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NOTES ON RECENT DISTRIBUTION RECORDS AND ECOLOGY OF BUTTERFLIES *ATHYMA CAMA* MOORE (1858) AND *TAGIADES MENAKA* (MOORE, 1866) FROM EASTERN KUMAON DIVISION, UTTARAKHAND, INDIA

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Recent distributional records of the two little known species of butterflies from Kumaon Himalayan Region of the state Uttarakhand is outlined in the present study with special emphasis on their ecology and conservation. The study confirms the presence of A*thyma cama* Moore (1858) which belongs to family Nymphalidae while *Tagiades menaka* (Moore, 1866) belonging to family Hesperiidae was re-discovered after a long century from the eastern Kumaon Division. Both species were recorded as uncommon during August, 2016 to July, 2017 from the remote village of Pancheshwar in district Champawat located at the edge of international boundary of India with north-western Nepal. The present findings indicate that the region holds immense potential for the existence of rich butterfly diversity that should be managed and conserved in order to reduce the adverse impact of ongoing developmental project of dam construction in the study area.

Key words: Behaviour, Conservation, Champawat, Host plants, Sal forest

The Kumaon Division, which comprises six major districts of the state Uttarakhand, is a mosaic of vivid landscapes within the central Himalayan sector and thus provides a complex habitat system for sustaining rich biological diversity. In particular, butterflies of the Kumaon Himalayan Region have been studied systematically, since 1880's. William Doherty, in his most pioneering work listed 271 species of butterflies contributing much to our understanding on their distribution in the Kumaon region (Doherty, 1886). Later, Hannyngton (1910-11) in his detailed survey recorded 378 species of butterflies including many endemic ones from the Kumaon region. Since then there is a lacunae in the data essential from the standpoints of ecology and conservation issues of butterflies. However, there exist several published records on distribution and diversity of butterflies from the protected areas of the state Uttarakhand. Moreover, increased awareness for butterflies due to citizen science initiatives has fueled resurgence of natural history and this has also resulted in new information on distribution of butterflies from the state Uttarakhand.

The present study which is a detailed note on the recent distribution records and ecology of the butterflies namely, *Athyma cama* Moore (1858) and *Tagiades menaka* (Moore, 1866) represents a fraction of the research studies that is still being conducted for butterfly diversity and conservation in the region of the main dam site under Pancheshwar Multipurpose Project, a bi-national scheme signed as Mahakali Treaty on February, 12, 1996 between the Governments of India and Nepal.

MATERIALS AND METHODS

Study site: Pancheshwar, is a low lying valley (29°26.84' N Latitude and 80°13.70' E Longitude) stretched within elevation range of 440 to more than 1000 meters above mean sea level in the Champawat district of Kumaon Division, Uttarakhand. The name 'Pancheshwar' is a compound of two hindi words 'Panch' (five) and 'Ishwar' (Lord), representing Lord of five rivers as the River Sarju from Bageshwar, the Ram Ganga from Almora, the River Dhauli and the River Gori from Pithoragarh amalgamate with the River Maha-Kali from Nepal. The village at Pancheshwar is connected with 40 km long road that begins at an altitude of 1600 meters from the main town of Lohaghat and runs down to the low-lying valley, reverent for the temple of sacred deity Lord Shiva that lies at the confluence of the Sarju River with the Mahakali River forming India's international boundary in north-western Nepal. The terrain is undulating with mountains and ridges intersected by deep ravines and rivulets in low-lying areas and covers grasslands on hilltops. The foothills on the north and south sides of the valley are covered with Moist Siwalik Sal Forest (3C/C2a) and Northern Tropical Dry Mixed Deciduous Forest (5B/C2) which merge with Upper

Himalayan Chir Pine Forest (9C1/b) at upper altitudinal zones (Champion and Seth, 1968). The valley receives yearly precipitation of roughly less than 1000 mm with variable climate of tropical to sub-tropical type, characterized by hot summer season (March-June), moist and wet rainy season (July-October) and cold winter season (November-February). Decline in environmental quality and subtle changes to forest climate as a result of pre-dam construction activities that include tunneling, road constructions, quarrying in the river bed, illicit felling of trees by locals and labors and others related is apparently threatening the sustenance of regional biodiversity.

Sampling: Both species studied in detail were recorded as a part of butterfly faunal surveys conducted during August, 2016 to July, 2017 in the Pancheshwar. Since both the species are fast fliers, we were able to photograph one living specimen of each using digital camera CANON 750D. The identification and characterization of butterflies was done with reference to Evans (1932), Wynter-Blyth (1957), Smith (1989) and Kehimkar (2016). The ecological aspects and larval food plants available in the study area were also noted. Two individual specimens of each species were collected by sweeping the aerial net and then subjected to morphometric measurements using electronic digital caliper. The collected specimens after required measurements were released from the point of their capture to avert biodiversity loss.

RESULTS AND DISCUSSION

1. *Athyma cama* Moore, 1858: Commonly known as Orange Staff Sergeant, belongs to sub-family Limenitinae of Nymphalidae family, Lepidoptera (Image 1). In India, there are 14 species that are known to occur under the genus *Athyma*, of which the present species has uncommon range of occurrence in the country (Kehimkar, 2016). All species under this genus are the typical Himalayan forms.

Global Distribution: The *Athyma cama* Moore is a forest species with its distribution at the foothills up to 1900 meters above mean sea level in the Himalayan Domain of the state Uttarakhand to north-east India (Varshney and Smetacek, 2015), extending in Nepal (Smith, 1989) to Myanmar and Thailand (Wynter-Blyth, 1957).

Species Characterisation: On an average wing span of the collected specimens was 72.50 mm (± 0.01 mm). The species is sexually dimorphic with dark brown colour at the upper side. Abdomen of the male at middle is white banded, and indistinct orange streak at the mid cell, series of white discal bands beyond cell and a post discal orange marking at upper side of the forewing are diagnostic characters of the male. Moreover, the upper side of the hindwing consists obscure white discal band starting from the inner margin to the costal, edging to the inner side white spots on the forewing. Female differs from the male in having sharply defined tawny orange bands, including narrow cell streak on upper side of the forewing and sub-marginal band across dorsal area of the hindwing.

Ecology: A total of 15 individuals from the forests at elevation ranges between 440 to 650 metres were recorded, that includes nine individuals during the summer season (March-June) and six during the monsoons (July-October). The species was recorded mainly between 12.00 to 04.00 hours of a day. Male individuals were mostly recorded from open degraded forested slopes separated by stream sides on the left bank of the Sarju River i.e., upstream of the confluence area in the village of Pancheshwar lying at an altitude of 500 meters. The individual male was seen puddling at the moist grounds along stream sides and nectaring on *Lantana camara* while aggressively attacking the other species of butterflies showing extreme territorial behaviour to keep them away from available nectar sources. In the sampling days of the mid September 2016 a single female individual probably due to its breeding season (monsoons) was recorded in the canopy gaps of dense sal (Shorea robusta) forest at an altitude of 600 meters, nearby the main construction dam site in Pancheshwar. The female was observed resting on the ground vegetation while flying rapidly to settle on the leaves of sal trees. The larval food plants of the butterfly include members of plant family Euphorbiaceae, of which species such as *Mallotus phillipensis, Phyllanthus emblica, Ricinus communis, Sapium insigne, Glochidion velutinum, Jatropha curcas, Acalypha indica, Acalypha brachystachya* and *Euphorbia hirta* are of common occurrence in the study area.

Previous and Recent Distribution Records: Doherty (1886) in his earliest records of the Kumaon butterflies observed this species as common in the district Almora; however, the same species was not reported in the detailed survey made by Hannyngton (1910-11). Recent record of this species from the Kumaon Himalaya was made by Smetacek (2012) as uncommon in the sub-tropical evergreen forest above 1200

meters, Jones Estate in the district Nainital. This record, however, was based on the notes maintained by his father and his own personal observations, in which he listed 243 species of butterflies recorded from 1951 to 2010 without specifying the sighting duration. The present study therefore confirms its distribution from the Kumaon region. This species was also recorded in the Garhwal region during the months of May and August as uncommon from the Dehradun valley, Uttarakhand (Singh and Sondhi, 2016). In the north-east side of the India, Gogoi (2012) recorded the species in the Dibang valley of Mishmi hills located in the eastern region of Arunachal Pradesh. Sengupta et al. (2014) reported the species in the sub-tropical broad-leaved hill forest of the Neora Valley National Park located at the tri-junction of West Bengal, Sikkim and Bhutan on the north and northeast. Similarly, Sondhi and Kunte (2016) reported this species during the post-monsoon season as uncommon in the altitudinal range of 1000 to 1900 meters of the Kameng Protected Area Network located in the western region of Arunachal Pradesh.

2. *Tagiades menaka* (Moore, 1866): Commonly known as Spotted Snow Flat, belongs to sub-family Pyrginae of Hesperiidae family, Lepidoptera (Image 2). A total of six species under the genus *Tagiades* that are known to occur in India are either uncommon or rare in their range of occurrence in the country (Kehimkar, 2016).

Global Distribution: The hesperid is a hill forest species with distribution between 700 to 2000 meters above mean sea level in the Himalayan Domain from Kashmir to north-east India (Varshney and Smetacek, 2015) including Nepal (Smith, 1989) and ranging to west of the China, Bhutan and northern Vietnam (Evans, 1932).

Species Characterisation: On an average wing span of the collected specimens was 46.75 mm (± 0.01 mm). The both sexes of this species are quite similar; however, abdomen of the female is white or striped at the end. The morphological characters of the species include forewing with pale brown colour and well developed discal and apical spots at the upper side. The one-third area of upper side hindwing is pale brown while the rest in outer half is snowy-white with two distinct discal dark brown spots.

Ecology: During the survey, a total of 13 individuals that includes six individuals during the summer season (March-June) and seven during the monsoons (July-October) were recorded mainly from the stream sides of rapta (causeway) covered by mixed upper Himalayan chir pine forest on the slopes. This locality is located 10 km south of the Pancheshwar valley along forest edges near the village Khaikot Talla lying within altitudinal ranges between 900 to 1200 meters. The species preferred wet grounds and moist rocks in shade close to water sources and was found active from 10.00 to 03.00 hours of a day during bright sunshine. The males and females were observed singly feeding on nectar sources of *Lantana camara* and *Cirsium walichii* on the stream sides. Males, in particular, were found engaged in actively patrolling the moist patches along the stream sides. The larval food plants of the butterfly include different species of *Dioscorea* and *Smilax*.

Previous and Recent Distribution Records: The first record for the presence of this species was made by Doherty (1886) from Sarju, Kali and Gori valleys in the Kumaon Himalaya but Hannyngton (1910-11) had not recorded the species during his expeditions. Since then virtually nothing is published related to its distribution and ecology from the Kumaon region, the species is therefore re-discovered in the present study after a long century in the Pancheshwar valley. Singh (2009) noted this during May-July species as uncommon at an altitudinal range between 1500-2000 meters from south-eastern part of the Kedarnath Musk Deer Reserve in the Garhwal Himalaya, Uttarakhand. Similarly, Singh and Sondhi (2016) reported this species as common during the summers and post-monsoon seasons from the Dehradun valley and Mussoorie hills in the Garhwal Himalaya. Naro and Sondhi (2014) recorded this species in the month of October from the North East Network compound, Nagaland. Sondhi and Kunte (2016) found it during the months of April and August as a rare species in the Pakke Tiger Reserve, western Arunachal Pradesh.

CONCLUSION

Documentation of such little known species of butterflies in the Kumaon Region reveals the importance of the study area in predicting the potential for many species to exist that have not been adequately recorded from the Kumaon Division of the state Uttarakhand. These records are also expected to meet the needs of understanding the importance of biodiversity conservation in such critical areas which are continuously being

affected from the large-scale developmental projects eroding and threatening flora and fauna.

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Image 1: *Athyma cama* Moore, 1858 (Male specimen)

Image 2: *Tagiades menaka* (Moore, 1866) (Female specimen)