

MISCELLANEOUS PUBLICATION
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Records of the Zoological Survey of India

**Account of the Indian Tons Valley Expedition 1972
with an annotated list of species and redescription
of *Colias electo fieldi* Menetries (Order Lepidoptera)
from the Indo-Palaeartic Region**

by
D. K. MANDAL

Issued by the Director
Zoological Survey of India, Calcutta

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ACCOUNT OF THE INDIAN TONS VALLEY
EXPEDITION-1972 WITH AN ANNOTATED
LIST OF SPECIES AND REDESCRIPTION
OF *COLIAS ELECTO FIELDI* MENETRIES
(ORDER LEPIDOPTERA) FROM THE
INDO-PALAEARCTIC REGION

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INTRODUCTION

The author, as a delegate from the Zoological Survey of India (Z. S. I.), joined the expedition at the unexplored Tons Valley of the Western Garhwal Himalayas, Uttar Pradesh, India, in the year 1972 in collaboration with the Anthropological Survey of India under the organisation of the Calcutta Mountaineering Club, "Dutagar"

The mission of the joint adventure was to make pioneering faunistic *cum* socio-cultural explorations together with an arduous attempt of scaling a virgin peak (c 6175 m) by the climbing members of the team which was composed of nineteen heads having left Calcutta on 19th September and returned on 20th October, 1972.

Presently, the systematic discussion based on a list of Lepidoptera comprising 11 species and 10 subspecies of butterflies and 6 species and only one subspecies of moths is rendered along with the redescription of one of these butterfly subspecies, *Colias electo fieldi* Ménétrières, from the Indo-Palaeartic region. The discussion is preceded by the general notes on earlier investigation of the high altitude lepidopterous fauna of the North-Western Himalayas and also account of climatology, biotic zonation, course and duration of trekking, field observation, biogeography, habits and cold adaptation in relation to the overall lot of material collected by the author on the expedition. Finally, a French summary, acknowledgements and references coupled with a table giving a cursory glance of field notes and a topo-sheet map

showing the route of expedition are also incorporated. All the elements, including the single indetermined but annotated geometrid species, which are repositied at Z. S. I., constitute new locality records for the Tons area.

EARLIER INVESTIGATION

Lang & Moore (1864) first contributed to the faunistic studies of Lepidoptera from an altitude of *c* 4550 metres in the areas other than the Tons Valley of the North-Western Himalayas. Later, Moore (1878) published an account of the fauna from the *Stoliczka*-Collection on the Indian Govt. Mission-1873 at Yarkand. Subsequently, Butler (1886), Doherty (1886), Mackinnon & de Nicéville (1897-1898), Hannyngton (1910-1911), Haude (1912), Bernardi & Lesse (1952), Stempffer (1952), Arora & Mandal (1977), Mandal & Chaudhury (1977) and Arora *et al* (1977) furnished further accounts of both the diurnal and nocturnal Lepidoptera on different surveys and expeditions at diverse altitudinal areas of the North-Western Himalayas, but excluding the Tons. Meanwhile, of the most important entomological publications ever made from the high altitude belts, those by Mani (1962, 1968) are noteworthy. Thus, as compared to the earlier known distributional pattern of fauna at least in respect of Lepidoptera, the present material from the Tons as an off-shoot of the North-Western Himalayas certainly provide an added interest of biogeography under the general spectra of climatology of the area, as attempted to clarify hereunder.

GENERAL CLIMATOLOGY

As discussed below, the item is concerned with three pertinent aspects, *viz.*, topography, soil and climate, of the Tons area in particular.

A. Topography

The Tons area, which is situated in the Western Garhwal Himalayas, has its own fascinating topography. From the Yamunotri glacier emerges the large River Yamuna as a cold, narrow and torrential stream. While flowing downward, it reaches a small village girdled by the mountains near Kalsi of the Chakrata subdivision on the way to Tuni in the district of Dehra Dun. The village, called

Haripur Byas, is also bathed by another mountain-river which pours into the River Yamuna at its final course. It is this river, or rather a streamlet, which is known as the Tons proper. It passes further interior and upward to its origin in the district of Garhwal. The Tons is embanked by varied tablelands amidst the mountainous valley equipped with an evergreen canopy of mostly the natural plant-succession that harbours diverse faunal associations. The team came across the Tons in flow at the first instance near a much low-land village, called Mohri (*c* 909 m), after having trekked an approximate distance of 24 kms. on the approach way to Jarmola, also a small but very steep-rising village on the north of Puraula, the north-eastern subdivision of Yamunotri at Tehri Garhwal. At Mohri, the Tons also receives another streamlet, locally called the "Garugad", as its feeder. Further, at a place about 3.5 kms. north-east of Osla, the last village about 80 kms. off Puraula along the upstream, the Tons bifurcates into Ruinsara-and Har-ki-Dun-gads, which originate respectively from the Bandarpunchh and Jamdar glaciers or "Bamaks", as locally called. In fact, the Ruinsara-gad is recognised as the upper Tons that comes out as a trickling flow from its glacier-bed, as actually observed by the team well above the snow-line (*c* 4050 m). The total vertical extent of the Tons from its source up to at least Mohri covers an approximate distance of 90 kms. amidst the awesome yet picturesque facies of nature. The terrain, particularly between Naitwar and Taluka—a couple of intermediate villages on the way from Puraula to Osla, being situated below the timber-line (*c* 3950 m)—lodges a fairly large sanctuary, called the Govind Pashu Vihar, with its huge resources of timber-yielding plants and wild animals. Interestingly enough, a fairly large perennial lake, locally called "Talao", was found at the snow-line where the Pre-Base Camp was pitched (*vide* Route Map).

B. Soil

As essential factor furnishing the edaphic texture to the relief of the Tons area, the soil is densely humid, soft and rich with decaying organic matters that form the litter of the forest-floor. It is often associated with stones, pebbles, sands and boulders. In places, graphites and huge marble-blocks were also encountered, while in some other places arid substrata with hard laterite condition appeared to predominate, that may be the result of artificial processings including jhoom-cultivation and deforestation practised frequently by the

hil tribals. At higher altitudes, the soil is fully clad with snow, particularly in the glacier zone.

C. Climate

Most important of all the abiotic factors is the climate, which basically governs not only the physiography, as represented by the couple of its preceding counterparts, but also the flora and fauna of the biotic series occurring in their respective niches and habitats. The phenotypic variations at the infra-specific levels, including geographical, seasonal, sexual and even individual, for certain forms, as dealt with from the lower to higher elevations in the Tons area, may be considered as good examples of impact of the climatological succession. The climate was mainly dry with moderate cold and occasional rainfall of the plain-type at lower altitudes, while it was badly unpredictable and extremely severe with the temperature falling at about -5°C , eternal deposit of snow, thin and rarified air and ghastly wind accompanied by blizzard or snow-storm at and above the snow-line, where also the day-length parameter was observed to have lasted for a longer period than that on the plains.

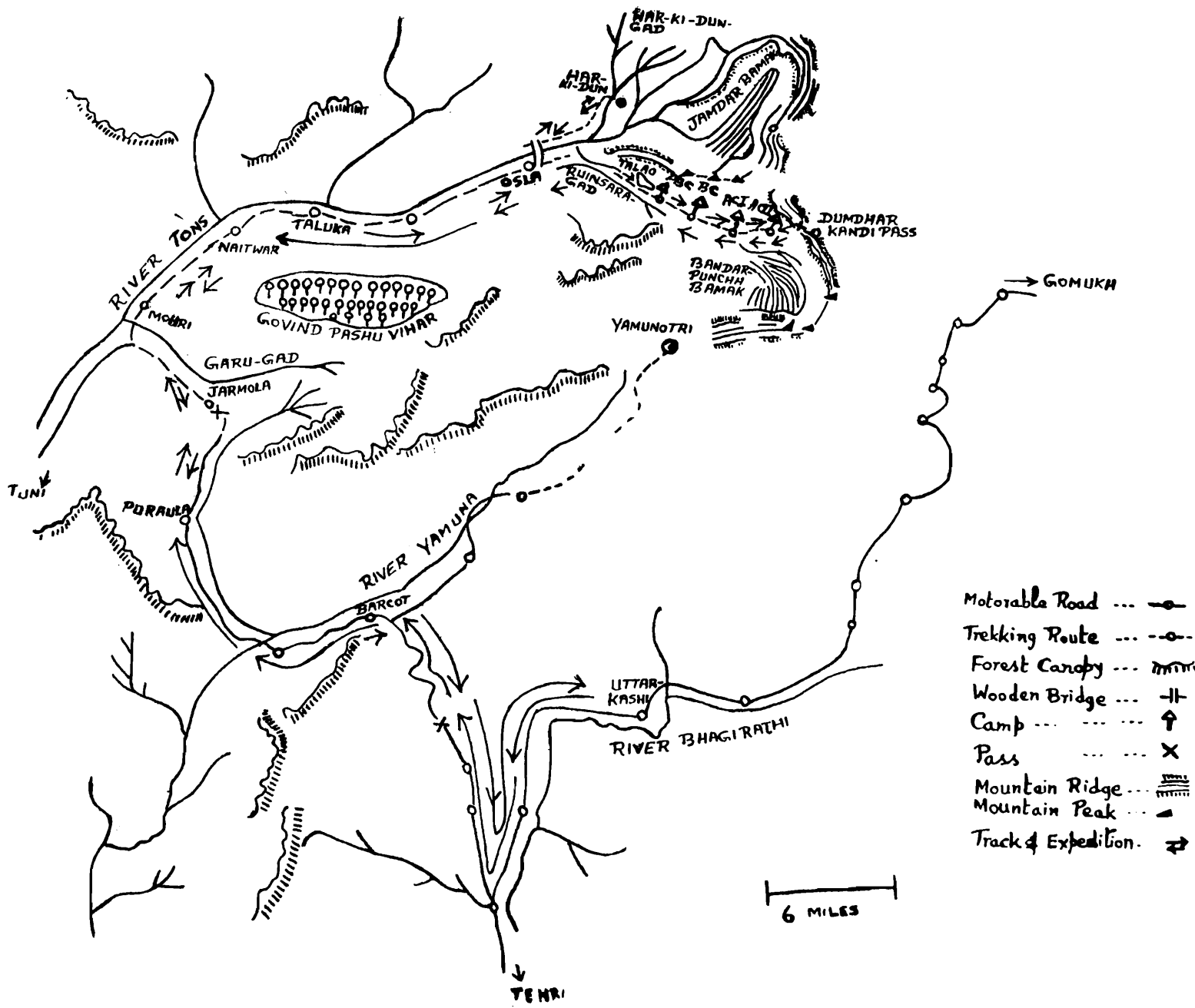
BIOTIC ZONATION

In relation to the aforesaid climatological features, the orientation of the macro-climatic biotic zones amidst the altitudes in clinal order of the Tons area may be briefed hereunder, while the faunal material, as presently available, are correlated to such zones under the Field Observation (*vide infra*).

A. Gradually Sloping Series

(a) **Plain zone** : Mainly dominated by the phanerogams, this zone extends between c 1212 and 2400 metres from Puraula to a little below Osla. But it shows a marked deviation from the usual topographical pattern near Jarmola, where a very steep elevation with scattered humid-deciduous and cultivated vegetations is encountered. To change for the next village, i.e., Naitwar, one would have to descend at as low as c 60 metres down the steep slope.

(b) **Plain-type grassy zone** : This zone is found almost everywhere between c 1000 and 3000 metres up to Osla and also lower Har-ki-Dun,



being often replaced by diverse aspects of relief, such as uneven rocky faces, denses of wild animals, particularly bear, and also nullahs, cascades, etc.

(c) **Hill-type grassy zone** : This zone, locally called "Bugiyal", elicits the preponderance of tall grasses in and around the timber-line, with their size diminishing on gradual ascent.

(d) **Rocky zone** : This zone, which was observed between Taluka and Osla and also on the way to Har-ki-Dun up to a certain altitude, say c 3250 metres, lodges sparsely distributed flora amidst the rocky substrata equipped with crevices, hanging caves, etc.

(e) **Barren zone** : This zone was first observed up to a certain distance between Osla and Pre-Base Camp, where the soil was reddish, hard and apparently devoid of vegetation.

B. Abruptly Steep Series

(a) **Icy zone** : This zone starts onwards from an elevation which one negotiates by an abruptly steep climb near the upper Har-ki-Dun-gad and Pre-Base Camp. It consists of hard, compressed and frozen ice-slabs of variable length and thickness with pale to crystal-clear smooth gliding surface, being either stuck to the mountain walls, or hanging like icicles from the ridges or even lying scattered along the alpine path in a very dangerous position. Small trees, shrubs and herbs are yet visible as the floral constituents of the zone.

(b) **Snowy zone** : This zone was covered with deep loose mat of snow which, when freshly deposited, became pure white and later, with further accumulation for a longer period, turned bluish in tinge. The condition was more experienced at higher altitude with greater exposure to the ultra-violet rays, where the floral distribution remained almost untraceable in the snow all around. The Base and First Advance Camps were pitched here.

(c) **Moraine-glacier zone** : This zone extends upwards from below the foot of the Dumdhar Kandi Pass, which was chosen as an ideal site for pitching the second and the last Advance Camp amidst the glacier. The members reached here with great hardship and observed the moraine as an admixture of stones, boulders and other debris, all having been fully covered with snow of the glacier-bed. The motion of the glacier was very slow, calm and quiet. Such glaciers over the mountains generally become tumultuous by undergoing rapid melting

in the summer and bring about great natural calamities including avalanches, which being aided by the strong wind-currents, speedily move downward and render complete ravages to the natural resources in the whole vicinity.

COURSE AND DURATION OF TREKKING

The route was followed from Uttarkashi (c 1150 m) by about 120 km-motorable road up to Puraula and thence onward by trek to further north-western inner line inclined to the east along the course of the River Tons up to the foot (c 5575 m) of the Dumdhar Kandi Pass amidst glacier. The Pass (c 5625 m) could not, however, be negotiated due to the prevalence of terrible mountaineering hazards. Under the severe circumstances in the Tons area, as mentioned above, the well-acclimatised team gained a formidable trekking experience amidst the almost suicidal mountaineering conditions, particularly when it was proceeding along the supra-snowline ridges at an angle gradient of about 45° with the substratum. The track was very often too narrow, steep and meandering, being flanked on one side by the high mountain face and continued abruptly, on the other, into the deep canyon. The area abounded in a vast sheet of knee to waist-deep snow at the present climax of altitude. Elsewhere, at a fairly lower altitude, where the corrosion of rocky faces was observed due to the enforcing currents of the roaring lofty waterfalls, the crossing tracks were very often blocked by the debris having rolled down perilously from the mountain-summits. Cautious stepping and strict observance of silence are the obligatory rules in trekking, otherwise the slightest impact of echo against the mountain walls garlanding the large valley may lead to sheer disaster at any moment.

The overall trekking period for the team having covered an approximate distance of 224 kms. from Puraula to the foot of the Dumdhar Kandi Pass and back took 21 days. The author, along with two other members of the team, also traversed an additional distance of about 20 kms. both ways from and to Osla for visiting Har-ki-Dun, whence the Jamdar glacier is approachable. Most of the collections were made with great difficulty during the trekking hours.

FIELD OBSERVATION

The present field-data of Lepidoptera in the Tons area, aided by the different gadgets received from either Z.S.I. or other sources including the Nehru Institute of Mountaineering, Uttarkashi, through

“DUTAGAR”, are tabulated on the basis of the author's own observations. All the localities, marked in codes, are cross-referred to the material examined under the SYSTEMATIC ACCOUNT (*cf.* Table).

BIÖGEOGRAPHY AND HABITS

The geographical distribution of Lepidoptera from the Tons area is quite interesting, being mainly concerned with the question of altitude. As compared to the bulk of the order from the tropical plains, the existing records of species seem to be much less available from the inner-line alpine zones like the one at Garhwal of the extra-peninsular Himalayan sector in India. Presently, only some of the elements are observed as the typical mountain-dwellers.

Amongst the butterflies, *Colias electo fieldi* Ménétriès and *Aulocera b. brahminus* (Blanchard) in the present collection exhibit an appreciable degree of alpine adaptation by attaining the height of *c* 5000 metres. On profile survey, certain species of the family Nymphalidae were also observed on flight at an approximate elevation of 3300 metres, but could not be collected, because they stayed far beyond reach. Again, the Snow-Apollo of the Papilionid genus, *Parnassius* Latreille, so common in the high altitudes of the North-Western Himalayas, could hardly be seen during the survey. Amongst the moths, at least two species, viz., *Apona cashmirensis* (Kollar) and *Percnia* sp., have been brought from the altitudinal range varying between *c* 2700 and 3300 metres. The remaining forms of both butterflies and moths were found at different heights from below 1000 to 3000 metres approximately. Unlike most of the butterflies, the moths under study rarely have their recorded subspecies.

As to the exotic pattern of distribution of the present material, *Hyphilare loreyi* (Duponchel) shows rather an isolated distribution in Europe, Africa, Western Asia, Japan, Pakistan, Burma and Sri Lanka, while *Colias electo* (Linn.) has its fairly continuous range from Europe, through Africa, up to Northern Burma and *Eilema affineola* (Bremer) extends from U. S. S. R. to the Far East through the Sino-Himalayan belt. *Eurema hecabe* (Linn.), on the other hand, extends from Africa up to the Far East through the Indo-Malayan belt of the oriental region. Amongst other elements including *Colias electo fieldi* Ménétriès and *Eurema hecabe contubernalis* (Moore), four occur in the Indo-Chinese, nine in the Indian and only one, i.e., *Trabala vishnou* (Lefebvre), in the Indo-Malayan areas. Of all the

species presently identified, only *Heliophorus sena* (Kollar) is confined between Nepal and Chitral of the Indo-Palaeartic belt and the rest are known from the North-Eastern Himalayas, too. Further, *Ypthima sakra nikaia* Moore is so far known to be endemic in the North-Western Himalayas of India proper.

Eurema hecabe contubernalis (Moore), which is almost cosmopolitan in the plains of India and abroad, has been first found from the North-Western Himalays up to the maximum altitude of c 1400 metres in the Tons area, while some including *Ypthima sakra* Moore, *Trabala vishnou* (Lefebvre), *Chalcosia auxo* (Linn.) and *Hyphilare loreyi* (Duponchel) constitute new locality records for the whole of Western Garhwal.

The aforesaid biogeographical aspects certainly influence the faunal habits, as witnessed by the author at least in respect of Lepidoptera from the area under surveillance. Almost all the species are diurnal and even the moths are hardly attracted to light, being much less active than the butterflies which usually remain on soaring flight either over tree-tops at lower elevations, or along ridges, or over gorges at comparatively higher elevations averagely between 09.00 and 16.00 hours of the sunny and moderately wet days.

COLD ADAPTATION

The phenomenon of cold adaptation, as exhibited by some of the material in the Tons area, is correlated with certain structural and colourational modifications of body and appendages in response to their ideal alpine habitats. The set of characters, being thus affected in general, may be noted hereunder.

1. Body stout, short, tinged melanic and with bushy vestiture of scales or modified hairs.
2. Head tending to be narrow and elongate.
3. Eyes small.
4. Antennae thickened.
5. All the three pair of legs short and thick.
6. Apical area of fore wings and anal area of hind wings much reduced ; veins of both pair of wings thickened.

7. Wing expanse—taken conveniently in set and pinned specimens as double the distance from apex of unilateral fore wing across its base up to the middle of mesothorax—also reduced.
8. Abdomen telescoped.

The reasons for such modifications adapted to cold may be attributed to the phenotypic reactions influenced by the low temperature in nature. Secondly, the features, however primitive they may be, remain variable for the alpine forms, as also stated by Schmid (1955). It so happens that some forms become well adapted to cold, while others are not at all so, even when they are allied to the former. Finally, this adaptation is apprehended to different degrees, when the allied members exhibit intermediaries between the two extremes. Excepting some disputable cases based on the complex origin of the above-mentioned features, being more concerned with phylogeny than cold adaptation particularly in the larger groups, the above interpretation seems to be justified at least in the lack of further determining factors at hand.

LIST OF SPECIES AND SUBSPECIES OF LEPIDOPTERA FROM
THE TONS VALLEY

Order LEPIDOPTERA

A. Suborder Rhopalocera (Butterflies)

I. FAMILY PIERIDAE

SUBFAMILY COLIADINAE

1. *Eurema hecabe contubernalis* (Moore)
2. *Colias electo fieldi* Ménériès

II. FAMILY SATYRIDAE

3. *Aulocera brahminus brahminus* (Blanchard)
4. *Aulocera swaha swaha* (Kollar)
5. *Erebia* (*Callerebia*) *scanda scanda* Kollar
6. *Ypthima sakra nikaea* Moore

III. FAMILY NYMPHALIDAE

VANESSA—Genus Group

7. *Aglais cashmiriensis cashmiriensis* (Kollar)

IV. FAMILY LYCAENIDAE

(a) CUPIDO—Genus Group

8. *Celastrina argiolus kollari* (Westwood)

9. *Zizeeria maha maha* (Kollar)

(b) LYCAENA—Genus group

10. *Lycaena phlaeas s'ygianus* (Butler)

11. *Heliophorus sena* (Kollar)

B. Suborder Heterocera (Moths)

V. FAMILY EUPTEROTIDAE

12. *Apona cashmirensis* (Kollar)

VI. FAMILY ZYGAENIDAE

SUBFAMILY CHALCOSIINAE

13. *Chalcosia auxo albata* (Moore)

VII. FAMILY LASIOCAMPIDAE

14. *Trabala vi hnou* Lefebvre

VIII. FAMILY ARCTIIDAE

SUBFAMILY LITHOSIINAE

15. *Eilema affineola* (Bremer)

IX. FAMILY NOCTUIDAE

SUBFAMILY HADENIINAE

16. *Hyphilare loreyi* (Duponchel)

X. FAMILY GEOMETRIDAE

SUBFAMILY GEOMETRINAE

17. *Percnia (Xenoplia)* sp.

SYSTEMATIC ACCOUNT

(For the details of material examined, *vide* Table)

Order LEPIDOPTERA

A. Suborder Rhopalocera (Butterflies)

I. FAMILY PIERIDAE

SUBFAMILY COLIADINAE

1. *Eurema hecabe contubernalis* (Moore)

1867. *Terias contubernalis* Moore, *J. Linn. Soc. Lond. (Zool.)*,
21 : 46.

1939. *Eurema hecabe contubernalis*, Talbot, *Fauna Brit. India*,
Butterflies, 1 : 527, fig. 177 (a—e).

Diagnostic characters : Body and wings fairly large and yellow. Fore wings always with terminal black border.

Seasonal variations : The present material belong to both the dry-season and wet-season forms (d.s.f. and w.s.f.), as given hereunder (for references, *vide* Talbot, 1939).

(i) *contubernalis* (Moore), d.s.f. : *Dorsal*.—Body and wings with ground-colour rich lemon-yellow. Fore wings with a deep black and fairly broad terminal border, being interiorly excavated between M_3 and Cu_{1b} and truncate at tornus. Hind wings with the border reduced to a dotted line.

Ventral.—Body and wings with ground-colour much pale, latter with prominent but variably oriented rusty markings, viz., fore pair with two small specks near mid-cell and one each at the end of veins reaching costa and termen, a large discal reniform, a short irregular

subapical bar from costa to M_3 and in male, with a pearly white sex-brand extending from base to the origin of Culb ; hind pair with a slightly curved prediscal series of three small spots, a slender and irregular discal orbicular, a highly irregular postdiscal series of curved streaks and also specks at venal ends.

(ii) *merguiana* (Moore), w.s.f., ♂ : *Dorsal*.—as in d.s.f., but fore wings with the terminal border extending more towards the base along dorsum and hind wings with the border being reduced to a very narrow band tapering posteriorly.

Ventral.—as in d.s.f., but both pair of wings with all the markings being obsolescent.

Distribution : India : North-Western Himalayas (Tons Valley) ; throughout the North-Eastern Himalayas ; Eastern Peninsula. Burma. Western Malaysia.

Material examined : 2 ♂♂ (J-N), c 1400 m, 25.ix., 13.x.

Wing expanse : 40-45 mm.

Remarks : Popularly known as the Common Grass Yellow, the butterfly is a fairly good flier and occasional visitor of flowers and damp patches in the tropico-temperate plains. Apparently a straggler, the subspecies shows an interestingly sympatric mode of distribution with *Eurema hecabe fimbriata* (Wallace) which is so far known to be endemic in the North-Western Himalayas. Reportedly, it is very common in the plains of India and shows sexual dimorphism but only in the w.s.f., in which the female is provided with a wide terminal border on both pair of wings and is hardly distinguishable from *E. hecabe fimbriata*, w.s.f. *excavatus* (Moore), though there are substantial differences from the d. s. f. of the same. Included in the HECABE—species group by Talbot (1939), the element constitutes new locality record for the North-Western Himalayas.

2. *Colias electo fieldi* Ménétriès

1855. *Colias fieldi* Ménétriès, *Enum. Corp. Anim. Mus. Petr.*,
1 : 79, pl. 1, fig. 5.

1865. *Colias fieldi*, Moore, *Proc. zool. Soc. Lond.*, p. 760.

1870. *Colias fieldi*, Butler, 1. c., p. 726.

1874. *Colias fieldi*, Moore, 1. c., p. 273.

1880. *Colias fieldi*, Elwes, *Trans. ent. Soc. Lond.*, p. 136.

1882. *Colias fieldi*, Moore, *Proc. zool. Soc. Lond.*, p. 254.
 1884. *Colias fieldi*, Elwes, *Trans. ent. Soc. Lond.*, 1 : 7.
 1885. *Colias fieldi*, Swinhoe, *Proc. zool. Soc. Lond.*, p. 140.
 1888. *Colias fieldi*, Butler, *Ann. Mag. nat. Hist.*, (6) 1 : 196.
 1893. *Colias fieldi*, Swinhoe, *Trans. ent. Soc. Lond.*, 3 : 308.
 1898. *Colias fieldi*, Mackinnon & de Nicéville, *J. Bombay nat. Hist. Soc.*,
 11 : 588.
 1903. *Colias fieldi*, Leslie & Evans, 1 c., 14 : 675.
 1906. *Colias fieldi*, Elwes, *Proc. zool. Soc. Lond.*, p. 482.
 1907. *Colias fieldi*, ♀ f. *leucania* Röber, in Seitz, *Macrolep. World, Fauna
 Palaearctica*, 1 : 68.
 1907. *Colias croceous fieldi*, Bingham, *Fauna Brit. India, Butterflies*, 2 :
 243, pl. 15, fig. 103.
 1909. *Colias fieldi*, Verity, *Rhopal. Palaearctica*, p. 266, pl. 46, figs. 26, 27.
 1909. *Eurymus fieldi*, Swinhoe, *Lep. Indica*, 7 : 171, pl. 605, figs. 4, 4 (a-e).
 1910. *Colias fieldi*, Hannington, *J. Bombay nat. Hist. Soc.*, 20 : 364.
 1910. *Colias fieldi*, Fruhstorfer, in Seitz, *Macrolep. World, Fauna Indo-
 Australia*, 9 : 165.
 1911. *Colias fieldi*, Peile, *J. Bombay nat. Hist. Soc.* 20 : 874.
 1927. *Colias fieldi edusina*, Riley, *Trans. ent. Soc. Lond.*
 75 : 124.
 1932 a. *Colias croceous fieldi*, Evans, *Ident. Indian Butt.*, ed. 2 : 81.
 1932 a. *Colias croceous edusina*, Evans, *l. c.*
 1932 b. *Colias croceous edusina*, Evans, *J. Bombay nat. Hist. Soc.*,
 36 : 200.
 1937. *Colias croceous edusina*, Peile, *Guide Coll. Butt. India*, p. 68,
 pl. 8, fig. 64.
 1937. *Colias fieldi fieldi*, Peile, *l. c.* p. 69.
 1939. *Colias erecto fieldi*, Talbot, *Fauna Brit. India, Butterflies*,
 1 : 562.

Redescription, ♂ : *Dorsal*.—Head, antennae, thorax anteriorly, cilia of both pair of wings and also legs including femoral hairs proximally, but not the femora, salmon-pink ; labial palpi and femora together with their distal hairs yellowish green ; thorax posteriorly and the entire abdomen black ; both pair of wings with ground-colour deep orange. Fore wings with basal scales greenish black ; discal spot large, mostly intra-cellular, spear-shaped, deep black and sparsely overlapped by a few orange-yellow scales ; terminal border black, very wide particularly at M_3 , with inner edge irregular, hardly produced proximally along dorsum, fairly sprinkled with pale yellow lanceolate scales and R_2 to R_{4+5} and also M_1 apically prominent. Hind wings with basal scales black and continued extero-posteriorly ; dorsum broadly pale yellow ; terminal border with inner edge irregular, not reaching the anal angle but continued along costa nearly up to the base whence it is sharply apart, being nacreous and swollen to lodge the yellow sex-brand on R_s ; discal

spot orange, ill-defined but larger than that of fore pair and largely extra-cellular in orientation.

Ventral.—Antennal clubs and labial palpi paler; thorax and abdomen greenish yellow; tibiae with a narrow patch of pale white scales; palpal hairs and also dorsal, costal and terminal borders including cilia of both pair of wings salmon-pink; ground-colour of wings orange-yellow. Fore wings with subcostal and subterminal areas pale green; discal spot as on the dorsal side, but centred with silvery-white; a postdiscal series of small pinkish spots, being abruptly curved outwards up to M_2 or M_3 , then followed up to $2A$ by black ones increasing gradually in size. Hind wings with more extensive greenish black dusting; a prominent pair of silvery-white discal spots enclosed in a common irregular ring diffused with pink, the anterior one being very small and often obsolescent or absent; postdiscal series of small pinkish spots also often absent.

♀ : *Dorsal.*—Body darker. Fore wings with terminal border wider and angular at M_3 ; subterminal spots seven in number and placed obliquely from R_2 up to the fold of Cu_2 , the smallest one on R_2 and the largest wedge-shaped one on Cu_{1b} , there being no spot on Cu_{1b} . Hind wings with greenish black scales almost throughout; terminal black border wider and extending along costa up to the base where it is neither much pale nor swollen, and continued posteriorly but faintly into the curved postdiscal series of obscure yellow spots of variable number and size; discal spot orange and mostly lying outside the cell, but without any ring.

Ventral.—As in male.

Seasonal variations: The present material are referable to both the anonymous dry and wet-season forms (d.s.f. and w.s.f.), as given below.

(i) d. s. f., ♂ ♀ : *Dorsal.*—Both pair of wings with the terminal border anteriorly wide, more so in female.

Ventral.—Hind wings with discal spot posteriorly subquadrate and larger than that of w. s. f. (*Vide infra*), postdiscal series of spots obsolescent or absent and terminal border narrowing towards the anal angle more bluntly than that of the fore pair.

(ii) w. s. f., ♂ : *Dorsal.*—Both pair of wings with the terminal border narrow, but tapering further towards the anal angle of hind wings.

♂ ♀ : *Ventral.*—Hind wings with the discal spot posteriorly rounded and smaller than that of d. s. f. (*vide supra*) and the post-discal series of spots prominent.

Distribution : China : Yunnan : Tibet. Pakistan : Baluchistan (Quetta) ; Chitral ; Indus. India : North-Western (including the Tons area) and North-Eastern Himalayas ; Eastern and Western Peninsulas. Nepal. Northern Burma.

Material examined : One ♂ (T-O), c 2650 m., 27 ix ; 2 ♀ ♀ (O-PBC), c 3050 m, 1. x. ; 1 ♂ (BC), c 4265 m, 2. x. ; 1 ♂, 1 ♀ (BC-ACI), c 4850 m, 3. x.

OTHER MATERIAL FROM THE NATIONAL COLLECTIONS AT Z. S. I. :

2 ♂ ♂, Western China : Yunnan. 5 ♂ ♂, 4 ♀ ♀, Pakistan : Chitral c 2430-3493 m, —vi, vii —. (*Leech coll.*) ; 1 ♂, Indus, —ii.—, 7 ♂ ♂, 7 ♀ ♀, India : Jammu & Kashmir, c 1970-2640 m, 3 ♂ ♂, 3 ♀ ♀, Gulmarg, c 2850 m, .—vi —, 1 ♂, 2 ♀ ♀, Pangi, 2 ♂ ♂, 1 ♀, Deosai Plains, c 3940 m, 16. viii. 1887 ; 8 ♂ ♂, 7 ♀ ♀, Himachal Pradesh : Simla, 6 ♂ ♂, 7 ♀ ♀, Kulu, 17. iii., —v.—, .—vii. 1880 (*A. G. Y coll.*) ; 6 ♂ ♂, 4 ♀ ♀, Uttar Pradesh : Mussoorie, 1 ♂, 1 ♀, Naini Tal, c 2330-2601 m. ,—vi. 1887 (*Mus. coll.*) ; 2 ♀ ♀, Punjab, .—ii.— ; 2 ♂ ♂, 3 ♀ ♀, Sikkim (*Carmichael coll.*) ; 2 ♂ ♂, 1 ♀, West Bengal : Darjeeling, .—.—. 1860, 1911 (*Lynch coll.*) ; 1 ♂, Assam ; 8 ♂ ♂ 4 ♀ ♀, Meghalaya : Shillong, .—iii., v.—. ; 1 ♂, Nagaland. 1 ♂, Nepal. 2 ♂ ♂, Northern Burma : Rangoon.

Wing expanse : ♂ ♀, 40-65 mm.

Remarks : Ménétriès (1855) first described the subspecies as *Colias fieldi* only by the male from the Himalayas, though he (*loc. cit.*) did not indicate for it any specific sector of this broad area. Bingham (1907) and Evans (1932 a) synonymised the species with *C. croceous* (Fourcroy) and treated the same as its subspecies, while Fruhstorfer (1910) and Peile (1937) retained it as valid and included the Indian members under its nominal subspecies. Evans (1932 a, 1932 b) also placed under *C. croceous* (Fourcroy) another subspecies, i. é., *edusina* (C. & R. Felder) from Tibet and Baluchistan, which was considered under *C. fieldi* Ménétriès by both Riley (1927) and Peile (*loc. cit.*). Talbot (1939), however, reconsidered the long-used name, *fieldi* Ménétriès, for the only exotically distributed Indian subspecies and the other aforesaid forms as synonyms of *electo* (Linnaeus) under the genus *Colias* Fabricius, to which he (*loc. cit.*) also relegated *Eurymus* Swainson and *Eriocolias* Watson as congeners.

The butterfly, which is known to be the most primitive in the family Pieridae, is popularly called the Dark Clouded Yellow. Principally adapted to the hilly conditions, the subspecies shows a marked sexual dimorphism and is more common in the North-Western than in the North-Eastern Himalayas. It is, however, hardly seen in congregation in their habitats, particularly in the Tons area during the period under report. The geographical *cum* seasonal variations are obviously concerned with the varied aspects of altitudes in the diverse abodes of the subspecies. From the present data, it appears that the approximate sex-ratio of male female in the North-Eastern Himalayas is as to 1 : 0.5, while that in the North-Western sector is nearly identical. Wynter-Blyth (1957) reported the Indian shrub, *Indigofera dosua*, over and above Clover, Melilot and Trefoil (*N.O.* Leguminosae) from England, as the food plants of the butterfly. He (*loc. cit.*), however, confused the range of distribution of the species, *Colias electo* (Linnaeus), with that of its subspecies, *C. electo fieldi* Ménétriès, by wrongly quoting Talbot (1939) who actually mentioned the distribution of the species from Europe to Northern Burma. The distribution of the subspecies was hitherto known from c 910 to 4550 metres in the Himalayas, but presently it is recorded new for a still higher elevation at c 4850 metres of the Tons area whence the specimens show the range of their wing expanse between 40 and 50 mm in either sex. Talbot (*loc. cit.*), however, commented on the misidentification and also non-availability in India of *C. fieldi*, ♀ f. *leucania* Röber, which the author has not ever seen.

The author adopts the Talbot's (1939) concept with certain modifications based on closer examination of all the one hundred and eleven specimens. The present study reveals certain variances of opinion in relation to the Talbot's (*loc. cit.*) observations on the subspecies. First, the treatment of characters was rather inadequate particularly in respect of the detailed colourations of wings in both sexes. Secondly, the interpretation of individual variations based on the size-criterion was not much satisfactory, since he (*loc. cit.*) himself admitted the fact of simultaneous occurrence of both the small "*edusina*" and the large anonymous form in the North-Western Himalayas ; hence, in the absence of definite jurisdiction for such forms, "*edusina*" is not presently included as a local morpho-variation. Lastly, the seasonal variations were not emphatically elaborated by him (*loc. cit.*) under the infra-specific account, although these were earlier referred to by Swinhoe (1909) and Gerould (1924). Keeping in view, the author gets a scope to redescribe the subspecies concerned.

II. FAMILY SATYRIDAE

3. *Aulocera brahminus brahminus* (Blanchard)

1844. *Satyrus brahminus* Blanchard, in *Jacquemont, Voy. de l'Inde*,
Ins., 4 : 22, pl. 2, fig. 4.

1911. *Aulocera brahminus brahminus*, Fruhstorfer, in *Seitz, Macrolep.*
World, Fauna Indo-Australia, 9 : 309.

Diagnostic characters : Fore wings with discal spots interiorly colinear between M_3 and anal vein : ventrally with subapical ocellus large. Hind wings with discal band of uniform width and oblique.

Morph (f.) : Only one, out of two known forms, to which the present material is referable, is given below (for reference, *vide* Talbot, 1947).

f. *Werang Lang* : Hind wings dorsally with the discal band quite prominent and reaching the anal margin, and ventrally strewn with brown striae almost throughout.

Distribution : India : Jammu & Kashmir ; Himachal Pradesh (Kulu) ; Uttar Pradesh (Mussoorie ; at the snows in the Nila and Tons). Bangladesh : Sylhet.

Material examined : One ♂ (BC-ACI), c 5000 m, 3. x.

Wing expanse : 56 mm.

Remarks : The butterfly, popularly called the Narrow-Banded Satyr, is known to occur rarely at high altitudes during July and August. It is shade-loving in nature, assumes protective colouration amidst the mountains and shows its size fairly reduced. It is allied more to *Aulocera brahminus dakwana* Evans from the Central and North-Western Himalayas than to *A. brahminns brahminoides* (Moore) from Sikkim and Southern Tibet, but can be readily distinguished from both of them by the characters mentioned above. The f. *werang Lang* from the North-Western Himalayas may similarly be distinguished from the f. *scylla* Butler from Sylhet of Bangladesh.

4. *Aulocera swaha swaha* (Kollar)

1844. *Satyrus swaha* Kollar, in *Hügel, Kasch. Rei. Sei*, 4 (2) : 444, pl. 14, fig. 1.

1911. *Aulocera swaha swaha*, Fruhstorfer, in *Seitz, Macrolep. World, Fauna Indo-Australia*, 9 : 309.

Diagnostic characters: Fore wings with discal spots interiorly not colinear between M_3 and anal vein, the spots being white but tinged with creamy-yellow. Hind wings with discal band broadly greyish and tapering posteriorly; ventrally, with the anal base greenish.

Distribution: Pakistan: Chitral; North-West Punjab. India: Himachal Pradesh (Kangra); Uttar Pradesh (Tons area; Mussoorie; Naini Tal); North-East Punjab; Sikkim.

Material examined One ♂, 1 ♀ (T—O), c 1969-2727 m., 27. ix.

Wing expanse: ♂, 55; ♀, 60 mm.

Remarks: The butterfly, popularly called the Common Satyr, is known to be locally common in the hilly meadows between c 1900 and 3000 metres in the North-Western Himalayas during the period from August to October. It can be distinguished by the above characters from *A. swaha garuna* Fruhstorfer from Kashmir to Kulu. The subspecies is known to be a high altitude dweller, though it is presently taken at an elevation much lower than that of *Aulocera b. brahminus* (Blanchard).

5. *Erebia (Callerebia) scanda scanda* Kollar

1844. *Erebia scanda* Kollar, in *Hügel, Kasch. Rei. Sei.*, 4(2): 452, pl. 17, figs. 3, 4

1947. *Erebia (Callerebia) scanda scanda*, Talbot, *Fauna Brit. India, Butterflies*, 2: 308.

Diagnostic characters: Fore wings with the dorsal ocellus bipupilled and of moderate size; the ventral one enclosed by a pale broad ring. Hind wings dorso-ventrally with a bipupilled ocellus in the area of Cu_{1b} ; ventrally, with white specks and a small additional ocellus in the area of Cu_2 . Both pair of wings distally much pale brown, with the terminal line indistinct.

Distribution: India: Jammu & Kashmir (Kashmir); Himachal Pradesh (Kangra); Uttar Pradesh (Tons area; Kumaon Hill; Mussoorie); South Sikkim. Nepal.

Material examined: One ♀ (T—O), c 2700 m, 27. ix.

Wing expanse: 57 mm.

Remarks: Popularly known as the Pallid Argus, the butterfly is locally common and univoltine in habit. It differs by the above characters from *Erebia (Callerebia) scanda opima* (Watkins)

from the North-Eastern Himalayas. Earlier, it was recorded at a maximum altitude between *c* 2150 and 3350 metres in the Kumaon Hill during the period from July to September by Doherty (1886), Mackinnon & de Nicéville (1897) and also Hannington (1910).

6. *Ypthima sakra nikaea* Moore

1874. *Ypthima nikaea* Moore, *Proc. zool. Soc. Lond*, p. 567.

1911. *Ypthima sakra nikaea*, Fruhstorfer, in Seitz, *Macrolep. World, Fauna Indo-Australia*, 9 : 292.

Diagnostic characters : Fore wings dorsally dark brown with a male brand. Hind wings ventrally with a pair of anal ocelli within a common iris, one interiorly pushed in the area of Cu_{1a} , one well developed in the area of M_1 and also one paired contiguous irides, each enclosing a single subapical ocellus. Both pair of wings without band.

Distribution : India : North-Western Himalayas (Western Garhwal : Tons ; Kumaon) ; Punjab (Murree).

Material examined : One ♂ (J-N), *c* 1400 m, 25. ix.

Wing expanse : 44 mm.

Remarks : Popularly known as the Himalayan Fivering, the butterfly is known to occur exclusively in the wet-season period. Talbot (1947) reported the subspecies to be common in the Kumaon Hills. It is recorded new for Western Garhwal. It still maintains its endemic status in the North-Western Himalayas of India proper. Talbot (*loc. cit.*) considered the element as one of the components of the PHILOMELA-species group.

III. FAMILY NYMPHALIDAE

VANESSA—genus group

7. *Aglais cashmiriensis cashmiriensis* (Kollar)

1844. *Vanessa cashmiriensis* Kollar, in Hügel, *Kasch. Rei Sei.*, 4(2) 442. pl. 11, figs. 3, 4.

1932 a. *Aglais cashmiriensis cashmiriensis* Moore, *Lep. Indica*, 4 : 87, pl. 316, figs 3, 3a.

Diagnostic characters : Ground-colour tawny. Fore wings with black markings as on tortoise-shell—one in cell, one discal and

another postdiscal—all being intervened by yellow ; one spot each at the origin of Cu_{1a} and Cu_{1b} ; terminal band slender. Hind wings with anal border fuscous, subterminal row of blue-centered black spots narrower than the tawny area between it and the disc.

Distribution : Pakistan : North Waziristan ; Safedkoh ; Chitral. India : Himachal Pradesh (Kulu : Simla) ; Uttar Pradesh (Garhwal, including the Tons).

Material examined : One ♂ (B), c 1000 m, 23. ix.

Wing expanse : 56 mm.

Remarks : The butterfly, popularly called the Indian Tortoise Shell, is restricted in the North-Western Himalayas of the Indian subregion at its subspecific status. With its sunlight-preferring habit and ill-developed secondary sexual characters in male, the form is known to be rather common up to an altitude of about 5000 metres in the areas other than the Tons of the North-Western Himalayas. Evans (1932 a) placed the butterfly in the URTICAE-species group and according to the present trend, this group now includes the members of the genus *Aglais* Dalmann.

IV FAMILY LYCAENIDAE

SUBFAMILY LYCAENINAE

(a) CUPIDO—genus group

8. *Celastrina argiolus kollari* (Westwood)

1852. *Lycaena kollari* Westwood, in *Doubleday, Westwood & Hewitson, Gen. Di. Lep.*, 2 : 491.

1962. *Celastrina argiolus kollari*, Cantlie, *Lycaen. port. Brig. Evans' "Ident. Indian Butt."*, p. 49, pl. 27.

Diagnostic characters : Fore wings blue, with the black terminal border narrow in male and bluish white, with the border wide in female ; discal row incomplete with the spot in area of M_1 shifted exteriorly ; termen markedly convex. Hind wings with discal spot in area of M_1 shifted interiorly ; base with a greenish blue sheen. Both pair of wings with the terminal border apically dilated, quadrate androconia and without dorso-discal white patch in male ; ventrally, ground-colour white with black markings.

Distribution : Pakistan : Chitral. India : North-Western Himalayas (Tons area; up to Kumaon).

Material examined : One ♂, 1 ♀ (N-T), c 1400 m, 26. ix.

Wing expanse : ♂, 27, ♀, 32 mm.

Remarks : Popularly known as the Hill Hedge Blue, the butterfly was reported by Evans (1932 a) and Cantlie (1962) as common in status. It is fond of light and shade of the primeval forests and low-flying in habit amidst hedges at lower altitude. It, however, shows no seasonal variation. The subspecies is readily distinguished by the shape of terminal border of fore wings and ventral ground-colour of both pair of wings from its ally, *C. argiolus jyntheana* de Nicéville from Nepal to Dawnas.

9. *Zizeeria maha maha* (Kollar)

1844. *Lycaena maha* Kollar, in Hügél, *Kasch. Rei. Sei.*, 4 (2) : 422.

1932 a. *Zizeeria maha maha*, Evans, *Ident. Indian. Butt.*, ed. 2 : 234, pl. 27.

Diagnostic characters : Fore wings dorsally dark brown, with a narrow black border in female; ventrally with a bar on the disc and a spot each in cell and in the area of R_5 at costa. Hind wings ventrally with a discal spot in the area of M_1 , being equidistant between one in the area of R_s and that in the area of M_2 , and also another in the area of Cu_2 . Both pair of wings basally suffused blue in female and ventrally with prominent markings.

Distribution : Pakistan : Baluchistan. India : Jammu & Kashmir ; Himachal Pradesh ; Uttar Pradesh (including the Tons area) ; Sikkim ; Assam ; Northern Peninsula. Burma.

Material examined : 2 ♀ ♀ (P-J ; J-N), 1300-1400 m, 24-25. x.

Wing expanse : 26-27 mm.

Remarks : Popularly known as the Pale Grass Blue, the butterfly is low-flying in habit in the Indian subregion. It is known to exhibit sexual dimorphism, in which the male is dull brown with a broad diffused black border on fore wings. Bingham (1907) exhaustively dwelt upon the seasonal variations, while Cantlie (1962) mentioned the males as "very variable". It is, however, not possible at the moment to corroborate their (*loc. cit.*) findings, since the material at hand is very poor. The subspecies is the smallest known of all the butterflies from India and abroad, while its ally, *Zizeeria maha ossa* (Swinhoe) from Peninsular India, is only a little larger in size.

(b) LYCAENA—genus group

10. *Lycaena phlaeas stygianus* (Butler)

1844. *Gerydus stygianus* Butler, *Ann Mag. nat Hist.*, (5) 13 : 194.

1962 *Lycaena phlaeas stygianus*, Cantlie, *Lycaen. port. Brig. Evans' "Ident. Indian Butt."* p. 83.

Diagnostic characters : Fore wings dorsally with dark scales poorly suffused brown in male ; ventrally, with apex broadly grey-brown in both male and female. Hind wings dorsally with small bluish discal spots, ventrally, the spots still smaller. Both pair of wings with ground-colour pale. Size small.

Distribution : Pakistan : Baluchistan ; Chitral. India : Jammu & Kashmir (Ladakh) ; Uttar Pradesh (Western Garhwal, including the Tons area).

Material examined : 2 ♂♂, 1 ♀ (T-O), c 2700-3000 m, 27. ix., 1.x.

Wing expanse : ♂, 26 ; ♀, 29 mm.

Remarks : Popularly known as the Common Copper, the butterfly is a common alpine dweller. The subspecies is restricted in the North-Western Himalayas of the Indian subregion. It was indicated by Evans (1932 a) as, "(= *eleus*, F. : *timeus*, Cr. : *baralacha* M.)", while Cantlie (1962) later reconsidered only *baralacha* (Moore) as a distinct subspecies from Kashmir to Nepal, with *indicus* Evans as its synonym under the species, *Lycaena phlaeas* (Hübner)

11. *Heliophorus sena* (Kollar)

1844. *Polyommatus sena* Kollar, in Hügel, *Kasch. Rei. Sei.*, 4(2) : 415.

1962. *Heliophorus sena*, Cantlie, *Lycaen. port. Brig. Evans' "Ident. Indian Butt."* p. 85.

Diagnostic characters : Fore wings dorsally dark shiny violet with broad terminal border in male ; ventrally deep yellow. Hind wings dorsally with a red terminal band in male ; ventrally, greenish brown with a distinct white line inside the terminal area ; black spots prominent at costa and anal margin near base.

Distribution : Pakistan ; Chitral. India : Jammu & Kashmir ; Himachal Pradesh ; Uttar Pradesh (Garhwal Himalayas, including the Tons area ; Kumaon).

Material examined : One ♂ (B), 1000 m, 23. ix.

Wing expanse : 26 mm.

Remarks : Popularly known as the Sorrel Sapphire, the species is restricted to the North-Western Himalayas of the Indian subregion. It is known to exhibit an extreme sexual dimorphism, in which the female is dorsally dark brown, with the red terminal band of hind wings being continued on to the fore pair. The male, as mentioned by Wynter-Blyth (1957), is more common in the open meadows than the female which does "not come out in the open much" The species is not represented by any subspecies on record.

B. Suborder Heterocera (Moths)

V FAMILY EUPTEROTIDAE

12 *Apona cashmirensis* (Kollar)

1848. *Gastropacha cashmirensis* Kollar, in *Hügel Kasch. Rei Sei.*, **4**(2) : 472, pl 21, fig. 4.

1892. *Apona cashmirensis*, Hampson, *Fauna Brit. India, Moths*, **1** : 52.

Diagnostic characters : Fore wings with apex produced, a black spot at end-cell. discal line curved below costa, postdiscal lines well defined, subterminal line diffused and terminal area much darker. Hind wings with subbasal and other lines obsolescent. In male, body and wings red-brown.

Distribution : India : Jammu & Kashmir ; Himachal Pradesh (Simla) ; Uttar Pradesh (Western Garhwal, including the Tons area) ; Sikkim.

Material examined : One ♂ (O—H), c 3340 m, 30. ix

Wing expanse : 90 mm.

Remarks : Popularly recognised as one of the series of Strichnoterygids, or Phialids, or Janids, the species is endemic in the Indian Himalayas and exhibits a befitting adaptation to the alpine climate. It shows sexual dimorphism, in which the female is greyish white and smaller than the male. It is very much allied to *Apona plumosa* Moore from the Nilgiri plateau in general facies ; also, it is allied to *A. shevaroyensis* Moore from the Shevaroyes of Northern Burma and elsewhere with the fore wings devoid of subbasal line ; but it can be distinguished from both the allies mainly by the fore wings with apex produced and also by the smaller size. Strand (1924) considered *major* Rothschild as the only Indian subspecies from Sikkim, with "its larger size, the less reddish yellow-cinnamon ground-colour and

the more distinct markings", but the present material does not fit in it.

VI. FAMILY ZYGAENIDAE

SUBFAMILY CHALCOSIINAE

13. *Chalcosia auxo albata* Moore

1879. *Chalcosia albata* Moore, *Proc. zool. Soc. Lond.*, p. 390.

1908. *Chalcosia auxo albata*, Jordan, in Seitz, *Macrolep. World, Fauna Indo-Australia*, 10 : 37.

Diagnostic characters : Body tinged blue. Fore wings dorsally metallic blue-green, with a pale yellow patch below cell, white discal band, prominent subapical spots and distally black between veins. Hind wings yellowish white, without black streak in cell and the terminal band irregular, black with blue spots and not reaching the anal angle ; ventrally, with black terminal band enclosing blue and white spots.

Distribution : India : North-Western Himalayas, including Western Garhwal (Tons area). Nepal.

Material examined : One ♂ (N—T), c 1400 m, 26. ix.

Wing expanse : 50 mm.

Remarks : Popularly known as one of the series of Burnets, the moth constitutes new locality record for Western Garhwal. Earlier considered by Hampson (1892) in the synonymy list of *Chalcosia idaeoides* Herring-Schäffer, now a subspecies of *Chalcosia auxo* (Linn.), *sensu* Jordan (1908), the present form is very closely allied to *C. auxo campa* Jordan from Tonkin, but can be readily distinguished from it by the characters, as mentioned above. The colouration of hind wings as "white" and "pure white", as observed by Hampson (*loc. cit.*) and Jordan (*loc. cit.*) respectively, may be considered as local variations. The moth exhibits diurnal habit.

VII. FAMILY LASIOCAMPIDAE

14. *Trabala vishnou* (Lefebvre)

1827. *Gastropacha vishnou* Lefebvre, *Zool. J.*, 3 : 207.

1887. *Trabala vishnou* (nec 'vishnu'). Cotes & Swinhoe, *Cat. Moths India*, 2 : 212 (No. 1456).

Diagnostic characters : ♂.—Body light apple-green. Antennae brownish. Fore wings with prediscal line present, discal speck dark and postdiscal line oblique. Hind wings with the discal line contiguous with the postdiscal line of fore pair. Both pair of wings with a series of small subterminal dark spots ; cilia dark brown.

Distribution : West and South-East China, including Hong Kong. India : Jammu & Kashmir (Kashmir) ; Himachal Pradesh (Kulu ; Simla) ; Uttar Pradesh (Western Garhwal : the Tons) ; Sikkim ; Assam (Sibsagar ; Silchar ; Cherrapunji) ; Meghalaya (Shillong ; Khasis) ; West Bengal (Calcutta) ; Bihar (Murree) ; Maharashtra (Bombay) ; Tamil Nadu (Nilgiris) ; Andaman Islands. Bhutan. Bangladesh : Sylhet. Burma. Sri Lanka. Sundaland.

Material examined : One ♂ (T), c 1500m, 12. x.

Wing expanse : 38 mm.

Remarks : Popularly known as one of the series of Shaggy-Haired Worms, the moth is sluggish in habit amidst the bush-wood under the state of protective resemblance and exhibits a marked sexual dimorphism. Reportedly, the female is much larger than male and ochreous-yellow to yellowish green, with fore wings having a large grey-centered discal spot and a black-irrorated red-brown patch along the entire dorsum. Cotes & Swinhoe (1887) referred to the wider variations of adults, while Grünberg (1911) dealt with the larval forms of the species. The material, which constitutes new locality record for Western Garhwal, is quite smaller as compared to the wing expanse varying between 50 and 60 mm for the male after Hampson (1892). The species can be well differentiated by the above characters from its ally from Tavoy to Java and Borneo, i.e., *Trabala irrorata* Moore, of which the Burmese distribution, *sensu* Cotes & Swinhoe (*loc. cit.*) and also Hampson (*loc. cit.*), was not, however, mentioned by Grünberg (1923).

VIII. FAMILY ARCTIIDAE

SUBFAMILY LITHOSIINAE

15. *Eilema affineola* (Bremer)

1864. *Lithosia affineola* Bremer, *Lepid. Ost-sibiriens*, p 97, pl. 8, fig. 5.

1922. *Eilema affineola*, Strand, in *Junk, Lep. Cat*, 26 : 532.

Diagnostic characters : Fore wings light straw-coloured ; costa suffused blackish. Hind wings with costa dorsally rather dark ; apex pointed ; ventrally not broad yellow.

Distribution : U.S.S.R. : Amur ; Ussuri. Korea. Japan : Tsushima ; Ohoyama. China : Shanghai ; Ichang. India : Jammu & Kashmir (Kashmir) ; Himachal Pradesh (Kulu) ; Uttar Pradesh (Western Garhwal, including Tons) ; West Bengal (Darjeeling) ; Sikkim.

Material examined : One ♀ (J—N), c 1454 m, 13. x.

Wing expanse : 42 mm.

Remarks : Popularly known as one of the series of Lichen Moths, the species is very much allied to *Eilema caniola* f. *vitellina* Boisduval from Europe. Seitz (1910), however, mentioned for the present species only one form, i.e., f. *aprica* Butler, from Japan and China, "which is unknown" to him. The moth is rather common during the summer and occurs at day time on the undersurface of foliage with wings folded. It is reported to show secondary sexual characters in male with setiform antennae and shaggy-haired abdomen which is much shorter in female.

IX. FAMILY NOCTUIDAE

SUBFAMILY HADENIINAE

16. *Hyphilare loreyi* (Duponchel)

1827. *Leucania loreyi* Duponchel, *Hist. nat. Lep. Fr.*, 4 : 81, pl. 105, fig. 7.

1910. *Hyphilare loreyi*, Warren, in Seitz, *Macrolep. World, Fauna Palaeartica*, 1 : 96, pl. 23 e, f.

Diagnostic characters : Fore wings greyish ochreous with a short black streak from base below cell, reniform stigma reduced to a white dot at lower angle of cell, terminal row of black dots on veins and subapical patch triangularly brown, being continuous with a pale oblique apical streak. Hind wings white, with veins fuscous near termen.

Distribution : Europe : Britain ; Spain ; Portugal ; Italy ; France ; Switzerland ; Austria. Africa : Egypt ; Morocco ; The Canaries ; Madeira. Western Asia : Asia Minor ; Armenia ; Syria. Pakistan : Karachi. India : Himachal Pradesh (Solan ; Kulu) ; Uttar Pradesh (Western Garhwal : the Tons) ; Sikkim ; Maharashtra (Bombay ; Pune). Burma. Sri Lanka. Japan.

Material examined One ♀ (B), c 1000 m, 23.ix.

Wing expanse : 32 mm.

Remarks : The species, popularly known as one of the series of Night fliers, was earlier considered by Hampson (1894) to have a fairly long synonymy list but excluding *caricis* Treitschke, which alone was subsequently relegated to the conspecific status of the same by Warren (1910). Both Hampson (*loc. cit.*) and Warren (*loc. cit.*) did not, however, specify the Indian localities of the species, though the former mentioned its distribution as "throughout India" and the latter, as "tropical" over and above the other ranges, as mentioned above. From the literature review, the cosmopolitan distribution of the species in India seems to be doubtful. Presently, it constitutes new locality record for the Western Garhwal Himalayas. The moth is reported to have secondary sexual features in male with antennae ciliated and abdominal tuft of hairs. It feeds on the graminaceous plants. It has been observed in the field to be attracted to the hilly flowers on a straight flight.

X. FAMILY GEOMETRIDAE

SUBFAMILY GEOMETRINAE

17. *Percnia* (*Xenoplia*) sp.

Diagnostic characters : Body much suffused with fuscous. Head and thorax black-spotted. Fore wings with costal and terminal areas irrorated with fuscous markings ; short fulvous streaks on veins near base ; postdiscal series of spots diffused. Hind wings with a single postdiscal and terminal series of small spots. Both pair of wings with ground-colour much white and tinged melanic. Abdomen a little longer than hind wings.

Material examined : One ♂ (T-0), c 2600 m, 27.ix.

Wing expanse : 41 mm.

Remarks : The species, popularly known as one of the series of Loopers or Ground-Measurers, is very much allied to *Percnia* (*Xenoplia*) *foraria* Guenée from India, China and Japan in respect of the black spots on head and thorax, short fulvous streaks on veins near base of fore wings and postdiscal and terminal series of spots of hind wings, but can be distinguished from it by the other colourations of body and wings as mentioned above. With this, the species under study is not merely a new record for the Garhwal Himalayas, but appears, on the other hand, to be new to science, though it could not be described forthwith on account of paucity of the material and also non-availability of the type of its allied form. The present species, in addition, is rather much smaller in wing expanse as compared to that recorded at 48-56 mm. by

Hampson (1895) for its ally. The moth is well adapted to the alpine climate with its slender build, small size and ample wings tinged melanic. It shows weak flight and sucks nectar from flowers at day time. The female could not be seen during the present survey.

RESUME

L' article s'agit de l'étude systématique accompagnée d'une liste de 17 espèces et de leurs formes des Lépidoptères y compris 11 de papillons et 6 de phalènes récoltées au cours de "Indian Tons Valley Expedition—1972" au Garhwal dans les Himalayas du nord ouest à l'Uttar Pradesh de l'Inde sous l'organisation de "DUTAGAR", le club de montagne à Calcutta. Il aussi s'incorpore de la revue d'un papillon des Pieridae, *Colias electo fieldi* Ménétrières, de la région Indo-palaearctique en outre d'un compte rendu générale de l'expédition du vale de Tons à la première fois concernant de climatologie, de zonation biotique, de route et de durée de marche au pas dans l'endroit exploré. Le compte rendu est précédé de l'investigation antérieure de la faune des Lépidoptères dans les Himalayas de nord-ouest et suivi d'observation du champs, de biogéographie, d'habitude, d'adaptation au froid et des références les plus récentes par rapporte aux matériaux actuels. Tous les animaux ont été récoltés par l'auteur de la part de Zoological Survey of India d'une range d'altitudes variant entre 1000 et 5000 mètres environ sur l'expédition qui est aussi assistée par les fonctioners de la part d'Anthropological Survey of India. Tous les matériaux ont pour nouveaux dossiers de répartition de l'aire de Tons y compris les quatre espèces, à savoir, *Ypthima sakra* Moore, *Trabala vishnou* (Lefebvre), *Chalcosia auxo* (Linné) et *Hyphilure loreyi* (Duponchel), aussi pour Garhwal de l'ouest entier. Il n'y a qu'une sousespèce, *Y sakra nikaea* Moore, qui est jusqu'ici connue comme endémique dans les Himalayas du nord-ouest en Inde propre. En fin, un tableau de répartition et aussi une carte montrant la territoire de Tons traversée ont été pourvues.

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REFERENCES

[Pages and also figures, if any, in the periodicals other than books, treatises and catalogues, have been indicated].

- ARORA, G. S. & MANDAL, D. K., 1977. On scientific results of Swiss Zoological Expedition to India. Part I Butterflies of Garhwal District (U. P. : India. *Newsl. zool. Surv. India*, 3(4) : 229-234.
- ARORA, G. S., MANDAL, D. K. & CHAUDHURY, M., 1977. On scientific results of Swiss Zoological Expedition to India Part II Moths of Garhwal District (North-Western Himalayas). *Newsl. zool. Surv. India*, 3(6) : 388-395
- BERNARDI, G. & DE LESSE, H., 1952. Lépidoptères récoltés par A. Barbezat au cours de l'expédition Lyonnaise—1951 au Garhwal. *Bull. mens. Soc. linn. Lyon*, 21(3) : 203-206, 2 figs ; (4) : 251-256 ; (5) : 256-258 ; (6) : 258-259.
- BINGHAM, C. T., 1907. *Fanna of British India*, Butterflies, 2 : London.
- BUTLER, A. G., 1886. On butterflies collected by Major Yerbury in Western India. *Proc. zool. Soc. Lond.*, pp. 355-395, pl. 35.
- CANTLIE, K., 1962. *Identification of Indian Butterflies—Evans' Lycaenidae revised*. London.
- COTES, E. C. & SWINHOE, C., 1887. *Cat. Moths India*, 2 : Calcutta.
- DOHERTY, W., 1886. A list of butterflies taken in Kumaon. *J. Asiat. Soc. Beng.*, 55(2) : No. 3, pp. 103-140.

- EVANS, W H., 1932 a. Identification of Indian Butterflies, ed. 2 (revised) Madras.
- EVANS, W H., 1932 b. The butterflies of Baluchistan. *J. Bombay nat. Hist. Soc.*, 36 : 196-209.
- FRUHSTORFER, H., 1910. In *Seitz, Macrolepidoptera of the World, Fauna Indo-Australia*, 9. Stuttgart.
- GEROULD, S. H., 1924. Seasonal changes in the melanic pigmentation in butterflies of the genus *Colias*. *Anat. Rec.*, 29 : 93-94.
- GRUNBERG, K., 1911. In *Seitz, Macrolepidoptera of the World, Fauna Palaeartica*, 2 : Stuttgart.
- GRUNBERG, K., 1923. In *Seitz, Macrolepidoptera of the World, Fauna Indo-Australia*, 10. Stuttgart.
- HAMPSON, G. F., 1892. *Fauna of British India, Moths*, 1. London.
- HAMPSON, G. F., 1894. *Fauna of British India, Moths*, 2. London.
- HAMPSON, G. F., 1895. *Fauna of British India, Moths*, 3. London.
- HANNYNGTON, F., 1910. The butterflies of Kumaon. *J. Bombay nat. Hist. Soc.*, 20(1) : 130-142 ; (2) : 361-372.
- HANNYNGTON, F., 1911. The butterflies of Kumaon. *J. Bombay nat. Hist. Soc.*, 20(3) : 871-872.
- HAUDE, G., 1912. Neue *Charltonius*-formen Gray von Nilang-Passe. *Societas ent.*, 27(17) : 75-76, figs. 1-3.
- JORDAN, K., 1908. In *Seitz, Macrolepidoptera of the World, Fauna Indo-Australia*, 10. Stuttgart.
- LANG, A. M. & MOORE, F., 1864. Notes on the diurnal Lepidoptera of North-Western India. *Entomologist's mon. Mag.*, 1 : 101-104, 131-133, 181-183.
- MACKINNON, P. W & DE NICEVILLE, L., 1897. A list of butterflies of Mussoorie in the Western Himalayas and neighbouring region. *J. Bombay nat. Hist. Soc.*, 11 : 205-221.
- MACKINNON, P. W & DE NICEVILLE, L., 1898. A list of butterflies of Mussoorie in the Western Himalayas and neighbouring region. *J. Bombay nat. Hist. Soc.*, 11 : 368-389, 585-605, pls.
- MANDAL, D. K. & CHAUDHURY, M., 1977. On a collection of butterflies (Lepidoptera : Rhopalocera) of the Indian Kalidhang Expedition—1974. *Newsl. zool. Surv. India*, 3(6) : 341-345.
- MANI, M. S., 1962. *Introduction to high altitude entomology*. London.
- MANI, M. S., 1968. Ecology and biogeography of high altitude insects. In *Junk, Series Entomol.*, 4 : 527+xiv., 80 figs.

- MENETRIES, E., 1855 *Enum. Corp. Anim. Mus. P. tr.*, 1
- MOORE, F., 1878. Descriptions of new species of Lepidoptera collected by the late Dr. F. Stoliczka during the Indian Govt. Mission to Yarkand in 1873 *Ann. Mag. nat. Hist.*, (5) 1 : 227-237.
- PEILE, H. D., 1937. *A guide to collecting butterflies of India*. Bombay.
- RILEY, N. D., 1927. The Rhopalocera of the third Mt. Everest Expedition. *Trans. ent. Soc. Lond*, 75 : 119-129.
- SCHMID, F., 1955. *Contribution à l'étude des Limnophilidae (Trichoptera)*. Lausanne (Suisse).
- SEITZ, A., 1910 In *Seitz, Macrolepidoptera of the World, Fauna Palaearctica*, 2. Stuttgart.
- STEMPFER, H., 1952. Lépidoptères récoltés par A. Barbezat au cours de l'expédition Lyonnaise—1951 au Garhwal. *Bull. mens. Soc. linn. Lyon.*, 21(11) : 181-184.
- STRAND, E., 1924. In *Seitz, Macrolepidoptera of the World, Fauna Indo-Australia*, 10. Stuttgart.
- SWINHOE, C., 1909. *Lep. Indica*, 7 : 97-184.
- TALBOT, G., 1939. *Fauna of British India, Butterflies*, 1. London.
- TALBOT, G., 1947. *Fauna of India, Ceylon and Burma, Butterflies*, 2. London.
- WARREN, W., 1910. In *Seitz, Macrolepidoptera of the World, Palaearctic Noctuidiform Phalaenae*, 3. Stuttgart.
- WYNTER-BLYTH, M. A. 1957. *Butterflies of the Indian region*. Bombay.

TABLE OF FIELD OBSERVATION

[Cf. material of species and subspecies examined under Systematic Account]

Locality with code in parentheses I	Range of altitude in metre (m) II	Date and hour of collection III	Climate IV	Vegetation V	Lepidopteran sp./subsp. collected by the author VI
Along the roadside ditch at Barcot (B) between Uttarkashi & Puraula	c 115.-1212	23. ix. 1972 : 11. 0-12.00	Sunny' with temperature at about 12°C	Phanerogamic afforestation	<i>Aglais c. cashmiriensis</i> (Kollar) <i>Heliophorus sena</i> (Kollar) & <i>Hyphilare loreyi</i> (Duponchel)
Between Puraula & Jarmola (P-J)	c 1212-1454	24. ix., 14. x. 1972 : 14 30-20 30	Intermittantly sunny and cloudy during day-time and rainy at night	Algae, Fungi, Mosses, Pines, Deodars, Firs, Juglans, etc. ; also the angiosperms of <i>N.O. s</i> Compositae, Verbenaceae, Labiatae, Canabaceae, Graminae, etc., including the cereals amongst terraced cultivation	<i>Zizeeria m. maha</i> (Kollar)
Between Jarmola & Naitwar (J-N)	c 1454-1394	25. ix., 13. x. 1972 : 09.00-19.00	Cloudy and rainy	Mostly paddy and grasses	<i>Eurema hecabe contubernalis</i> (Moore), <i>Ypthima sakra nikaea</i> Moore, <i>Zizeeria m. maha</i> (Kollar) & <i>Eilema affineola</i> (Bremer)

(ii)

I	II	III	IV	V	VI	Contd.
Between Naitwar & Taluka (N-T)	c 1394-1969	26. ix., 12. x. 1972 : 09.15-18.15	Cold and dry	Apparently changing to Nettles and Gymnospermic forms for a certain distance towards higher elevations	<i>Celastrina argiolus kollari</i> (Westwood). <i>Chalcosia auxo albata</i> Moore & <i>Trabala vishnou</i> (Lefebvre)	
Between Taluka & Osla (T-O)	c 1969-2727	17. ix., 11. x. 1972 : 08.00-16.30	Colder and drier, being often accompanied by mild snowfall	Densely wet forest with Algae, Fungi, Lichens, Mosses, Ferns, Junipers, Juglans, Cactii, Barleys, Birches, Cardamums, Pears, Oaks, Millets, Paddy, Potatoes, etc.	<i>Colias electo fieldi</i> Ménétrés <i>Aulocera s. swaha</i> (Kollar), <i>Erebia s. scanda</i> Kollar, <i>Lycaena phlaeas stygianus</i> (Butler) & <i>Percnia</i> sp.	
Between Osla & Har-ki-Dun (O-H)	c 2727-3340	29-30. ix. 1972 : 10.30-15.30	Chilly cold with snowfall alternating with sunlight	Junipers, Birches, Chrysanthymum, Rhododendron, Black-Berries, Nettles, small grasses, etc.	<i>Lycaena phlaeas stygianus</i> (Butler) & <i>Apona cashmirensis</i> (Kollar)	
Between Osla & Pre-Base Camp (O-PBC)	c 2727-3950	1. x. 1972 : 08.00-17.00	Rarified and windy	Scattered Magnolia and Birches at lower elevations, being replaced by Buggyals at higher elevations	<i>Colias electo fieldi</i> Ménétrés	

(iii)

I	II	III	IV	V	VI	Contd.
Between Pre-Base Camp & Base Camp (PBC-BC)	c 3950-4270	2.9-x. 1972 : 09.00-13.00	Almost incessant snowfall	Highly scattered grasses with stunted growth	<i>Colias electo fieldi</i> Ménétriés	
Between Base Camp & Advance Camp I (BC-ACI)	c 4270-5000	3.5-x. 1972 : 09.00-13.00	Highly rarified	Flore scanty in vision, being mostly covered under snow	<i>Colias electo fieldi</i> Ménétriés & <i>Aulocera b brahminus</i> (Blanchard)	
Between Advance Camp I & Advance Camp II (AC I-AC II)	c 5000-5200	6. x. 1972 : 09.00-15.00	Temperature nearly at—5°C; snowfall approximately 25-30 cm during 24 hours	No trace of flora	No Lepidoptera observed	
Between Advance Camp II & the Foot of Dumdhar Kandi Pass (AC II-FDKP)	c 5200-5575	7. x. 1972 : 09.00-13.00	Profuse snowfall in the form of flakes, being later followed by blizzard for about an hour in the afternoon	No trace of flora	No Lepidoptera observed,	

E R R A T A

Pages	Lines from		Errors	To read
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