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Cover Photo by Tshulthrim Drukpa of a *Nymphalis antiopa* Butterfly

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FIRST REPORT OF COMMON FIVE-RING *YPTHIMA BALDUS* (INSECTA: LEPIDOPTERA: NYMPHALIDAE) FOR PAKISTAN

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Reviewer: Peter Smetacek

Abstract

Common Five-ring butterfly *Ypthima baldus* (Fabricius, 1775) is reported from Pakistan for the first time.

Introduction

The Common Five-ring *Ypthima baldus* (Fabricius, 1775) is a common and widespread species in South Asia. It is represented on the Indian sub-continent by 3 subspecies:

(i) *Y. b. madrasa* Evans, 1924: South India (Gujarat to Kerala).

(ii) *Y. b. satpura* Evans, 1924: Central India (Madhya Pradesh and Chattisgarh) (Varshney and Smetacek, 2015).

(iii) *Y. b. baldus* (Fabricius, 1775): North Eastern Ghats (Orissa, Jharkhand) to West Bengal, and Himalayas, up to 2200m, from Himachal Pradesh, east through Northern Punjab (India), Uttarakhand, Nepal, Bihar, Sikkim, Bangladesh, Bhutan to North-east India (except Mizoram) (Paul Van Gasse, 2019). In Himachal Pradesh, it has been recorded upto Kangra and in Punjab (India) from Siwaliks, but not so far from Pakistan, therefore it was quite expected, particularly from Himalayan parts of Pakistan.

Methodology

After a long wait and search, the second author found a member of *Ypthima* Huebner, 1818 at Sherwan, Abbotabad, KPK Province on 17-19 June, 2019, that looked very different from other Five-rings which were already recorded from Pakistan (i.e. *Y. lisandra* (Cramer, [1780]), *Y. nikaeva* Moore, [1875] and *Y. bolanica* Marshall, 1882). He photographed both *recto* and *verso* surfaces of the wings of the butterfly with a Nikon D7500 and 18-140

mm lens. The first author identified it as *Ypthima baldus*, which was later confirmed by Peter Smetacek.

Results and Discussion

The photographed butterfly was identified using keys and information given in the available literature. (Evans, 1932; Talbot, 1947; Kehimkar, 2016; Smetacek, [2016]; Bhakare and Ogale, 2018). It has 3 pairs of ocelli on the under hindwing, of which the apical ocellus is not larger than the others. The middle pair is shifted out of line with the tornal pair of ocelli. Underside ground colour is pale with darker sub-basal, discal and submarginal fasciae. Upperside has pale area containing ocelli, bordered by dark discal and submarginal lines. These features confirm its identity as *Ypthima baldus* and separate it from other Pakistani 'Five-rings'.

Conclusion

Prior to this record, *Ypthima* was represented in Pakistan by 7 species (i.e. *Ypthima narenda* (Kollar, [1844]), *Y. inica* Hewitson, 1865, *Y. asterope* (Klug, 1832), *Y. bolanica*, *Y. lisandra*, *Y. nikaeva* and *Y. kasmira* Moore, 1884) (Tshikolovets and Pages, 2016). With the addition of *Y. baldus*, 8 members of this genus are known from Pakistan. The total number of butterfly species known from Pakistan after this record has reached 441, which is expected to increase in the future.

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Fig 1: *Ypthima baldus* (underside)



Fig 2: *Ypthima baldus* (upperside)

BAORISA HIEROGLYPHICA (INSECTA: LEPIDOPTERA: NOCTUIDAE) IN HIMACHAL PRADESH

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Reviewer: Peter Smetacek

Baorisa hieroglyphica Moore, 1882 is an unusual moth known from the Kumaon Himalaya (Smetacek, 2008) eastwards along the Himalaya to N.E. India (Hampson, 1894). Hitherto, the Kumaon Himalaya of Uttarakhand was considered its western limit. On 14.ix.2015, a specimen of this moth entered the author's house at the above address in Solan district, Himachal Pradesh, India (1700m amsl). During the following weeks, that is between 14 September and the first week of October, 2015, around 20 individuals of this species were observed around the house. During subsequent years, no specimens were observed, despite conditions being practically the same as the year in which they were recorded. The possibility that the

specimens recorded in the present study were part of a migration during 2017 cannot be ruled out, since they do not appear regularly as would a breeding local population.

In any event, the current record is of interest in that it extends the known distribution of this species considerably westward, even if this is only the limit of a migratory swarm.

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Fig: *Baorisa hieroglyphica*

RE-DISCOVERY OF THE PRICKLY ASH ELFIN *AHLBERGIA HARADAI* (IGARASHI, 1973) (INSECTA: LEPIDOPTERA: LYCAENIDAE) IN NEPAL

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Introduction

On 14 June 1963, the Japanese Lepidoptera Expedition to Nepal collected six larvae at 2400m in the forest above Godavari, east of Kathmandu. Two were on the trunk and four were feeding on the fruits of timur (*Zanthoxylum oxyphyllum*, a local tree also known as the Prickly Ash). One larva was conserved. The other five larvae turned into pupae 6-10 days later and were taken to Japan. One pupa was conserved. One butterfly, a female, emerged on 23 April 1964. In 1973, Igarashi described it as a new species, naming it *Ahlbergia haradai*, the Prickly-Ash Elfin. Colin Smith (2017) has referred to it as "Harada's Hairstreak".

On 16 March 2016 a male *A. haradai* was discovered by M.L., high on a branch of a tree in the forest above Godavari at about 2400m. On 4 May 2016, a female was photographed by P. v. d. P. sitting on bare ground near Shivapuri NP at about 2000m. And on 20 May 2016, M.L. saw another one in the same tree. This was 53 years after the first caterpillars of the species were collected. In 2017, 2018 and 2019 M.L. surveyed the *Z. oxyphyllum* trees above Godavari. No *A. haradai* were found in the first two years but in 2019 on 1, 5 and 10 May some 11 individuals, including a mating

pair, were observed high in the same timur tree or a nearby *Quercus semecarpifolia*.

The first two observations of *A. haradai* adults were mostly due to chance, as M.L. was taking out visitors to see the Blue Peacock (*Papilio arcturus*), while P.v.d.P. was on a bicycle trip. This chance was most likely increased by 2016 being a good year for the species. 2017 and 2018 were probably poor years for the species and 2019 good again. Before 2016, *A. haradai* was never seen in Nepal, due to a combination of low numbers of butterfly observers in the area, the early time of the year when *A. haradai* starts flying and the fact that *A. haradai* stays mostly high up in the trees where chance observations are low. For the same reasons, *A. haradai* may not have been found yet outside Kathmandu Valley. Kathmandu Valley has 25 species that have never been found outside the valley, and belongs with Pokhara valley to the best surveyed areas for butterflies in Nepal. Another species only encountered in Kathmandu Valley and flying even earlier in spring at altitudes above 2000m is *Amblopala avidiëna nepalica*, the Chinese Hairstreak.

M.L. has observed *A. haradai* flying with other early spring and often fairly rare butterflies, such as *Teinopalpus imperialis* Hope, 1843 (Kaiser-i-Hind), *Graphium*

eurous (Leech, [1893])(Six-Bar Swordtail), *Papilio arcturus* Westwood, 1842(Blue Peacock), all of Nepal's *Byasa* Moore, 1882 species (*B. latreillei* (Donovan, 1826), *B. polyeuctes*, *B. dasarada* (Moore, 1858), *B. plutonius* (Oberthur, 1876): Rose, Common, Great and Chinese Windmills), *Dilipa morgiana* (Westwood, [1850])(Golden Emperor), *Hestina nicevillei* (Moore, [1895])(Scarce Siren) and *Neope pulaha* (Moore, [1858])(Veined Labyrinth). Unlike many other Lycaenidae, *A. haradai* has so far not been observed to chase butterflies belonging to different species.

This report describes the first records of a male and a female *Ahlbergia haradai* flying in Nepal. For the time being the species is endemic to Nepal. It is likely that *A. haradai* and several others of the 25 species which have up till now only been recorded from Kathmandu valley are also found in other parts of Nepal.

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Fig 1: *Ahlbergia haradai* (male)



Fig 2: *Ahlbergia haradai* (female)

CAMPTOLOMA MANGPUA (INSECTA: LEPIDOPTERA: NOLIDAE) IN ARUNACHAL PRADESH, INDIA

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Reviewer: Stefan Naumann

Introduction

The genus *Camptoloma* Felder, 1874 is represented in India by two species, *C. binotatum* Butler, 1881 and *C. mangpua* Zolotuhin & Witt, 2000. Both occur in the eastern Himalaya, the former from Nepal (Yoshimoto, 1993) eastwards to Meghalaya (Hampson, 1894) and the latter only known from the states of West Bengal and Sikkim (Zolotuhin & Witt, 2000). *C. binotatum* is also known from Myanmar and southern China (Zolotuhin & Witt, 2000).

The two species known from India are restricted to mountainous regions with heavy rainfall, between 1520 m (Shillong) and 1600 m (Godavari) for *C. binotatum* and 1000 m (Namchi) and 1900 m (Darjeeling-Mangpu road) for *C. mangpua*. Both species appear to be univoltine, with a single generation in mid-June for *C. binotatum* and a similar generation for *C. mangpua* in late June and early July.

Material Examined

2 exs. Arunachal Pradesh, Roing-Hunli road, Kilometre 65 (2200m) 8.vii.2019 (*Leg., det. et Coll.* Peter Smetacek) and 2.viii.2019 (*Leg. et Coll.* A. Vaidya). Forewing length: 14-18 mm, expanse 30-40 mm.

Both specimens examined bear the distinctive features mentioned in the original description, i.e. "wings are very narrow, forewings with protruded top and without anal angle, this is rounded in a very typical way. Ground colour

of wings bright yellow, the hindwings darker. The wing pattern is also very characteristic. All transversal black fasciae which are so typical for *Camptoloma* are present, antemedial fascia curved, postmedial one straight, subterminal fascia contrarily curved, terminal fascia slightly teathed. Red pattern very strong, of bright red colour, much more contrasting than in other *Camptoloma* species and coming along M-Cu-cellula basally. Abdomen of monotonous dark yellow colour without distinct pillow of hair-formed scales.

Discussion

The present records extend the known distribution of this little known species from Sikkim eastwards to the Mishmi Hills in eastern Arunachal Pradesh. It appears to be univoltine, with records between mid-June and the beginning of August, since surveys in the eastern Himalaya at other times of the year have failed to record it. It occurs from 1000 m elevation to over 2200 m elevation. Curiously, only one specimen appears at a time, suggesting that it occurs at low density in nature. On the other hand, the preponderance of females recorded suggests that the species, especially males, are not often attracted to artificial light and therefore, they might be more common in nature than appears from records obtained at artificial light. The present specimens are slightly larger than the type series, which had an expanse of 35-36 mm and

forewing length 16-17 mm, while the present specimens have an expanse of 30 – 40 mm and a forewing length from 14 to 18 mm. The early stages are unknown.

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Fig: *Camptoloma mangpua*

FIRST REPORT OF *DANAUS CHRYSIPPUS* FORM *DORIPPUS* (INSECTA: LEPIDOPTERA: NYMPHALIDAE) FROM ANDHRA PRADESH, INDIA

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Reviewer: Piet van der Poel

Introduction

The Plain Tiger *Danaus chrysippus* (Linnaeus, 1758) occurs in four forms over its known distribution from Africa, through Asia to Australia. These are the typical form *chrysippus*, which is predominant in Asia, the form *dorippus* Klug, which lacks any white marking on the forewing and is the dominant form in parts of Africa, form *amplifascia* Talbot, where the subapical series of white spots on the forewing *recto* extends inwards to the discocellulars and the form *alcippoides* Moore, which has white hindwings. In India, the latter three forms are not often encountered.

D. chrysippus dorippus was believed to occur west of what is now Pakistan (Marshall & de Niceville, 1883) but it has been reported from parts of the Indian subcontinent subsequently, namely from Sri Lanka (Woodhouse & Henry, 1942), Bengal (Best, 1954), Bihar (Harman, 1950), Rajasthan (Donahue, 1962), Delhi (Ashton, 1972), near Pune in Maharashtra (editorial note following Best, 1954), the submontane tract of Kumaon and Garhwal (Atkinson, 1882) and the outer range of the Kumaon Himalaya in Bhimtal (Smetacek, 2001).

On the whole, it was believed that the form *dorippus* was a dry zone form, since it is the

commonest of the forms of *D. chrysippus* in parts of Africa that are relatively drier. Wynter-Blyth (1957) also noted that it was a dry zone form.

A male specimen of *D. chrysippus* form *dorippus* was recorded during a faunal survey at the Ravva Onshore Terminal of Vedanta Limited, Cairn Oil and Gas, Surasani Yanam, Uppalaguptam Mandal, East Godavari district - 533213, Andhra Pradesh at 10 m above sea level on August 8, 2019 with a forewing length of 31 mm. This is the first record of the form from the south east coast of the Indian peninsula, which is a region of heavy rainfall. This was the only specimen of this form among many (20+) individuals of *D. chrysippus* observed that day.

Acknowledgment

The authors are grateful to D. Muthukumarasamy and J. Thomas Christopher for permission to study the fauna of the Block and to publish the findings.

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Fig.: *Danaus chrysippus* form *dorippus*

**CHELONIOPHAGY BY CHECKERED KEELBACK,
XENOCHROPHIS PISCATOR (SCHNEIDER, 1799) ON INDIAN
PEACOCK SOFTSHELL TURTLE, *NILSSONIA HURUM*
(GRAY, 1830)**

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Reviewer: Zeeshan Mirza

Introduction

Checkered Keelback *Xenochrophis piscator* is non-venomous snake found in or near freshwater lakes or rivers. Similarly, Indian peacock softshell turtle, *Nilssonina hurum* (Trionychidae), is a relatively abundant large riverine species that is found in rivers and reservoirs. *X. piscator* is a commonly encountered species, found in India, Afghanistan, China, throughout South and Southeast Asia (Barooah & Sarma, 2016). Likewise, *N. hurum* is a vulnerable (IUCN, 2000) species distributed over eastern Pakistan, northern and central India, Bangladesh, and Nepal. *X. piscator* normally consume mainly invertebrates (Pough *et al.*, 2001) and are economically important as major predators of insects (Wadeker, 1963). Juveniles feed primarily on tadpoles, frogs, and aquatic insects, whereas adults feed primarily on fishes and frogs but occasionally take rodents and birds (Schleich & Kastle, 2002; Whitaker & Captain, 2008). On the other hand, foxes, hawks, herons, bitterns, owls, bullfrogs and large fish are known to be common predators of juvenile turtles and their eggs. *X. piscator* is a non-venomous snake active throughout the day and night, whereas, *N. hurum* is primarily nocturnal and omnivorous (Das *et al.*, 2010).

If grasped, *X. piscator* strikes rapidly with great determination; Daniel (1983) noted that it is among the most vicious of Indian snakes. Turtle's defense mechanism of retracting their heads and limbs under their shells can be dynamic at times depending on its adaptation to regular predators. Juveniles of *N. hurum* are observed feeding on mosquito larvae and fish, while adults consume snails, earthworms, prawns, fish, frogs, carrion, and vegetation (Das *et al.*, 2010) which is abundant in the study area. Along with this species, 16 other turtle species are extant in Nepal belonging to Geomydidae, Trionychidae and Bataguridae (Shah & Tiwari, 2004).

Observations

The chelonian survey took place in Jagadishpur reservoir of Kapilvastu, Nepal, from January to June, 2019. Rapid sweep survey was carried out in the wetland considering the peak activities of chelonians in day and evening. The behavioral activity of *X. piscator* preying on juvenile *N. hurum* was observed and photographed on the northern side of Jagadishpur Lake (27°37'19.41"N & 83° 5'41.54"E). It was photographed at 15.00 hr on January 17, 2019. The species was identified by consulting available literature, (Aryal *et al.*, 2010) field guides and books and

also from online resources (<http://www.iucn-tftsg.org>) and then confirmed by experts.

Result and discussion

In the present study, *X. piscator* was found to be predated on *N. hurum* inhabiting Jagadishpur reservoir. *X. piscator* is mainly aquatic, inhabiting mostly freshwater wetlands but uncommon in forested areas and coastal regions (Fugler, 1982). *X. piscator* can be active during both day and night (Parmar, 2018). They feed on fish, frogs, occasionally rodents, birds, tadpoles and aquatic insects (Ahsan, 1983) which suggests that they have equal preference for diurnal and nocturnal prey. The present finding shows that *X. piscator* feeds also on chelonian species which is not a regular prey. *X. piscator* or any species of snakes are not known to be common predators of chelonians. During the survey, live and dead shells of *N. hurum* encountered frequently suggests that the area is suitable habitat for this turtle in terms of food and space but is under anthropogenic and predation pressure.

Despite their speed, Daniel (1983) noted that *X. piscatoris* among the most vicious snakes which strikes rapidly with determination towards its prey. Also, this specific situation may have occurred because of the thriving population of Indian peacock softshell turtles in their juvenile phase. Chelonians are long-lived species with longer generation times and high juvenile mortality (Congdon, Dunham, & van Lobel Sels, 1993; Gerlach, 2008). Given that their shell is a soft shell, they are unable to stay in the sun for extended periods of time (Albers, 2012) which could have made it easier for *X. piscator* to attack while in the aquatic habitat as shown in Fig.1. The softshell turtles, here represented by *N. hurum*, are more vulnerable to predators due to their lack of a shell (Kruzer, accessed on ix.20.2019). The snake at the study site may have

chosen them to feed on due to their hunting pattern; an aquatic habitat supporting an abundance of turtles. However, the present finding resembles the findings by Schleich (1982) reporting the predation of young *Testudo marginata* by *Malpolonmon pesselanus insignitus* in Lakonia, Southern Greece. This record is a contribution to the field of ecological study of *Xenochrophis piscator* and *Nilsonnia hurum* in Nepal. This information would contribute to further understanding the importance of turtles within the dynamics of food webs.

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Fig. 1: *Xenochrophis piscator* predating on *Nilssonina hurum*



Fig. 2: Northern side of Jagadishpur Reservoir

***NYMPHALIS ANTIOPA* (INSECTA: LEPIDOPTERA:
NYMPHALIDAE) IN THE HIMALAYA**

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Introduction

Nymphalis antiopa is a very widespread butterfly species, with a known distribution from Europe in the west to Japan in the east as well as on the North American continent. Across this wide range, there is little variation. Fruhstorfer (1909) described a subspecies from Szechuan, which differed from Japanese specimens in being smaller, the pale outer margin of the underside narrower and more heavily marked with black spots; the distal margin of the upperside darker yellow than the European forms, with the subapical spots narrower, reminding one of the North American form. He named the subspecies *yedanula* after the Chinese Empress.

Some years before this, native collectors of Captain Elwes and Otto Muller had collected the species at high elevation in native Sikkim and across the passes in Chumbi valley. It had also been recorded in Bhutan (Marshall & de Niceville, 1886). Bailey (1912) mentioned that "It occurs in Bhutan, where I have taken it. I had also found it in the Chumbi Valley, where I believed it to be rare until one day, going up an exposed spur, I saw dozens feeding on the nectar of the wild, cream-coloured scabious." Both these reports give no exact location within the Indian subcontinent for this species. Evans (1927) placed the Himalayan population under *yedanula* (Fruhstorfer, 1909), thus extending the known distribution of the subspecies from the type

locality in Siao Lou, Szetchuan, China. On 23.iii.2013, P.v.d.P. photographed an individual at Tshalunang, MewangGewog, Thimphu, Bhutan at an elevation of 2950m. It was basking in an open area in mixed forest. On 5.iv.2015, he saw several individuals near Tsochekha, Genekha Gewog, Thimphu Dzongkhag, Bhutan at around 3100m, of which he photographed one. These were flying around some bushes in fallow agricultural fields not far from the forest edge. The last observation, by Tshulthrim Drukpa and Karma Wangdi was an individual photographed on 31.vii.2019 at Chelela pass (3791m; 27.3709 N 89.2924 E). It was active at 11.45 am and was flying about low sub-alpine vegetation. It perched on an Aster flower, but did not feed. It later settled on the ground on some wet mud, where it fed. In Bhutan, the species has also been reported from Bumthang (3.vii.2010; 2892 m; N:27 32 44.0 E:90 43 29.1); Pelala (2.vii.2013; 3439 m; N:27 32 12.92 E:90 12 07.84) and Phrumshingla (6.vi.2009; 3746 m; 27 24 06.68 E:90 59 46.22) by Karma Wangdi. There are no known localities for this butterfly in India other than the mention of it being taken by native collectors at high elevation in Native Sikkim by Marshall & de Niceville (1886). For this reason, this species has not been included by Varshney & Smetacek (2015) (Peter Smetacek, *pers. comm.*). It is not known why it is included in Schedule 1 of the Wildlife (Protection) Act, 1972, which is the

highest level of protection afforded to a wild creature under Indian law, since it is a very widespread and common butterfly over most of its range. The occurrence of *N. antiopa* across central and western Bhutan, indicates that it is not unlikely that it may also still be found in Sikkim.

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Fig: *Nymphalis antiopa* (underside)

THREE NEW LYCAENID BUTTERFLY RANGE EXTENSIONS FROM CHHATTISGARH, INDIA

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Introduction

Jashpur district is situated in north-eastern Chhattisgarh, bordering Jharkhand and Odisha to the east. The area occupies the southernmost part of the Chota Nagpur plateau and the landscape is dotted with small hillocks. The region supports mixed tropical deciduous forest with Sal (*Shorea robusta*) as dominant vegetation. It is watered by the Eeb river, which is a tributary of the Mahanadi. Previously, the butterflies of the state were surveyed by Chandra *et al.* (2014), who also compiled earlier data from Jashpur and other districts, reporting a total of 137 species from Chhattisgarh.

Opportunistic surveys for butterflies were undertaken between 9th April, 2019 to 21st May, 2019 by the authors in Badalkhol Wildlife Sanctuary, Ranidah, Kailash gufa, Gullu, Deshdekha, Damera, Sogda Ashram and Jashpur Nagar town. The paths followed on foot were randomly chosen and the main criterion for choosing suitable paths was the likelihood of encountering butterflies along the way. The survey resulted in the documentation of 80 species of butterflies.

In the present paper, three species discovered during the present survey, namely *Horaga onyx* (Moore, 1858), *Rapala varuna* (Horsfield, [1829]) and *Chilades parrhasius* (Fabricius, 1793) are reported from this area,

extending their known distribution to Chhattisgarh, India.

The specimens were identified with the help of the photographs using Smetacek ([2016]) and Bhakare & Ogale (2018).

Common *Onyx Horaga onyx*

Specimens observed: 2 exs.: 11.iv.2019 and 18.iv.2019 Collector's Bungalow, Jashpur Nagar (22° 52' 42.936" N 84° 8' 18.732" E).

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

Remarks: This is usually a forest butterfly (Smetacek ([2016]); Bhakare & Ogale (2018)), so its appearance in the Collector's Bungalow is remarkable, since the closest forest is about 2 km away (22° 53' 15" N 84° 07' 16" E). The second specimen observed was not photographed. It was attracted to a neon tubelight on the verandah of the Collector's Bungalow on 18th April, 2019 at 8:20 pm. There are two subspecies of this butterfly on the mainland of India, *H. o. onyx* from Himachal Pradesh to N.E. India and *H. o. cingalensis* from Maharashtra to Kerala (Varshney & Smetacek, 2015). The difference can best be observed on the upperside. Since the upperside of the present individuals was

not observed, the sub-specific status remains to be assigned to the Chhattisgarh population in due course.

Indigo Flash *Rapala varuna*

Specimens documented: 4 exs.: 18.iv.2019; 17.iv.2019 at Collector's Bungalow, Jashpur Nagar (22° 52' 42.936" N 84° 8' 18.732" E), 18.v.2019 at Kailash Gufa stream (23° 04' 12" N 83° 33' 40" E) and 20.v.2019 Vedic Vatika, Jashpur Nagar (22° 52' 23" N 84° 09' 18" E). Known Distribution: Himachal Pradesh to Uttarakhand; Maharashtra to Kerala, West Bengal; Andaman & Nicobar Island (Andamans), Sikkim to North East India (Varshney & Smetacek, 2015).

Remarks: This is a common butterfly, its presence overlooked is unusual. There are three sub-species of this butterfly from the mainland of India, *R. v. grisea* from Himachal Pradesh to Uttarakhand; *R. v. lazulina* from Maharashtra to Kerala and West Bengal; and *R. v. gebenia* from Sikkim to North East India. The difference between these requires physical comparison between specimens of the different subspecies. Since no specimens of this species were taken in the present study, subspecific status cannot be assigned to the Chhattisgarh population.

Small Cupid *Chilades parrhasius*

Specimens documented: 20.v.2019 at Alori village's streamside, Kubdibathan, Manora block, en route to Gullu (22°56'25.3"N 83°58'25.2"E).

Known Distribution: Rajasthan to Kerala, eastwards to Uttar Pradesh; Himachal Pradesh and Uttarakhand (Varshney & Smetacek, 2015).

Remarks: The current record represents an eastward extension to the global distribution of this species. In the current scenario of global warming, eastward extensions of South Asian fauna are very unusual, since most recent range extensions follow a trend of east

to west extension of range (Panthee *et al.*, 2018; Smetacek 2016; 2011; 2005; 2004; 2002; 1994).

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Fig. 1: *Chilades parrhasius*



Fig. 2: *Horaga onyx*



Fig. 3: *Rapala varuna*

**FIRST REPORT OF THE MOTH *XYLOPHYLLA*
PUNCTIFASCIA (LEECH, 1900) (INSECTA: LEPIDOPTERA:
EREBIDAE) FROM INDIA**

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Introduction

The moth *Xylophylla punctifascia* (Leech, 1900) was described from the Omei Shan in Szechuan province of S.W. China. Originally described in the genus *Phyllodes* Boisduval, 1832, Hampson erected the genus *Xylophylla* for it. Later, the species *X. staudingeri* (Semper, 1901); *X. eyndhovii* (Vollenhoven, 1858); *X. roseigera* (Butler, 1883); *X. verhuelii* (Vollenhoven, 1858); *X. conspicillator* (Cramer, 1777) were also transferred to it. Of these species, all except one, i.e. *X. staudingeri*, is now known from India.

Material Examined

A single individual of *X. punctifascia* was photographed at MV light on 23.v.2012 at Dzuleke (1200 m), Nagaland. Two years later, another specimen was observed on 29.vii.2014 at Benrue (1300 m), Peren district, Nagaland.

Discussion

Although the specimens were not collected, the species is so distinct that it is possible to place it to species level on the basis of the photographs reproduced below. The moth is also known from Chiang Mai province of Thailand (Kononenko, 2013).

The individuals observed were attracted to the light late in the evening. They did not rest on the white sheet, but on the ground among low growing plants. Leech (1900) in the original description, mentions that this species represents a dead leaf in shape and markings of the forewing.

There appears to be a single annual generation from May to July, since normally large moths like this cannot complete a life cycle within two months. It has not been recorded in other months of the year at the same locations. The type series from China was also recorded in July. All known members of the genus are attracted to light.

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Fig: *Xylophylla punctifascia*

MITES ON SOME MEDICINAL PLANTS OCCURRING IN PURULIA AND BANKURA DISTRICTS OF SOUTH BENGAL WITH TWO NEW REPORTS FROM INDIA ALONG WITH KEYS TO DIFFERENT TAXONOMIC CATEGORIES

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Introduction

The two districts, viz. Purulia and Bankura, come under South Bengal and both are considered as drought prone areas. Purulia is located between 22.60° and 23.50° North latitude, 85.75° and 76.65° East longitude. Bankura district is located in 22.38° and 23.38° North latitude and between 86.36° and 87.46° East longitude. The collection spots in Purulia district were Bundwan, Baghmundi, Jalda-I, Santuri and those in Bankura district were Chhatna, Bishnupur, Simlapal. The total land areas of these two districts are 6259 and 6882 sq. km., respectively. The climatic conditions of the two districts are tropical to sub-tropical. Although both the districts are very dry areas but they are good habitats for many medicinal plants. So far as mites on medicinal plants are concerned, though some works like Gupta *et al.* (2003), Ghosal *et al.* (2003), Lahiri *et al.* (2004), Gupta S.K (2005), Gupta *et al.* (2005), Roy *et al.* (2006), Roy & Saha (2010), Gupta *et al.* (2015), Mondal & Gupta (2016), Gupta *et al.* (2017), have been published, none of those studies intensively covered these two districts. In view of that, the present study was taken up during July 2018 to April 2019 and this paper documents the mite species collected from medicinal plants of those areas, and provides information regarding their collection data, diagnosis, distribution and importance, if any.

A total of 30 species of mites belonging to 19 genera, 9 families, and 4 orders have been

reported, of those, 11 being phytophagous, 17 being predatory and 2 being fungal feeders. It has also included 2 species, viz. *Amblyseius sakalava* Blommers and *Orthotydeus caudatus* (Duges), the records of which were earlier unknown from India. These apart, *Raoeilla pandanae* Mohanasundaram has also been reported for the first time from West Bengal. All the measurements given in the text are in microns. A key to all taxonomic categories has also been provided.

Materials and Methods

The mites including both phytophagous and predatory groups were collected during July, 2018 to April, 2019 from medicinal plants encountered in Purulia and Bankura districts of South Bengal. The collection was done by directly examining the leaves in the field itself with a 20x pocket lens and the collected specimens were preserved in 70% ethyl alcohol. Initially, mounting was done in lactic acid and were gently heated over an electric bulb (40 watts) and subsequently permanently mounted in Hoyer's medium. For identification, the updated literature was consulted.

Results

The systematic account deals with a total of 30 species under 19 genera, 9 families and 4 orders collected from 27 species of medicinal plant. Out of these, 11 species under 9 genera, 3 families were phytophagous, 17 species under 8 genera, 4 families and 2 orders were

predatory and the remaining 2 species under 2 families were fungal feeders. Regarding relative abundance, 8 species of phytophagous mites, viz. *Porcupinychus abutiloni* on *Piper nigrum*, *Oligonychus biharensis* on *Aegle marmelos*, *Tetranychus macfarlanei* on *Rauvolfia serpentina*, *Polyphagotarsonemus latus* on *Mentha arvensis* and *Raoiella pandanae* on *Phoenix dactylifera* were most abundant and important as pests. Among predatory mites, *Amblyseius adhatodae*, *Amblyseius largoensis*, *Agistemus fleschneri* and *Pronematus elongatus* were abundant as predators. Keys to different taxonomic categories have also been given.

Systematic Account

Subclass-Acari

⊙ **Key to Superorders/ Orders/ Suborders of subclass Acari:**

1. With 1-4 pairs of dorsolateral or ventrolateral stigmata posterior to coxae II, legs II-IV with peripodomeric fissure associated with slit organ, tarsus of legs I with dense dorsal cluster of solenidiform setae subdistally...Superorder-Parasitiformes*

* Normally tritosternum present having a distinctive base and 1 or 2 laciniae, palp tarsus with forked seta, stigmata present laterally between 3rd and 4th coxae... Order-Mesostigmata

- Without visible stigmata posterior to coxae II, coxae of legs integrated with venter of podosoma and often forming coxisterna, coxae of leg II-IV without peripodomeric fissure and slit organ, tarsus of leg II with sparse pairing of dorsal setae.....2
2. Chelicerae rarely chelate, fixed digit often regressed, movable digit hook, knife, needle or stylet-like structure, palpi simple or modified to thumb claw process.....2
Order- Trombidiformes*

* Tracheal system with 1 pair of stigmata between bases of chelicerae or on anterior prodorsum...Suborder-Prostigmata

- Chelicera typically chelate, dentate, stylet-like palp never with thumb claw process, empodium claw-like or sucker-like...Suborder Sarcoptiformes,3

3. Prodorsum without specialized sensory organ, genital aperture exposed or partially covered by paragenital flaps, inversely V, U or Y shaped with 2 pairs of genital papillae...Suborder-Oribatida, Cohort- Astigmata

- Prodorsum usually with a pair of specialized setae arising from sensory pits (bothridia or pseudo-stigmatic organ), genital aperture covered, leg claw with a median claw-like empodium (tridactyle)

or only empodial claw present (monodactyle).....Suborder-Oribatida (excluding Astigmata)

A. Phytobogous Group

Order: Trombidiformes

Sub order: Prostigmata

⊙ **Key to the families of Prostigmata:**

1. Gnathosoma usually circular, palpi minute, lying closely appressed laterally, chelicerae tiny, stylet-like....Family -Tarsonemidae
- Gnathosoma variously shaped, generally conspicuous, chelicerae distinct, palpi well developed.....2
2. With a distinct palpal thumb claw process.....4
- Without a distinct palpal thumb claw process.....3
3. Chelicera with opposed stylet or scissors-like,...FamilyTydeidae/Iolinidae
- Chelicera whip-like and long, genital aperture transverse..... Family-Tenuipalpidae

4. Chelicera not long and whip-like, rather short and stylet-like,
Genital aperture longitudinal....Family-Stigmaeidae
- Chelicera long, re-curved, whip-like arising from stylophore, genital aperture transverse....Family-Tetranychidae

Family1: Tetranychidae

⊙ **Key to the genera of Tetranychidae:**

1. Empodium with tenent hairs, female with 3 pairs of anal setae and male with 5 pairs of genito anal setae....
Subfamily-Bryobiinae
Humeral setae (C₁) contiguous with first pair of dorsolateral setae.....Tribe-Hystrichonychini (genera-*Hystrichonychus*, *Porcupinychus*)
- Empodium without tenent pairs, or empodium may be absent, female with 1 or 2 pairs of anal setae, males with 3-4 pairs of genito anal setae.....Subfamily-Tetranychinae.
2. With 2 pairs of para anal setae, genus-*Schizotetranychus*
- With 1 pair of para anal setae..... 3
3. Empodium of Tarsus I without claws.....genus-*Eutetranychus*
- Empodium of Tarsus I ends in claws..... 4
4. Tarsus I with duplex setae distal and approximate, empodial claw with proximo ventral hairs.....genus-*Oligonychus*
- Tarsus I with duplex setae well apart, empodial claw splits into 3 pairs of hairs....genus-*Tetranychus*

Subfamily: Bryobiinae

1. *Hystorichonychus* sp. nr *gracilipes* (Banks)

Tetranychus gracilipes Banks, 1900, *USDA, Tech.Ser.*8:72.

Hystoriconychus gracilipes, Pritchard & Baker, 1955, *Pacific Coast. Ent. Soc. Mem. Ser.*2:39.

Diagnosis: The dorsal setal characters do not tally with those of *gracilipes* and also difference exists in the chaetotaxy of tibia and tarsus of both leg I and leg II. Further study is being done to ascertain its identity.

Collection Data: 1 ♀, West Bengal, Bankura Dist., Shimlapal forest, ex. *Piper nigrum*, 30.ix.2018.

Distribution: India (West Bengal).

Remarks: Only once encountered, economic importance unknown.

2. *Porcupinychus abutiloni* Anwarullah

Porcupinychus abutiloni Anwarullah, 1996, *Can.Ent.* 98: 71-75.

Porcupinychus abutiloni, Gupta, 1994, *Mem., Zool. Surv. India* 18(1):16-18.

Diagnosis:

Female: Body including rostrum 400 long, 200 wide, oval, terminal sensillum of palp longer than broad. Idiosomal setae thick serrate on tubercles. Tarsus I with 1 sensory and 2 tactile setae proximal to duplex setae. Tarsus II with 1 sensory and 2 tactile setae.

Collection Data: 5 ♀, West Bengal, Purulia Dist., Bundwan, ex. *Marsilea quadrifolia*, 8.x.2018.

Distribution: India (West Bengal, Punjab, Gujarat), Pakistan.

Remarks: Moderate infestation occurred on both surfaces of mentioned host causing severe chlorosis.

Sub-family: Tetranychinae

3. *Eutetranychus maximae* Nassar & Ghai
Eutetranychus maximae Nassar & Ghai, 1981, *Oriental Ins.*15: 333-396.

Eutetranychus maximae, Gupta, 1994, *Mem., Zool. Surv. India*, 18(1): 33-34.

Diagnosis:

Female: Body including rostrum 450 long, 330 wide, propodosomal setae 3 pairs. Hysterosomal setae 10 pairs, set on strong tubercles, propodosoma with longitudinal

striae, hysterosomal striation between 2nd and 3rd dorsocentral setae in V pattern.

Collection Data: 2♀, West Bengal, Bankura Dist., Chhatna, ex. *Murraya koenigii*, 18.x.2018.

Distribution: India (West Bengal, Delhi).

Remarks: Occurred on upper surface of mentioned host causing no damage worth mentioning.

4. Schizotetranychus baltazari Rimando

Schizotetranychus baltazari Rimando, 1962, *Tech. Bull. Coll. Agric. Univ.*, 11:52.

Schizotetranychus baltazari, Gupta, 1994, *Mem., Zool. Surv. India* 18(1):89-90.

Diagnosis:

Female: Body including rostrum 310 long, 220 wide, Tarsus I with 9 tactile setae proximal to duplex setae. Tibia I with 1 tactile and 7 sensory setae.

Collection Data: 3♀, West Bengal, Bankura Dist., Chhatna, ex. *Murraya koenigii*, 18.x.2018.

Distribution: India (West Bengal, Assam, Karnataka), Myanmar, Thailand, Taiwan, Hong Kong, Philippines.

Remarks: Moderate infestation was seen on the mentioned host on upper leaf surface, producing stippling on leaves.

5. Oligonychus biharensis (Hirst)

Paratetranychus biharensis Hirst, 1924, *Ann. Mag. nat. Hist, London*, 9(14): 522-527.

Oligonychus biharensis, Pritchard & Baker, 1955, *Pacific Coast Ent. Soc. Mem. Ser. 2*: 364-365.

Oligonychus biharensis, Gupta, 1994, *Mem., Zool. Surv. India*, 18(1): 100-103.

Diagnosis: Body including rostrum 400 long, 300 wide. Palp with terminal serisillum 3 times longer than wide, tibia I with 1 sensory and 9 tactile setae, tarsus I with 1 sensory and 4 tactile setae proximal to duplex setae. Preanal setae shorter than inner and outer sacra.

Collection Data: 3♀, West Bengal, Purulia Dist., Santuri, ex. *Aegle marmelos*, 10.ix.2018.

Distribution: India (West Bengal, Andaman & Nicobar Is., Bihar, Gujarat, Karnataka, Kerala, Tamil Nadu), Antigua, Brazil, Hawaii, Mauritius, Philippines, Thailand, Taiwan.

Remarks: Often encountered on the host on upper surface, causing first yellowing and then browning of leaves, followed by defoliation.

6. Tetranychus macfarlanei Baker & Pritchard

Tetranychus macfarlanei Baker & Pritchard, 1960, *Hilgardia* 29: 455-574.

Tetranychus macfarlanei, Gupta, 1994, *Mem., Zool. Surv. India* 18 (1): 129-131.

Diagnosis:

Female: Body including rostrum 350 long, 330 wide. Terminal sensillum of palp shorter than broad. Tarsus I with 2 sensory and 3 tactile setae proximal to duplex setae. Tarsus II with 1 sensory and 4 tactile setae. Outer and inner sacral setae of same length.

Collection Data: Several males and females, West Bengal, Purulia Dist., Santuri, ex. *Rauvolfia serpentina*, 10.ix.2018.

Remarks: Infestation during July-October was nil, appeared in second fortnight of March and became abundant in April.

Family2: Tenuipalpidae

⊙ **Key to the genera of Tenuipalpidae:**

1. Dorsosublateral hysterosomal setae absent or not more than 1 pair, genital and ventral plates separate, well defined, the latter being rectangular palp 4-5 segmented...genus-*Brevipalpus*
- Dorsosublateral hysterosomal setae 2-4 pairs, palp two segmented...genus-*Raoiella*

Genus: Brevipalpus

⊙ **Key to the species of Brevipalpus:**

1. Tarsus II with single solenidion.....2
- Tarsus II with 2 solenida.....*phoenicis*
2. Propodosoma with irregular reticulation dorsolaterally, median area smooth..... *obovatus*

- Propodosoma not like above, trochanter IV without seta..... *euphorbiae*

7. *Brevipalpus euphorbiae*

Mohanasundaram

Brevipalpus euphorbiae Mohanasundaram, 1982, *Entomon* 7(4): 427-429.

Brevipalpus euphorbiae, Gupta & Mandal, 2015, *Mem., Zool. Surv. India*, 22 (2): 19.

Diagnosis: Body 290 long, 175 wide, rostrum extends beyond middle of femur I, palp 4-segmented, 5 pairs of dorsocentral hysterosomal setae being serrate, 1 pair of medioventral propodosomal setae.

Collection Data: 4♀, West Bengal, Purulia Dist., Jalda-I, ex. *Solanum xanthocarpum*, 28.xi.2018.

Distribution: India (West Bengal, Punjab, Tamil Nadu).

Remarks: Importance unknown.

8. *Brevipalpus obovatus* Donnadieu

Brevipalpus obovatus Donnadieu, 1875, *Ann. Soc. Linn. Loyn (n. ser.)*, 22(1876): 29-136.

Brevipalpus obovatus, Gupta & Mandal, 2015, *Mem., Zool. Surv. India*, 22 (2): 23-24.

Diagnosis: Tarsus II with single sensory rod, no propodosomal reticulation, 6 pairs of dorsolateral hysterosomal setae.

Collection Data: 2♀, West Bengal, Purulia Dist., Jalda-I, ex. *Clerodendrum inerme*, 28.xi.2018.

Distribution: India (Delhi, Punjab, Tamil Nadu, Haryana and West Bengal). This is one of the widely distributed species throughout the world.

Remarks: This mite caused the appearance of brownish spots which later coalesce to form brownish patches.

9. *Brevipalpus phoenicis* (Geijskes)

Brevipalpus phoenicis Geijskes, 1939, *Arten. Meded. Landb.-Hoogeschool Wageningen*, 42(4): 1-68.

Brevipalpus phoenicis, Gupta & Mandal, 2015, *Mem., Zool. Surv. India*, 22(2): 24-25.

Diagnosis: Mediolateral area of propodosomal region with polygonal cells. Hysterosoma reticulated throughout its length.

Collection Data: 10♀, West Bengal, Bankura Dist., Bishnupur, ex. *Moringa oleifera*, 7.xii.2018.

Distribution: India (West Bengal, Arunachal Pradesh, Assam, Bihar, Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Maharashtra, Meghalaya, Odisha, Punjab, Sikkim, Tamil Nadu, Tripura). This species is known from different parts of the world and from India this has been recorded from extensive areas. (Gupta & Mandal, 2015).

Remarks: This mite causes light brownish patches on leaves.

10. *Raoiella pandanae* Mohanasundaram

Raoiella pandanae Mohanasundaram, 1989, *Indian J. Acar.* 10(1&2): 31-33.

Raoiella pandanae, Gupta & Mandal, 2015, *Mem., Zool. Surv. India* 22(2):42-43.

Diagnosis: Body round, propodosoma with 3 pairs of setae, Hysterosoma with 3 pairs of dorso centrals and 5 pairs of dorso lateral, 4 pairs of dorsosublateral setae, genital plate with 2 pairs of setae.

Collection Data: 8♀, West Bengal, Bankura Dist., Bishnupur, ex. *Phoenix dactylifera*, 7.xii.2018.

Distribution: India (West Bengal, Tamil Nadu).

Remarks: This is the first report from West Bengal. It occurred on under surface of leaves producing reddish patches.

Family 3. Tarsonemidae

11. *Polyphagotarsonemus latus* (Banks)

Tarsonemus latus Banks, 1904, *Proc. U. S. Nat. Mus.*, 32(1553): 615.

Hemitarsonemus latus, Dutta, 1958, *Indian Farm.*, 8: 10-12.

Polyphagotarsonemus latus, Gupta, 2012, p.187.

Diagnosis: Body oval, tiny, glossy or whitish. Hysterosoma of female with 1 pair of ventral

setae situated between coxae IV. Terminal claw of leg IV of male reduced to small tubercle.

Collection data: 5♀, West Bengal, Purulia Dist., Baghmundi, ex- *Mentha arvensis* on 5.ix.2018.

Distribution: India (Cosmopolitan).

Remarks: This mite in all stages was found abundantly on lower surface of apical leaves of *Mentha arvensis* causing crinkling of leaves. *Scapulaseius polyanthaeae*, as its predator, was found associated with this tarsonemid mite.

B. Predatory Group

Family 4: Iolinidae

12. *Pronematus elongatus* Baker

Pronematus elongatus Baker, 1968, *Ann. Ent. Soc. Amer.* 61: 1093-1094.

Pronematus elongatus, Gupta, 2003, *Mem. Zool. Surv. India* 20 (1): 124-125.

Diagnosis: Propodosoma with longitudinal striation. Histerosomal plate with transverse striation between D₁-D₂. Tarsus I longer than tibia I, Distal setae of tarsus I slightly longer than segment, solenidion on tarsus I short and rounded.

Collection Data: 1♀, West Bengal, Bankura Dist., Bishnupur, ex. *Punica granatum*, 25.ix.2018.

Distribution: U.S.A, India (Jammu & Kashmir, West Bengal).

Remarks: It was found associated with mealybug.

Family 5: Stigmaeidae

Genus: *Agistemus*

© Key to the species of *Agistemus*:

1. Propodosomal plate reticulate.....*fleschneri*
- Propodosomal plate not reticulate..... 2
2. Ratio of setae ae/ae-ae 1.5 or more..... *industani*
- Ratio of setae ae/ae-ae less than 1.5..... *edulis*

13. *Agistemus* sp. nr *edulis* Gupta

Diagnosis: Propodosomal plate non-reticulate with 3 pairs of setae and hysterosomal plate with 5 pairs of setae. Measurements of setae ae-40, be-80, ce-60, a-60, b-60, c-65, la-63, ae/ae-ae=1.42, a-b=70

Collection Data: 3♀, West Bengal, Bankura Dist., Shimlapal forest, ex. *Melia azadirachta*, 20.ix.2018.

Distribution: India (West Bengal, Arunachal Pradesh).

Remarks: This species, although close to *Agistemus edulis* but the measurements of dorsal idiosomal setae do not tally with those of *Agistemus edulis*.

14. *Agistemus fleschneri* Summers

Agistemus fleschneri Summers 1960, *Proc. Ent. Soc. Wash.*, 62: 237-240.

Agistemus fleschneri, Gonzalez-Rodriguez 1965, *Univ. Calif. Pub. Ent.*, 41: 30-31.

Agistemus fleschneri, Gupta, 2003, *Mem., Zool. Surv. India* 20 (1): 101-102.

Diagnosis: Propodosoma with polygonal cells, 3 pairs of setae on propodosoma measuring ae-40, be-69, ce-65, a-50, la-50, b-45, lm-50, c-52, li-55, e-30, le-10.

Collection Data: 2♀, West Bengal, Bankura Dist., Chhatna, ex. *Carculigo orchioides*, 3.ix.2018.

Distribution: India (Arunachal Pradesh, Assam, Manipur, Meghalaya, Sikkim, Tripura, Delhi, West Bengal, Haryana, Punjab, Andaman & Nicobar Is.), U.S.A, Chile, Mexico.

Remarks: Although this is known to be a good predator of spider mites but such behavior was not observed in the present study.

15. *Agistemus industani* Gonzalez - Rodriguez

Agistemus industani Gonzalez-Rodriguez, 1965, *Univ. Calif. Pub. Ent.*, 41: 40.

Agistemus industani, Gupta, 2003, *Mem., Zool. Surv. India* 20(1): 104-105.

Diagnosis: Propodosomal shield smooth. Measurements of setae ae-56, be-80, ce-65, a-55, b-70, lm-70.

Collection Data: 2♀, West Bengal, Purulia Dist., Bundwan, ex. *Emblica officinalis*, 15.ix.2018.

Distribution: India (West Bengal, Arunachal Pradesh, Mizoram, Nagaland, Uttar Pradesh, Punjab, Tamil Nadu, Karnataka).

Remarks: Importance of this species is unknown.

Family 6: Tydeidae

16. *Orthotydeus caudatus* (Duges).

Orthotydeus caudatus, Zhang et al. 2001, MAF Science Policy, Project FMA 171, July 2001: 25.

Diagnosis: Idiosoma 300 long, propodosoma with 4 pairs of setae including sensory setae. Idiosoma with 11 pairs of setae, of which 4 pairs on dorsocentral series, 3 pairs of posterior opisthosomal setae (h₁, h₂ and ps₁) and remaining on dorsocentral series. Femur II with 2 setae, Femur III with 1 seta.

Collection Data: 1♀, West Bengal, Purulia Dist., Jalda-I, ex. *Clerodendrum inerme*, 22.viii.2018.

Distribution: Ireland, Canada (Manitona), Egypt, Ukraine, Sweden, New Zealand, India (West Bengal).

Remarks: This species was so far not known from India.

Order: Mesostigmata

Family 7: Phytoseiidae

☉ **Key to the tribes and genera of sub family Amblyseiinae:**

1. Sternal shield with posterior projection, some forward migration of preanal setae JV2 and ZV2, preanal setae in male arranged in tangential row rather than in triangular pattern.....Tribe-Euseiini, genus-*Euseius*,
-Sternal shield without posterior projection, no forward

migration of JV2 and ZV2, preanal setae in male arranged in triangular pattern not in tangential row.....2

- 1. Setae S₄ absent...tribe-Kampimodromini, genus-*Paraphytoseius*
- Setae S₄ present.....3.

- 2. Ratio of setae s₄: Z₁<3.0:1.0Tribe-Typhlodromipsini
- Ratio s₄: Z₁> 3.1:1.0...Tribe-Amblyseiini, genus-*Amblyseius*
- 3. Dorsal shield with waist at level of R₁ seta.....Genus-*Typhlodromips*
- Dorsal shield without prominent waist at the level of R₁ seta..... Genus-*Scapulaseius*

Genus: *Amblyseius* (after Denmark & Muma, 1989)

☉ **Key to the species of *Amblyseius*:**

- 1. Cervix long slender, tubular or fundibular.... *largoensis* group, 2
- Cervix sacular or sacular with various modifications...punctatus group.....*kulini*.
- 2. Spermathica with tubular cervix..... 3
- Spermathica with fundibular cervix
- 3. Z₅ 275 micron long..... *sakalava*.
- Z₅ about 200 micron long..... *largoensis*.
- Z₅ about 250 micron long..... *herbicolus*.
- Z₅ about 100 micron long..... *adhatodae*.
- S₄ less than 100 micron long..... *herbicoloides*.

17. *Amblyseius kulini* Gupta

Amblyseius kulini Gupta, 1978, *Indian J. Acar.* 2 (2): 62-65.

Amblyseius kulini, Gupta, 2003, *Mem.Zool.Surv. India* 20(1): 22.

Diagnosis:

Female: Dorsal shield 300 long, 230 wide. j₁, j₃, s₄, Z₄, Z₅ measure 28, 44, 82, 85 and 200 respectively Macrosetae on leg IV, genu-70, tibia-60, basitarsus-60.

Collection Data: 2♀, West Bengal: Purulia Dist., Bundwan, ex *Paederia foetida*, 6.vii.2018.

Distribution: India, West Bengal (Purulia, Bankura), Assam, Meghalaya.

Remarks: The host forms a new habitat record for the species.

18. *Amblyseius largoensis* (Muma)

Amblyseiopsis largoensis Muma, *Ann. Ent. Soc. Amer.*, 48:266.

Amblyseius largoensis, Wei-nan, 1984, *Acarology* VI, 1: 222.

Amblyseius largoensis, Gupta, 2003, *Mem., Zool. Surv. India* 20 (1): 22-23.

Diagnosis: Dorsal shield 375 long, 270 wide, setae j_1, j_3, s_4, Z_5, Z_4 measure 36, 50, 105, 270, 100 respectively. Macrosetae on leg IV: genu-100, tibia-65, basitarsus-50.

Collection Data: 2♀, West Bengal: Purulia Dist., Bundwan, ex. *Paederia foetida*, 6.vii.2018; 2♀, Bagmundi, ex. *Gloriosa superba*, 7.vii.2018, 4♀, 1♂, Bankura Dist, Simlapal forest, ex. *Clerodendrum inerme*, 30.vii.2018, 1♀, Bankura, Simlapal forest, ex. *Datura metel*, 30.vii.2018, 3♀, 1♂, Bankura, Bishnupur, ex. *Thespesia lampus*, 4.viii.2018.

Distribution: Australia, Southeastern U.S., Mexico, Guatemala, Jamaica, Bahamas, Puerto Rico, South Africa, Thailand, India (West Bengal, Manipur, Tripura, Nagaland, Arunachal Pradesh, Punjab, Odisha, Sikkim, Andhra Pradesh Assam, Himachal Pradesh, Tamil Nadu, Puduchery, Kerala, Uttar Pradesh, Jammu & Kashmir, Gujarat, Andaman & Nicobar Is., Lakshadwip Is., Mizoram, Bihar, Meghalaya, Karnataka)

Remarks: Abundantly available on most of the mentioned plants. It was found feeding on juvenile stages of *Brevipalpus obovatus* on *Clerodendrum inerme*.

19. *Amblyseius sakalava* Blommers

Amblyseius sakalava Blommers, 1976: *By dragen Tot de Dierkunde* 46(1): 96.

Amblyseius sakalava, Denmark & Muma, 1989, *Occ. Pap. Fla. St. Coll. Of Argl.* 4: 56-57.

Diagnosis: Dorsal shield 375 long, 250 wide j_1, j_3, s_4, Z_4, Z_5 measure 40, 57, 104, 282 and 110 respectively, Macrosetae on leg IV: genu-127, tibia-96, basitarsus-68.

Collection data: 2♀, West Bengal, Purulia Dist., Bundwan, ex. *Carica papaya*, 6.vii.2018.

Distribution: Madagascar (Malagasy Republic). New report from India.

Remarks: New record from India.

20. *Amblyseius adhatodae* Muma

Amblyseius adhatodae Muma, 1967, *Fla. Ent.*, 50: 268-270.

Amblyseius adhatodae, Gupta, 2003, *Mem, Zool. Surv. India* 20(1): 15.

Diagnosis: Dorsal shield 380 long, 270 wide j_1, j_3, s_4, Z_5, Z_4 measure 45, 58, 130, 300 and 150, respectively. Macrosetae on leg IV: genu-100, tibia-70, basitarsus-90.

Collection data: 1♀ 1♂, West Bengal, Bankura Dist., Simlapal forest, ex. *Marsilea quadrifolia*, 30.vii.2018

Distribution: India (Maharashtra, West Bengal), Pakistan.

Remarks: Importance unknown.

21. *Amblyseius herbcicolus* (Chant)

Typhlodromus (Amblyseius) herbcicolus Chant, 1959, *Can Ent.*, 91: 84-85.

Amblyseius herbcicolus, Lo, 1986, *Pl. Prot. Bull. Taiwan*, 28: 31-39.

Diagnosis: Dorsal shield 360 long, 260 wide, j_1, j_3, s_4, Z_5, Z_4 measures 25, 35, 110, 210, 120 respectively. Macrosetae on leg IV: genu-130, tibia-80, basitarsus-70.

Collection data: 2♀, West Bengal, Purulia Dist. Jalda-I, ex-*Tectona grandis*, 7.viii.2018.

Distribution: Portugal, Pakistan, South America, North America, West Indies, Africa, Australia, Turkey, Egypt, Japan and China, India (West Bengal, Tripura, Mizoram, Sikkim, Tamil Nadu).

Remarks: Found associated with *Oligonychus biharensis*, but feeding was not observed.

22. *Amblyseius herbcicoloides* McMurtry & Moraes

Amblyseius herbcicoloides McMurtry and Moraes, 1984, *Internal. J. Acarol.* 10(1):27-37.

Amblyseius herbicolidoides, Denmark & Muma, 1989, *Occ. Pap. Fla. St. Coll. of Agri.*, 4: 57-58.

Diagnosis: Dorsal shield 340 long, 230 wide, j_1 , j_3 , s_4 , Z_5 , Z_4 measure 35,42,70,300,65 respectively. Macrosetae on leg IV: genu-139, tibia-110, basitarsus-45.

Collection data: 2♀, West Bengal, Purulia Dist., Jalda-I, ex. *Calotropis procera*, 7.viii.2018.

Distribution: Fiji, India (West Bengal, Karnataka).

Remarks: Importance not known.

Genus: *Euseius*

⊙ **Key to the species of *Euseius*:**

1. Setae S_2 - S_5 equal..... *ovalis*.
- S_2 - S_5 unequal, S_4 , S_5 equal and longer than S_2 *sacchari*.

23. *Euseius ovalis* (Evans)

Typhlodromus ovalis Evans, 1953, *Ann. Mag. Nat. Hist.*, 6: 458-461.

Amblyseius (Euseius) ovalis, Gupta, 1986, *Fauna of India: Phytoseiidae*, p. 92-94.

Euseius ovalis Gupta, 2003, *Mem., Zool. Surv. India* 20 (1): 42-43

Diagnosis: Dorsal shield 330 long, 240 wide measurements of setae j_1 30, Z_5 45. Other setae small or very small, macrosetae on leg IV: genu-35, tibia-25, basitarsus-45.

Collection Data: 4♀, West Bengal, Bankura Dist., Chhatna, ex. *Woodfordia fruticosa*, 14.viii.2019.

Distribution: India (Arunachal Pradesh, Assam, Sikkim, Mizoram, Meghalaya, Tripura, West Bengal, Manipur, Bihar, Andhra Pradesh, Karnataka, Tamil Nadu, Puduchery, Kerala, Maharashtra, Gujarat, Punjab, Andaman & Nicobar Isls., Lakshadwip Isls.), Philippines, Taiwan, Hawaii, Mauritius, Mexico, Malayasia, Hong kong, Japan, Indonesia, New Zealand, Australia.

Remarks: Though it is known to be a good predator but such behavior was not observed during present study.

24. *Euseius sacchari* (Ghai & Menon)

Amblyseius sacchari Gai & Menon, 1967, *Oriental Ins.*, 1: 75-76.

Amblyseius (Euseius) sacchari Gupta, 2003, *Mem., Zool. Surv. India* 20 (1): 45-46.

Diagnosis: Dorsal shield 320 long, 240 wide, measurements of setae j_1 30, j_3 10, s_4 15, Z_5 , 43, Z_4 , 11. Macrosetae on leg IV: genu-30, tibia-33, basitarsus-50.

Collection Data: 2♀, West Bengal, Bankura, Dist. Chhatna, ex. *Croton persiflora*, 14.viii.2018, 1♀, Purulia Dist., Santuri, ex. *Asparagus racemosus*, 22.viii.2018.

Distribution: India (Arunachal Pradesh, West Bengal, Bihar, Tamil Nadu, Gujarat, Punjab, Himachal Pradesh, Karnataka).

Remarks: Importance not known.

Genus: *Paraphytoseius*

⊙ **Key to the species of *Paraphytoseius*:**

1. Macrosetae of leg IV spatulate..... *bhadrakaliensis*.
- Macrosetae on leg IV non-spatulate, more or less rod like..... *orientalis*.

25. *Paraphytoseius orientalis* (Narayanan, Kaur & Ghai).

Typhlodromips (Amblyseius) orientalis Narayanan, Kaur & Ghai. 1960, *Proc. Nat. Inst. Sci.* 26B: 394.

Amblyseius (Paraphytoseius) multidentatus, Gupta, 2003, *Mem., Zool. Surv. India*, 20 (1): 59-60.

Diagnosis: Dorsal shield 290 long, 160 wide, measurements of setae j_1 35, j_3 80, s_4 111, Z_5 100, Z_4 80 all being thick and serrate. Macrosetae on leg IV: genu-28, tibia-30, basitarsus-30.

Collection Data: 3♀, 1♂, West Bengal, Bankura Dist., Bishnupur, ex. *Clerodendrum inerme*, 22.viii.2018, 2♀, Bankura Dist., Chhatna, ex. *Terminalia arjuna*, 14.viii.2019.

Distribution: India (West Bengal, Bankura Dist., Bishnupur, ex. *Clerodendrum inerme*, 22.viii.2018, 2♀, Bankura Dist., *Terminalia arjuna*, 14.viii.2019.

Remarks: Moderate occurrence in association with *Brevipalpus* mite on *Terminalia arjuna*.

26. Paraphytoseius bhadrakaliensis (Gupta)

Amblyseius bhadrakaliensis Gupta, 1970, *Bull. Ent. Soc. India*. 10: 127-128.

Amblyseius bhadrakaliensis, Prasad, 1974, *Indira Acar. Pub. House, Ludhiana*: 161.

Paraphytoseius bhadrakaliensis, Chant & McMurtry, 2007, *Indira. Pub. House, Michigan, U.S.A*: 53.

Diagnosis: Dorsal shield 270 long, 138 wide, measurements of setae j_1 22, j_4 - j_6 and J_5 6 to 8 long, j_3 50 long, Z_5 80 long, Z_4 70 long, r_3 23 long, s_4 73 long. The other setae on dorsal shield measure 7-10 long. Macrosetae on leg IV: genu-30, tibia-34, basitarsus-45.

Collection Data: 2♀, 1M, West Bengal, Purulia Dist., Santuri, ex. *Terminalia chebula*, 31.viii.2018.

Distribution: India (Cosmopolitan).

Remarks: This mite was found in association with *Brevipalpus* mite.

27. Scapulaseius polyantheae (Gupta)

Amblyseius polyantheae Gupta, 1975, *Internat. J. Acarol.* 1(2): 42-43.

Amblyseius (Typhlodromips) polyantheae, Gupta, 2003, *Mem., Zool. Surv. India* 20 (1): 79.

Diagnosis: Dorsal shield 310 long, 240 wide. Measurements of setae j_1 20, j_3 15, s_4 30, Z_5 60, Z_4 30, other setae measure between 8-10 long. Macrosetae on leg IV: genu-27, tibia - 33, basitarsus-30.

Collection Data: 2♀, West Bengal, Purulia Dist., Baghmundi, ex. *Mentha arvensis*, 5.ix.2018.

Distribution: India (West Bengal, Tripura, Mizoram)

Remarks: Found associated with *Polyphagotarsonemus latus*, on which it was found feeding on eggs.

28. Typhlodromips syzygii (Gupta)

Amblyseius syzygii Gupta, 1975, *Internat. J. Acarol.*, 1(2): 44-45.

Amblyseius (Typhlodromips) syzygii, Gupta, 2003, *Mem., Zool. Surv. India* 20(1): 82-83.

Diagnosis: Dorsal shield 300 long, 200 wide, Measurements of setae j_1 20, j_3 20, s_4 20, Z_5 70 (serrate), Z_4 35. Macrosetae on leg IV, genu-45, tibia-30, basitarsus-50.

Collection Data: 4♀, West Bengal, Purulia Dist., Baghmundi, ex. *Ocimum tenuiflorum*, 5.ix.2018.

Distribution: India (West Bengal, Odisha, Tripura, Meghalaya, Bihar, Sikkim, Mizoram, Uttar Pradesh), Thailand.

Remarks: Found associated with *Polyphagotarsonemus latus*, feeding on its eggs.

Family 8: Glycyphagidae

29. Glycyphagus domesticus (De Geer)

Acarus domesticus De Geer, 1778, *Mem. Hist. Ins.* 7: 106-109.

Glycyphagus domesticus, Hughes, 1970, *Min. agri. Fish food, Lond. Tech. Bull.*, 9: 140-143.

Glycyphagus domesticus, Kort *et al.*, 1997, *Clinical and Experimental Allergy*, 27(3): 921.

Diagnosis:

Male: Idiosoma round, cuticle dull, covered with minute papillae, crista metopica extends from base of chelicera up to level of ve seta, idiosomal setae pectinate, radiate from body surface, supracoxal seta forked and branched, legs long with tapering segments, terminate in pre tarsus and small claw.

Collection Data: 5♀, West Bengal, Purulia Dist., Baghmundi, ex. *Mangifera indica*, 24.xii.2018.

Distribution: India, Japan, Australia, Canada, Europe.

Remarks: This is commonly a fungal feeding mite and its occurrence here is an accidental matter.

Family 9: Oribatulidae

30. Scheloribates sp.

Collection Data: 5♀, West Bengal, Bankura Dist., Bundwan, ex. *Phoenix dactylifera*, 20.i.2019.

Distribution: India (West Bengal).

Remarks: This is normally associated with soil/litter and hence its occurrence here appears to be accidental.

Discussion

Out of the mites collected, the most abundant and injurious species were *Porcupinychus abutiloni* on *Marsilea quadrifolia*, *Oligonychus biharensis* on *Aegle marmelos*, *Tetranychus macfarlanei* on *Rauvolfia serpentina* and *Raoiella pandanae* on *Phoenix dactylifera*. Among predatory species, *Amblyseius largoensis*, *Amblyseius adhatodae*, *Agistemus fleschneri*, *Pronematus elongatus* were abundant and important predators.

Among the moderately abundant phytophagous species mention may be made of *Schizotetranychus baltazari* on *Murraya koenigii*, *Brevipalpus phoenicis* on *Moringa oleifera*, while among the predatory group the moderately abundant species were *Amblyseius kulini* on *Paederia foetida*, *Amblyseius herbicolus* on *Tectona grandis*, *Euseius ovalis* on *Woodfordia fruticosa* and *Paraphytoseius orientalis* both on *Clerodendrum inerme* and *Terminalia arjuna*.

Among the least abundant species were *Hystorichonychus* sp. nr *gracilipes* on *Piper nigrum*, *Eutetranychus maximae* on *Murraya koenigii*, *Brevipalpus euphorbiae* on *Solanum xanthocarpum* and *Brevipalpus obovatus* on *Clerodendrum inerme* under phytophagous group and *Amblyseius sakalava* on *Carica papaya*, *Euseius sacchari* on *Asparagus racemosus*, *Agistemus* sp. nr *edulis* on *Melia azadirach*, *Agistemus industani* on *Embllica officinalis* and *Orthotydeus caudatus* on *Clerodendrum inerme* under predatory group. Both the fungal feeding species were least abundant.

Among the 27 species of medicinal plants examined in present study, *Clerodendrum inerme*, which had the maximum number(4) of mite species followed by *Phoenix dactylifera*, *Paederia foetida*, *Marsilea quadrifolia*, *Murraya koenigii* and *Mentha*

arvensis each inhibited 2 mite species each while the remaining 21 species harboured 1 species each. Among the predatory mites, Phytoseiidae was most dominant occurred on plant 12 species and that was followed by Stigmaeidae representing 3 species. The families Iolinidae and Tydeidae harboured 1 species each.

Conclusion

The present paper reports the occurrence of a total of 30 species under 9 families, 19 genera and 4 orders from 27 species of medicinal plants collected from Purulia and Bankura districts of West Bengal. This includes 11 species belonging to phytophagous group, 17 species under predatory group and 2 species under fungal feeding group. Out of these, *Porcupinychus abutiloni* on *Marsilea quadrifolia*, *Oligonychus biharensis* on *Aegle marmelos*, *Tetranychus macfarlanei* on *Rauvolfia serpentina* and *Raoiella pandanae* on *Phoenix dactylifera* were most abundant and injurious phytophagous species. Among predatory species, *Amblyseius largoensis*, *Amblyseius adhatodae*, *Agistemus fleschneri*, *Pronematus elongatus* were abundant and important predators. *Clerodendrum inerme* harboured the maximum number of 4 species. *Marsilea quadrifolia*, *Murraya koenigii*, *Phoenix dactylifera*, *Mentha arvensis* and *Paederia foetida* had 2 species each while the remaining species harboured 1 species each. In addition, it also reports 2 species, i.e. *Orthotydeus caudatus* and *Amblyseius sakalava*, the occurrence of which were earlier unknown from India. Further, *Raoiella pandanae* on palm was earlier not reported from West Bengal. The collection data, distribution, importance, if any, and keys to the different taxonomic categories have also been given.

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CONTRIBUTION TO THE KNOWLEDGE OF BUTTERFLIES IN AND AROUND SUKINDA VALLEY, ODISHA, INDIA

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Abstract

This study presents the first comprehensive list of butterfly species found in and around Sukinda valley. A total of six sites in Sukinda valley were surveyed between October, 2016 and January, 2017, where we observed a total 92 species of butterflies under six families, including one new record (*Gerosis bhagava*) for the state Odisha. Ashokjhar waterfall was the richest site in terms of species, with 74 species recorded from there.

Key Words: Butterfly, Checklist, New record, *Gerosis bhagava*, Odisha

Introduction

Odisha is well known for its rich biodiversity (Rodgers & Panwar, 1988) with three Biogeographic Zones (Deccan Peninsula, Lower Gangetic Plain and East Coast). In this state, studies on butterfly fauna started late in the nineteenth century when the first record from Odisha was published by Taylor & de Niceville (1888), comprising a list of butterflies from the Khurda district. In the twentieth century, Crawford (1921) reported some butterflies from Meghasani hills of Mayurbhanj district and at the same time Annandale & Dover (1921) also published a list of butterflies from Barkuda Island. Since then, many works on butterflies have been published (Mandal & Nandi, 1984; Mandal & Maulik, 1991; Sahu *et al.* 2006; Sethy *et al.* 2006; Sethy & Jana, 2009; Nair, 2007, 2011; Das & Sahu, 2011; Mohapatra *et al.* 2012;

Palei & Rath, 2014; Payra *et al.* 2016; Paria *et al.* 2018; Boruah *et al.* 2019, etc.) covering different parts of the state. Mohapatra *et al.* (2012) published a book in which more than 200 species of butterflies were reported from the state. However, no data on butterflies is available from the Sukinda region of Odisha. Hence, we documented the butterfly species found in and around Sukinda valley area of Jajpur district, Odisha.

Materials and Methods

Study area

Sukinda valley with an area of over 200 km² is under Cuttack Forest Division, located in the Jajpur District, Odisha. The valley lies between Mahagiri and Daitari hills with undulating terrain where the elevation varies from 100 to 800 m. This area receives 1700 mm of rainfall on an average and temperature varies from 14° C to 46° C through the year. The forest types are Northern Tropical Dry Deciduous Forest and Dry Peninsular Sal Forests (Champion & Seth, 1968), where plants like *Shorea robusta*, *Terminalia tomentosa*, *Anogeissus latifolia*, *Pterocarpus marsupium*, *Terminalia belerica*, *Adina cordifolia* are dominant.

This study was conducted in the following six sites i.e. S1- Ashokjhar waterfall (21.040854° N 85.897324° E, 160 m a.s.l.), S2- Duarseni Nala (21.035209° N 85.850109° E, 145 m a.s.l.), S3- Ragada Dam (21.063992° N

85.731310° E, 116 m a.s.l.), S4- Patna Nala (21.078207° N 85.759016° E, 175 m a.s.l.), S5- Sasubhuasuni Nala (21.118014° N 85.737238° E, 224 m a.s.l.) and S6- Sukinda forest Range Office (20.961694° N 85.914453° E, 69 m a.s.l.) of Sukinda valley from October, 2016 to January, 2017.

Data collection and Identification

To document butterflies we carried out opportunistic surveys in between 7 am to 12 pm. Species were photographed using a Canon digital camera and identified with the help of field guide books and taxonomic literature (Evans, 1932; Kehimkar, 2008, 2016). In difficult cases, we used standard entomological nets to capture specimens and release them immediately at the spot of capture. Specimens were not collected during the study.

Results and Discussion

During these four months, we recorded a total 92 species of butterflies belong to 65 genera of six families from Sukinda valley area (Table 1). From the above six sites, we observed that the greatest variety of butterflies occurred at the Ashokjhar site, followed by Range Office, Sasubhuasuni Nala, Ragada Dam, Duarseni Nala and Rankia Nala.

The site 1 i.e. Ashokjhar site is well known for its beautiful waterfall called Ashokjhar. It is also a well-known tourist place of Jajpur district located on the eastern side of the Mahagiri hills. Below the perennial waterfall, the stream supports a patch of moist deciduous forest. The Duarseni nala (Site 2) is a seasonal stream located opposite the core mining belt on the southern side of Mahagiri hill. There is dense canopy Sal forest on rocky terrain. The 3 and 4 sites (Ragada dam and Patna nala) located adjacent to the core mining belt of Sukinda is one of the 10 most polluted places on Earth (Blacksmith Institute, 2007). At these sites, fewer species of butterflies i.e. only 21 and 14 respectively, were sighted during the study period. Similarly, the site 5 (Sasubhuasuni nala) is also a perennial stream

located on the western side of the Daitari hills. This site is characterized by rocky terrain along with fairly dense forest where *Shorea robusta* and *Terminalia* species are dominant. The Range Office site (Site 6) is located in the middle of Sukinda town, far from the core mining belt of Sukinda. A total of 50 species of butterflies were observed at this site during the survey period, which is approx 55 percent of the total observed species. Hence, along with the Ashokjhar site, site 6 is also favourable for butterflies in the Sukinda valley region. This site is characterized by shrub patches and a small flower garden inside the Range Office campus, which attracts a number of butterflies. Haidar *et al.* (2017) observed that, in Banagladesh, shrub patches with an abundance of flowering plants are preferable for butterflies.

Significant record

On 11 November, 2016 at about 12:30 pm a single individual of *Gerosis bhagava* (Moore, [1866]) was observed while it was mud-puddling near the Ashokjhar waterfall. This record of *G. bhagava* (Moore, [1866]) Common Yellow-breast Flat (Fig. 1) is very significant for the Sukinda valley, as well as for Odisha. *G. bhagava* is represented by two subspecies, i.e. *G. b. andamanica* (Wood Mason and de Niceville, 1881) and *G. b. bhagava* (Moore, [1866]). *G. b. andamanica* is confined to the Andaman and Nicobar Islands, whereas *G. b. bhagava* ranges from “Goa to Jharkhand and south to Kerala; Sikkim to N.E. India” (Varshney & Smetacek, 2015). From the above mentioned hitherto published information, it is evident that there was no reliable record of *G. bhagava* from Odisha. Hence this species can be considered as a new record for Odisha.

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Table 1: List of the recorded butterflies from Sukinda valley, Odisha, India

Sl. No	Scientific Name	Common Name	IWPA 1972 Status	Sites						
				1	2	3	4	5	6	
Family HesperIIDae										
1.	<i>Borbo cinnara</i> (Wallace, 1866)	Rice Swift						+	+	
2.	<i>Celaenorrhinus leucocera</i> (Kollar, [1844])	Common Spotted Flat		+					+	
3.	<i>Coladenia indrani</i> (Moore, [1866])	Tricolour Pied Flat		+						
4.	<i>Gerosis bhagava</i> (Moore, [1866])	Common Yellow Breast Flat		+						
5.	<i>Matapa aria</i> (Moore, [1866])	Common Redeye		+	+					+
6.	<i>Pelopidas mathias</i> (Fabricius, 1798)	Small Branded Swift		+						+
7.	<i>Suastus gremius</i> (Fabricius, 1798)	Indian Palm Bob		+	+	+	+	+	+	+
8.	<i>Tagiades japetus</i> (Stoll, [1781])	Common Snow Flat		+						
9.	<i>Tagiades gana</i> (Moore, [1866])	Suffused Snow Flat		+						
10.	<i>Tagiades litigiosa</i> Möschler, 1878	Water Snow Flat		+						
11.	<i>Udaspes folus</i> (Cramer, [1775])	Grass Demon		+					+	+

12.	<i>Spialia galba</i> (Fabricius, 1793)	Indian Grizzled Skipper								+
13.	<i>Telicota colon</i> (Fabricius, 1775)	Indian Pale Palm-Dart								+
14.	<i>Baoris farri</i> (Moore, 1878)	Paint-brush Swift	I V	+						
Family Papilionidae										
15.	<i>Pachliopta aristolochiae</i> (Fabricius, 1775)	Common Rose		+	+	+				+
16.	<i>Pachliopta hector</i> (Linnaeus, 1758)	Crimson Rose	I	+		+				+
17.	<i>Graphium agamemnon</i> (Linnaeus, 1758)	Tailed Jay		+						+
18.	<i>Graphium doson</i> (C. and R. Felder, 1864)	Common Jay		+						+
19.	<i>Graphium nomius</i> (Esper, 1799)	Spot Swordtail		+						+
20.	<i>Papilio clytia</i> Linnaeus, 1758	Common Mime	I	+						+
21.	<i>Papilio crino</i> Fabricius, 1793	Common Banded Peacock		+					+	+
22.	<i>Papilio demoleus</i> Linnaeus, 1758	Lime Butterfly		+	+	+	+	+	+	+
23.	<i>Papilio polymnestor</i> Cramer, 1775	Blue Mormon		+	+					+
24.	<i>Papilio polytes</i> Linnaeus, 1758	Common Mormon		+	+	+	+	+	+	+
Family Pieridae										
25.	<i>Appias libythea</i> (Fabricius, 1775)	Striped Albatross	I V	+						+
26.	<i>Catopsilia pomona</i> (Fabricius, 1775)	Common Emigrant		+	+	+	+	+	+	+
27.	<i>Catopsilia pyranthe</i> (Linnaeus, 1758)	Mottled Emigrant		+						+
28.	<i>Delias eucharis</i> (Drury, 1773)	Common Jezabel		+	+					+
29.	<i>Eurema andersonii</i> (Moore, 1886)	One-spot Grass Yellow								+
30.	<i>Eurema blanda</i> (Boisduval, 1836)	Three-spot Grass Yellow		+		+				

31.	<i>Eurema laeta</i> (Boisduval, 1836)	Spotless Grass Yellow				+			+
32.	<i>Eurema hecabe</i> (Linnaeus, 1758)	Common Grass Yellow		+	+	+	+	+	+
33.	<i>Cepora nerissa</i> (Fabricius, 1775)	Common Gull		+					+
34.	<i>Leptosia nina</i> (Fabricius, 1793)	Psyche		+	+	+	+	+	+
35.	<i>Pareronia hippia</i> (Fabricius, 1787)	Common Wanderer		+					
Family Riodinidae									
36.	<i>Abisara bifasciata</i> Moore, 1877	Double-Banded Judy		+					
Family Lycaenidae									
37.	<i>Arhopala amantes</i> (Hewitson, 1862)	Large Oakblue		+			+	+	
38.	<i>Arhopala atrax</i> (Hewitson, 1862)	Indian Oakblue		+					+
39.	<i>Amblypodia anita</i> Hewitson, 1862	Purple Leaf Blue		+					
40.	<i>Caleta decidia</i> (Hewitson, 1876)	Angled Pierrot		+					+
41.	<i>Castalius rosimon</i> (Fabricius, 1775)	Common Pierrot				+	+		+
42.	<i>Catochrysops strabo</i> (Fabricius, 1793)	Forget-Me-Not		+	+				+
43.	<i>Curetis thetis</i> (Drury, [1773])	Indian Sunbeam		+					
44.	<i>Euchrysops cnejus</i> (Fabricius, 1798)	Gram Blue		+					
45.	<i>Everes lacturnus</i> (Godart, [1824])	Indian Cupid		+					
46.	<i>Jamides celeno</i> (Cramer, [1775])	Common Cerulean		+	+	+	+		+
47.	<i>Jamides bochus</i> (Stoll, [1782])	Dark Cerulean		+					
48.	<i>Lampides boeticus</i> (Linnaeus, 1767)	Pea Blue	II	+		+			
49.	<i>Leptotes plinius</i> (Fabricius, 1793)	Zebra Blue		+					
50.	<i>Loxura atymnus</i> (Stoll, 1780)	Yamfly		+					
51.	<i>Megisba malaya</i> (Horsfield, [1828])	Malayan		+					

52.	<i>Neopithecops zalmora</i> (Butler, [1870])	Quaker		+					+
53.	<i>Rapala manea</i> (Hewitson, 1863)	Slate Flash		+					
54.	<i>Rapala varuna</i> (Horsfield, [1829])	Indigo Flash	II	+					
55.	<i>Rathinda amor</i> (Fabricius, 1775)	Monkey Puzzle		+					+
56.	<i>Spindasis syama</i> (Horsfield, [1829])	Club Silverline		+			+		
57.	<i>Zeltus amasa</i> (Hewitson, 1865)	Fluffy Tit		+					
58.	<i>Zizeeria karsandra</i> (Moore, 1865)	Dark Grass Blue					+		+
59.	<i>Pseudozizeeria maha</i> (Kollar, [1844])	Pale Grass Blue		+			+		+
60.	<i>Zizina otis</i> (Fabricius, 1787)	Lesser Grass Blue					+		+
61.	<i>Zizula hylax</i> (Fabricius, 1775)	Tiny Grass Blue					+		+
Family Nymphalidae									
62.	<i>Acraea terpsicore</i> (Linnaeus, 1758)	Tawny Coster						+	+
63.	<i>Athyma perius</i> (Linnaeus, 1758)	Common Sergeant		+					+
64.	<i>Athyma selenophora</i> (Kollar, [1844])	Staff Sergeant							+
65.	<i>Charaxes psaphon</i> Westwood, 1847	Plain Tawny Rajah		+					
66.	<i>Charaxes solon</i> Fabricius, 1793	Black Rajah		+					
67.	<i>Danaus chrysippus</i> (Linnaeus, 1758)	Plain Tiger		+	+				+
68.	<i>Danaus genutia</i> (Cramer, [1779])	Common Tiger							+
69.	<i>Euploea core</i> (Cramer, [1780])	Common Crow	I V				+	+	+
70.	<i>Euthalia aconthea</i> (Cramer, [1777])	Common Baron					+	+	+
71.	<i>Euthalia lubentina</i> (Cramer, [1777])	Gaudy Baron	I V	+					
72.	<i>Symphaedra nais</i> (Forster, 1771)	Baronet		+	+				
73.	<i>Hypolimnas bolina</i> (Linnaeus, 1758)	Great Eggfly		+	+				

74.	<i>Hypolimnas misippus</i> (Linnaeus, 1764)	Danaid Eggfly	II	+						+
75.	<i>Junonia almana</i> (Linnaeus, 1758)	Peacock Pansy								+
76.	<i>Junonia atlites</i> (Linnaeus, 1763)	Grey Pansy								+
77.	<i>Junonia hierta</i> (Fabricius, 1798)	Yellow Pansy								+
78.	<i>Junonia iphita</i> (Cramer, [1779])	Chocolate Pansy		+	+				+	+
79.	<i>Junonia lemonias</i> (Linnaeus, 1758)	Lemon Pansy				+				+
80.	<i>Junonia orithya</i> (Linnaeus, 1758)	Blue Pansy		+	+	+				+
81.	<i>Kallima inachus</i> (Boisduval, 1846)	Orange Oakleaf		+						
82.	<i>Melanitis leda</i> (Linnaeus, 1758)	Common Evening Brown		+					+	
83.	<i>Moduza procris</i> (Cramer, [1777])	Commander		+						+
84.	<i>Mycalesis perseus</i> (Fabricius, 1775)	Common Bushbrown		+					+	+
85.	<i>Neptis hylas</i> (Linnaeus, 1758)	Common Sailer		+					+	+
86.	<i>Orsotriaena medus</i> (Fabricius, 1775)	Nigger		+						
87.	<i>Pantoporia hordonia</i> (Stoll, [1790])	Common Lascar		+						
88.	<i>Phalanta phalantha</i> (Drury, [1773])	Common Leopard		+					+	+
89.	<i>Polyura athamas</i> (Drury, [1773])	Common Nawab		+						
90.	<i>Cynitia lepidea</i> (Butler, 1868)	Grey Count	II	+					+	
91.	<i>Tirumala limniace</i> (Cramer, [1775])	Blue Tiger		+				+	+	+
92.	<i>Ypthima huebneri</i> Kirby, 1871	Common Fourring		+						

Legends: “+” indicates presence of the species at the site



Fig. 1: *Gerosis bhagava*



Fig. 2: *Kallima inachus*



Fig. 3: *Eurema blanda*



Fig. 4: *Abisara bifasciata*



Fig. 5: *Spindasis syama*



Fig. 6: *Tagiades gana*

THE HAWKMOTHS (LEPIDOPTERA: SPHINGIDAE) OF MUSSOORIE, UTTARAKHAND, INDIA: CONFIRMATION OF FAUNAL DRIFT IN RESPONSE TO CLIMATE CHANGE

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Reviewer: Jean Haxaire

Introduction

The Hawkmoths of parts of the present day administrative division of Garhwal, Uttarakhand, India, were surveyed by F.B. Scott during the 1920s. Since modern attractants like mercury vapour lamps had not been developed at that time, he located most of his species in the caterpillar stage and probably attracted moths to paraffin lamps and electric lamps available at the time.

The results were published (Bell & Scott, 1937) and added considerably to the available information about the family at the time, remaining the standard work on the subject for India.

Smetacek (1994) noted a possible extension westward to the known distribution of over 30 species of typically eastern Himalayan hawkmoths and suggested this was in response to ongoing climate change in the region. However, the main study site of Smetacek (1994) at Bhimtal was around 200 km east of Mussoorie, where Scott (in Bell & Scott, 1937) had undertaken his work, giving rise to the possibility that the species newly recorded from Bhimtal had, in fact, always been present there. Therefore, a survey of the hawkmoths of Mussoorie was seen as the only way of conclusively proving that the moths had extended their distribution westward along the Himalaya in the period after Scott had concluded his studies, or around 1937 at

the latest, since this was the date of publication of the work.

Material and Methods

Mercury vapour lamps were set up at two locations in Mussoorie, one at Oakville (2150 m), Landour, Mussoorie, the private residence of the Alter family and the second at the Hanifl Centre for Outdoor Education and Environmental Study at Woodstock School, Mussoorie (2130 m). The lamps reflected their light off a white cloth screen. Surveys were conducted at different seasons over the course of a year, from March, 2014 to March, 2015. No Sphingidae were recorded during March and April, 2014 and 2015. Some were recorded in May, June and July.

Specimens were curated at the Hanifl Centre. They are now stored partly at the Hanifl Centre and partly at the Butterfly Research Centre, Bhimtal, Uttarakhand. The results of the study have been presented in Table 1.

Discussion

There are relatively few hawkmoth species found over 2000 m elevation in the western Himalaya. Of these, we recorded a fair percentage, but widespread species like *Theretra nessus* (Drury, 1773), *Theretra clotho* (Drury, 1773), *Theretra alecto* (Linnaeus, 1758), *Theretra lycetus* (Cramer, 1775) and *Agrius convolvuli* (Linnaeus, 1758) were conspicuous by their absence. Species

normally found at that elevation which did not appear include *Cechenena mirabilis* (Butler, 1875), *Dahira rubiginosa* Moore, 1888 and *Langia zenzeroides* Moore, 1872.

Of interest is that out of 22 species recorded, 7 are westward extensions and were not recorded from Mussoorie by Bell & Scott (1937). Only two *Rhagastis* Rothschild & Jordan, 1903 species were recorded from the Western Himalaya by Bell & Scott (1937), yet there are now at least four, with *R. velata* (Walker, 1866), which was not recorded in the present study, probably found at lower elevation, since it is by far the commonest member of the genus in Kumaon.

The present survey confirms the presence of *Marumba cristata*, which is well established at Mussoorie, but was not recorded by Bell & Scott (1937). Smetacek (2004) also reported *M. cristata* from Shimla, Himachal Pradesh, which is west of Mussoorie, on the basis of a single forewing found on a hotel verandah. The present records confirm that *M. cristata* is indeed now established in Mussoorie, where it was not found less than a century ago. The Indian population of this species has not been bred, but in China, it has been bred on *Persea* Mill. (= *Machilus* Rumphius), *Litsea* Juss. and *Phoebe* Nees. of the Lauraceae (Bell & Scott, 1937), all of which genera are represented in Mussoorie (Brandis, 1874). Interestingly, freshly emerged *M. cristata* larvae refused to feed on *Persea odoratissima* Nees. in Bhimtal, Kumaon (P.S.).

Similarly, *Dolbina inexacta* was not recorded from Mussoorie prior to 1937 and is likely a new entrant. It feeds on *Olea glandulifera* Wall. (Smetacek, 2000) which is found from low elevation to 1820 m in the area (Brandis, 1874). In this case again, the larval host plant existed but the moth had failed to colonise the area when surveys were carried out prior to 1937.

Rhagastis Rothschild & Jordan, 1903 feed on Vitaceae and Araceae (Bell & Scott, 1937), which occur plentifully in Mussoorie.

The main result of this year long study is the vindication of the proposition that there was a westward faunal drift along the western Himalaya during the second half of the 20th century. One third of the species recorded in the study are new records for the area, which is a very large proportion by any standards. This is taking into consideration that the area around Mussoorie was very thoroughly studied by F.B. Scott and that he studied the area from the foot of the hills to over 2000 m elevation, while the present study was confined to the area above 2000 m elevation. Almost certainly, surveys at lower elevation, below 1500 m, will yield further new records for the area. It seems likely that this colonisation of the western Himalaya by eastern Himalayan elements was the result of changes in the soil humidity regime in the area, since the larval host plants of these species are native to the western Himalaya. This was predicted as a consequence of global climate change in the region in Myers (1986). Stephen Alter, a resident of Mussoorie, noted that in his memory, the hills are more heavily forested now than during the 1960s and 1970s, when Himalayan Oak (*Quercus* sp.) was cut on a large scale to produce charcoal. The 1980 Indian Supreme Court ban on felling of trees above 1000 m elevation has resulted in a re-greening of the countryside that had been degraded over centuries to supply fuel and fodder to villages and the town of Mussoorie.

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Table 1.

S. N.	Species	Bell & Scott, 1937	Present records 2014 Mussoorie	Smetacek 1994 Kumaon	New record	Notes
1.	<i>Acherontia lachesis</i> (Fabricius, 1798)	Y	Y	Y		24.vi.2014
2.	<i>Pseudodolbina fo</i> (Walker, 1856)	Y	Y	Y		23.vii.2014
3.	<i>Dolbina inexacta</i> (Walker, 1856)		Y	Y	Yes	18.vi.2014; 31.vii.2014
4.	<i>Ambulyx sericeipennis</i> Butler, 1874	Y	Y	Y		24.vi.2014
5.	<i>Ambulyx placida</i> Moore, 1888	Y	Y	Y		24.vi.2014
6.	<i>Clanis deucalion</i> (Walker, 1856)		Y	Y	Yes	21.vi.2014; 27.vi.2014
7.	<i>Marumba cristata</i> (Butler, 1874)		Y	Y	Yes	22.vi.2014; 25.vi.2014
8.	<i>Marumba sperchius</i> (Menetries, 1857)	Y	Y	Y		21.vi.2014
9.	<i>Clanidopsis exusta</i> (Butler, 1874)	Y	Y	Y		21.vii.2014
10.	<i>Cypa pallens</i> Jordan, 1926	Y	Y	Y		24.vi.2014; 23.vii.2014 ;

						31.vii.2014 .
11.	<i>Ampelophaga rubiginosa</i> Bremer & Grey, 1852	Y	Y	Y		21.vii.2014 ; 22.vii.2014 ; 23.vii.2014 ; 27.vii.2014
12.	<i>Acosmeryx naga</i> (Moore, 1857)	Y	Y	Y		21.iv.2014; 21.vi.2014; 31.vii.2014
13.	<i>Eupanacra metallica</i> (Butler, 1874)	Y	Y	Y		20.vi.2014
14.	<i>Macroglossum saga</i> Butler, 1878		Y	Y	Yes	22- 31.vii.2014
15.	<i>Macroglossum nycteris</i> Kollar, [1844]	Y	Y	Y		13.v.2014
16.	<i>Hippotion celerio</i> (Linnaeus, 1758)	Y	Y	Y		15.v.2014; 31.vii.2014
17.	<i>Theretra clotho</i> (Drury, 1773)		Y	Y		22.vi.2014.
18.	<i>Rhagastis confusa</i> Rothschild and Jordan, 1903	Y	Y	Y	Yes	25.vi.2014; 21.vii.2014
19.	<i>Rhagastis olivacea</i> (Moore, 1872)	Y	Y	Y		21.vi.2014; 24.vi.2014; 22.vii.2014
20.	<i>Rhagastis acuta</i> (Walker, 1856)		Y	Y	Yes	21.v.2014
21.	<i>Rhagastis castor</i> (Walker, 1856)		Y	Y	Yes	21.vi.2014
22.	<i>Cechetra scotti</i> Rothschild, 1920	Y	Y	Y		24.vi.2014; 23.vii.2014 ; 31.vii.2014

***CHALCOSIOPSIS VARIATA* (INSECTA: LEPIDOPTERA: ZYGAENIDAE) IN ARUNACHAL PRADESH, INDIA**

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Reviewer: Alka Vaidya

Introduction

The little known moth *Chalcosiopsis variata* Swinhoe, 1894 was described on the basis of four female specimens from Shillong, Meghalaya, India. The present whereabouts of this series of specimens is unknown according to the card index in the Natural History Museum, London, U.K. A single specimen of what appears to be a male was recorded from the Mishmi Hills of Arunachal Pradesh. Following the data of specimen:

Chalcosiopsis Swinhoe, 1894

C. variata Swinhoe, 1894

Material Examined:

1 Male; Forewing 14 mm, expanse 32 mm. 8.v.2019. Km 17 on Hunli to Anini road, 600 m, Lower Dibang district, Arunachal Pradesh, India. *Leg., det. et Coll.* Peter Smetacek, Butterfly Research Centre, Bhimtal.

Remarks: The present record extends the known distribution of this species to Arunachal Pradesh from the type locality in Meghalaya. It was attracted to artificial light at night, although it might also be active during the daytime. If the type series was indeed obtained in Shillong (1520 m) rather than in some nearby location, then this taxon

inhabits the altitudinal belt between 600 m and 1520 m. There is no information available about the flight time of the type series.

The specimen examined is 4 mm smaller than the type series, which had an expanse of 36 mm.

In the type series, the extent of the broad black border to the hindwing *recto* was noted to be variable. In the specimen examined, the antennae are minutely ciliated and appear shorter than those of the specimen illustrated by Hampson (1896). On the forewing, the oblique white band from the costa is straight, not slightly curved as illustrated in Hampson (1896).

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Fig 1: *Chalcosiopsis variata* verso surface



Fig 2: *Chalcosiopsis variata* recto surface