of the forewing upperside intense orange-brown. The wings bear the typical yellow and orange pattern characteristic of the genus. Antennae orange-brown, quadripectinate, 9.0 mm in length, with 25 segments in total, maximum length of rami 1.3 mm.

Forewing apex elongate, produced with slightly rounded tornus, the outer margin concave. Antemedial area orange-brown, central part of the medial area egg-yolk yellow, basal portion of the medial area orange-brown, separated by a serrate line from the antemedial area. In the centre of the yellow medial area an almost round. orange-brown ocellus, outwardly defined by black scales, of 3.5 mm diameter. The postmedial line consists of an inner orange brown and an outer yellow zigzag band, the costal half of this line medially with black scales. Postmedial area again orange-brown, with a violet apical patch and a yellow portion at the lower angle. In between the veins is a row of submarginal small dark greyish patches. Outer margin dark yellow.

Hindwing groundcolour yolk yellow, with small antemedial and medial orange-brown patches around the abdominal margin, the medial patch reaching the round hindwing ocellus, which has an orange-brown centre with central hyaline patch, circled with light blue and a broad black line, and is of 4.5 mm diameter in total. Additional markings are a blackish tiny zigzag postmedial line, followed by a row of larger orange brown and smaller black patches. Outer margin darker yellow.

On ventral surface, both fore- and hindwings with pinkish orange antemedial area, suffused there with white scales. Forewing medial area yellow with central orange-brown ocellus, outer margin of that ocellus somewhat darker than centre, median area outwardly defined by a dark brown zigzag postmedial line. Postmedial area darker, orange, marginal zone more pinkish, with dark grey subapical patch and a row of small patches of same colour between the veins. Hindwing medial area yellow, the ocellus dark red with a black ring and a pink shade directed to the anal margin. The median area is separated by a serrate, dark grey postmedial line. The postmedial area is yellow, suffused with pinkish scales and with a row of small dark blue patches. Outer fringe dark yellow.

Male genitalia (Figs. 4, 7a – c): Uncus with one central process, sclerotized at its ventral end. Dorsal process of the valves prolate, bent and sclerotized, internal process with very short dorsal thorn and a long, broad and acute process. Saccus very short, triangular, juxta with two lateral broad-based processes, tapered to their tips. Aedeagus right lateral with broad sclerite, right and left lateral with a serrate margin. Vesica with apical sclerite with two larger and three smaller spines.

Female and preimaginal instars are unknown.

Distinctive characters and discussion

The species described here is compared with its probable nearest relative, *L. luteopeplus*, described from the Khasi Hills in Meghalaya, India. Not many records for that species exist to our knowledge, and aside from the small type series in the Natural History Museum, London (holotype and one male paratype; Figs 2a & b) with unknown collection date, but bequeathed by Rothschild in 1939, we know only of two further males in the senior author's collection (Figs. 3a & b). They bear the locality "India, Mizoram, Phawngpui, x.1990, leg. local collector" and are morphologically similar to the type specimens. Also, male genital structures of the holotype (Fig. 5; reproduced from Nässig & Holloway, 1988) compare well with those of a Mizoram specimen (Fig. 6).

L. himalayana n. sp. differs from *L. luteopeplus* by its somewhat larger wingspan and the somewhat more quadrate, broader form of the wings. It is of more intense colouration, the ocelli on dorsal side are little

larger, and on ventral side the antemedial and postmedial areas are more orange, in contrast to a yellow colour in *L. luteopeplus*. Male genitalia of both species differ significant: *L. luteopeplus* has a more triangular dorsal process of the valves, the inner process has a long and bent dorsal thorn and a short and broad internal process, much broader than in *L. himalayana* n. sp. The saccus of *L. luteopeplus* is larger and more triangular; the lateral processes of the juxta have a narrow base and are longer, and the aedeagus is less sclerotized, less serrate on its margin; the vesica has only one larger and one smaller apical spine.

Samples of both taxa were analysed in the barcoding project of the University of Guelph, Canada, and results show about 2% divergence of COI barcodes in the resulting tree. The system assigns two different automatically created Bin Code numbers, that of *L. himalayana* **n**. **sp**. being ADQ8984 (Barcode of Life, 2021).

While *L. luteopeplus* is known only from two localities at medium elevation south of the Brahmaputra River, the known localities of *L. himalayana* **n. sp**. are two places in the Himalayan foothills in central Arunachal Pradesh, India, well separated from each other by the wide lowland valley of the Brahmaputra. A similar separation of species south and north of this lowland area was mentioned in several other cases of Saturniidae already, e.g., for *Archaeoattacus edwardsii* (White, 1859) versus *Arch. malayanus* Kurosawa & Kishida, 1984 (Naumann *et al*., 2016), or *Saturnia zuleika* Hope, 1843 versus *S. lesoudieri* Le Moult, 1933 (Naumann & Nässig, 2010)

In general morphological differences between nearly related species within the genus *Lemaireia* are not easily visible and mainly can be mentioned when large series are available. In our case only very few specimens were available to us, but the external morphological differences to its nearest relative and other species in addition to differences in male genitalic structures, results of DNA barcoding and zoogeographical reasons supported and justified proposing *L. himalayana* n. sp. as a different species.

Acknowledgements

We would like to thank the following persons who helped over the years with information, material, and notes on the manuscript: Gil Bretscheider (Lichtenstein, Germany), Alessandro Giusti (The Natural History Museum, London, Great Britain), Ian J. Kitching (The Natural History Museum, London, Great Britain), Swen Loeffler (Lichtenstein, Germany), Tomas Melichar (Pribram, Czech Republic), Wolfgang A. Naessig (Senckenberg-Museum, Frankfurt am Main, Germany), and Rodolphe Rougerie (MNHN Paris, France). SN is grateful to the Natural History Museum, London, for permission to figure genitalia structures from their collection.

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Fig.1: *Lemaireia himalayana* **n. sp**., male holotype, India, Arunachal Pradesh, dorsal view

Fig.2: *Lemaireia himalayana* **n. sp**., male holotype, India, Arunachal Pradesh, ventral view

Fig.3: *Lemaireia luteopeplus*, male holotype, India, Meghalaya, Khasi Hills, dorsal view, NHM

Fig.4: *Lemaireia luteopeplus*, male holotype, India, Meghalaya, Khasi Hills, ventral view, NHM

Fig.5: *Lemaireia luteopeplus*, male, India, Mizoram, dorsal view

Fig.6*: Lemaireia luteopeplus*, male, India, Mizoram, ventral view

Fig.7: *Lemaireia himalayana* **n. sp**., holotype, male genitalia prep. no. 2600/19 Naumann

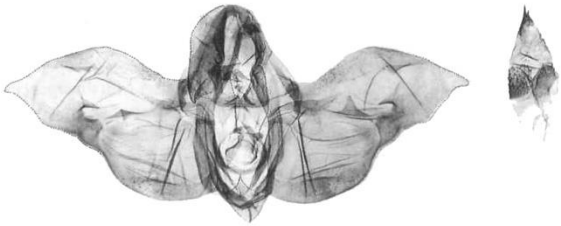

Fig.8: *Lemaireia luteopeplus*, holotype, male genitalia prep. no. B.M. Sat. 531.

Fig.8: *Lemaireia luteopeplus*, India, Mizoram, male genitalia prep. No. 2601/19 Naumann.

Fig.9: *Lemaireia himalayana* **n. sp**., same genitalia as in Fig. 4, lateral view.

Fig.10: *Lemaireia himalayana* **n. sp**., same genitalia as in Fig. 4, posterier view.

Fig.11 *Lemaireia himalayana* **n. sp**., same genitalia as in Fig. 4, Aedeagus.

LYMANTRIA (*PORTHETRIA*) *APICEBRUNNEA* (INSECTA: EREBIDAE: LYMANTRIINAE) IN ARUNACHAL PRADESH: AN ADDITION TO THE INDIAN FAUNA

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Reviewer: Sankararaman H.

Lymantria Hubner, [1819] is a large Palaearctic and tropical Asian genus of moths, many of which are confusingly similar. *Lymantria* (*Porthetria*) *apicebrunnea* Gaede, 1932 was described from Sichuan, China and also recorded from Guangxi and Yunnan provinces (Pogue & Schaefer, 2007). Males are somewhat variable.

During a survey of the Dibang valley, Arunachal Pradesh, three males of this species were collected. This confirms the occurrence of this species in India and is an addition to the known fauna of the country.

Material examined: 3 males. Forewing length: 26 – 30 mm.; expanse: 56 - 66 mm. India, Arunachal Pradesh, Lower Dibang Valley district, 17 km NE of Hunli, elevation ca. 600 m. 5.vii.2019; x 3; *Leg. et Coll*. Peter Smetacek, Butterfly Research Centre, Bhimtal, Uttarakhand. (Figures 1 and 2).

Diagnosis: We dissected two males (figure 1b, 1c and 2b, 2c) and compared genitalia with that illustrated in Pogue & Schaefer (2007); both matched *L. apicebrunnea*.

Pogue & Schaefer (2007) re-described male *L. apicebrunnea* with the following features:

Head: front and vertex white; scape white with a few pink scales medially, antenna white at base becoming dark brown, bipectinate; labial palpus white.

Thorax: a narrow line of pink scales between head and thorax; remainder of thorax white; forefemur white long pink and white fringe, foretibia white, lateral border with white fringe, tarsi white, segments 3-4 dark grey; middle and hind femora white with pink scales apically, tibiae white with white fringe, tarsi white, segments 3 – 4 grey; underside pink medially, white laterally.

Forewing: Length 25-28 mm (n=3); ground colour white; basal area with two black dots, one at costa and one at M vein; antemedial line a black dash from costa to R vein; orbicular spot absent; reniform spot not evident, incorporated into postmedial line; postmedial line brown, crenulate, from costa to posterior margin; submarginal line brown, crenulate, from costa to posterior margin; outer margin a wide brown band; fringe white with dark brown spots between veins.

Hindwing: Ground colour white; costal margin a wide brown band solid to Rs cell; fringe white with faint brown spots between veins, usually not extending to inner margin of wing.

Abdomen: entirely white both dorsally and ventrally; tymbal absent on third sternite.

Pogue & Schaefer (2007) distinguish between males of *L. apicebrunnea* and *L. brunneoloma* Pogue & Schaefer, 2007 using the following features:

Forewing length is shorter in *L. brunneoloma* and the outer margin has a much wider brown border than in *L. apicebrunnea*. The subterminal line is not as deeply scalloped in *L. brunneoloma* as in *L. apicebrunnea*. The postmedial line is discernable only as a faint spot along the posterior margin of the forewing in *L. brunneoloma*, but it is a well-defined

crenulate line in *L. apicebrunnea*. The male genitalia has a straight dorsal process in the valve of *L. brunneoloma* and in *L. apicebrunnea* it is curved towards the apex. The saccus is short with a truncated apex in *L. brunneoloma*, and elongate and narrow with a rounded apex in *L. apicebrunnea*.

From *L.* (*Porthetria*) *xylina* Swinhoe 1903 Pogue & Schaefer (2007) distinguish *L. apicebrunnea* by the following features:

L. xylina lacks the brown forewing outer margin that is present in *L. apicebrunnea*. Also, and unlike *L. apicebrunnea*, *L. xylina* is pink on the legs and has a pink neck and underside. The labial palpus is larger and black in *L. xylina* and white in *L. apicebrunnea*. In *L. xylina* the saccus in the male genitalia is wider and stouter than that in *L. apicebrunnea*.

From *L.* (*Porthetria*) *brotea* (Stoll, 1780), Pogue & Schaefer (2007) distinguish *L. apicebrunnea* by the lack of a wide brown margin on the forewing that is present in *L. apicebrunnea*. There also can be a pale pink flush in the posterior area of the hindwing in *L. brotea* that is absent in *L. apicebrunnea*. The male genitalia differ from those of other *Lymantria* (*Porthetria*) species in that the costal margin of the valve is relatively short and slightly curved.

Remarks

The material examined lacks any pink scales and the palpi are dirty white. It is possible that the use of ammonia in curating them caused the scales to change colour, as in the case of several other pigments. Alternately, it is possible that the Arunachal Pradesh population lacks pink, unlike the population from China.

The three moths were found flying singly between 11 am and 1 pm along the motor road. The flight was very erratic, quite unlike any butterfly but somewhat like Geometridae and other members of Lymantriinae. They were not found to be attracted to artificial light at night, or flowers, wet mud, animal droppings during the daytime. They inhabit dense forest and were completely absent from open areas.

Acknowledgement

We are grateful to Jibi Pulu, Roing, for many kindnesses that made the trip possible and to Pranob Gogoi, Dibrugarh, for constant support and to P.W. Schaefer, Newark, for literature.

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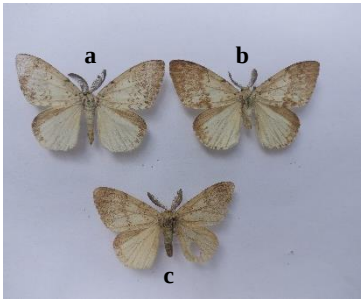

Fig.1: *Lymantria apicebrunnea,* view

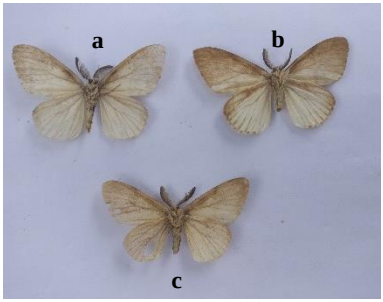

Fig.2: *Lymantria apicebrunnea*,view

SYMPATRY OF *B. LUDLOWI* AND *B. LIDDERDALII* AND RANGE EXTENSION OF *BHUTANITIS LUDLOWI* IN BHUTAN

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Reviewer:

Abstract

Sympatry of *B. ludlowi* and *B. lidderdalii* in Bhutan and an additional locality for *Bhutanitis ludlowi* in Tashigang District, Eastern Bhutan is reported.

Keywords: *Bhutanitis ludlowi, Bhutanitis lidderdalii*, sympatry, Trashigang

Introduction

Bhutanitis ludlowi is a rare butterfly species confined to a few small pockets in Bhutan and India. Recent sightings in Bhutan were at an elevation of 2200 - 3300 m with maximum observations between 2600 - 2700 m. After its original collection in 1933-1934, *B. ludlowi* was rediscovered in 2009 from Bumdeling Wildlife Sanctuary, Trashiyantse, Eastern Bhutan. Over the years, further sightings were reported from different parts of the district leading to the belief that it could probably be found in other parts of Bhutan.

Earlier records of *B. ludlowi* were all from protected areas but the following observation are from outside the protected area system of Bhutan and extend the known range of *B. ludlowi* in the country. Owing to possible threats by unscrupulous collectors in the future, the details of the locations like GPS coordinates and specific area names have not been mentioned in this report.

From 20.viii.2021 in Trashiyangtse, the species was observed at two different locations other than the known locality, Tarphel in Bumdeling Wildlife Sanctuary. On 21.viii.2021, five individuals were observed at the first location at an altitude of 2762 m feeding on Buddleja sp. (figures 1 & 2). On the same day, at the base camp at another location (2600 m), a dead specimen was observed near a government school kitchen.

On 27.viii.2021, one single worn individual was observed flying at Khaling, Tashigang at an elevation of 2700 m at noon (figures 3 & 4). In the next few days, two worn specimens were observed. Photographs were sent and the identity of the species confirmed by Mr. Motoki Saito.

Interestingly, a few fresh specimens of *B. lidderdalii* were also observed and photographed flying in the same place. Several further field visits by both authors were made but there was no evidence of *B. ludlowi* in the area during the month of September. This is the first time in Bhutan where two species of *Bhutanitis* were found to be sympatric. However, the time of activity of the two species has only an overlap of a few days, during the end of the brood for *B. ludlowi* and the beginning of the brood for *B. lidderdalii*. *B. lidderdalii* has been observed to be flying in larger numbers the from latter part of the second week of September, with many individuals observed in flight and some road kills. While the observation of *B. ludlowi* was restricted to one location, *B. lidderdalii* was observed almost throughout the stretch of 30 km of the study area.

The current findings prove that the *B. ludlowi* is found in other areas of Bhutan and that there may be need to conduct more research to ascertain the occurrence in other parts of Bhutan. *B. lidderdalii* has been observed over most of Bhutan above a certain elevation (South, Central, Eastern and Western) and further field surveys may also lead to observing *B. ludlowi* in the same locations as *B. lidderdalii.*

While they do face threats from habitat destruction such as road construction, hyodropower development, etc., general observations on negative impacts by human development activities have not been assessed for this species. Development aspirations cannot be ignored but conscious effort for protection of such important habitats is important and Government of Bhutan has ensured protection of such habitats from severe destruction. It is therefore safe to mention that these species may not face severe threats as they might have in other parts of the world.

It is suggested that Government of Bhutan might encourage plantation of *Aristolochia griffithi* in school yards in the area as well as other areas under private and government supervision, where stable populations of *B. ludlowi*, the national butterfly, could be maintained over the years as an educational and conservation tool.

Reference

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Fig.1: *B. ludlowi*, Phrumsengla National Park (PNP), Ura, Bumthang

Fig.2: *B. ludlowi, Phrumsengla National Park (PNP), Ura, Bumthang*

Fig.3: *B. lidderdalii, Khaling Gewog*

Fig.4: *B. lidderdalii, Khaling Gewog*

THE SMALLEST KNOWN INDIAN CABBAGE WHITE *PIERIS CANIDIA* (INSECTA: LEPIDOPTERA: PIERIDAE)

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Reviewer: P. Smetacek

The largest and smallest members of a species has always attracted attention. In the case of insects that undergo metamorphosis, it is believed the size is determined by the amount of food the larva ate.

Usually, butterflies and moths that are bred in captivity emerge smaller than their wild relatives of the same species. While the largest size a species can attain is a commentary on its ability to take in oxygen, metabolise glucose and enable the functioning of the various systems of its body, the smallest size is usually a commentary on the least amount of food that the species needs to survive. If the larva obtains less than the bare minimum, it will not be able to proceed with metamorphosis and will die of malnutrition.

Panthee & Smetacek (2020) recorded additions to the known size of Indian butterflies, based on specimens in the collection of the Butterfly Research Centre, Bhimtal and the Wankhar Butterfly Museum, Shillong. In that, it was noted that the smallest known specimen of the Indian Cabbage White *Pieris canidia* (Linnaeus, 1768), recorded on 8.iv.2016, had a wingspan of 42 mm and a forewing length of 20 mm, compared to the known expanse of 45-60 mm given by Evans (1932).

On 1.i.2021, a remarkably small specimen of this species was recorded in the garden of the Butterfly Research Centre, Jones Estate, Bhimtal, Uttarakhand (1500 m) by AA.

Its wingspan is 36 mm, compared to 42 mm and the forewing length is 17 mm compared to 20 mm for the previously known smallest specimen of the species, also recorded at the Butterfly Research Centre. Figure 1 shows a four specimens of *P. canidia*, a normal female and male in the top row, the female specimen recorded in 1.i.2021 at bottom left and the previous record holder for the smallest *P. canidia*, a female at bottom right.

It is noteworthy that the two smallest specimens are females, which might translate to an ability to survive harsh periods with the minimum food. The present smallest specimen was collected in January, which might mean that the larva fed in December, when there is not much plant growth due to the cold weather.

References

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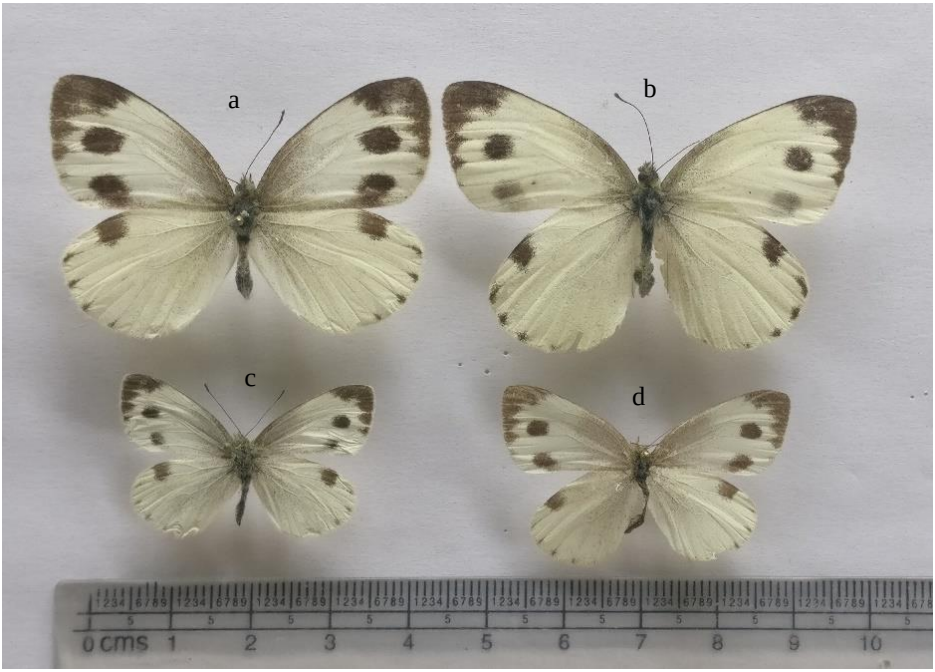

Fig.1: *Pieris canidia*, normal specimen, a. female, b. male, c. new smallest specimen & d. previous smallest specimen

FEEDING ECOLOGY OF THE INDIAN EAGLE OWL *BUBO BENGALENSIS* (AVES: STRIGIDAE) IN LUCKNOW DISTRICT, UTTAR PRADESH, INDIA

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Reviewer: Peter Smetcek

Abstract

A study was undertaken to discover the food habits of *Bubo bengalensis* in a densely populated landscape. Mammals accounted for an estimated biomass of 86.4%; of which rodents comprised 65.1%. The diet of the owl species comprised different rodent species like *Tetera indica* (27.06%), *Rattus rattus* (24.16%), *Bandicota bengalensis* (11.60%), *Funumbulus pennanti* (0.50%) as principal food; however, *Lepus nigricolis* (18.03%), and *Suncus murinus* (1.22%) were other mammalian prey. Birds were almost significant non-mammalian prey items which formed a source of persistent food followed by anurans (3.20%) and reptilians (3.06%). Chiropterans contributed only a small portion of biomass consumed i.e. 0.96%. This study might confirm the niche components supportive of *Bubo bengalensis* populations.

Keywords: Indian Eagle Owl, Regurgitated food, Seasonal difference, Diet range, Percentage biomass

Introduction

The Indian Eagle Owl (*Bubo bengalensis*) is a large owl with prominent brown ear-tufts and is largely crepuscular and nocturnal in nature. They occur throughout peninsular India. *Bubo bengalensis* is also called the Rock Eagle Owl, the Bengal Eagle Owl or Indian Great Horned Owl. The genus *Bubo* comprises some of the world's largest species of owls which enjoy tertiary level in the food chain and are also excellent indicator organisms of the ecosystem they inhabit. The prey spectrum of only two species have been extensively studied in the northern hemisphere, *viz*., the Eurasian Eagle Owl *Bubo bubo* and *B. bengalensis* (Herrera & Hiraldo, 1976; Martinez *et al*., 1992; Martinez, 2003). The Indian Eagle Owl has received little attention in India. Owls of genus *Bubo* are nearly cosmopolitan, found everywhere except the Australian region and on south west Pacific islands, where they are replaced by *Ninox* owls, and in the Arctic. There are many short communications concerning the diet of the species that are based on casual observations (Ali, 1969, 1996; Ali & Ripley, 1987).

The aim of this study is to identify the prey spectrum and prey selection by *Bubo bengalensis* which can lay the cornerstone for further investigation. Foraging behavior of *B. bengalensis* was considered while evaluating habitat requirements and also documentation of prey species available within the foraging range of owls, because prey species availability reflects diet composition. The entire study was conducted from February, 2016 to January, 2019.

Study Area

The entire study was conducted in Lucknow district. There are some forest patches along the river Gomti like Kukrail, Musabagh, Banshigarhi, Rehmankheda, PGI campus. All these forest patches provide a good habitat for owl species. A few nesting and roosting sites were located in these forest patches. On the boundary of the forest, there are extensive agricultural fields which provide a good prey base for the owl species.

Lucknow, the capital of Uttar Pradesh, is situated 123 m above sea level. It is situated between 26.30° & 27.10° North latitude and 80.30° & 81.13° East longitude. It covers an area of 3,244 sq.km. It is surrounded on the eastern side by the district of Barabanki, on the western side by the district of Unnao, on the southern side by Raebareli and on the northern side by Sitapur and Hardoi districts. The Gomti river flows through the city. Some of the tributaries of this river are Kukrail, Loni, Beta etc. The Sai river flows south of the city and in the east enters Raebareli district. The major towns of Lucknow district are Malihabad, Gosainganj, Mohanlalganj, BakshiKaTalaab, Amethi etc. The distance from the sea gives Lucknow an extreme continental climate with the prevalence of continental air during major parts of the year. Only during the four months from June to September about 75 % of the total rainfall is realized. The summers in Lucknow are very hot and winters very cold. The temperature may rise up to about 46° Celsius in summers, though the average temperature is around 38-39° Celsius. Though the winters are not bitterly cold on most days, the temperature may fall to 3-4° Celsius for a few days in winters when the cold winds from the Himalayan region make the winters chilly. The winters are also marked by mist and fog in the mornings. (Anonymous ,2012).

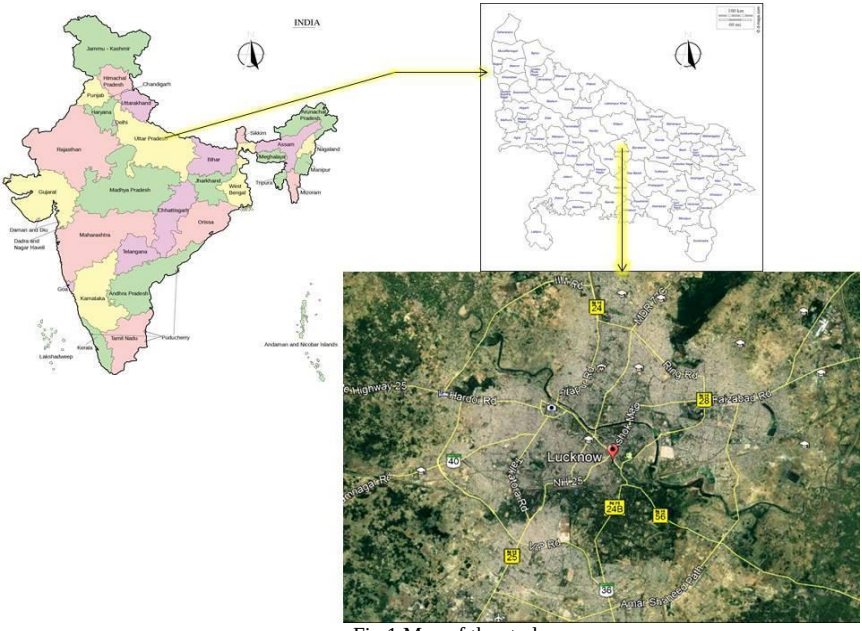

Fig.1 Map of the study area

Materials and Methods

Spots were located by secondary survey from the general public, usually residents of the areas concerned. Suspected habitats were located through discussions with Forest Department officials and villagers. Owl habitats have been surveyed throughout the district on foot at night, equipped with powerful flashlights, a DSLR Camera (Canon 70D) and binoculars (Bushnell 10x70x70). Most of the surveys were conducted along the periphery of forests on calm nights from March to October when owls are most responsive.

Although, the pellet analysis method (Errington, 1930) was the standard method for the identification of composition of diet of owls, adhering to that method will yield inaccurate estimates of overall diet of the owls, hence carcass leftovers too were analyzed (Simmons *et al*., 1991). A simple key for identification of rodents in pellets (based on structure of lower mandibles) was used to produce unbiased data of prey consumed by *Bubo bengalensis* (Ramanujam, 2004). This method was well grounded to give accurate figures of rodents and other vertebrates and non-vertebrates by including cadaver remains with heads found within their territory. Identification of prey remains in pellets considered on the reference collection and with a guide to related species (Anonymous, 1995). To identify the carcass remains of different prey items on the basis of morphological characteristics, literature was followed, *viz.*, for amphibians (Daniels, 2005), reptiles (Daniels, 1992), birds (Ali, 1996; Ali & Ripley, 1987), bats (Bates & Harrison, 1997). Arthropods were identified to family level using existing literature (Borror, 1992).

Broadcast surveys were also conducted during night to determine the presence of owls. Broadcast surveys consisted of playing breeding calls to elicit a response from owls. The collection of pellets and carcass remains were done during the day time mostly from March to August. Pellets were collected from the different locations within the study area. Each site was visited repeatedly depending upon the presence of owls.

Pellets were soaked in water and then gently teased apart. Unbroken pellets were analyzed individually. Prey species were isolated carefully and each was then separated to many sets of skull with right and left mandibles as much as possible. These along with all incomplete skeletal sets (skull, left and right mandible), were counted as an individual. The intact ones were included for dry weight analysis (Yalden & Morins, 1990). Biomass (Quantitative percentage) of food ingested was measured by dry weight analysis. The prey biomass was determined assigning to each species its average weight reported in the literature, e.g. Macdonald & Barret (1993) for mammals. For this, each food item was dried in sun for a few days so that no moisture was left. Dry weight was chosen as the standard criterion because differences in moisture content of prey items could prejudice the values (Sugden, 1973), and also because of more direct nutritional rendition (Reinecke, 1979). Standard trapping method was used to estimate the Murid population in the study area (Barnett & Dutton, 1995).

The following parameters were also calculated:

1. The percentage of the biomass of prey from pellets observed
2. The correlation between prey items in different seasons.

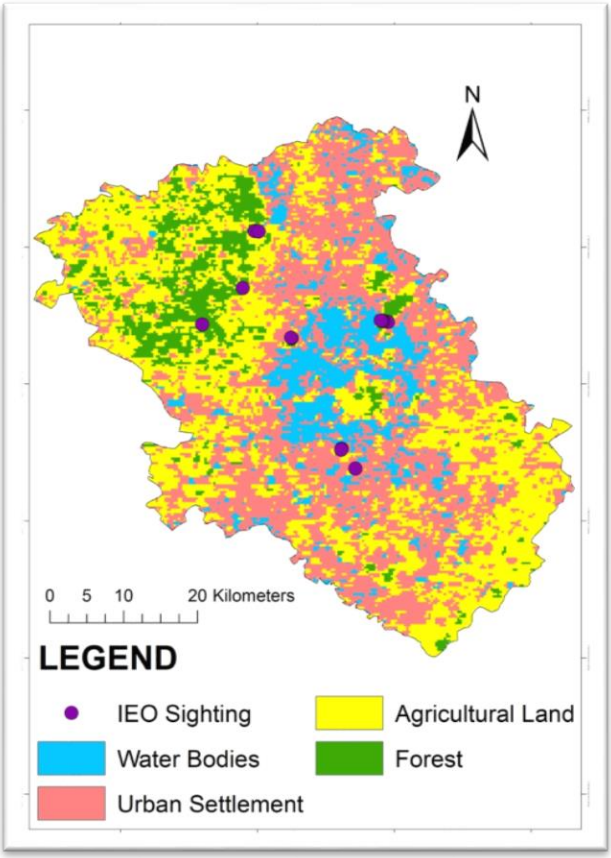

Fig.2: Map of Lucknow District

Results

A total of 1231 prey items were identified from pellets and carcass remains, accounting for a biomass (dry weight) of 63,742.27 g. Three general classes of prey were mammals, non-mammalian vertebrates and arthropods. *Tetera indica* comprised of 27.06% of biomass which was highest among all the prey items while *Rattus rattus* was the second highest prey item that accounted for 24.16% of biomass. *Lepus nigricollis* was the third highest prey biomass comprising 18.03%. Among all the prey items, *Tetera indica* & *Rattus rattus* were staple food items since the availability and habitat of these species were most suitable, while *Lepus nigricollis, Bandicota bengalensis* and Aves were constant food. Some other mammals, Anurans and arthropods fall in the Auxiliary and Opportunistic food items prey category for Indian eagle owls.

Table 1. The prey of *Bubo bengalensis*: compiled data from all sites

S.N.	Prey species	Total nos.	Percentage	Estimated Biomass (g)	% of biomass	Category
1	*Mus* (Linnaeus, 1758) sp., the Indian mouse	206	16.73	3 143.11	4.93	AF
2	*Rattus rattus* (Linnaeus, 1758), the black house rat	115	9.34	15 400.7	24.16	SF
3	*Milardia meltada* (Gray 1837), the soft – furred rat	33	2.70	129.9	0.20	OF
4	*Tetera indica* (Hardwicke, 1807), the Indian gerbil	286	23.23	17 250.4	27.06	SF
5	*Bandicota bengalensis* (Gray, 1835), the lesser bandicoot rat	288	23.40	7 394.5	11.60	AF
6	*Funambulus pennanti* (Wroughton 1905), the northern palm squirrel	36	2.91	319.2	0.50	OP
7	*Lepus nigricollis* F. Cuvier, 1823, the Indian hare	26	2.10	11 494.2	18.03	CF
8	*Suncus murinus* (Linnaeus, 1766), Asian House Shrew	87	7.09	779.73	1.22	OF
9	Chiroptera	13	1.05	607.62	0.96	OF
10	Aves	27	2.20	3 233.68	5.08	CF
11	*Calotes* sp.	75	6.09	160	0.26	OF
12	*Varanus bengalensis* (Daudin, 1802), Bengal monitor	14	1.13	1 786.96	2.80	AF
13	Anurans	5	0.40	2 042.25	3.20	AF
14	Coleopterans	11	0.90	*	*	OF
15	Orthoptera	9	0.73	*	*	OF

Total		1 231	100	63 742.27	100

SF (Staple food) - prey frequency >20%; CF (Constant food)- Prey frequency between 5-20%; AF (Auxiliary food) – Prey frequency between 1-5%; OF (Opportunistic food) - >1%

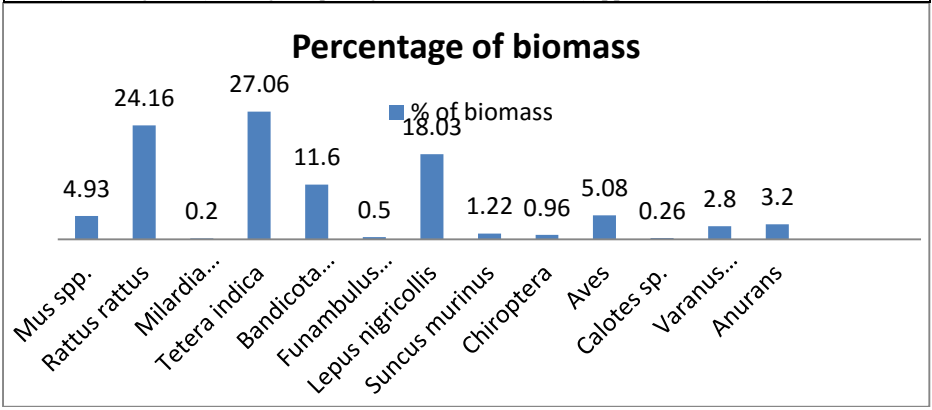

Fig.2 Percentage of biomass of the prey items

Seasonal variation in Indian eagle owl food, Lucknow, 2016-2018

Table 2. Showing seasonal variation of prey items in pellets

S. N.	Species	2016			2017			2018		Total
		Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer	
1	*Mus spp.*	12	24	38	15	32	41	16	28	206
2	*Rattus rattus*	36	42	23	29	51	26	42	39	288
3	*Milardia meltada*	-	1	-	-	2	-	-	-	3
4	*Tetera indica*	43	52	31	36	42	35	42	25	306
5	*Bandicota bengalensis*	16	4	19	6	17	22	13	8	115
6	*Funambulus pennanti*	-	1	2	-	2	-	-	1	6
7	*Lepus nigricollis*	7	3	-	5	1	-	8	2	26

8	*Suncus murinus*	5	8	1	1	6	-	7	9	37
9	*Chiroptera*	1	3	1	2	4	-	3	-	13
10	Aves	7	1	2	6	5	4	2	-	27
11	*Calotes sp.*	-	2	-	1	2	-	-	-	5
12	*Varanus bengalensis*	-	1	6	-	2	4	-	1	14
13	Anura	-	-	42	-	-	33	-		75
14	Coleoptera	-	29	18	-	27	22	-	2	98
15	Orthoptera	-	2	5	-	2	3	-	-	12
Total		127	176	188	107	195	190	133	115	1231

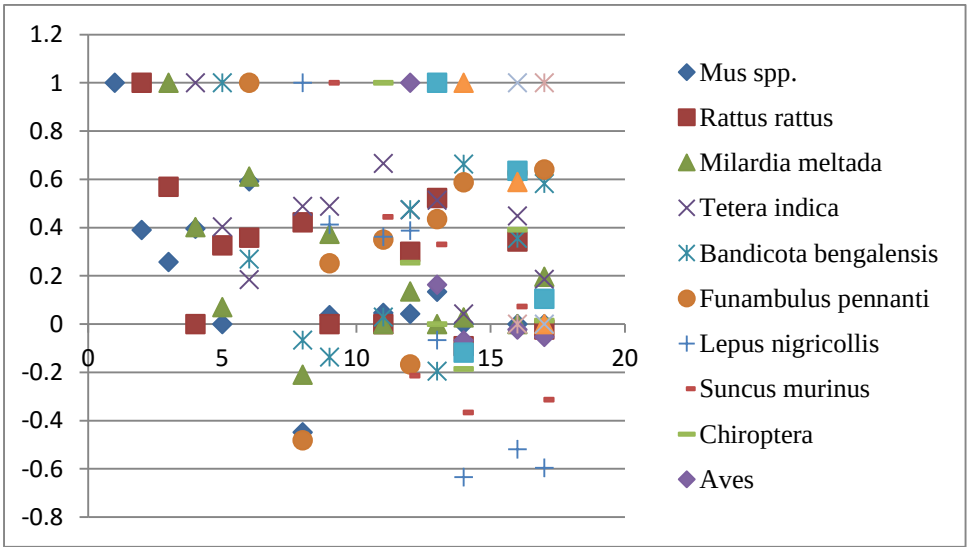

Fig. 3 Value of correlations between prey items

Table 3. Correlation between prey items

	Mus spp.	*Rattus rattus*	*Milardia meltada*	*Teterai ndica*	*Bandicota bengalensis*	*Funambulus pennanti*	*Lepus nigricollis*	*Suncus murinus*	Chiroptera	Aves	*Calotes sp.*	*Varanus bengalensis*	Coleoptera	Orthoptera
Mus spp.	1													
Rattus rattus	0.39	1												
Milardia meltada	0.257	0.569	1											
Teterai indica	0.395	.836**	0.402	1										
Bandicota bengalensis	.719*	0.327	0.071	0.40300	1									
Funambulus pennanti	0.592	0.358	0.612	.18400	0.269	1								
Lepus nigricollis	-0.448	0.422	-0.209	.48900	-0.066	-0.481	1							
Suncus murinus	0.037	.776*	0.374	.488	-0.137	0.252	0.413	1						

Chiroptera	0.047	.695*	.742*	0.6660	0.0291	0.351	0.362	0.445	1					
Aves	0.043	0.3	0.136	.47400	0.475	-0.167	0.388	-0.213	0.255	1				
Calotes sp.	0.134	0.523	.869**	0.5130	-0.195	0.436	-0.066	0.331	.772*	0.164	1			
Varanus bengalensis	.827**	-0.091	0.028	0.043	0.663	0.588	-0.634	-0.366	-0.186	-0.068	-0.118	1		
Coleopterans	.702*	0.342	.694*	0.449	0.356	0.627	-0.519	0.073	0.391	-0.023	0.636	0.589	1	*
Orthoptera	.783*	-0.023	0.196	0.186	0.582	0.641	-0.596	-0.313	0.015	-0.053	0.105	.956**	.743*	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Discussion

An aggregate of 166 prey articles were identified from pellets, pellet remains 84 from Arunachala Hill and 82 from Pondicherry University campus with biomass from pellet and prey remnants was 22,620.17g, 11,240.59g from Arunachala and 11,379.58g from Pondicherry University. Out of the 166 prey items 102 were small mammals accounting for a biomass of 13,973.90g, 5,616.83g (49.94%) from Arunachala and 8,357.07g (73.42%) from Pondicherry University. The murid rodents dominated 44.99% in Arunachala and 70.13% in Pondicherry University while the anurans followed for a collective biomass of 12.87% in

both areas. The others Coleoptera, Orthoptera and *Paratelphusa* sp. accounted for an insignificant biomass of 0.51% (Ramanujam *et al.,* 2017). Siva *et al.* (2019) studied and analyzed 1082 regurgitated pellets returned 2077 prey items with a mean of 1.91. The diet constituted 65.1% of rodent prey and the remaining 34.83% of vertebrate and invertebrate animals. The mean percentage of prey composition was maximum 31.15% *Millardia meltada* Soft-furred Field Rat, 12.95% *Bandicota bengalensis* Lesser Bandicoot Rat, 10.25% *Mus booduga* Indian Field Mouse, and 10.24% of other rodent species progressively. The 34.83% of non-rodent prey, the owls ingested insects (Rhinoceros beetles, 9.58%), Arachnida (Solifugae or Sun spider, *Galeodes* sp., 9.58%), reptiles (*Calotes* sp., 3.7%), amphibians (3.56%), shrews (*Suncus murinus*, 2.84%), and others (5.57%).The studies and analysis of the diet suggests that the Indian Eagle Owl is a dietary generalist (Ali & Ripley, 1969; Ramanujam, 2006). The various species of rodent prey, which formed the major part of the diet of the owls were 55% relative abundance and 85% total biomass (Jain *et al*. 1993; Parshad, 1999). Different samples of pellets show significant highly positive relationship (α =0.01) include *Tetera indica* with *Rattus rattus* (r=0.836), *Milardia meltalda* with *Calotes* spp. (r=869), *Mus* spp. with *Varanus bengalensis* (r=.827) and Orthoptera with Coleopterans. Other sample of pellets show significant relationship (α=0.05) include *Mus* spp. with *Bandicota bengalensis* (r=.719), *Suncus murinus* with *Rattus rattus* (r=.776), Chiroptera with *Rattus rattus* (r=.695), Chiroptera with *Milardia meltada* (r=.742), Calotes with Chiroptera (r=.772), Coleopterans with *Rattus rattus* (r=.702), and Orthopteran with Coleopterans (r=.743).

Conclusion

In the present study, the diet constituted 65.1% of rodent prey and the remaining 34.83% of vertebrate and invertebrate animals. Among all the prey items *Tetera indica* & *Rattus rattus* were found to be staple food items due to its availability while *Lepus nigricollis, Bandicota bengalensis* & Aves were constant food. Some other mammalian, Anurans and arthropods were found in Auxiliary and Opportunistic food items category. *Tetera indica* were included in most abundant food item preyed upon by Indian Eagle Owl. After *Tetera indica*, *Rattus rattus* was the second highest prey item in food that accounted for second highest biomass. *Lepus nigricollis* was the third highest prey biomass comprising 18.03%.

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INDIVIDUAL VARIATION IN *NYCTEMERA ADVERSATA* (INSECTA: LEIPDOPTERA: EREBIDAE) IN THE INDIAN HIMALAYA

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Reviewer: Sankararaman H.

Introduction

Nyctemera adversata (Schaller, 1788) is a wide spread moth that occurs throughout the Indian subcontinent (Hampson, 1894). Holloway (1988) ignored the peninsular Indian records and reported the species from the Himalaya, west and south China, Japan, Peninsular Malaysia, Sumatra and Borneo. It often occurs in large numbers and is by far the commonest member of the genus throughout the subcontinent. It occurs in several broods through the year and the larvae have been bred on *Debregeasia*, *Girardinia*, *Urtica* (Urticaceae) and *Gynura* and *Crassocephalum* (Asteraceae) in Bhimtal (Smetacek & Smetacek, 2011). Holloway (1988) compiled earlier information on the subject to report *Erechtites*, *Erigeron*, *Gynura*, *Picris*, *Senecio* and other Asteraceae as larval host plants.

The Arctiinae are known to be subject to some individual variation, especially in the Arctiini. The range of individual variation within a species has never been documented in this species. Holloway (1988) noted that the row of brown patches on the hind wing were of various sizes but did not note any other individual variation in this species. Similarly, Hampson (1894) did not note any individual variation in the species. Barlow (1982) noted that there is "considerable variation in the extent of the black markings on the wings". He did not clarify whether the variation was geographical, seasonal or individual. Although the fuscous markings on both the wings varied greatly in the specimens examined in the present study, the distinctive abdominal markings served to easily separate it from the sympatric and similar *N. cenis* (Cramer [1777]).

We have here depicted the range of individual variation in this species.

In the current study the species has been recorded from 400 – 1500 m, although Kishida (1992) reported it at 1600 m elevation in Nepal.

Methodology

Moths were surveyed using an ultraviolet lamp of 250 watts in Roing, Lower Dibang Valley district, Arunachal Pradesh and at the Butterfly Research Centre, Bhimtal (1500 m) and Jeolikote (1200 m), both in Nainital district, Uttarakhand. In addition, specimens in the reference collection of the Butterfly Research Centre (BRC) were examined.

Material examined: 27 exs.: BRC, Bhimtal, Sattal and Jeolikote, Nainital district, Uttarakhand. 1200 – 1500 m.

Leg. Fred Smetacek Sr.; Peter Smetacek and A. Agnihotri: 6.vi.1981 (1 ex.); 7.vi.1981 (1 ex.); 15.ix.1983 (1 ex.); 13.x.1983 (1 ex.); 28.iv.1986 (1 ex.); 20.iv.1992 (1 ex.); 3.v.1992 (1 ex. Female); 28.v.1992 (2 exs.); 30.v.1992 (1 ex.); 31v.1992 (2 exs.); 3.vi.1992 (2 exs.); 20.ix.1992 (1 ex.); 2.x.1993 (1 ex.); 26.x.1993 (1 ex.); 27.x.1993 (2 exs.); 23.v.1998 (1 ex.); 11.x.1998 (1 ex.); 23.x.1998 (1 ex.); 14.xi.1998 (1 ex.); 28.xi.1999 (1 ex.);

22.x.2020 (1 ex.); Roing (390m) Arunachal Pradesh: 28.iv. – 15.vi.2021 (2 exs.)
Forewing length: 24 - 28 mm.

Discussion

Of the 27 specimens examined, 23 match the specimens figured in Hampson (1894), Holloway (1988), Kishida (1992) and Spitsyn *et al*. (2015). Holloway's (1988) specimen is a little darker than that depicted by Hampson (1894) and Spitsyn *et al*. (2015). Barlow (1982) depicted a much darker specimen, quite as dark as the darkest specimen examined in this study.

In this study, specimens of *N. adversata* have been recorded from April to June and from September to November, suggesting that there are at least two generations in the western Himalaya. It has also been recorded in April, May and November at low elevation in Arunachal Pradesh although specimens were not taken from the eastern Himalayan autumn brood.

A specimen with remarkably reduced fuscous markings on both the wings was recorded in BRC on 23.x.1998 (fig. 1a); subsequently a specimen only a little more heavily marked was recorded from Roing in May, 2021 (fig. 1b) among dozens of individuals similar to those depicted in Hampson (1894) and Holloway (1988) (fig. 1c). During the same period a heavily marked individual (fig. 1d) similar to that depicted in Barlow (1982) was recorded at the same time in Roing. This confirms that, although rare, the extent of fuscous markings on the wings of *N. adversata* is individually variable and not linked to geography or the seasons. However, no heavily marked individual has ever been recorded from the western Himalaya in over 50 years of observation.

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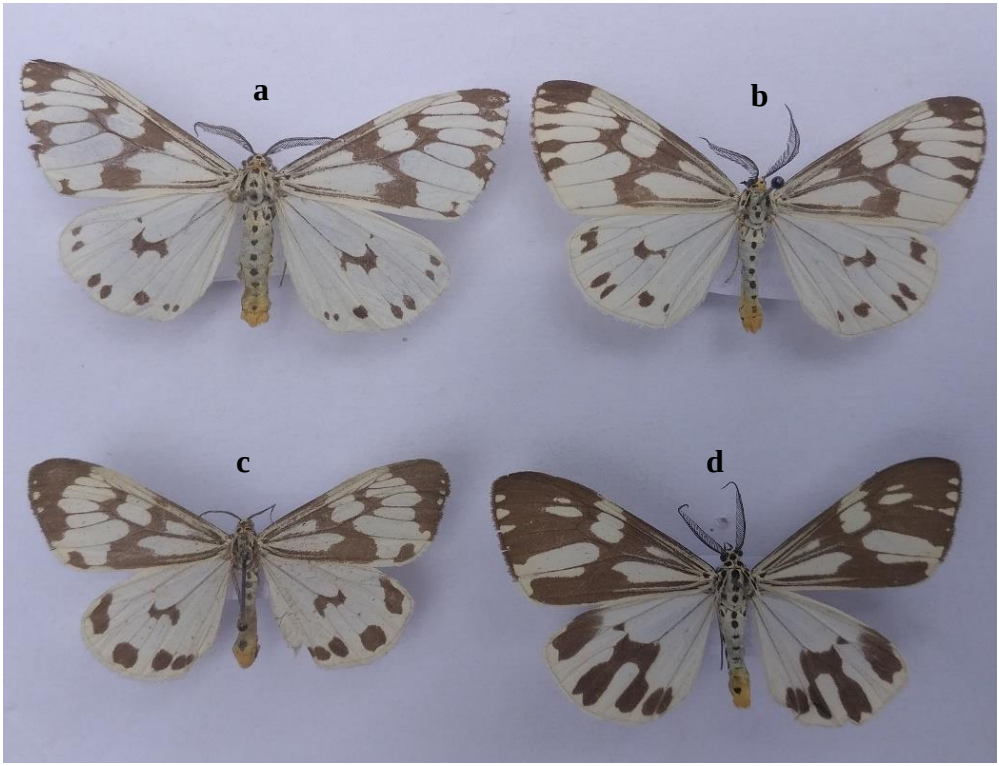

Fig.1: *N. adversata*, a. reduced fuscous markings on both the wings b. specimen only a little more heavily marked, c. similar to those depicted in Hampson (1894) & Holloway (1988) & d. heavily marked individual