

**“DIVERSITY AND BIOECOLOGICAL STUDIES OF
BUTTERFLIES OF KASHMIR HIMALAYA”**

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By

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CERTIFICATE

No.....

Dated:

This is to certify that the thesis entitled “Diversity and Bioecological Studies of Butterflies of Kashmir Himalaya”, is the original work of Mr. Aijaz Ahmad Qureshi, Ph.D Research Scholar, P. G. Department of Zoology, University of Kashmir, Srinagar and is being submitted for the first time. The work has been carried out under the supervision and guidance of Prof. R. C. Bhagat, P. G. Department of Zoology, University of Kashmir.

It is further certified that the Scholar has put in the required attendance in the Department and fulfills all the requirements for the award of the degree of Doctor of Philosophy in Zoology.

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—Read! For thy lord is most bountiful,
Who has taught [man] the use of the pen,
[And] Taught man what he knew not!!

The Holy Quran (96:3-5)

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Abbreviations/symbols used in various chapters in the present thesis:

Aha -	Aharbal	ANT	:	Antenna	
Apr	:	April	Aru	:	Aru
Aug	:	August	Ban	:	Bandipora
Bar	:	Baramulla	Bud	:	Budgam
C	:	Common	CEN. GR:	:	Central Groove
Che	:	Cheshmashahi	Cu1a	:	1 st Cubitus
Cu1b	:	2 nd Cubitus	CLY	:	Clypus
DC	:	Discal Cell	Dec	:	December
Dnp	:	Dachigam National Park	Dod	:	Dodhpathri
Feb	:	February	FEM	:	Femur
Fig	:	Figure	Figs	:	Figures
FW	:	Forewing	Gan	:	Ganderbal
gen	:	Genus	genn	:	Genera
Gul	:	Gulmarg	Han	:	Handwara
Haz	:	Hazratbal	HMT	:	HMT
HL	:	Head Lobe	HW	:	Hindwing
Jaw	:	Jawahar Tunnel	Jun	:	June
Jul	:	July	Kas	:	Kashmir
Kha	:	Khanabal	Kul	:	Kulgam
LAB.PL:	:	Labial Palpi	LDC	:	Lower Discocellulars
m	:	Metre Above Sea Level	M ₁	:	1 st Median
M ₂	:	2 nd Median	M ₃	:	3 rd Median
Mag	:	Magam	Mar	:	March
MDC	:	Middle Discocellulars	May	:	May
mm	:	Milimetre	NC	:	Not Common
NR	:	Not Rare	Nis	:	Nishat
Nov	:	November	Oct	:	October
Pam	:	Pampore	Pah	:	Pahalgam
PC	:	Precostal Cell	Pul	:	Pulwama

PV	:	Precostal Vein	Qaz	:	Qazigund
R	:	Rare	R ₁	:	1 st Radius
R ₂	:	2 nd Radius	R ₃	:	3 rd Radius
R ₄	:	4 th Radius	R ₅	:	5 th Radius
Rs	:	Radial Sector	Sal	:	Salamabad
Sc	:	Subcosta	Sep	:	September
Shn	:	Shankarachriya	Sho	:	Shopian
Sop	:	Sopore,	sp	:	Specie
spp	:	Species	Sri	:	Srinagar
Tan	:	Tangmarg	TIB	:	Tibia
UDC	:	Upper Discocellulars	Uri	:	Uri
1A+2A:		1 st Anal Vein	3A	:	2 nd Anal Vein
*	:	New Record	^	:	Larval host plant
+	:	Species reported during present work			
-	:	Species not reported during present work			
¥	:	Included in the Wildlife Protection Act of India (1972)			

**“Dedicated
to my beloved Grandfather
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CONTENTS

CHAPTER	PAGE(S)
Certificate	i
Acknowledgements	ii-iv
Abbreviations	v-vi
1. GENERAL INTRODUCTION	1-7
1.1. Study Areas	1-2
1.2. Morphological features of butterflies	2-5
1.3. Economic importance of butterflies	5-7
2. MATERIAL AND METHODS	8-12
2.1. Collection & Preservation	8-9
2.2. Mountant and Slide mount (Permanent) preparation	9-11
2.3. Statistical methods and data techniques	10-12
3. REVIEW OF LITERATURE	13-28
3.1. Zoogeographical regions (General).....	13
3.2. Afrotropical region	14-15
3.3. Australian region	15
3.4. Nearctic region	15-18
3.5. Neotropical region.....	18-20
3.6. Indo-Malayan region	20-24
3.7. Palaearctic region	25-28
4. RESULTS AND DISCUSSION	29-91
4.1. Systematic account of butterfly-fauna and field studies	29-83
4.1.1. Key to the families of butterflies	29
4.1.1.1. Family Danaidae (Genus: <i>Danaus</i>).....	29-32
4.1.1.2. Family Hesperiiidae (Genus: <i>Pelopidas</i>)	32-33
4.1.1.3. Family Libytheidae (Genus: <i>Libythea</i>)	33-35
4.1.1.4. Family Lycaenidae (Genera: <i>Aricia</i> , <i>Lampides</i> , <i>Lycaena</i>)	35-38
4.1.1.5. Family Nymphalidae (Genera: <i>Argyreus</i> , <i>Childrena</i> , <i>Cynthia</i> , <i>Neptis</i> , <i>Phalanta</i> , <i>Junonia</i> , <i>Hypolimnas</i> , <i>Issoria</i> , <i>Vanessa</i>).....	38-56

4.1.1.6. Family Papilionidae (Genus: <i>Papilio</i>)	56-59
4.1.1.7. Family Pieridae (Genera: <i>Anaphaeis</i> , <i>Aporia</i> , <i>Catopsilia</i> , <i>Colias</i> , <i>Eurema</i> , <i>Gonepteryx</i> , <i>Pieris</i> , <i>Pontia</i>)	59-75
4.1.1.8. Family Satyridae (Genera: <i>Aulocera</i> , <i>Callerebia</i> , <i>Maniola</i> , <i>Melaniies</i> , <i>Pararge</i>)	76-84
4.2. Life-Cycle Studies of Nymphalids	84-88
4.2.1. Life-Cycle of <i>Cynthia cardui</i>	84-86
4.2.2. Life-Cycle of <i>Vanessa cashmirensis</i>	86-88
4.3. Bioecological Studies of some butterflies	88-91
5. CONCLUSION, CHECKLISTS, SUMMARY AND FIGURE PLATES	92-206
5.1. Conclusion	92-96
5.2. Systematic, updated and annotated checklist of butterflies	97-111
5.3. Checklist of Host-plants	112-118
5.4. Summary	119-120
5.4. Figure Plates (Drawings, Figures and Photographs)	121-206
6. BIBLIOGRAPHY	207-230

1. GENERAL INTRODUCTION

Butterflies are the most abundant group of insects on the earth which belong to the insect order Lepidoptera, under phylum Arthropoda and are recognizable among the general public, and science due to their beautiful colours, and graceful flight. The butterflies are found in every part of the world wherever the flowering plants are existing and even in very high-altitude, arctic, antarctic mountains, covered with perpetual snow and glaciers. Butterflies are one of the best studied groups, not only geographical subspecies, but even varieties, races, seasonal and sexual forms have been named and described from different regions of the world.

1.1. Study Areas:

The study area, Kashmir Valley, is of paramount importance, because of its central position in Asia, and also as a doorway in between Palaearctic and Oriental region in the Northern India. Kashmir Valley lies between $33^{\circ}.20'$ and $43^{\circ}.54'$ N Latitude and $73^{\circ}.55'$ and $75^{\circ}.35'$ E Longitude, covering an area of 15,948 Sq. Kms. Topographically, it is a deep elliptical bowl-shaped valley bounded by lofty mountains of the Pir Panjal Range in the south and south east and the Great Himalayan Range in the north and east, with 64% of the total area being mountainous. The valley is an asymmetrical fertile basin stretching from northeast to northwesterly direction. Its diagonal length (from southeast to northwest corner) is 187 Km, while the breadth varies considerably, being 115.6 Km along the latitude of Srinagar. The altitude of the floor of the valley at Srinagar is 1600m (above sea level). On the basis of temperature and precipitation, the Kashmir valley has four seasons as: (a) Winter Season (December to February); (b) Spring Season (March to May); (c) Summer Season (June to August) and (d) Autumn Season (September to November) in a year.

Kashmir Valley is divided into six districts- Anantnag, Baramulla, Budgam, Kupwara, Pulwama and Srinagar. However, with the creation of four new districts namely Bandipora, Ganderbal, Kulgam and Shopian, the total number of districts of valley has now increased to ten (Anonymous, 2008, 2009) (See Fig., 253; Plate- LXIX). In the present study, being first of its kind from the valley, nearly 60 different places belonging to ten administrative districts of the valley and falling in different altitudinal ranges were extensively surveyed during the years of 2004-2007. The district-wise localities and areas, covered during the course of present survey are: Anantnag (Aru, Baisaren, Jawahar Tunnel, Kokernag, Pahalgam,); Bandipora (Hajan, Sonwari,); Baramulla (Baba Reshi, Boniyar, Gantmulla, Gulmarg, Model

Town, Mirgund, Pattan, Salamabad, Sangri, Sopore, Tangmarg, Trikanjan, Uri,); Budgam (Budgam, Chadoora, Dodhpathri, Khan Sahib, Magam, Narbal, Soibugh); Ganderbal (Ganderbal, Safapora,); Kulgam (Kulgam, Qazigund); Kupwara (Batpora, Handwara, Langate, Trehgam, Vodhpora); Pulwama (Awantipora, Pampore); Shopian (Aharbal, Shopian) and Srinagar (Bemina, Botanical garden, Cheshmashahi, Dachigam National Park, Harwan, Hazratbal, HMT area, Hokersar, Nishat, Pantha Chowk, Parimahahal, Shankaracharya and Shalimar).

Some of the places like Aharbal, Aru, Baba Reshi, Botanical Garden, Cheshmashahi, Dachigam National Park, Harwan, Hazratbal, Hokersar, Kokernag, Nishat, Parimahahal, Pahalgam, Shankaracharya, Shalimar, Srinagar, and Uri, are famous tourist spots. Places like Baisaren and Dodhpathri, are the newly identified tourist places having tremendous diversity of flora and fauna, and were extensively surveyed for the butterfly fauna during the course of present study.

In the present study 40 species of butterflies, distributed over 29 genera, belonging to eight families, viz., Danaidae, Hesperiiidae, Libytheidae, Lycaenidae, Nymphalidae, Papilionidae, Pieridae and Satyridae, have been studied. Key to families, genera and species is presented in the present thesis. Biology of two species namely *Cynthia cardui* and *Vanessa caschmirensis* (Nymphalidae) is given for the first time. Eight species belonging to 3 families namely *Danaus genuita*, (Danaidae), *Catopsilia pomona*, *C. pyranthe*, and *Eurema hecabe* (Pieridae) and *Issoria gemmata gemmata*, *Junonia orithya*, *J. almana*, and *Phalanta phalanta* (Nymphalidae) are reported for the first time from Kashmir Himalayas. A systematic, updated and annotated checklist of 155 butterfly species including hitherto unknown species, being reported from Kashmir, is also given (see section 5.1.2). Besides this, many new food plants are being reported for the first time from this region and a checklist of host plants is also presented during the course of present study (see section 5.1.3).

1.2. Morphological Features of the Butterflies.

The butterfly body is made of three parts: head, thorax and abdomen. The head has a pair of antennae or feelers which are usually long and knobbed at the ends. The antennae are sensitive to touch and smell, and have a specific number of segments, sometimes of use in identification. There is a pair of compound eyes, one on each side of the head. The eyes are beveled so that a wide angle of vision is possible. The sight of butterflies like many other insects is good for detecting movements, but not details. Each compound eye is made up of thousands of tiny eye modules called ommatidia, each of which has a small lens connected to

the optic nerve. The other main feature on the head is tongue, or proboscis, used for sucking up liquids. Its structure resembles two straws fused together and zipped up, (Feltwell, 2001).

The first three segments from the head form the thorax, which bears legs and wings. There are three pairs of legs viz., Prothoracic, Mesothoracic and Metathoracic and each leg is divided into 5 segments - coxa, trochanter or hip, femur or thigh, tibia, and tarsus or foot. Coxa is the segment which is attached to the body. Trochanter is very small, between coxa and femur. Femur is the strongest part of the leg and shorter than tibia. Tibia is slender and may be long and freely movable. Sometimes tibia are armed with spurs or spines or with hair. Tarsus consists of five segments of variable length, the fifth ending in a claw, sometimes bifid, may be blunt or padded.

There are two pairs of membranous wings, called forewings and hindwings, which are supported by veins. The venation is a very important tool for classification and most of the identification of the butterflies is based on the venation and maculation of the wings. The broad area near the base from which the veins arise are known as cells. These also give important clues for identification of groups and species. The surface of the forewing is crossed by 12 veins which according to old numerical nomenclature are generally counted from 1 to 12, starting from the inner margin. However, technical names in place of numbers have been adopted in the present work, accordingly all the 12 veins are parts of five major veins namely Subcosta (Sc), Radius (R), Median (M), Cubitus (Cu) and Anal (A). The Subcosta is always undivided. There are five branches of Radius (R_1 to R_5), three branches of Median (M_1 to M_3) and two branches of Cubitus (Cu1a and Cu1b). The two Anal veins exist separately as 1A+2A and 3A. It is worthwhile to mention that all the 12 veins do not exist freely but instead some of the veins get fused together, others become absent and the pattern characterizes different species, genera and families. Most commonly, there is fusion or loss among the branches of Radius and the two Anal veins. The hindwing has only 8 veins because of the fusion of R_1 with Sc and the coalescence of the four other branches of Radius into a joint vein called Radial Sector (Rs). In forewing, space between anal margin-1A+2A, 1A+2A-Cu1b, Cu1b-Cu1a, Cu1a- M_3 , M_3 - M_2 , M_2 - M_1 , M_1 - R_5 , R_5 - R_4 , R_4 - R_3 , R_3 - R_2 , R_2 - R_1 , and R_1 -Sc is referred to as interspace 1a, 1b, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 respectively. Similarly, in hindwing space between anal margin-3A, 3A-1A+2A, 1A+2A-Cu1b, Cu1b-Cu1a, Cu1a- M_3 , M_3 - M_2 , M_2 - M_1 , M_1 -Rs, and Rs-Sc+ R_1 is referred to as interspace 1a, 1b, 1c, 2, 3, 4, 5, 6, and 7 respectively. The numerical nomenclature and different parts of wings are shown in (Figs., 1, 2; Plate- I).

The Lepidopteran wings generally do not have cross veins and, therefore, the surface of the wings is not divided into cells. However, the bases of the veins Radius, Median and Cubitus usually get fused to form a basal cell which is closed by three veins between bases of R and M termed as upper, middle and lower discocellulars. This cell is referred to as discal cell or discoidal cell. Some of the species show the presence of a short and usually curved precostal vein or precostal spur arising from near the base of Subcosta and directed towards costal margin.

The wings of butterflies are roughly quadrangular as shown in the figure.... In this figure, the margin between A and B is the anterior or costal margin, the margin between B and C is the apical margin or termen and the margin between C and D is the inner or posterior margin. The angle at A is the basal angle, the angle at B is the apex or apical angle and the angle at C is the tornus.

Wings are covered with scales and these are arranged like overlapping roof tiles. Each scale is attached by a thin shaft that is inserted into a socket in the wing membrane similar, to feathers in birds. The surface of each scale has five longitudinal ridges criss-crossed with finer ridges, giving the appearance of a honeycomb. There are three types of scales - pigimentary scales, structural scales and scent scales. The pigimentary scales are flat and coloured chiefly by melanins. Melanins are responsible for the colours black and brown, which are synthesized internally by the butterfly. The yellows, oranges and reds are taken from the food plant and are directly incorporated into integuments. Most of the blue, purple, green or metallic hues are caused by the interference of the light. Structural scales are present generally only in males and these generate the blue-green colours. Scent or androconial scales are only present in males, and are connected to secretory glands at their bases; they store chemicals known as pheromones, which are generally required in courtship displays for attracting a mate. The wings bear diverse patterns and are very useful in the identification of any butterfly. The wing colour patterns serve as a visual aid during courtship display and mating. The brightly coloured patterns of the male serve as long-range communicators. The average wing beat of a butterfly is 25 beats per minute or less, (Haribal, 1992).

The abdomen having ten segments consists of digestive and reproductive systems. The last two to three segments at the tip form the reproductive organs known as genitalia which are male genitalia and female genitalia respectively. The genitalia show various variations within different families, genera and species and are important in the identification.

Butterflies have a complete four-stage development or metamorphosis and are therefore classified as holometabolous. The four stages are: egg or ovum (Plural: ova), the embryonic stage (Fig., 60-62, 201, 233- 235; Plates- XVI, LVI, LXIV), the caterpillar or larva (plural: larvae), the principal feeding and growing stage (Fig., 181-185, 201, 203, 235-239, 242, 243, 245, 247; Plates- LI, LII, LVI, LXIV, LXVI, LXVII),; the chrysalis or pupa (plural; chrysalides, pupae), a transition stage (Fig., 188-194, 205-207, 228, 241, 242, 246; Plates- LII- LIV, LVII, LXII, LXVI, LXVII),; finally the adult or imago (plural: imagos, imagines), the principal dispersive stage and sole reproductive one. Duration of life-cycle and stages vary with the species and the season. *Cynthia cardui* and *Vanessa cashmiriensis* complete their life cycles between 31-45 and 26-38 days respectively.

1.3. Economic Importance:

The larval stages of butterflies have been found in Kashmir Valley to be destructive to diverse plant species, including agricultural and horticultural crops, forest range plantations, medicinal plants and other economically important plants. The larvae are the primary herbivores in the ecosystem; the adults generally feed on nectar and also act as pollinators of flowering plants. The caterpillars feed on leaves, bore inside buds, eat flowers and others consume fleshy fruits (Fig., 181, 183, 247, 248; Plates- LI, LXVII),.

Some of the major/serious butterfly pest species, belonging to different families of agricultural, horticultural and forestry importance occurring in Kashmir are: Lycaenids- *Chaetoprocta odata* on *Juglans regia* (Juglandaceae), *Deudorix epijarbas* on *Aesculus indica*, (Hippocastanaceae) and *Punica granatum* (Punicaceae)), *Virachola isocrates* on *Punica granatum* (Punicaceae), Nymphalids- *Cynthia cardui* on *Urtica dioica* (Urticaceae), Papilionids- *Papilio demoleus* on Anar () and Pierids- *Pieris brassicae* on *Brassica* spp. (Brassicaceae), *Pieris rapae* on *Brassica* spp. (Brassicaceae) and *Raphanus sativus* (Apiaceae) and *Pontia daplidice* on *Brassica* spp. (Brassicaceae);

The butterflies are also one of the important food chain components of the birds, reptiles, spiders and predatory insects. They also have great importance for the study of genetics, insect plant interaction and co-evolution etc. (Sathe *et al.* 2004). Butterflies show distinct pattern of habitat utilization. The nature of vegetation is the important factor which determines the dependence and survival of a species on a particular habitat. Being highly sensitive to change in the environment, they are easily affected by even relatively minor perturbation in the habitat and are considered as indicators of environmental quality (Uniyal and Mathur, 1998). The presence of butterflies emphasizes availability of the larval food

plants in great abundance. There is an intimate association between butterflies and plants (Nishida, 2002., Uniyal and Mathur, 1998) and butterflies and ants (DeVries and Poinar, 1997, Pierce *et al.*, 2002, Thomas *et al.* 1989) and their lives are exceptionally interlinked. Among butterflies the ability to form intimate associations with ants has evolved in families Lycaenidae and Riodinidae. The fundamental nature of these symbiotic associations is that caterpillars provide ants with food secretions in exchange for protection against predators. Some of the butterfly species showing symbiotic relationships with ants include *Euliphyra leucyana*, *E. mirifica*, *M. arion*, *Maculinea rebeli*, *M. telius*, etc. Many butterfly species like *Aulocera padma*, *Cynthia cardui*, *Lycaena phlaeas*, *Pelopidas mathais*, *Pieris brassicae*, and *Pontia daplidice* help in the pollination process (Fig., 177, 179, 213- 216; Plates- L, LIX),.

The butterflies have also commercial values such as butterfly-farming, butterfly-Parks, etc., are gaining more importance, both in national and international economy in many countries like Canada, China, Kenya, Malaysia, Papua New Guinea, Singapore, UK, and USA. These activities form an important aspects of ecotourism and tourism-linked wildlife. In India, butterfly farming is also gaining importance and recently a butterfly Park has been established in Bangalore (Karnataka) which shows country's interest and commitment in the conservation of butterfly biodiversity. In addition to this, the concept of butterfly gardens/parks, undoubtedly helps to boost tourism in different parts of the world, including Kashmir Valley, for attracting more tourists and to check the dwindling of natural populations of butterflies of this region thereby will offer protection to endangered species. Keeping in view the values of butterflies, Wildlife Protection Acts: Indian Protection Act 1972, 1989, as well as separate Jammu and Kashmir Act (1978), give legal protection to the butterfly-fauna. Besides, Red Data Book of IUCN (1983), has included endangered butterfly species of the World.

The butterfly-fauna occurring in diverse localities and areas of Kashmir Himalayan regions, is not fully explored. The earlier lepidopterologists who have given fragmentary taxonomic surveys and biodiversity accounts of butterfly species and their surveys were also stretched to the regions now as Pakistan Occupied Kashmir (POK) and Ladakh are; Lang (1868), Moore (1874), Bingham (1905, 1907), Leslie and Evans (1903), Evans (1932), Thomas-Glover(1936), Home (1938), Talbot (1939, 47), Wynter-Blyth (1957), Eisner (1978), Vis and Coene (1987), Eisner and Weiss (1990), and Jamdar (1991, 92). During the course of present investigations, extensive surveys have been carried out for the purpose of detailed assessment of various taxon groups of butterflies, monitoring of abundance and distribution

of various species, and to ascertain the preferred host-food plants, with other bioecological observations made in vast agro-ecosystem of Kashmir Himalayan region, during different months/seasons of the year. The present detailed survey of biodiversity of butterflies has revealed that number of species, previously reported from this region were not traceable, and hence needs both *in-situ* and *ex-situ* conservation programmes for their revival.

2. MATERIALS AND METHODS

This chapter includes different methods and techniques used both in the field as well as in the laboratory, for the completion of the present work and these mainly involved field surveys in different localities/areas of Kashmir, collection, killing, preservation, rearing, slide preparation, drawings, field photography, collection of meteorological data, identification of host-plants and statistical analysis, pertaining to butterfly-fauna and their ecological and biological investigations.

2.1. Collection & Preservation Methods of Butterflies:

The present study on the butterflies of Kashmir Valley was carried out during the years of 2004-2007. For this purpose, different stages of butterflies like eggs, larvae, pupae and adults were collected from different areas/localities of all ten administrative Districts of Kashmir Valley, encompassing different habitats like gardens, parks, mountains, forests, orchids, vegetable areas, open fields, and agricultural areas and other cultivated avenues at low-land and high-altitude areas/regions of the Valley. Random surveys were conducted fortnightly in different months/seasons of the year, depending on the prevailing weather conditions and butterfly activity. Each District was surveyed at least twice a month. The size of the field site/transact was between 50 meters to 1000 meters.

Adult butterflies were collected either with the help of traditional insect collecting net or by hand-picking. After collection, the butterflies were killed in killing bottles, saturated with ethyl-acetate. Thereafter, killed specimens were then shifted in paper envelopes of desired size and were properly labelled bearing (i) sample number, (ii) date of collection, (iii) name of the place and (iv) name of the collector. The collected specimens were stretched on an insect stretching board by passing an entomological pin of required size through the thorax. The wings were spread in such a manner that the lower margin of the fore-wing was at right angle to the body and the antenna in front of the head. After proper spreading, the specimens were left for about 2 to 4 days and were then shifted to wooden insect storing boxes (Figs., 82, 84; Plates- XXVI). Each specimen was labelled bearing same information as was written on the paper envelopes previously. In order to protect the collected specimens from the pests and fungus either cotton balls dipped in ethyl acetate vapours or benzene dipped papers were periodically inserted in these boxes. The storage boxes were kept at clean and dark places. In this connection, techniques adopted are those given by: (Borrer *et al.* 1976; Haribal, 1992; Kunte, 2000; and Wynter-Blyth, 1957).

Butterfly larvae and pupae were killed by dropping them into a vial containing about 9 parts of 80% alcohol and 1 part of glacial acetic acid (GAA) or in XA mixture. The addition of GAA helps prevent discolouration. After 48 hours the specimens were transferred to Hood's solution or 80% alcohol to which a little glycerine was added. Sometimes the larvae were also killed by dropping them into hot water that has just come off the boil. The material was then left for cooling and after that transferred to Hood's Solution for preservation (Borror *et al.* 1976, Holloway *et al.* 1987).

XA Mixture was prepared by adding 50 ml of 95% ethyl alcohol to 50 ml of xylene and Hood's solution preparation involved addition of 50 ml of 70-80% ethyl alcohol to 50 ml of glycerine.

Eggs were placed directly into Pempel's fluid for sometime and were then transferred to Hood's Solution / 80% alcohol, to which a little glycerine was added. The Pempel's fluid, given by Ehrlich and Ehrlich (1961), was based on the following composition:-

(i)	95% commercial ethyl alcohol	:	15 parts
(ii)	Distilled water	:	30 parts
(iii)	Formalin	:	6 parts
(iv)	Glacial acetic acid	:	4 parts.

2.2. Mountants and Slide mount (permanent) Preparation:

For studying various morphological characters/features for identification of specimens, permanent slide-mounts of various body structures like antenna, legs and wings were prepared. Among these structures, wing colouration and wing venation were found most helpful in identification. To study wing-venation, wings were first discoloured or bleached and then mounted (Fig., 83; Plate- XXVI). For this purpose, both fore and hind wings were cut and placed in Petri dishes, containing 95% alcohol for 1 to 2 minutes and then were transferred to 10% Hydrochloric acid (HCL) for up to 1 minute. After this they were placed in the mixture of sodium chloride and sodium hypochlorite (having both the chemicals in equal proportion i.e., 50-50) until the colour was removed. The wings were continuously cleared with a soft brush. They were rinsed in distilled water to remove the excess bleach. After this they were dehydrated by running successively increasing concentrations of different grades of alcohol like 30% alcohol (5 to 10 minutes), 50% alcohol (5 to 10 minutes), 70% alcohol (10 to 15 minutes), 90% alcohol (10 to 15 minutes), 100% /absolute alcohol (10 to 15 minutes). Before shifting to 90% alcohol, the wings were stained with eosin. After absolute (100%) alcohol they were cleared twice in xylol (xylene) for 10-15 minutes and

were placed on a slide and mounted in DPX or Canada balsam or Berlese's Mountant and covered with a cover slip and labelled properly. Similarly permanent mounted slides of other body structures like antennae, legs, and larval heads were made. These structures were first cleared by putting them into a 10% solution of KOH (potassium hydroxide) by either keeping them for 12 to 24 hours or heating them until they become clear. They were dehydrated and mounted in the same manner as were wings. However, no stain was used in this process. The Berlese's mountant had following composition:-

(i)	Gum Arabic	:	5-8 grams
(ii)	Distilled Water	:	30 ml
(iii)	Glucose Syrup	:	10 ml
(iv)	Glacial Acetic Acid (GAA)	:	5 ml
(v)	Chloral Hydrate	:	5 ml

The procedure for the preparation of Berlese's mountant involved following steps:-

- (1) Glucose syrup was prepared by dissolving 5 grams of glucose in 5 ml of water.
- (2) Gum Arabic was dissolved in distilled water and glucose syrup added to it.
- (3) Chloral hydrate was added up to saturation point to the above mixture. But excess addition of this chemical was avoided as excess of it causes crystal formation.
- (4) Glacial Acetic Acid was also added and the whole mixture was then heated gently. It was stirred occasionally and air bubble formation was avoided.
- (5) The solution was then filtered while hot through glass wool.

The drawings were made either with the help of a Tri-Simpler Complex (TSP) or with the aid of a stereomicroscope fitted with a prism type of Camera lucida. The microscope was properly calibrated and scales were drawn accordingly. Measurements of wing span of adults, second instar and larger larvae and pupae were made with a millimeter plastic scale (Fig., 81; Plate- XXVI). Length of the larvae was measured during the most common resting position. The behaviour of larvae, pupae and adults was observed in both field and laboratory conditions. To study the biology/life cycles of some butterflies they were reared in the laboratory. For this purpose their eggs, larvae or pupae along with their host-plants were collected and were immediately transferred to rearing cages of desirable sizes. Newly immersed larvae were provided with fresh and soft food. The food was changed after every 12 to 24 hours. The rearing cages were regularly cleaned and continuously monitored. All the stages of butterflies namely eggs, larvae, pupae and adults were separately preserved. For

aforementioned techniques/methods, Bhate (2005), Borror *et al.* (1976) and Harry (2005) have been followed.

2.3. Statistical Methods and Data Techniques followed.

Various statistical methods like Correlation Coefficient, Margalef's Index, Shannon-Weiner Index, Shannon Equability Index, Simpson's Index, were used for studying the diversity and abundance of butterflies. For this purpose works of Simpson (1949), Southwood and Henderson (2000), Khan *et al.* (2003 & 04) and Zar (2006) were followed. The formulae for various statistical/diversity indices are given below:

(i). Shannon- Weiner Index:

$$H = - \sum_{i=1}^n p_i \log p_i$$

Where "pi" is the proportion within the sample of the number individuals of "ith" species and is denoted as $\frac{n_i}{N}$ where "ni" is the number of "ith" individuals and "N" is the total number of individuals.

(ii). Shannon Equitability Index:

$$H = \frac{H}{H_{\max}} \quad \text{Where } H_{\max} = \log_2 S$$

Where "H" is the Shannon –Weiner's diversity index and H_{\max} is the \log_2 of the S and "S" is the total number of individuals in the sample.

(iii). Margalef's Index:

$$d = \frac{S-1}{\log_e N}$$

Where "S" is the number of species and "N" is the number of individuals

(iv). Simpson's Index:

$$D = 1 - \sum_{i=1}^n p_i^2$$

Where "pi" is the proportion of "ith" species and is denoted as $\frac{n_i}{N}$, where "ni" is the number of "ith" individuals in "ith" species and N is the total number of individuals in the sample.

The necessary meteorological data of different places was obtained from Meteorological Department, Srinagar Office and Directorate of Economics and Statistics, Planning and Development Department, Government of Jammu and Kashmir. Similarly data pertaining to

altitude of different places, was acquired from Directorate of Environment, Ecology and Remote Sensing, Government of Jammu and Kashmir. Host-plants were identified in the Centre of Plant Taxonomy, Department of Botany, University of Kashmir, Srinagar. For nomenclature of host-plants, works of Dar *et al.* (2002), Haribal (1992), Kunte (2006), Singh and Kachroo (1987) and Wynter-Blyth (1957) were followed. Photography was performed both in the field as well as in laboratory with the help of cameras namely Sony Digital Camera (Sony Digital Handycam, Model No.DCR-TRV460E, 20X Optical and 990X Digital Zoom, Made in Japan) and Olympus (Model No. FE270, 7.1 Mega pixel, and 3 X Optical Zoom, Made in Japan).

3. REVIEW OF LITERATURE

A great deal of research work has been done on the biology, taxonomy, ecology, and conservation of butterflies from different parts of the world, including Indian sub-continent. This Chapter includes brief reviews of important research papers, monographs and other outstanding publications and books on aforementioned aspects of butterfly-fauna, from different countries and areas of the world, under six different zoogeographical regions/realms (Fig., 254; Plate- LXX), currently recognized, as given by Udvardy (1975), Cox (2000, 01) and Newton & Dale (2001).

3.1. World/Zoo-geographical Regions (General):

Shields (1974), gave a bibliographical index of world distribution and zoogeography of butterflies. The same author in the year 1989 reported a total number of butterfly species existing in different zoogeographical regions and sub-regions as 17,280 spp. which accounts for 9-12% of all the known lepidopteran species, distributed over 1,855 genera, 35 sub-families and 7 families. Lamas (1991) gave a list of 175 periodical publications, dealing exclusively with lepidopterological studies, published from different parts of the world.

The diversity and biogeography of order Lepidoptera of different faunal regions has been studied by Heppner (1991). Garcia-Barros (2000) gave egg size of 1184 butterfly species, distributed in different parts of the world. In a recently published encyclopedia, Feltwell (2001), has given abundance, distribution, status and wingspan of more than 1000 species of butterflies, found in different parts of the world.

In the recent years, studies on the relationship between habitats and butterfly biology, and need of a resource-based concept for conservation of butterflies, have been accomplished by Dennis *et al.* (2003). Also classification of *Danaus* group of butterflies on the basis of morphological and DNA studies, has been given by Smith *et al.* (2005).

An index of bibliographical references of about 260 butterflies from different parts of India, Maldives, Myanmar, Nepal, Pakistan and Sri Lanka, has been given by Varshney (1997). In 1983, he gave common names of butterflies from India and neighbouring countries and in (1986) wrote about the importance of scientific and popular names of butterflies. Detailed studies on various genera and species of butterflies with regard to their common names, distribution, status, synonymy, type-species, food-plants belonging to countries like Bangladesh, Bhutan, India, Myanmar, Nepal, Pakistan and Sri Lanka, covering 8 families of butterflies, viz. Danaidae, Libytheidae, Lycaenidae, Nymphalidae, Papilionidae, Pieridae, Riodinidae and Satyridae, have been accomplished by Varshney (1993, 94 & 97).

3.2. Afrotropical (=Ethiopian) Region:

It includes Africa, south of the Sahara and Indian Ocean Islands, Madagascar, Comoro Islands, Seychelles, and Mascarene Islands. Its total area is approximately 21 million km². (See Fig., 254; Plate- LXX).

Descriptions of 21 species of genus *Neptis* (Nymphalidae) from Ghana, with taxonomic importance of white marks in the forewing and of interior structures on the male valvae, have been given by Usher (1979). Also, in the year 1986, he described a new species *Acraea kibi* (Nymphalidae) from this region. Recently, Larsen (1994), described *Diopetes kakumi* (Lycaenidae), a new Hairstreak from Kakum National Park, Ghana. Further, from this region, reports of 425 species of butterflies collected during the expedition to principal parks and reserves, has been provided by Emmel & Larsen (1997).

Clarke & Larsen (1986) studied the speciation problems in the *Papilio machaon* group of butterflies (Papilionidae) of Yemen and suggested that the entire *P. machaon* complex is in a liable state as regards speciation throughout its range and the relationships between the various forms are not expressed through the traditional species and subspecies concept.

Duodu & Lawson (1989) studied the reproductive behaviour, courtship, mating, oviposition, and adult emergence of the Tossa Jute Defoliator, *Acraea tersicore* in Ghana. The butterfly fauna of Kakamega Rain Forest and Masai Mara Savanna in Kenya, covering 219 species has been studied by Emmel & Warren (1993). Owen & Smith (1993) studied the mimicry in *Danaus chrysippus* and described its polymorphic Mullerian mimics in Africa. The Lepidoptera, collected in Kenya and Tanzania, has been investigated by Puechredon (1993).

Dejean & Beugnom (1996) in Yaounde (Cameroon) studied the myrmecophilous behaviour of two lycaenids, *Euliphyra mirifica* and *E. leucyana* with weaver-ant, *Oecophylla longinoda* and found that these butterflies are myrmecophiles, living in association with their host ant throughout their larval life. From Ghana, Sourakov & Emmel (1997, 97a, 97b and 97c) studied the immature stages, taxonomic relationships and morphology of genera, viz. *Bicyclus*, *Hallelesis*, *Ypthima* and *Ypthimomorpha* (Satyrinae) and life history of *Oboronia liberiana* and *O. ornate* (Lycaenidae), and *Pyrrhocalcia iphis* and *Pardaleodes tibullis* (Hesperiidae).

The species richness, abundance and habitat change of butterflies of Comoro Islands using transect count methods, has been studied by Lewis *et al.* (1998). Kielland (2002),

published a faunal report of Tanzania regarding order Lepidoptera and mentioned 213 species of butterflies from this African region.

3.3. Australasian Region:

It includes Australia, New Guinea, New Zealand and Pacific Islands, including Solomons, New Hebrides, New Caledonia, and Chathams. Its total area is approximately 8.9 million km². (See Fig., 254; Plate- LXX).

Craw (1978) for the first time gave the revision of Satyrid butterflies, belonging to genus *Argyrophenaga* Doubleday from New Zealand, and also described three species. Besides wing colouration, wing pattern, male genitalia, flight behaviour and key to species are given.

Kitching *et al.* (1978) gave a checklist of 79 butterflies, belonging to 5 families: HesperIIDae (16 sp.); Lycaenidae (25 spp.); Nymphalidae (24 spp.); Papilionidae (5 spp.) and Pieridae (9 spp.), from the Australian Capital Territory.

Gibbs (1980) in New Zealand, reviewed the nomenclature and status of New Zealand Copper butterfly, *Lycaena rauparaha* (Fereday) and described adult, larval, and pupal characters. In addition to these, he also gave key to this species complex and cleared the previous confusion over the nomenclature and status of this species complex.

Jones *et al.* (1980) in Australia studied the movements of *Pieris rapae*. Zalucki & Kitching (1982) in Australia, studied the mortality estimates for the immature stages of two butterfly species; viz *Danaus chrysippus* and *D. plexippus* by observing the survival of egg cohorts on different sized patches of food plants (*Asclepias* spp.) and found that most of the mortality in both species occurred in the early stages. Kitching (1983) studied the myrmecophilous organs of the larvae and pupa of the lycaenid butterfly, *Jalmenus evagoras* (Donovan) in Australia. Braby (1995) gave geographic distribution, relative abundance, habitat association and status of 16 tropical Satyrinid butterfly species from Northeastern Australia. New (1997) from Australia gave the importance of butterflies as an 'umbrella group' for the conservation of biodiversity.

3.4. Nearctic Region:

It includes North America, Mexico, north of the tropics, and Greenland. Its total area is approximately 21 million km². (See Fig., 254; Plate- LXX).

Keys to families, genera and species of butterflies, pertaining to North American forms, have been given by Ehrlich and Ehrlich (1961). Brussard & Ehrlich (1970), studied the effects of air, temperature, wind, and solar radiation on the behaviour and population

structure of *Erebia apipsodea* (Satyrinae), in Colorado, USA. Greene (1970) studied the head measurements and weights of the Bean Leaf Roller, *Urbanus proteus* (Hesperiidae) from Florida, USA.

Platt *et al.* (1970) made an extensive analysis of the male valval shapes among the North American *Limenitis* (Nymphali), and clarified the inter- and intra-specific relationship of these butterflies. Detailed conservation studies on Lepidoptera in the United States of America has been accomplished by Pyle (1976). Life-cycle and immature stages of *Vanessa annabella* (Field) (Nymphalidae), have been described by Dimock (1978), from California (USA).

Clench (1979), while studying the butterflies of Pennsylvania, described procedures for making of 'state or regional' and 'local study' lists of butterflies and also gave a logarithmic scale for describing population sizes.

Chew (1980) studied the larval food plant preferences of five *Pieris* species namely *Pieris napi macdunnoughii*, *P. n. oleacea*, *P. occidentalis*, *P. rapae* and *P. virginiensis* in North America. Studies on the population size, extinction, reduction, stability and increase of two nymphalid species *Euphydryas editha* and *E. chalcedona* in relation to drought of 1975-77 in California, USA, have been conducted by Ehrlich *et al.* (1980).

Some ecological observations on the butterflies of the Churchill region of Northern Manitoba, Canada, have been made by Oosting and Parshall (1980). A comparative studies on the growth, development and reproduction of the Black Swallowtail butterflies (*Papilio polyxenes*), in Costa Rica and USA have been done by Blau (1981). Higgins (1981) gave geographical distribution and taxonomy of subfamily Melitaeinae (Nymphalidae) and revived genus *Phycoides* Hubner and described 137 species from America.

The distribution of the European Skipper, *Thymelicus lineola* (Oschenheimer) (Lepidoptera: Hesperidae) in Manitoba and Northwestern Ontario, Canada, has been studied by Preston & Westwood (1981). Lederhouse *et al.* (1982) studied the possible mechanisms that contribute to protandry in butterflies, using Black Swallowtail butterfly, *Papilio polyxenes* F., as a model in New York, USA. Troubridge *et al.* (1982), reported *Oeneis excubitor*, a new satyrid species from North American Arctic.

Studies on the effects of companion plants on oviposition of *Pieris rapae* (Pieridae) and *Trichoplusia ni* (Noctuidae) on collard plants in Virginia, USA, have been done by: Latheef & Irwin (1979) and Latheef & Ortiz (1983). The influence of temperature upon the development and feeding ecology of the Eastern tiger Swallowtail butterfly, *Papilio glaucus*

L. under natural and controlled conditions in New York, USA, has been studied by Scriber and Lederhouse (1983).

Byers & Richards (1986) studied the feeding behaviour and pest status of *Nymphalis antiopa* (Nymphalidae) on *Onobrychis viciifolia* (Leguminosae) in Canada. De Vries (1986) gave list of host plants of Costa Rican butterflies. Murphy *et al.* (1986) studied the population dynamics and conservation status of two closely related species, viz. *Euphydryas editha* and *E. chalcedona* by using mark-recapture techniques and their drawbacks and suggested many ways and techniques which can be helpful in conserving the butterfly-fauna in USA.

Malcolm *et al.* (1987) in Florida (USA), studied the life-history pattern in relation to temperature constraints and latitude in monarch butterflies. Troubridge & Parshall (1988) reviewed the *Oeneis polixenes* (Fabricius) complex (Satyrinae) and described two new subspecies *Oeneis polixenes luteus* and *O. p. woodi* and one species *Oeneis philipi* from Northwestern America. The same authors in 1990 described *colias johanseni*, (Pieridae) a new species from Arctic Canada.

The butterfly-fauna of the High-Andes, California, USA, has been surveyed by Shapiro (1992) and he also gave many reasons for the low diversity of butterflies in this region. Calhoun (1995) studied the population of *Anthanassa frisia* (Lepidoptera: Nymphalidae) in Central Florida, USA and gave its distribution in some new places.

Two new records, with descriptions of butterflies, viz. *Eurema albula* (Pieridae) and *Anthanassa argentea* (Nymphalidae) from United States, have been given by Chuah & Cushing (1995). New *et al.* (1995) described butterfly conservation management prevailing mostly in Europe and North America. Ross (1995) studied relationship between the feeding and protecting behaviour of antbirds, army ants and butterflies of family ithomiinae in USA.

The advantages and disadvantages of optimized portable bait traps for sampling of butterflies in USA has been studied by Shuey (1997). Swengel & Swengel (1997), studied the butterflies of prairie and barrens habitats of North America and their relationship with ecosystem conservation. Grundel *et al.* (1998) investigated the effects of canopy cover, shade, host-plant quality, habitat use and conservation status of endangered Karner Blue butterfly *Lycaeides melissa samuelis* Nabokov (Lycaenidae) in USA.

Swengel (1998) studied the effects of burning, grazing, haying, mowing and management of butterfly abundance in USA. Gattelle (2000) studied the distribution and taxonomy of *Pterourus troilus* (Linnaeus) (Papilionidae) and described a new subspecies *P. t. fakahatcheensis* Gattelle from Florida, USA. Kerr *et al.* (2001) in Canada studied the

relationship between habitat, species richness and community structure of butterflies, using high-resolution biodiversity and environmental data.

Mattoni *et al.* (2001) used transect counts to monitor the population size of endangered El Segundo Blue butterfly, *Euphilotes bernardino allyni* (Shields) in United States. Schneck (2001), has given various suggestions about butterflies mainly of American species, for knowing and attracting them to the gardens. Villoria *et al.* (2003), described brachyptery or wing reduction coupled with flightlessness in the females of genus *Redonda* Adams and Bernard (Lepidoptera: Nymphalidae: Satyrinae) from Andes of Venezuela.

Nally *et al.* (2004) made a comparative study of diversity of butterflies and birds of Great Basin area, USA and found that variation in species composition of birds and of butterflies depend on both sampling grain (the smallest resolvable unit of study) and on the relative proximity of sampling units across the landscape. In the same year, Levy and Connor, used Pipevine Swallowtail, *Battus philenor* (Papilionidae) as a test species to observe whether gardens attract more species than natural sites in California, USA and found that usually no gardens were attracting a large number of species and are not hotspots for conservation purposes.

3.5. Neotropical Region:

It includes Tropical Mexico, Central America, South America and adjacent Islands (Galapagos, Falklands), the West Indies. Its total area is approximately 18.2 million km². (See Fig., 254; Plate- LXX).

Balcazar (1993), studied the distribution, taxonomy, seasonality and zoogeography of butterflies of Pedernales, Michoacan, Mexico. Constantino (1993), for the first time described the biology of *Haetera piera* and its new host plant *Spathiphyllum wallisii* (Araceae) from Colombia.

In Jamaica (West Indies), Garraway & Parnell (1993) and Garraway *et al.* (1993), studied larvae and conservation biology, and ecology of endangered *Papilio homerus* Fabricius (Papilionidae) respectively. Iftner *et al.* (1993) described *Hemiargus ammon* (Lucas), a new species from this region.

Garraway *et al.* (1993a), studied the biology, diapauses, immature stages, hostplants, larval polymorphism and ecology of the vulnerable Jamaican Kite Swallowtail, *Eurytides marcellinus* (Doubleday) (Papilionidae) in Jamaica. Hall and Willmott (1993) described some new records of butterflies of Costa Rica.

Descriptions of four new species of Hairstreak butterflies, belonging to genus *Serratofalca* (Lycaenidae) of Argentina, have been given by Johnson & Sourakov (1993). Llorente-Bousquets *et al.* (1993) studied the biogeography, phenology, ecology and taxonomy of *Archaeoprepona demophoon* (Huebner) in Mexico and also described *A. d. mexicana* a new subspecies.

Pyrz (1993, 93a) described *Memphis grandis*, a new record and *Memphis salinasi*, (Nymphalidae) a new species from Venezuela. Salazar (1993), studied the distribution of Heliconinae (e.g., *Heliconius heurippa*) (Nymphalidae) of Colombia.

Austin (1994) described a new species, *Haemactis albamarita* (Lepidoptera: HesperIIDae: Pyrginae) from Brazil and also gave key to the males of genus *Haemactis*. From this region, Brown & Freitas (1994) studied the systematics and juvenile stages of 66 spp. of Nymphalids (Ithomiinae). The same authors in the year 2002, studied the comparative study of butterfly communities in different habitats in Brazil.

Hedges & Johnson (1994), gave distribution of *Calisto tasajera* (Lepidoptera: Nymphalidae: Satyridae) in the Dominican Republic and also provided a key to the species of genus *Calisto*. Otero (1994), studied early stages and Life-history of *Sea sophronia* (Lepidoptera: Nymphalidae: Eurytelinae) in Venezuela. Austin, (1995), studied HesperIIDae of Rondonia area of Brazil and described two new species as *Drephalys croceus* Austin and *Drephalys tortus* Austin.

Methods for the preparation of portable bait traps for the study of butterflies and description of 3 new species of genus *Arcas* genus (Lepidoptera: Lycaenidae), with revised key to the genus, from Brazil, have been given by Austin and Riley (1995) and Austin & Johnson, (1995) respectively. Beccaloni & Gastan (1995) studied the species richness prediction of butterflies, using Neotropical ithomines as an indicator group. Benyamini & Johnson (1995) reviewed the genus *Heoda* (Lycaenidae) and described new species from Chile.

The butterfly-fauna of Eastern and Western Ecuador, with descriptions of 12 new species of family Riodinidae, and genus *Machaya* as new to the area and *Argyrogrammana*, as an extremely rare genus, have been studied by Hall & Willmott (1995, 95a, 95b, 1996, 96a). Hernandez *et al.* (1995) described *Parides gundlachianus alayoi* (Papilionidae) a new subspecies from Cuba.

A photographic presentation of 29 species of butterflies, belonging to Papilionidae and Pieridae, from six (6) Neotropical countries namely Brazil, Costa Rica, Ecuador, Mexico,

Peru and Venezuela, has been given by Krizek (1995). Life-histories of butterflies from Las Alturas area of Costa Rica and butterfly-fauna of Kenya have been investigated by Sourakov (1995) and Sourakov & Emmel (1995) respectively. From Mexican region, Warren (1996) and Warren & Gonzalez-Cota (1996), studied Hesperiid behaviour, biogeography and taxonomy of *Amblyscirtes patriciae* (Bell) and *Dalla bubobon* (Dyar) respectively. Wolfe (1996) studied the host-plants and biology of *Zethera musides* Semper in Philippines.

Austin *et al.* (1997) studied the Neotropical genus *Entheus* Hubner in Brazil and described two new species, and Austin (1997) described two new species of this genus from Peru and Ecuador. Austin *et al.* (1996) gave an annotated list of 535 species of butterflies of Tikal National Park of Guatemala. Austin (1997a) studied the Neotropical genus *Eracon* Godman & Salvin in Rondonia, Brazil and described two new species.

Baccaloni (1997) studied the ecology, natural history, behaviour and mimicry of Ithomiinae butterflies and Pelz (1997) described life-history of *Pedaliodes parepa* (Satyrinae), from Ecuador. Horner-Devine *et al.* (2003) studied the biogeography and possible conservation opportunities of butterfly fauna in human-dominated landscapes of Costa Rica.

3.6. Indo-Malayan (=Oriental) Region:

It includes Southeast Asia and adjacent Islands, south of Himalayas, through the Indonesian Archipelago, Philippines, and Borneo to “Wallace’s Line” between Bali and Lombok. Its total area is approximately 9.6 million km². (See Fig., 254; Plate- LXX).

The earliest detailed studies on the butterfly-fauna, pertaining to Indian and adjoining areas including Kashmir of British India, in the consolidated monographs and outstanding papers, are given by Marshall & De Niceville (1883, 86 & 89); Bingham (1905, 1907); Evans (1913, 13a, 14, 20, 27 & 32).

Earlier, the common butterflies of plains of Indian regions, were extensively studied by Young (1905, 1906, 06a, & 06b). Bell (1910, 1913, 13a, 1914, 1916, 1918, 18a, 1920, 20a, 25 & 27) in a series of research papers described more than 250 butterfly species from plains of India, including those met within the hill stations of the Mumbai (Bombay). Descriptions of immature stages of various butterfly species of Indian sub-continent have been given by Sevastopulo (1938, 1940, 40a, 1944, 44a, 1946, 46a, 1947, 47a).

Notes on 114 species of Indian butterflies including Burma, Sri Lanka (Ceylon) and Pakistan, and description of biogeography of Indian butterflies, have been provided by Sanders (1955) and Holloway (1974). Nadkerny (1970) gave information on some 27

butterfly species present in the collection of the Bombay Natural History Society, Bombay. Varshney (1978) described 15 species of butterflies acting as pests of food-plants belonging to 6 families viz. Hesperiiidae (5 spp.), Lycaenidae (3 spp.), Nymphalidae (2 spp.), Papilionidae (1 sp.), Pieridae (3 spp.) and Satyridae (1 sp.) in India. In (1979, 1985 and 1990) he made nomenclature changes in the Wynter-Blyth's book on the butterflies of Indian region.

Ghai *et al.* (1979) reported 11 species of butterflies belonging to 3 families namely Hesperiiidae (5 spp.), Nymphalidae (4 spp.) and Satyridae (2 spp.) which act as pests of rice in India. The important information pertaining to rare, very rare or endangered butterflies of Peninsular India and 63 butterflies species from north-west India, have been presented by Saharia (1998), Kunte (2006) and Pajni *et al.* (2006).

3.6.1. Southern India:

Yates (1931, 31a) reported 278 species belonging to families namely Amathusiidae (1 sp.), Danaidae (10 spp.), Hesperiiidae (66 spp.), Lycaenidae (80 spp.), Nymphalidae (50 spp.), Papilionidae (18 spp.), Pieridae (31 spp.) and Satyridae (22 spp.) from Coorg, India.

Larsen (1977, 87, 87a, 87b) reported 299 species of butterflies from Nilgiri hills and other parts of the Southern India. Patil & Rajashekargouda (1986) reported new host plants of Citrus butterfly, *Papilio demoleus* from Karnataka. Gupta and Shukla (1988) reported 128 butterfly species/subspecies distributed in 67 genera and five families from Arunachal Pradesh (India) and also provided key to the genera and species. Rajasekhar (1995) studied the butterfly populations at Gundy National Park, Madras and recorded 37 species distributed over 5 families namely Danaidae (5 spp.), Nymphalidae (12 spp.), Papilionidae (6 spp.), Pieridae (12 spp.) and Satyridae (2 spp.). Babjan & Archana (1999) reported 40 butterfly species distributed under 7 families, from Krishnapuram Grama Panchayath, Alappuzha district, Kerala, India.

Sreekumar and Balakrishnan (2001) studied the diversity and habitat preference of butterflies of Neyyar Wildlife Sanctuary, South India and recorded 84 species under nine families. In the year 2002, Chitra & Mahendran and Baskaran & Solaiappan, recorded 14 and 33 species of butterflies respectively from Tamil Nadu. Nair (2002, 03) recorded 96 butterfly species in 5 families from Government College Campus, Kozhikode, Kerala, India.

Raju *et al.* (2003) studied the ecology and status of butterflies of Visakhapatnam, Andhra Pradesh, India and reported 68 species distributed over 5 families. In the year 2004, Rao *et al.* gave a checklist of 89 species of butterflies belonging to 64 genera and five

families from Nagargunasagar Srisailam Tiger Reserve, Andhra Pradesh, India. Viswanthan *et al.* (2004) gave a comparative study of biodiversity of butterflies between Bangalore and Jammu region and recorded 24 species of 7 families and 43 species of 7 families from Bangalore and Jammu region respectively.

Ambrose and Raj (2005) reported 24 species of butterflies distributed over 4 families viz. Acraeidae (1 species), Danaidae (8 spp.), Libytheidae (1 spp.) and Papilionidae (14 spp.) from Kalakad-Mundanthurai Tiger Reserve, Tamil Nadu, India. Ghosh and Siddique (2005), studied butterfly diversity in and around urban areas of Kolkata, India and described 68 species distributed over 5 families namely Papilionidae (10 spp.), Pieridae (14 spp.), Lycaenidae (13 spp.), Nymphalidae (26 spp.) and Hesperidae (5 spp.) respectively. Kumar *et al.* (2007) gave a list of 57 butterfly species distributed in 44 genera and five families from Tiger-Lion Safari, Thyavarekoppa, Shimoga, Karnataka, India. Rufus and Sabarinathan (2007) gave a checklist of 85 species in 5 families from Thengumarahada, Nilgiris, Southern India.

3.6.2. Eastern and Western Ghats:

From Eastern Ghats of India, Best (1954) reported 111 species belonging to 8 families from Nagalapuram hills. Various studies on the conservation, diversity, distribution, and taxonomy of hundreds of species of butterflies occurring in Western Ghats of India, have been done by: Best (1951); Bean (1964); Kunte *et al.* (1999), Arun (2003), Padhye *et al.* (2006) and Kunte (2008).

3.6.3. Garhwal (Uttarakhand):

Mandal (1984) described 10 genera and 11 species of butterflies, and redescribed *Colias electo fieldi* Menetries from Tons Valley Garhwal. Descriptions of 35 species, belonging to 25 genera and 4 families, viz., Lycaenidae, Nymphalidae, Papilionidae and Pieridae from Nanda Devi National Park, are provided by Uniyal (2001, 04).

3.6.4. Western India (Maharashtra & Gujarat):

Aitken & Comber (1903) reported 130 butterfly species distributed in three families from Konkan. Shull (1963, 63a, 63b, & 1964) gave occurrence of butterflies *Hypolimnas misippus* form *inara* (Cramer), and *Cirrochroa thais* (Fabricus) and reported 150 species distributed among 9 families namely Acraeidae (1 sp.), Danaidae (7 spp.), Erycinidae (2 spp.), Hesperidae (22 spp.), Lycaenidae (44 spp.), Nymphalidae (26 spp.), Papilionidae (10 spp.), Pieridae (25 spp.) and Satyridae (8 spp.) from South Gujarat, India.

Pandharipande (1991) reported 60 species of butterflies distributed over 8 families namely Acraeidae (1 sp.), Danaidae (4 spp.), Hesperidae (8 spp.), Lycaenidae (11 spp.), Nymphalidae (12 spp.), Papilionidae (6 spp.), Pieridae (10 spp.) and Satyridae (8 spp.) from Nagpur City (Maharashtra), Central India. Bhalodia *et al.* (2002, 02a, 02b) reported 44 species of butterflies in 8 families and 34 species in 6 families from Ratanmahal Wildlife Sanctuary, Gujarat and Narayan Sarovar Wildlife Sanctuary, Gujarat respectively.

Palot & Soniya (2003), described 48 species under five families and showed family Nymphalidae being the dominant one from Lonar Crater Lake, and Rane & Ranade (2004) recorded 72 species of butterflies distributed in 5 families from Tamhini-Dongarwadi area.

The taxonomy, biodiversity and distribution of butterflies belonging to Mumbai (Bombay), have been investigated by Davidson *et al.* (1896, 96a), Best (1951, 77, 77a) and Abdulali (1980). Sathe *et al.* (2004) studied biodiversity of butterflies of Kolhapur city and recorded 25 species.

3.6.5. Madhya Pradesh:

Gupta and Shukla (1987) reported 62 species of butterflies belonging to 38 genera of 9 families from Bastar district, Madhya Pradesh. Singh and Koshta (1997) recorded 19 species in 11 genera and 4 families from Kanha National Park, Madhya Pradesh. Chandra *et al.* (2002) reported 38 species in 28 genera and 8 families from Pench Tiger Reserve, Madhya Pradesh. Chandra *et al.* (2007) gave a checklist of 174 species/subspecies distributed in 100 genera and 8 families from Chhattisgarh and Madhya Pradesh states of India.

3.6.7. Rajasthan:

Palot & Soniya (2000, 01) described 40 species of butterflies from Keoladeo National Park, Rajasthan, India.

3.6.8. Eastern India (Assam and Manipur):

Tytler (1914, 16) gave notes on more than 270 butterfly species from Manipur and Naga Hills, India. Earlier, Parsons & Cantlie (1947), reported more than 173 species from Khasi and Jaintia hills, Assam and later Cantlie (1952) reported 203 species from these regions. Arora and Mandal (1981) described 32 butterfly species of family Papilionidae from Arunachal Pradesh and adjoining areas of Assam.

In the recent years, Basistha *et al.* (1999), Barua *et al.* (2004) and Bhuyan *et al.* (2005), contributed to butterfly-fauna of Assam, from Orang Wildlife Sanctuary, Garbhanga Reserve Forest, and Regional Research Laboratory Campus (Jorhat) respectively.

3.6.9. Andaman and Nicobar Islands:

The distribution of more than 20 species of butterflies, belonging to the family Pieridae and Papilionidae in the Andaman and Nicobar Islands, has been investigated by Arora & Nandi (1980, 82). Recently, Khatri (1993), suggested possible factors, responsible for threatening the butterfly-fauna of these regions, by comparing the previous and recent available literature and the authors present observations.

3.6.10. Jharkhand:

Kumari and Kumar (2004) while studying the ecobiodiversity of butterflies of tribal zone of Jharkhand, India recorded 80 species distributed over 5 families namely Hesperidae (11 spp.), Lycaenidae (10 spp.), Nymphalidae (35 spp.), Papilionidae (9 spp.) and Pieridae (15 spp.) from the area.

3.6.11. Orissa:

Mandal and Nandi (1983) described 10 species of Papilionidae from Orissa, India.

3.6.12. Bihar:

Morrison-Godfrey (1947) gave a list of 134 butterfly species from South Bihar. Varshney and Nandi (1976, 1980) reported 48 butterfly species falling in 8 families from Patna (Bihar), India. Varshney *et al.* (1981) described 35 butterfly species under 25 genera and 9 families from Hazaribagh National Park and adjoining areas in South Bihar, India.

3.6.13. Myanmar (Burma):

Previous studies on butterfly species existing in different parts of Myanmar, has been provided by De Niceville (1896, 99), Watson (1896), Ellis (1918), Ollenbach (1921), Tytler (1927, 39, & 40) and Carrrot (1938).

3.6.14. Philippines, Thailand, Malaysia and Indonesia:

Pyrz (1994) discussed the conservation of National Parks and butterflies in Thailand. Boireau (1995) studied cannibalistic behaviour in *Elymnias hypermnestra* (Linnaeus) (Lepidoptera: Nymphalidae: Satyrinae), under optimal conditions in a greenhouse from Philippines and Zaidi & Kayau (1998) recorded 43 species in 7 families namely Danaidae (8 spp.), Hesperidae (4 spp.), Lycaenidae (16 spp.), Nymphalidae (7 spp.), Papilionidae (2 spp.), Pieridae (5 spp.), and Riodinidae (1 sp.) from Sayap-Kinabalu Park, Malaysia. Tangah *et al.* (2004) reported 40 species distributed in 4 families in Sabah, Borneo, Malaysia. Tati-Subahar *et al.* (2007) studied the distribution of butterflies of West Java, Indonesia along with altitudinal gradients and reported 23 species.

3.7. Palaearctic Region:

It includes all of Europe, Africa north of the Sahara, and Asia, north of the Himalayas. Its total area is approximately 46 million km². (See Fig., 254; Plate- LXX).

3.7.1. China, including Tibet and Turkestan:

The butterflies collected by earlier authors from these regions, have been studied by South (1913, 13a) and Thomas-Glover (1936).

3.7.2. Sikkim Himalaya:

Haribal (1992) gave status, distribution, larval and adult food plants and brief diagnostic characters of nearly 600 coloured photographs of 400 butterfly species of Sikkim Himalaya and other areas of India.

3.7.3. Nepal:

Bailey (1951, 51a) gave a list of 365 butterfly species distributed in 10 families namely Acraeidae (1 sp.), Amathusiidae (1 sp.), Danaidae (8 spp.), Erycinidae (12 spp.), Hesperidae (45 spp.), Lycaenidae (111 spp.), Nymphalidae (76 spp.), Papilionidae (32 spp.), Pieridae (34 spp.), and Satyridae (45 spp.) from Nepal. Wadhi & Parshad (1968), reported 16 species as new records, distributed in 6 families namely Danaidae (2 spp.), Lycaenidae (3 spp.), Nymphalidae (6 spp.), Papilionidae (1 sp.), Pieridae (3 spp.) and Satyridae (1 spp.) from different regions of Nepal. Further, Smith (1983) described 3 new subspecies *Dallacha hyagriva nepalica*, *Metaporia leucodice debdice*, and *Parnassius epaphus chiddii*, from this Himalayan bioregion.

3.7.4. Pakistan, including POK (Pakistan occupied Kashmir):

The authors, who have contributed through their major research papers on taxonomy and diversity of butterflies from Pakistan (West) as well from Azad Kashmir, include Rhe-Philipe (1918), Sabir *et al.* (2000), Abbas *et al.* (2002), Khan *et al.* (2003, 04) and Tayyib *et al.* (2005).

3.7.5. Brunei:

Orr & Hauser (1996) studied the species richness and diversity of unique butterfly fauna of Kuala Belalong, Brunei and reported 342 species.

3.7.6. Europe:

Montesinos (1986) studied distribution, species richness and diversity of butterflies in Central Spain. Munguira & Martin (1993), in Spain made observations on the ecological features, geographic distribution, phenology, adult resources, habitat and conservation of 13 Lycaenid species listed in the Spanish Lepidoptera Red Data Book. Dennis (1997), gave relationship between endemism, rarity and species richness of European butterflies. Easton &

Pun (1997), listed 74 butterfly species from the Portuguese territory of Macau, of which 57 are new records. Dennis *et al.* (1999, 2000) studied the significance of butterfly distribution maps in Britain and suggested ways to improve their efficiency. Krauss (2003), in Germany studied the relationship between immigration, extinction, turnover of butterfly species and habitat area and habitat isolation and observed that large habitat fragments are of special importance for the conservation of the specialized, most endangered butterfly species.

3.7.7. Turkey:

Okyar & Aktac (2006) and Ozdemir & Seven (2007), described and reported 61 species and 43 species of butterflies respectively, from Turkey.

3.7.8. Japan:

Sibatani (1992) gave reasons for the decline and conservation strategies of butterflies of Japan. Yoshida *et al.* (2004) studied the butterfly assemblages at two urban parks Nogwa Park and Koganei Park in Musashino area of Tokyo, Japan and reported 35 and 25 species in 7 families in each area respectively.

3.7.9. Jordan:

Katbeh-Bader *et al.* (2003) recorded 61 butterfly species with some new records from different ecological zones of Jordan.

3.7.10. Indian Himalayan Regions:

3.7.10.1. North Western Himalayas (General):

The investigation on earlier collection, of insect-faunas, including butterfly-fauna from various regions and areas of Himalayan regions described by various European Entomologists are incorporated in the monographs published by Hugel (1848). Mani & Singh (1961, 61a, 1962, 62a, 62b, & 63) during their entomological surveys of Himalaya reported 77 species of butterflies, distributed in 4 families namely Lycaenidae (5 spp.), Nymphalidae (21 spp.), Papilionidae (31 spp.), and Pieridae (20 spp.), including 24 species from Kashmir.

Rose & Sharma (1998, 99) studied the taxonomy of the genus *Ypthima* Hubner (Satyridae) from the West and N-West Himalaya and in the year 1998a, these authors reported two new species and also gave role of genitalia in the identification of *Melanitis* species (Satyridae). Further, in the year 2000, they described 6 species of the genus *Lethe* Huebner from North-Western Himalaya and gave their taxonomy and distribution. Uniyal & Mathur (1998), recorded 50 species and 34 genera distributed over 5 families of butterflies from Great Himalayan National Park, Western Himalaya. Joshi *et al.* (2008), gave

distribution of 122 insect species distributed in 6 orders, including 37 butterfly species from Western Himalayas.

3.7.10.2. Mussoorie:

Mackinnon & De Niceville (1898), gave a list of 322 butterflies from Mussoorie and neighbouring regions. Ollenbach (1930) identified many places suitable for butterfly collecting and gave a list of 145 butterfly species, distributed in 8 families from Mussoorie. Rhe-Philipe (1931, 31a) reported 246 species from Simla hills. Shull (1962) collected more than 100 butterfly species in a single day at Mussoorie, India. niyal (1999) gave distribution of Yellow Swallowtail butterfly, *Papilio machaon* at Great Himalayan National Park, Himachal Pradesh. Thakur *et al.* (2002), reported 49 species, belonging to 38 genera and 9 families from Kalatop-Khajjiar Wildlife Sanctuary in Himachal Pradesh. Sood *et al.* (2004) made a comparative study of growth rate of the cabbage white butterfly, *Pieris brassicae* (L.) on cabbage and cauliflower from Himachal Pradesh. Kittur *et al.* (2006), reported 70 species belonging to 15 genera of 5 families from Simbalbara Wildlife Sanctuary, Himachal Pradesh.

3.7.10.3. Delhi:

Donahue (1966, 1967) described 72 species from Delhi, India. Smetacek (1997) gave distribution of *Pieris brassicae* Linnaeus in Delhi, India.

3.7.10.4. Kashmir Himalayas:

The earliest research publications solely devoted to butterfly-fauna of Kashmir Himalayas, have been given by Hugel (1848), Lang (1868), Moore (1874, 77), Marshall and De Niceville (1883, 86 & 89), Evans (1932), Thomas-Glover (1936), Home (1938). Thereafter, Fauna of British India monographs also included volumes on butterflies, with valuable information on these insects, pertaining to Kashmir Himalayas, authored by Bingham (1905, 07) and Talbot (1939, 47). The former author reported 73 species of butterflies distributed in 5 families namely Lycaenidae (8 spp.), Nemeobidae (2 spp.), Nymphalidae (43 spp.), Papilionidae (9 spp.), and Pieridae (11 spp.) from Kashmir of British India.

Evans (1932) reported 92 species of butterflies, distributed in 8 families namely Danaidae (2 spp.), Erycinidae (2 spp.), Hesperidae (7 spp.), Lycaenidae (15 spp.), Nymphalidae (24 spp.), Papilionidae (9 spp.), Pieridae (8 spp.), and Satyridae (25 spp.) from various Kashmir regions of British India.

Thomas-Glover (1936) while studying the butterflies and moths of Chinese Turkestan reported 42 butterfly species distributed over 5 families and 19 genera from Kashmir

Himalayan regions. Talbot (1939, 47), reported 56 species of butterflies distributed in 4 families namely Danaidae (2 spp.), Papilionidae (19 spp.), Pieridae (9 spp.), and Satyridae (26 spp.) from different regions of Kashmir of British India.

Wynter-Blyth (1957) reported 61 species of butterflies distributed over 8 families such as: Danaidae (2 spp.), Erycinidae (1 sp), Hesperidae (4 spp.), Lycaenidae (9 spp.), Nymphalidae (16 spp.), Papilionidae (9 spp.), Pieridae (6 spp.), and Satyridae (14 spp.) belonging to different regions of Kashmir of present times as well to the Kashmir of Himalayan areas of British Empire.

Das *et al.* (1964) and Das & Verma (1965), gave faunal-lists of butterfly species, covering 27 and 23 spp., respectively from Kashmir. Later, Malik *et al.* (1972) reported 6 spp. of butterflies acting as pests of Horticulture/agricultural importance. Haribal (1990) studied behaviour of *Vanessa cashmiriensis* (Kollar) (Nymphalidae) in Kashmir Himalayas. In the year 1992, she gave a list of 34 species of butterflies distributed in 4 families namely Lycaenidae (3 spp.), Nymphalidae (21 spp.), Papilionidae (8 spp.), Pieridae (2 spp.) from Kashmir. However, her list was mainly based on the works of Talbot (1939, 1947) and Wynter-Blyth (1957) rather than on field observations or monitoring.

Jamdar (1991, 92) studied the migration of the Large cabbage white butterfly, *Pieris brassicae* in Overa wildlife Sanctuary, of Kashmir. Hillaludin (1997) gave a list of 23 species of butterflies distributed in 5 families namely Libytheidae (1 sp.), Nymphalidae (9 spp.), Papilionidae (2 spp.), Riodinidae (2 spp.), and Satyridae (9 spp.) based on the previously published research publications of various authors, from Kashmir Himalayan region.

4. RESULTS AND DISCUSSION

4.1. Systematic Account of Butterfly Fauna and Field Studies

4.1.1. Key to the Families of Butterflies:

1. Antennae widely separated at base; both wings with all twelve veins present **Hesperiidae**
Antennae approximated at base; forewing with two or more veins coincident or forked or missing.....2
2. Base of antennae touching eyes**Lycaenidae**
Base of antennae not touching eyes 3
3. Fore tarsi perfect in both sexes..... 4
Fore tarsi imperfect and brush-like in one or both sexes..... 5
4. Fore tibia with a large median spine..... **Papilionidae**
Fore tibia without medial spine**Pieridae**
5. Fore tarsi perfect in female; palpi more than twice as long as head**Libytheidae**
Fore tarsi imperfect in both sexes; palpi not more than twice as long as head6
6. Forewing vein 1b bifurcate at base and hindwing cell closed by tubular vein
..... **Danaidae**
Forewing vein 1b not bifurcate in species in which hindwing cell closed by tubular vein..... 7
7. Hindwing cells closed; discocellular veins present**Satyridae**
Hindwing cells open; discocellular veins absent..... **Nymphalidae**

4.1.1.1. Family: Danaidae

4.1.1.1.1. Genus: *Danaus* Kluk

Danaus Kluk 1730, *Zweirz. Hist. Pocz. gospod.*, 4:83.

Key to the species of genus *Danaus*:

Both pair of wings with veins broadly black; hindwing with a sex bag below Cu1b in male..... *genuita*

Both pair of wings without any markings on veins; hindwing with a sex bag below Cu1b in male, accompanied by three more smaller spots above in an arc ... *chrysippus*

I. *Danaus chrysippus* Linnaeus

(Figs. 1, 2, 13, 95, 96; Plates- I, IV, XXIX)

Papilio chrysippus Linnaeus, 1758, *Syst. Nat.* Ed. x. 471.

Danaus chrysippus, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 11-12.

Danais chrysippus, Evans, 1932, *The Identification Indian Butterflies*. p. 88.

Danaus chrysippus, Varshney, 1979, *J. Bombay nat. Hist. Soc.*, 76 (1): 34.

Danaus chrysippus, Varshney, 1993, *Oriental Insts.*, 27:365.

(i). Common Name: The Plain Tiger

(ii). Diagnostic Features: Antennae black, club elongate, blunt at apex. Head black, decorated with patches of shining white scales. Eyes without hairs. Abdomen ochraceous above, whitish below. Thorax also black, a complete whitish line lies in the centre on the upper side. Last thorax segment has dark orange or dark yellowish hairs on the upper side. Lower side decorated with black and white dots, the latter being in more numbers. Forewing dark orange; with apical black region narrowing along costal margin and towards tornus, black apical part carrying five almost contiguous large white spots arranged in an oblique row. Veins on wings not heavily marked with black. Under surface coloured like upper surface except tip of apical part looks pale yellow with almost all the spots of upper surface visible on under surface. Hindwing orange with marginal border black and has an incomplete row of minute white spots, with three black spots on the discocellularis in female and an additional large bulging black spot in male. Under surface light orange with marginal border black, white and black spots of upper surface prominently visible, fourth large black spot of male studded with white scales in middle. The butterfly is somewhat oily and smooth in touch. Hindwing Lower Discocellularis (LDC) larger than Middle Discocellularis (MDC) and Upper Discocellularis (UDC). Wingspan: 82-84mm. Lower/ Middle/ Upper Discocellularis

(iii). Hosts and Localities: On rocks and moist soil at Dnp, 1670 m, 11-vi-2005, 1♂, 1♀, Mixed Forest; *Tagetes petula*, Uri, 1400 m, 3-viii-2007, 1♀, Hilly and Forest area; *Lantana* sp. Gul, 2644 m, 7-vii-2006, 1♀, Forest.

(iv). Distribution: Kashmir, Africa, China, India, Jordan, Myanmar, Pakistan, Russia, Sri Lanka, Turkey, United Kingdom.

(v). Field Observations: It flew from May to August and the present findings showed that it was mostly a fast and quick flier and flies singly. It mostly took long and higher flight and was usually very difficult to catch. It flew during mid days when the temperature is comparatively higher. It was present at places having a diverse flora at low land areas or in or near the forests. It was highly attracted to damp and moist places, animal excreta mammal droppings and rotten fruits and puddling behaviour is greatly noticeable. It showed little association with other butterflies and preferred undisturbed places. This species did not come at the same place again and again. Before landing it covered a large distance.

(vi). **Remarks:** Previously, Wynter-Blyth (1957) and, Das and Verma (1964) reported it from Kashmir. Thomas-Glover (1936) reported it from Gilgit. *Tagetus petula* is the new host-plant record for this species and is being reported for the first time from Kashmir. It mimics with the female of *Hypolimnas misippus* (Danaid Eggfly). The present findings reveal that this species is not common in Kashmir Valley and needs some attention from conservation point of view. Pajni *et al.* (2006) described it as common in Chandigarh, Punjab, Himachal Pradesh and Haryana.

II. *Danaus genutia* (Cramer)

(Figs. 93, 94; Plate- XXIX)

Papilio genutia Cramer, 1779, *Pap. Exot.*, 3:23. pl. 203

Danais plexippus, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 10-11.

Danais plexippus, Evans, 1932, *The Identification of Indian Butterflies*. p. 88.

Danaus plexippus, Talbot, 1947, *Fauna British India, Butterflies*. Vol. II. p. 23-27.

Danais plexippus, Wynter-Blyth, 1957, *Butterflies Indian Reg.* p. 69.

Danaus genuita, Varshney, 1993. *Oriental Inst.*, 27:365.

(i). **Common Name:** The Common Tiger

(ii). **Diagnostic Features:** Head black, covered with small patches of white scales; antennae black; club elongate, very gradual, blunt at apex; eyes without hairs; thorax black, with two pairs of white spots and a median obliterated white streak. Forewing dark orange, its margins and veins broadly black, prominent black apical part carrying five white elongated spots separated by veins, with much smaller four to their interior, also with a double incomplete row of small white spots along termen; under surface showing black veins and white spots of upper surface. Hindwing dark orange, veins broadly black and a sex bag just below vein Cu1b in male, with black marginal border and carrying two rows of white spots; under surface lighter but otherwise similar to upper surface. Wingspan: 58-93mm

(iii). **Hosts and Localities:** On unknown host plant, Kas, 3-viii-2004, 1♀, Hilly and Forest area.

(iv). **Distribution:** Kashmir, Afghanistan, Burma, China, India, Pakistan, Sulawesi.

(v). **Field Observations:** *D. genuita* showed restricted occurrence in few forest areas of Kashmir Valley and was observed to be a fast flier. It was seen flying from June to August.

(vi). **Remarks:** This species is not common in Kashmir Valley and needs some attention for its future conservation. Recently, Singh (2009) reported it rare from Kadarnath

Musk Deer Reserve, Garhwal, India. This species is being recorded for the first time from Kashmir region.

4.1.1.2. Family: HesperIIDae

4.1.1.2.1. Genus: *Pelopidas* Walker

Pelopidas Walker 1870, *Entomologist*, 5:56.

I. *Pelopidas mathias* (Fabricius)

(Figs. 23,24, 85, 86, 213; Plates-VI, XXVII, LIX)

Hesperia mathias Fabricius, 1898, *Ent. Soc. Suppl.*, p 433.

Baoris mathias mathias, Evans, 1932, *Identification Indian Butterflies*. p. 417, plate, 32

Baoris mathias, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 486, plate-72.

Pelopidas mathias, Varshney *et al.* 1981, *Rec. Zool. Surv. India*, 31:1-38.

Pelopidas mathias, Varshney, 1983, *Rec. Zool. Surv. India*, Occ. Pap. No. 43. 1- 49.

(i). Common Name: The Small Branded Swift

(ii). Diagnostic Features: Antennae black to brownish black, club dark brown, narrowing into a short hook; Head light brownish on upper side and dusted with white on under side, Eyes without hairs, brownish; Thorax black brown, shining on upper side and having brownish hairs on sides with more near abdominal side, and light brownish on underside; Abdomen dark brown on upper side and light brown on under side. Forewing upper side dark dull brown with numerous whitish spots, two comparatively more prominent in discal cell and series of six to eight post discal spots, undersurface of forewing light brown with various spots of upper surface showing through in both sexes. Hind wing upper surface dark brown covered with light yellow or brownish yellow long scales, more densely in female, four to five small postdiscal white spots, undersurface light brown with a series of five to six postdiscal white spots between Sc+R₁ and Cu_{1a} in both sexes. Wing span: 32-40mm.

(iii). Hosts and Localities: On *Carduus edelbergi*, Han, 1680 m, 11-viii-2007, 6♂, Paddy field and vegetable garden; Dod, 2700 m, Forest, 16-vii-2007, 5♂; Pah, 2500 m, 28-vi-2004, Forest; *Digitalis purpurea*, Sho, 2146 m, 22-viii-2007, 5♂, Mountainous area; *Oryza* sp., Han, 1680 m, 11-vii-2007, 1♂, 2♀, rice field and agricultural land; *Tagetus petula*, Gul, 2644 m, 27-viii-2005, 5♂, mixed Forest; grasses, Gan, 2084 m, 11-iv-2004, 1♂, 1♀,

(iv). Distribution: Kashmir, China, Japan, India, Myanmar, Philippines, Sri Lanka.

(v). **Field Observations:** It was noticed usually a slow to moderate flier, flying both singly as well in groups. While basking in the sun, it kept its fore-wings vertically upright in comparison to horizontally placed hind wings. Flight activity was seen from June to October.

(vi). **Remarks:** Earlier, Wynter-Blyth (1957) and Malik *et al.* (1972) reported it from Kashmir. Recently, Singh (2009) reported it as uncommon species from Kadarnath Musk Deer Reserve, Garhwal, India. The present study revealed that this species is common in Kashmir Himalayan regions. *Carduus edelbergi*, *Digitalis purpurea*, and *Tagetes petula* are the new hostplants of this species, encountered during the course of present study.

4.1.1.3. Family: Libytheidae

4.1.1.3.1. Genus: *Libythea* Fabricius

Libythea Fabricius 1807, *Mag. F. Insekten*. (Illiger), 6:284.

I. *Libythea lepita lepita* Moore

(Figs. 5, 6, 54, 55, 97, 98, 226; Plates- II, XIV, XXX, LXII)

Libythaeta lepita Moore, 1857, *Cat. Lep. Ins. Mus. East India Coy*, 1: p. 240.

Libythea lepita race *lepita*, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 473-474

Libythea lepita lepita, Evans, 1932, *The Identification Indian Butterflies*. p. 194.

Libythea lepita lepita, Gupta & Skukla, 1988, *Rec. Zool. Surv, India*. Occ. Pap. No.109. p.72-73.

Libythea lepita, Varshney, 1994, *Oriental Inst.*, 28:191.

(i). **Common Name:** The Common Beak

(ii). **Diagnostic Features:** Antennae brownish; Head orange brownish; Thorax upperside blackish brown with light brownish hairs on sides, underside dark brown; Abdomen shining and brown on upperside, blackish brown on underside. Forewing upperside darker brown; cell with an orange yellow streak which is much narrower for two-thirds of its length from base, then abruptly expanded anteriorly so as to fill the apex of the cell, the inner margin of the apical portion and the anterior margin of the basal portion forming a clearly defined right angle; upper discal spot somewhat diamond-shaped; subcostal spot and preapical spot placed obliquely outwards from it more distinctly double, the lower portion of the sub-apical spot orange-yellow; the upper postdiscal orange patch of hindwing narrower, placed obliquely transverse reaching from 1A+2A to M₁ covered with light brownish hairs. Underside of forewing dark brown or pale brown, orange and white markings as on the upperside, but the preapical double spot entirely nearly white. Underside of

hindwing dark grayish or dark brown usually without any spots or markings, post discal patch not visible on the under side. Hindwing Lower Discocellularis (LDC) larger than Middle Discocellularis (MDC) and Upper Discocellularis (UDC). R_3 nearer to R_4 than R_2 . Hindwing cell nearly U shaped at the base. $Sc+R_1$ away from R_s . M_1 and M_2 go away from each other. Forewing falcate. Pattern of colouration varies being light in some or dark in others. Wing span: 40-52mm.

(iii). Hosts and Localities: On *Rubus ulimefolius*, Dnp, 1670 m, 29-iii-2007, 4♂, Mixed Forest; *Celtis australis*, Gul, 2644 m, 22-vi-2006, 2♂, 1♀, Forest; roads and moist soil, Dod, 2700 m, 07-ix-2007, 6♂, Forest.

(iv). Distribution: Kashmir, India, Pakistan, Sri Lanka

(v). Field Observations: This butterfly species was observed attracted to damp places, animal excreta and rotten fruits and shows a prominent mud puddling behaviour. It sits on roads, rocks, sand, dry leaves with its wings folded. During folded wing condition it matches with the colouration of dusty roads, open fields or rocks and is very difficult to locate. It thus gives it protection from many of its predators and is an example of protective colouration. It is highly sensitive and avoids flying during rains, low light and temperature, human influenced areas, and was distributed in undisturbed natural habitats having a mixed but diverse flora. It flies both very nearer to ground as well as higher and shows slow, fast and very fast flight. When both the sexes chase each other or when disturbed or when flying singly they fly very fast and take a zigzag, up down type of flight. At such occasions it is very difficult to catch. It flies when there is high intensity of sun light and is even very active during very hot mid days. It was observed to be active in the field from April to September, both in groups as well as singly.

(vi). Remarks: The present field study has revealed that this species being occasional but not Common in Kashmir Valley. It occurred at very few places having a unique habitat. At Dachigam National Park, it was highly abundant and occurred in hundreds during the month of April and May. However such type of rare behaviour was neither observed in other months or years nor at other places. Marshall and De Nicevelle (1886), Gupta and Shukla (1988), Haribal (1991), and Wynter-Blyth (1957) had previously recorded it from Kashmir. Recently, Kawahara (2009) while studying the phylogeny of family Libytheidae gave its distribution in Kashmir. Ambrose and Raj (2005) described it not common at Kalakad-Mundanthurai Tiger Reserve, Tamil Nadu and Singh (2009) reported it uncommon from Kadarnath Musk Deer Reserve, Garhwal, India. It has already been listed in the Indian

Wildlife Protection (1972) Act. *Rubus ulimefolius* is the new host-plant for this species from Kashmir (India).

4.1.1.4. Family: Lycaenidae

Key to the Genera of Family Lycaenidae:

1. Hindwing with tornus not produced 2
Hindwing with tornus produced *Lycaena*
2. Underside of wings without any black, circular spots, except tornal spots on hindwing, later tailed at Cu1b *Lampides*
Underside of wings with black spots, in addition to tornal spots on hindwing, later without tail *Aricia*

4.1.1.4.1. Genus: *Aricia* R.L.

Aricia R. L., 1817, *Jenaische Allgem. Lit. Ztg. Jena.*, 14(1): 280.

I. *Aricia agestis* (Denis and Schiffermuller)

(Figs. 27, 28, 53, 101, 102; Plates-VII, XIV, XXXI)

Papilio agestis Denis and Schiffermuller, 1775, *Ankundung Sys. Werkes Schmett.* p. 84.

Lycaena astrarche, Bingham, 1907, *Fauna British India, Butterflies.* Vol. II. p. 337-338.

Polyommatus astrarche, Evans, 1932, *The Identification Indian Butterflies.* p. 228.

Aricia agestis, Varshney, 1997, *Oriental Inst.*, 31:105.

(i). **Common Name:** The Orange-Bordered Argus.

(ii). **Diagnostic Features:** Antennae brownish with some minute whitish markings on the ventral side, club well defined. Thorax brownish black, shining on upper side and dull creamish on underside and covered with creamish scales/hairs. Abdomen brownish having some area creamish on the underside. Forewing with 11 veins and upper side brown with a bar at end cell, and 4 to 6 submarginal spots orange/copper coloured; underside forewing dark gray with black spot at end cell, six more black spots on the discal area in an irregular manner. Hindwing upper side brown, a row of marginal spots inwardly bordered with nearly 5 to 6 orange spots; underside dark, end cell with black spots; a row of orange inwardly black edged sub marginal spots, a series of nearly 11 to 12 black outwardly white edged marginal spots. Wing Span: 22-34mm.

(iii). Hosts and Localities: On *Mentha longifolia*, Dnp, 1670 m, 28-vii-2005, 3♂, 5♀, Mixed dense forest; Han, 1680 m, 21-iv-2004, 2♂, 1♀, paddy field and vegetable garden; Kul, 1647 m, Agricultural land; Gul, 2644 m, 03-vii-2006, 4♂, 8♀, Forest; Pam, 1586.5 m, 08-ix-2007, Open field along National Highway; Uri, 1400 m, 20-vii-2005, 6♂, 7♀, Vegetable area along with forest.

(iv). Distribution: Kashmir, Europe, India, Iran, Jordan, Pakistan, Turkey.

(v). Field Observations: This butterfly species was found attracted to damp muddy places and also showed mud puddling behaviour. Flying was witnessed nearer to the ground and as a slow-flier, active in both shady and open places. It mostly kept its wings folded when nectering and remained active in the fields from April to October.

(vi). Remarks: Marshall and De-Niceville (1889), Bingham (1907), Evans (1932), Wynter-Blyth (1957) reported it from British Kashmir region. The present study revealed that this species is common in Kashmir Himalayas. However, Singh (2009) reported it as rare from Kadarnath Musk Deer Reserve, Garhwal, India. *Mentha longifolia* is the new hostplant of this species and is reported for the first time from Kashmir Himalayan Regions.

4.1.1.4.2. Genus: *Lampides* Huebner

Lampides Huebner 1819, *Verz. bekannt, Schmett.*, 5:70.

II. *Lampides boeticus* Linnaeus

(Figs. 25, 26, 103, 104, 224; Plates- VII, XXXI, LXI)

Papilio boeticus Linnaeus, 1767, *Syst. Nat.* Ed. XII. 789.

Polyommatus boeticus, Bingham, 1907, *Fauna British India, Butterflies*, Vol. II. p. 432-234.

Lampides boeticus, Evans, 1932, *The Identification Indian Butterflies*, p. 236.

Lampides boeticus, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 289-290, plate 43.

Lampides boeticus, Varshney, 1997, *Oriental Insts.*, 31:94.

(i). Common Name: The Pea Blue.

(ii). Diagnostic Features: Antennae black, their segments ringed with white; club gradual, apex blunt and orange; eyes densely hairy. Forewing dark brown, suffused sparsely with shining scales in female and shining suberrect violet blue scales in male; under surface light brown with a number of zigzag pale brown and white bands within cell and on entire surface beyond it. Hindwing more or less concolorous with forewing, tailed at Cu1b, tail narrow and black and tipped with white, male with two circular black spots one on each side

of Cu1b, spots margined with white along with additional obscure white submarginal spots in female; under surface light brown with wavy white lines: throughout, with two black jewelled spots surrounded by orange between Cu1a and tornus in both sexes. This species can be readily identified from the presence of a pair of black spots near the tornus on the under surface of hindwing. Wing Expanse: 26-34mm.

(iii). Hosts and Localities: On *Pisum sativum*, Han, 1680 m, 11-viii-2007, 4♂, 6♀; Nis, 1583 m, 1♂, 2♀; Sop, 1581.8 m, 5♂, 1♀, Sho; 2146 m, 3♂, 2♀, Vegetable gardens.

(iv). Distribution: Kashmir, Africa, Australia, Burma, China, Europe, Germany, India, Japan, Jordan, Pakistan, Sri Lanka, Switzerland.

(v). Field Observations: *L. boeticus* was seen as a slow flier and mostly moved nearer the ground. It preferred moist and dull soil and sand, plant shadows, animal droppings, etc. as resting places and showed mud puddling behavior. Was found in the fields from May to September, and the butterfly kept its wings folded when sitting or nectering. Its distribution was seen restricted to low-land areas of Kashmir valley.

(vi). Remarks: Earlier, Malik *et al.* (1972) reported it from Kashmir. It is common in Kashmir Himalayas. Varshney (1997), treated it endangered in the Indian region. It has already been listed in the Indian Wildlife Protection (1972) Act.

4.1.1.4.3. Genus: *Lycaena* Fabricius

Lycaena Fabricius 1807, *Mag. f. Insektenk. (Illiger)*, 6:285.

III. *Lycaena phlaeas* (Linnaeus)

(Fig. 99, 100, 216; Plates, XXX, LIX)

Papilio phlaeas Linnaeus, 1761, *Faun. Suec.* 1078:285.

Chrysophanus phlaeas, Marshall and De Niceville, 1889, *Butterflies India, Burma and Ceylon*. Vol. III, p. 315-317.

Lycaena phlaeas indicus, Evans, 1932, *The Identification Indian Butterflies*, p. 244.

Lycaena phleas, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 301, plate 42.

Lycaena phlaeas, Varshney, 1997, *Oriental Inst.*, 31:108.

(i). Common Name: The Common Copper, Small Copper.

(ii). Diagnostic Features: Antennae brownish. Head dull brownish. Thorax blackish brown on upper side and dull creamish and shining on underside. Abdomen brownish on upperside and dull silvery creamish on underside. Forewing upperside pale reddish-copper adorned with nearly 8 black spots. Discal area more or less overlaid with blackish scales; underside forewing with orange ground colour adorned with numerous black marks. All

black marks on the orange colour, no one on the brownish area of the apex and inner margin. Cell with 3 black spots, the one at discocellularis larger and bigger than others. Apex and inner margin brownish fawn. Hindwing upperside grayish brown with a broad obscure grayish red or orange marginal band, frequently dusted with a row of faint blue spots inwards of this marginal band. A row of black marks bordering the outer edge of the orange margin. Inner margin lightly dusted with small brownish hairs. Underside of the hindwing grey-brown or brownish fawn with minute spots nearly 14 in number, those along the costal margin being comparatively larger than others. Orange colouration of marginal area visible on the underside. Male similar to female but slightly smaller and copper colouration is brighter in female than male. Wing Span: 28-34mm.

(iii). Hosts and Localities: On *Digitalis purpurea*, Bar, 1600 m, 29-vi-2006, 4♂, 6♀, Forest; *Mentha longifolia*, Gul, 2644 m, 03-vii-2006, 2♂, 6♀, Forest; Uri, 1400 m, 20-vii-2005, 3♂, 3♀, Forest; *Tagetus petula*, Han, 1680 m, 11-viii-2007, 7♂, 2♀, Agriculture field and orchids along roads; Sop, 1581.8 m, 16-vi-2004, 2♂, 1♀, Orchids; Kre, 1731 m, 14-vii-2006, 1♂, 2♀, Hilly area; Dod, 2700 m, 07-ix-2007, 1♂, 1♀, Dense forest; Gan, 2084 m, 11-iv-2004, 9♂, 2♀, Agricultural land.

(iv). Field Observations: The butterfly species found usually as a slow to moderate flier and preferred nearer to the ground but when disturbed it was seen flying very fast both singly as well as in groups. When nectering or sucking the juices, it kept its wings open. Seen attracted to moist and damp soil, dead leaves and plants and animal droppings for resting and showed mud puddling behavior. It flew from May to September.

(v). Distribution: Kashmir, Africa, China, India, Japan, Jordan, Pakistan, Turkey,

(vi). Remarks: The present study showed the common distribution of this species in all the districts of the Valley. Earlier, Evans (1932) and Thomas-Glover (1936) gave its distribution in Kashmir (British). *Digitalis purpurea*, *Mentha longifolia* and *Tagetus petula*, are the newly reported host-plants of this species from Kashmir Himalayan Regions.

4.1.1.5. Family: Nymphalidae

Key to the Genera of Family Nymphalidae:

1. Hind wing precostal vein arising opposite the origin of vein Sc+R₁ *Neptis*
 Hindwing precostal vein arising beyond the origin of vein 8 2
2. Forewing vein R₂ arises from vein R₅ or near end cell 3
 Forewing vein R₂ arises before end cell 6
3. Forewing with vein R₂ arising from vein R₅; vein R₃ ending on costa *Phalanta*

Forewing with vein R ₂ arising from cell and vein 9 ending on the apex	4
4. Hindwing precostal vein straight and obscure	<i>Issoria</i>
Hindwing precostal vein curved forward	5
5. Underside of hindwing ochreous and olive brown	<i>Argyreus</i>
Underside of hindwing dark green	<i>Childrena</i>
6. Eyes hairy	7
Eyes smooth	8
7. Fore tarsi clothed with long shaggy hair in both sexes	<i>Cynthia</i>
Fore tarsi not clothed with long shaggy hair in female	<i>Vanessa</i>
8. Palpi black above, white beneath; head and thorax black with white spots	<i>Hypolimnas</i>
Palpi not as above; head and thorax not white spotted	<i>Junonia</i>

4.1.1.5.1. Genus: *Argyreus* Scopoli

Argyreus Scopoli 1777, *Introd. Hist. Nat.*: 431.

I. *Argyreus hyperbius* (Johanssen)

(Fig., 169, 170, 171, 172; Plate, XXXXVIII)

Papilio hyperbius Johanssen, 1764, *Amoen. Acad.*, 6:408.

Argynnis hyperbius, Bingham, 1905, *Fauna British India, Butterflies*, Vol. I. p. 438-441.

Argynnis hyperbius hyperbius, Evans, 1932, *The Identification Indian Butterflies*, p. 182.

Argynnis hyperbius, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 220.

Argyreus hyperbius, Varshney, 1994, *Oriental Insts.* 28:168.

(i). **Common Name:** The Indian Fritillary.

(ii). **Diagnostic Features:** Antennae pale brown to dark brown, club broad, Head dark brownish; Thorax on upperside pale to dark brown and covered with small pale hairs, underside creamish; Abdomen pale brown on upperside and light brown on underside and dusted with white; Forewing in male orange with costal and apical margins black; black markings including a loop and a speck and also an elongate spot in cell, a spot on discocellularis, rows of prominent spots in discal, postdiscal and submarginal parts; under surface mostly reddish with apex ochraceous, with most of black spots of upper surface showing through except olivaceous brown colouration of spots in ochraceous region and those with additional four silvery white spots. Hindwing in male coloured like forewing, with

diffused black marginal band enclosing orange lunules, an elongate spot in discocellulars, along with conspicuous rows of discal, postdiscal and submarginal black spots; under surface mottled with ochraceous, its olivaceous brown and silvery white markings bordered in prediscal, discal and submarginal region. Female forewing dark orange, densely dusted with black, with apical region beyond middle of costal margin to tornus black and suffused with violet, also having a broad white band between costa and submarginal spots upto Cu1a, with various black spots resembling those of male, under surface similar to male but white band of upper surface bordered on inner margin with violet and black. Female hindwing exactly like that of male on upper as well as under surface. Wingspan: 66-70 mm.

(iii). Hosts and Localities: On *Tagetes petula*, Dnp, 1670 m, 06-vi-2006, 3♂ 4♀, Mixed diverse flora; *Viola tricolor*, Dod, 2700 m, 16-vii-2007, 2♂, 3♀, Forest.

(iv). Distribution: Kashmir, Myanmar, India,

(v). Field Observations: Flying of this species was seen usually singly and quickly. It took a long flight and caused difficulty in catching. Seen sitting on moist and muddy soil/sand, near watery places, with puddling behavior. It showed its occurrence from May to October.

(vi). Remarks: It is not commonly found in the valley and is restricted to certain forest areas. Earlier, Marshall and De Nicevelle (1886) reported it from British Kashmir.

4.1.1.5.2. Genus: *Childrena* Hemming

Childrena Hemming 1934, *Proc. R. Ent. Soc. London*, B, 12: 30.

II. *Childrena childreni* (Gray)

(Figs. 9, 10, 161, 162, 225, 227, 228; Plates- III, XXXXVI, LXII)

Argynnis childreni Gray, 1831, *Zool. Misc.*, 1:33.

Argynnis childreni race *sakontala*, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 435-436.

Argynnis childreni childreni, Evans, 1932, *The Identification Indian Butterflies*. p. 182.

Argynnis childreni, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 221.

Childrena childreni, Varshney, 1994, *Oriental Insts.* 28:168.

(i). Common Name: The Large Silverstripe

(ii). Diagnostic Features: Antennae reddish brown to blackish brown; Head large, cardamom brown; Thorax upperside turmeric yellow, shining, large and covered with turmeric yellow or brownish yellow hairs, underside dull yellow and covered with small

shining dark yellowish hairs; Abdomen turmeric yellowish to blackish brown and covered with small yellowish hairs, underside dull creamish yellow; Forewing upperside rich fulvous or cardamom brown, with nearly twenty six (26) jet-black spots/markings distributed in different regions- three spots inside discal cell, the one near the discocellularis larger, one large spot on discocellularis, one spot between IA+2A and Cu1b, one between M₃ and R₅ and another between R₄ and R₅ near costal margin in the discal area, two rows of spots in the submarginal area, each row with seven (7) spots and all spots show increase in size from apex to tornal area, all veins from 1A+2A to R₄ with at least two spots in between, some areas like between IA+2A and Cu1b, Cu1a and M₃, M₃ and R₅, R₅ and R₄ and R₄ and R₃ with three (3) spots, marginal area dusted with two rows of blackish lines from apex to tornus with a trace of fulvous or turmeric brown colouration in the form of a line, undersurface terracotta-red, apex light greenish with some light brown and white colouration, nearly all spots of upperside seen through, however those on apex less prominent than others; one additional blackish spot between M₃ and M₂ nearer to basal area; Hindwing upperside like forewing with nearly sixteen (16) black spots and tornal area with blue suffusion; discal cell with one spot and two similar spots outside cell in line with discal spot nearly at right angle to the costal margin; one discocellular spot and a small spot below it near discal cell, two rows of spots in the submarginal area, the row towards outer side with six large spots and the row towards innerside with five comparatively small spots, with seven (7) spots and all spots show increase in size from apex to tornal area; all veins from 1A+2A to R₄ with at least two spots in between, marginal area dusted with black with some ill defined turmeric area in between; undersurface of Hindwing rich metallic or dark green with nearly six silver bands including the terminal bands, upperside spots not visible, marginal area silvery white with two light brownish lines, outer one zigzag like; inner margin of both wings dusted with turmeric coloured scales/hairs. Wingspan: 66-78 mm.

(iii). Hosts and Localities: On *Budlegia asiatica*, Dod, 2700 m, 28-vii-2005, 2♂, 1♀, Forest; *Mentha longifolia*, Uri, 1400 m, 05-vii-2007, 5♂, Forest and mountainous area; *Rubus niveus*, Dnp, 1670 m, 29-vii-2007, 5♂, 4♀, Mixed dense vegetation.

(iv). Distribution: Kashmir, India, Myanmar, Pakistan.

(v). Field Observations: Flying by this species seen both singly and in groups, and it took moderate to fast flight. It was highly attracted towards moist soil and sand, watery places, open roads and animal excreta and showed prominent mud puddling behaviour. Its flight Activity was from May to October.

(vi). **Remarks:** Bingham (1905), Marshall and De Nicevelle (1886) and Varshney (1994), included it in the check list. It was not common and is restricted to very few places of Kashmir Himalayas. Singh (2009) reported it as rare from Kadarnath Musk Deer Reserve, Garhwal, India. *Budlegia asiatica*, *Mentha longifolia* and *Rubus niveus* are the new hostplants for this species from Kashmir valley. Its pupae lie hanged and resembles the dead leaves of *Rubus niveus*- the new larval hostplant, which makes it difficult to locate. All the developmental stages of this butterfly species can be seen on *Rubus niveus* plant.

4.1.1.5.3. Genus: *Cynthia* Fabricius

Vanessa Fabricius 1807, *Mag. f. Insektenk. (Illiger)*, 6:281.

III. *Cynthia cardui* (Linnaeus)

(Figs. 29, 30, 60, 159, 160, 179, 233-243; Plates- VII, XVI, XXXXV, L, LXIV-LXVI)

Papilio cardui Linnaeus, 1758, *Syst. Nat.* x, 1:474.

Vanessa cardui, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 365-366.

Vanessa cardui, Evans, 1932, *The Identification Indian Butterflies*. p. 177.

Vanessa cardui, Wynter-Blyth, 1957, *Butterflies Indian Region*. p.

Vanessa cardui, Mathur & Srivastava, 1967, *Indan For.*, 93(7-2):669.

Cynthia cardui, Varshney, 1994, *Oriental Insts.*, 28:175.

(i). **Common Name:** The Painted Lady.

(ii). **Diagnostic Features:** Antennae black or brownish black, club elongated and tipped with pale white or yellow. Eyes without hairs. Head larger, brownish. Thorax black and shining on upperside, covered by silky brownish scales on sides, underside creamish and covered with creamish or milky white scales. Abdomen blackish brown on upperside and light brownish on underside. Forewing dusky black near base, ochraceous orange in median and black in distal part; black portion carrying postdiscal white patch between costal margin and M_2 , four submarginal white spots between costa and M_3 and faint lunar white marks to outside of submarginal spots; orange area with confluent irregular black spots forming a zigzag band; basal area dusted with golden brown scales extending along inner margin; under surface ochraceous orange to orange red in middle and dusky brown in the remaining part, black and white spots of upper surface showing through on under surface, with marginal and submarginal wavy white lines bearing black spots. Hindwing dark orange, covered with long orange hair from base to tornus below anterior margin of cell, its base and costal margin

blackish, former suffused with golden brown scales, with marginal, submarginal and postdiscal black spots of different shapes more or less arranged in rows; under surface dull white, mottled with olive brown and ochraceous, with four prominent postdiscal ocelli and submarginal row of bluish black elongate spots. Wing span: 48-64 mm.

(iii). Hosts and Localities: On *Carduus edelbergi*, Aha, 2200 m, 10-vii-2006, 2♂, 3♀, Forest; *Cerastium cerastoides*, Tan, 2220 m, 25-v-2005, 1♂, 2♀, Forest along general road; *Cersium wattutus*, Pah, 2500 m, 28-vi-2004, 5♂, 8♀, Dense Forest; *Digitalis purpurea*, Sho, 2146 m, 22-viii-2007, 1♂, 2♀, Mountainous area; *Erodium cicutarium*, Kha, 1596 m, 02-v-2004, 2♂, 1♀, Hilly area with mixed vegetation; *Euphorbia helioscopia*, Ban, 1582 m, 28-vi-2005, 4♂, 1♀, Hilly area with mixed vegetation; *Medicago polymorpham*, Qaz, 1900 m, 29-vi-2004, 2♂, 7♀, Forest near agricultural land; *Mentha longifolia*, Dnp, 1670 m, 29-vii-2007, Mixed dense vegetation; *Tagetus petula*, Han, 1680 m, 11-viii-2007, 2♂, 1♀, Orchids near Forest; *Thymus serpyllum*, Uri, 1400 m, 05-vii-2007, 6♂, 9♀, Forest and mountainous area; *Urtica dioica*, Gul, 2644 m, 04-viii-2007, 5♂, 11♀, Forest.

(iv). Distribution: Kashmir, India, Jordan, Myanmar, Pakistan, Turkey,

(v). Field Observations: *C. cardui* remained active in the field from April to November but was most abundant from May to August. It was found flying in various habitats like forests, gardens, hilly places, orchids, parks, roads, agricultural land and open fields of Kashmir Valley, took a moderate to fast and quick flight and flied very high in the air. It preferred to fly during mid days but its movement was not much effected during very hot days. It was very much attracted to damp places, moist soil or sand and animal excreta and shows mud puddling behaviour. All the developmental stages (eggs, larvae, pupae and adults) of this butterfly found wide occurrence on the host plant, *Tagetus petula*.

(vi). Remarks: Thomas-Glover (1936), Wynter-Blyth (1957), and Mathur and Srivastava (1967), earlier reported it from J&K state, a pest of aromatic and medicinal plant, viz. *Blumea lacera*. *C. Cardui* has already been listed in the Indian Wildlife Protection (1972) Act. The present survey has revealed it as very common distribution in Kashmir Himalayas. *Carduus edelbergi*, *Cerastium cerastoides*, *Cersium wattutus*, *Digitalis purpurea*, *Erodium cicutarium*, *Euphorbia helioscopia*, *Medicago polymopha*, *Mentha longifolia*, *Tagetus petula* and *Thymus serpyllum*, are the new records of hostplants for this species. The butterfly completes its whole developmental stahgfegees on *Tagetus petula* which is the newly recorded larval as well as adult food plant for this species from Kashmir valley.

4.1.1.5.4. Genus: *Hypolimnna* Huebner

Hypolimnias Huebner 1819, *Verz. bekannt, Schmett.*, (3):45.

IV. *Hypolimnias misippus* (Linnaeus)

(Fig. 175, Plate- XXXXIX)

Papilio misippus Linnaeus, 1764, *Mus. Ulr.*, 264.

Hypolimnias missipus, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 388-389.

Hypolimnias misippus, Evans, 1932, *The Identification Indian Butterflies*. p. 173.

Hypolimnias misippus, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 202.

Hypolimnias misippus, Varshney, *Oriental Insts.* 28:177.

(i). Common Name: Danaid Eggfly

(ii). Diagnostic Features: Species strongly dimorphic sexually. Wing Expanse: 57-80 mm.

Male: Antennae black to brownish black, club gradual but prominent. Head black with various whitish spots. Eyes without hairs. Thorax blackish on upperside and pale brown on underside and dotted with whitish spots. Abdomen black on both upperside and underside with numerous whitish spots on underside. Forewing black, with a large oval white discal spot and a small preapical white spot, both spots narrowly margined with iridescent blue; under surface rust red at base, golden brown in apical area and fuscous from below Cu_{1a} to inner margin, with three white specks inside anterior margin of cell, a large postdiscal and small preapical white spot margined with fuscous of upper surface seen through, also with two submarginal white spots and two rows of white lunules along termen. Hindwing black, a much larger discal white and somewhat rounded spot margined with iridescent blue; under surface rust red at base and in postdiscal area, with very broad discal white band from costa to inner margin, also with a black spot each at base of $Sc+R_1$ between $Sc+R_1$ and anterior margin of cell and a most conspicuous spot between $Sc+R_1$ and R_s , with a series of five less prominent submarginal white specks and two rows of white lunules along termen.

Female: Antennae, Head, Thorax and Abdomen as in male. Forewing tawny, with costal margin and termen black and costal margin carrying a white spot in middle, its termen having two rows of elongate white lunules; under surface lighter than upper, with only basal half of costal margin broadly black and carrying four white spots, with scattered white submarginal spots and two rows of white lunules in black marginal border. Hindwing tawny, a black spot between $Sc+R_1$ and R_s , its black marginal band carrying a row of white lunules; under surface lighter than upper, with a black spot each at base of $Sc+R_1$, on discocellulars

and a V-like spot between Sc+ R₁ and R_s, with also a row of small white submarginal spots and two rows of white lunules in marginal black border.

(iii). **Hosts and Localities:** On moist and muddy soil, Dnp, 1670 m, 11-vi-2005, 2♂, Mixed diverse flora; Hilly and open field, Pul, 1690 m, 08-ix-2007, 2♂, 1♀.

(iv). **Distribution:** Kashmir, Africa, India,

(v). **Field Observations:** It was found as a fast flier and mostly remained active singly from May to October. It was attracted to moist soil, damp places, open areas, animal droppings and shows puddling behavior.

(vi). **Remarks:** According to Varshney (1994), it is endangered from Indian region. Recently, Singh (2009) reported it as uncommon from Kadarnath Musk Deer Reserve, Garhwal, India and this species has already been listed in the Indian Wildlife Protection (1972) Act. It was not common in Kashmir Himalayas.

4.1.1.5.5. Genus: *Junonia* Huebner

Junonia Huebner 1819, *Verz. bekannt, Schmett.*, (3):34.

Key to the species of genus *Junonia*

1. Upperside of forewing without prominent ocelli, pale to dark brown, with darker brown bands *iphita*
Upperside of forewing with variegated ocelli in interspace 2, general colour varies 2
2. Upperside of wings with their general colour bright shining blue which in hindwing extends nearly to base along costa *orithya*
Upperside of wings tawny, with a number of short black bars in and beyond the cell of forewing *almana*

V. *Junonia almana* (Linnaeus)

(Fig., 147, 148; Plate- XXXXII)

Papilio almana Linnaeus, 1758, *Syst Nat.* (ed. 10), 1:472

Junonia almana, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p.361-362.

Precis almana almana, Evans, 1932, *The Identification Indian Butterflies*. p. 176.

Junonia almana, Varshney, 1994, *Oriental Inst.*, 28:176.

(i). **Common Name:** The Peacock Pansy

(ii). **Diagnostic Features:** Antennae blackish brown; club gradual, blunt at apex; eyes without hairs. Wet season form: forewing orange, base along with costal and apical margins dusted with black, with four black and black margined short sinuous bands, two with discal

cell and two beyond it, black margined two unequal postdiscal ocelli between M_1 and M_2 and $Cu1a$ and $Cu1b$, both white -centered but later bigger in size, with a black marginal and submarginal line; under surface brownish ochraceous, with three sinuous bands at base and a diffused postdiscal band accommodating two white-centered smaller ocelli and a bigger ocellus between $Cu1a$ and $Cu1b$, with termen brown and accompanied by two sinuous black submarginal and one marginal line. Hindwing orange, dusted with black at base and with orange hairs along inner margin, a larger postdiscal bipupilled ocellus between $Sc+R_1$ and M_3 and very small ocellus between $Cu1a$ and $Cu1b$, with three black sinuous lines on and along termen; under surface brownish ochraceous, with marginal and submarginal sinuous lines and two ocelli of upper surface showing through, with two additional ochraceous bands in prediscal and discal parts. In dry season form, termen of forewing strongly bent towards at M_1 and scalloped between M_1 and $Cu1b$, ocellus just below costal margin absent, a single submarginal line visible in both wings. Hindwing with inconspicuous ocelli of upper surface reduced to specks between M_1 and $Cu1a$ and $Cu1b$. Wing span: 46-60mm.

(iii). **Hosts and Localities:** On unknown host plant, Kas., 28-vii-2004, 1♂, 1♀, Mixed vegetation.

(iv). **Distribution:** Kashmir, India, Sri Lanka, Myanmar (Burma),

(v). **Field Observations:** *J. almana*, was found as quick flier, and showed its occurrence in wet and dry forms. It flew from May to September.

(vi). **Remarks:** It is not common in Kashmir Himalayas and is being reported for the first time from Kashmir valley.

VI. *Junonia iphita* (Cramer)

(Fig., 151, 152; Plate- XXXXIII)

Papilio iphita Cramer, 1779, *Pap. Exot.*, 3, pl. 209, fig. C, D.

Junonia iphita, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 356-357.

Precis iphita siccaata, Evans, 1932, *The Identification Indian Butterflies*. p. 177.

Precis iphita, Wynter-Blyth, 1957, *Butterflies Indian Reg.* p. 208-209.

Precis iphita, Varshney, 1994, *Oriental Inst.* 28:176.

(i). **Common Name:** The Chocolate Pansy

(ii). **Diagnostic Features:** Antennae pale to dark brown on upperside and light brown on underside, club gradual, pointed at apex. Head pale brown to chocolate brown. Eyes without hairs. Thorax blackish brown on upperside and shining and covered with small pale hairs, underside dark brown to pale brown; Abdomen brownish on upperside and light brown

on underside. Forewing dull brown, darker in basal half, with an irregular dark brown loop in discal cell and another on discocellulars, also with a diffused postdiscal band and two dark brown submarginal lines; under surface dark brown, with sinuous broad band in cell and another on discocellulars along with a row of faint postdiscal ocelli; Hindwing more or less coloured like forewing, having a postdiscal row of five minute and faint ocelli with lower most between Cu1a and Cu1b comparatively bigger and darker, with two blackish brown submarginal sinuous lines; under surface coloured like forewing, with a broad sinuously dark margined discal band fading below lower margin of cell, having a postdiscal straight band between costal margin and tornus, with or without an ochraceous spot between Sc+ R₁ and Rs, row of small diffused ocelli and a sinuous submarginal line, inner margin of hindwing covered with light brownish hairs/scales. Wingspan: 60-68 mm.

(iii). Hosts and Localities: On *Thymus serpyllum*, Uri, 1400 m, 20-vii-2005, 2♂, Forest and mountainous area.

(iv). Distribution: Kashmir, India

(v). Field Observations: The flight activity of *J. i. iphita* was observed, from May to September, preferred it during hot mid days and avoided flying during rain, low light, and temperature. Its distribution in the Valley was confined to places like Batpora, Boniyar, Dachigam, Dodhpathri, Gantmulla, Qazigund and Uri.

(vi). Remarks: This species is not found common in Kashmir Valley. Earlier, Marshall and De-Nicevelle (1886) and Wynter-Blyth (1957) reported it from Kashmir. *Thymus serpyllum* is the new hostplant of this species and is reported for the first time from Kashmir Himalayan regions.

VII. *Junonia orithya* (Linnaeus)

(Figs. 19, 20, 149, 150, 212; Plates- V, XXXXIII, LVIII)

Papilio orithya Linnaeus, 1758, *Syst. Nat.*, Ed.X.473.

Junonia orithya, Bingham, 1905, *Fauna British India, Butterflies*, Vol. I. p. 358-359.

Junonia orithya, Varshney, 1994, *Oriental Inst.*, 28:176.

(i). Common Name: The Blue Pansy

(ii). Diagnostic Features: Antennae brown, dusted with light yellowish colour, club abrupt. Head cardamom brown. Eyes without hairs, Thorax blackish, shining on upperside with small blackish hairs/scales close to first abdominal segment, underside creamish with very small creamish hairs. Abdomen blackish on upperside and creamish on underside. Forewing with basal two-third black, with or without orange bars in cell followed by

ochraceous, discal area near apex dull black and tornus shining blue; pattern including blackish band in ochraceous area, two variegated postdiscal ocelli and a double black band along termen; under surface ochraceous, marked by three black margined orange bands in basal half, a black-centred ocellus margined with orange and fuscous, present between Cu1a and Cu1b and a black spot above between M₁ and M₂. Hindwing black in basal area and shining blue elsewhere, with two variegated postdiscal ocelli, its costal and apical margins ochraceous with two submarginal and one marginal black line; under surface of hindwing ochraceous, with or without faint to slightly distinct numerous sinuous brown lines from base to apical area, having a broader diffused postdiscal band. Wingspan: 40-50 mm.

(iii). Hosts and Localities: On grasses, Haz, 1584, m, 22-vi-2006, 2♂, 1♀, open field; *Medicago polymorpha*, Dod, 2700 m, 28-vii-2005, 1♂, 1♀, Forest; *Mentha longifolia*, Dnp, 1670 m, 28-vii-2005, 1♂, 2♀, Mixed diverse flora; *Rubus ulimefolius*, Gul, 2644 m, 27-viii-2005, 2♂, 1♀, Forest; *Thymus serphyllum*, Uri, 1400 m, 05-vii-2007, 1♂, 3♀, Forest and mountainous area.

(iv). Distribution: Kashmir, India, Jordan, Pakistan. Nepal, Myanmar, Saudi Arabia, Sri Lanka.

(v). Field Observations: *J. orithya*, remained active from April to October and usually flew singly and occasionally in groups, during mid days when the light and temperature was quite high. Being extremely sensitive, the butterfly avoided flying during rain or when disturbed. Found sitting on grasses, open places, animal droppings and muddy places and also showed puddling behavior. The individuals of this butterfly took long flights.

(vi). Remarks: The butterfly species found to be common in selected places of Kashmir. This species is being recorded for the first time from Kashmir Valley. *Medicago polymorpha*, *Mentha longifolia*, *Rubus ulimefolius* and *Thymus serphyllum*, are the new hostplants of this species and are reported for the first time from this region.

4.1.1.5.6. Genus: *Issoria* Huebner

Issoria Huebner 1819, *Verz. bekannt, Schmett.*,(2):31.

Key to species of genus *Issoria*:

- Hindwing with tornus angulate, underside silvery spots comparatively large, Wingspan: 42-52 mm *lathonia*
- Hindwing with tornus rounded, underside silvery spots comparatively small. Wingspan: 34- 42 mm *gemmata*

VIII. *Issoria lathonia* (Linnaeus)

(Figs., 165, 166; Plates- XXXXVII)

Papilio lathonia Linnaeus, 1761, *Faun. Suec.* p. 282.

Argynnis lathonia race *issaea*, Bingham, 1905, *Fauna British India, Butterflies.* Vol. I. p. 441-442.

Argynnis lathonia lathonia, Evans, 1932, *The Identification Indian Butterflies.* p. 183.

Argynnis lathonia, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 222. Plate, 36

Issoria lathonia, Varshney, 1994, *Oriental Inst.*, 28:169.

(i). Common Name: The Queen of Spain Fritillary.

(ii). Diagnostic Features: Antennae brownish, club elongated tipped with turmeric-brown; Head fulvous or chocolate-brown; Thorax cardamom brown on upperside and covered with numerous greenish hairs, underside creamish yellow and covered with creamish hairs; Abdomen blackish brown on upperside and creamish brown on underside; Forewing upperside bright pale-fulvous or turmeric-brown, varying from a yellowish to a rich reddish tint with a series of black spots in different regions, basal area light brownish, marginal area light brown and eyed with yellow, a series of seven black spots in the submarginal area, underside brown to dark reddish brown, tornal area dusted with yellow, upperside spots seen through with basal area less brown, discal cell with three spots which show increase in size towards discocellulars, one large discocellular spot, areas between all veins from 1A+2A to R₄ with black spots, marginal area with two thin black lines filled with black and turmeric-brown colouration alternatively; Hindwing upperside like forewing with basal area dark brown, a row of seven submarginal black spots, marginal area light brown with seven small spots joined to marginal area with yellow; underside hindwing cinnabar-red with broad, conical silvery markings pointed inwardly, discal cell with a silvery spot eyed with black; base of both wings and upper dorsal area of hindwing suffused with olivaceous brown or cardamom brown. Wingspan: 42-52 mm.

(iii). Hosts and Localities: On grasses, Pah, 2500 m, 26-vi-2004, 2♂, Forest; *Taraxacum officinale*, Dod, 2700 m, 07-ix-2007, 3♂, 1♀, Forest.

(iv). Distribution: Kashmir, India, Europe, Africa, Central Asia,

(v). Field Observations: *I. lathonia* was observed flying mostly singly and quickly which caused difficulty in catching this butterfly. This butterfly species was found sitting on open grounds and fields. Its flight activity seen, during hot mid days when there was enough light, remained prevalent from May to September.

(vi). **Remarks:** Das and Verma (1965), Das *et al.* (1964), Marshall & De Niceville (1886), earlier reported it from Kashmir, however, during the present survey, *I. lathonia* was not observed as a common species in Kashmir Himalayas.

IX. *Issoria gemmata gemmata* Butler

(Figs.: 41, 42, 163, 164; Plates- XI, XXXXVI)

Argynnis gemmata Butler, 1881, *A. M. N. H.* vii, p. 32.

Argynnis gemmata, Marshall and De Niceville, 1886, *Butterflies India, Ceylon, Burma.* p. 138-139.

Argynnis gemmata, Bingham, 1905, *Fauna British India, Butterflies*, Vol. I. p. 442-443.

Argynnis gemmata gemmata, Evans, 1932, *The Identification Indian Butterflies*, p. 184.

Argynnis gemmata gemmata, Haribal, 1991, *Butterflies Sikkim Himalaya*, p. 162, pl. 46.

(i). **Common Name:** The Gem Silverspot.

(ii). **Diagnostic Features:** Antennae brownish, club elongated; Head blackish brown; Thorax blackish brown on upperside and covered with small brownish hairs, underside creamish yellow and covered with creamish hairs; Abdomen blackish on upperside and creamish brown on underside. Forewing upperside fulvous varying from a yellowish to a rich reddish tint with a series of black spots in different regions, basal area light brownish, marginal area light brown and eyed with yellow, a series of seven black spots in the submarginal area, underside brown to dark reddish brown, tornal area dusted with yellow, upperside spots seen through with basal area less brown, Hindwing upperside like forewing with basal area dark brown, a row of seven submarginal black spots, marginal area light brown with seven small spots joined to marginal area with **yellow**; underside Hindwing cinnabar-red with broad, conical silvery markings pointed inwardly, discal cell with a silvery spot eyed with black. Wingspan: 34-42 mm.

(iii). **Hosts and Localities:** On *Taraxacum officinale*, Gul, 2644 m, 04-viii-2007, 2♂, 1♀, Forest with mixed vegetation.

(iv). **Distribution:** Kashmir, India, Nepal, Pakistan, Tibet.

(v). **Field Observations:** It flew from May to September and took slow to moderate flight. It preferred forest and hilly areas as its habitat with diverse floral wealth. It was highly distributed at Gulmarg during the months of June and July.

(vi). **Remarks:** This species found restricted to hilly and forest areas and is usually not found at low land areas. Evans (1932) described it rare from Indian region. *A. g. gemmata*, is being recorded for the first time from Kashmir valley.

4.1.1.5.7. Genus:

Neptis Fabricius 1807, *Mag. f. Insektenk. (Illiger)*, 6:282.

X. *Neptis hylas astola* (Linnaeus)

(Figs.: 21, 22, 153, 154; Plates-VI, XXXIV)

Neptis astola Moore, 1872, *Proc. Zool. Soc. London*. p. 560.

Neptis eurynome, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 323-324.

Neptis hylas astola, Evans, 1932, *The Identification Indian Butterflies*. p. 166.

Neptis hylas, Varshney, 1983, *Rec. Zool. Surv. India, Occ. Pap. No. 47*. 1- 49.

Neptis hylas astola, Gupta and Shukla, *Rec. Zool. Surv. India, Occ. Pap. No. 109*, p. 44-45.

Neptis hylas, Varshney, 1994, *Oriental Inst.*, 28:178.

(i). **Common Name:** The Common Sailor

(ii). **Diagnostic Features:** Antennae blackish brown, club gradual; Head small, black to blackish brown; Eyes without hairs. Thorax upperside shining, blackish and dusted with some greenish area and underside brownish with small creamish hairs. Abdomen blackish brown on upperside and brownish to creamish brown on underside. Forewing upperside black, with a long cone-like white spot in discal cell and a triangular white spot beyond cell between M_2 and M_3 , with an arc of seven postdiscal white spots and seven to eight comparatively smaller submarginal concolorous spots, undersurface dull rust to chocolate brown with inner border grayish brown, all the whitish spots of upper surface showing through and bordered with grayish brown, marginal area between M_2 to R_5 dull whitish; Hindwing upperside black with a discal white band of confluent spots and a row of five postdiscal white spots, undersurface coloured like forewing but without grayish brown area, with spots of upper surface showing through distinctly and additional white lines on both sides of postdiscal white band. Wing Span: 46-56mm.

(iii). **Hosts and Localities:** On *Medicago polymorpha*, Dnp, 1670 m, 04-viii-2006, 4♂, Mixed dense vegetation; *Mentha longifolia*, Han, 1680 m, 11-viii-2007, 1♂, Forest; *Rubus ulimefolius*, Uri, 1400 m, 05-vii-2007, 1♂, Forest and mountainous area; *Thymus serphyllum*, Bot, 1667 m, 1♂, Garden with mixed vegetation; Nis, 1583 m, 1♂, moist and muddy soil.

(iv). Distribution: Kashmir, Burma, India, Pakistan, Nepal

(v). Field Observations: This butterfly species showed restricted distribution in places like Dachigam National Park, Gulmarg, with declining found in population. Flight activity observed singly, from May to September and that too quickly. Preferred to sit on open rocks, grounds, moisty places and animal droppings, and puddling behavior was also seen.

(vi). Remarks: It was not common in Kashmir and as compared to previous studies it showed decline in its population number. Earlier, Evans (1932), Gupta & Shukla (1987, 88), Haribal (1992), Marshall and De Niceville (1886), and Varshney *et al.* (1981) reported its distributon from Kashmir Himaliyan regions. *Medicago polymorpha*, *Mentha longifolia*, *Rubus ulimefolius*, and *Thymus serphyllum* are the new hostplants of this species and are reported for the first time.

4.1.1.5.8. Genus: *Phalanta* Horsfield

Phalanta Horsfield 1829, *Descr. Cat. Lep. Ins.*, Mus. East India Co., (2): pl. 7.

XI. *Phalanta phalanta* (Drury)

(Fig., 173, 174; Plate- XXXXIX)

Papilio phalanta, Drury, 1770, *Exot. Inst.* 1:41, pl. 21, figs 1, 2.

Atella phanlanta, Wynter-Blyth, 1957, *Butterflies of Indian Reg.* pp. 224-225.

Phalanta phalanta, Varshney, 1994, *Oriental Inst.*, 28:170-171.

(i). Common Name: The Common Leopard

(ii). Diagnostic Features: Antennae brown; club abrupt with apex blunt; eyes with out hairs. Forewing orange, with numerous black spots and semilunar markings, with a row of marginal blackish spots bordered on inside by a black line; under surface pale to copper brown, with most of upper surface pattern faintly seen through. Hindwing orange, black spots and various markings restricted to distal part; under surface pale to copper brown, majority of spots of upper surface faintly and differently showing through. Wing span: 56-66 mm.

(iii). Hosts and Localities: On grasses, Pah, 2500 m, 26-vi-2004, 1♂, Forest; On *Salix* sp., Dnp, 1670 m, 06-vi-2006, 1♂ 1♀, Mixed diverse flora.

(iv). Distribution: Kashmir, India, Pakistan, Burma, Sri Lanka

(v). Field Observations: This butterfly was found as a very fast flier and flying at low to medium height. Found flying singly from May to September. The butterfly species kept its wings stretched out and in the same in constant motion, when at rest. During rains it took fast but small zigzag flight. Their distribution was seen mostly restricted to forest areas

like Aharbal, Baisaren, Pahalgam, Dodhpathri, Kokernag, Uri, Boniyar, Kupwara, and Bandipora, etc., but occasionally found at low lying areas also.

(vi). **Remarks:** Recently, Singh (2009) reported *P. phalanta* a rare species from Kadarnath Musk Deer Reserve, Garhwal, India. It is not common in Kashmir Valley and is a new record from the area.

4.1.1.5.9. Genus: *Vanessa* Fabricius

Vanessa Fabricius 1807, *Mag. f. Insektenk. (Illiger)*, 6:281

Key to the species of genus *Vanessa*:

HW with outer margin produced at vein M₃.Wing span 42-60 mm*cashmiriensis*

HW with outer margin not produced at vein M₃.Wing span 52-62 mm*indica*

XII. *Vanessa cashmirensis* (Kollar)

(Figs. 11, 12, 62, 63, 167, 168, 181- 200, 231; Plates- III, XVI, XXXXVII, LI-LV, LXII)

Vanessa cashmiriensis Kollar, 1844, in *Hugel, Kasch. Rei. Sei.*, 4(2):442, pl. 11, fig. 3, 4.

Vanessa cashmirensis, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 367.

Vanessa cashmirensis cashmirensis, Evans, 1932, *The Identification Indian Butterflies*, p. 179.

Vanessa cashmiriensis, Gupta and Shukla, 1988, *Rec. Zool. Surv. India*.109:60.

(i). **Common Name:** The Indian Tortoiseshell

(ii). **Diagnostic Features:** Antennae black, club elongated, tip creamish brown; Head small, brown; Thorax upper side brownish and covered with silky brownish hairs, underside dull blackish brown covered with dull blackish hairs; Abdomen brownish on upper side and dull creamish on the underside; Forewing upperside with basal part yellow, irrodated with golden scales, marginal area black with light brown colouration in between, rest of wing orange red with various black spots and traces of yellow, cell with a quadrate black bar across the middle, a large black discocellular spot which touches the costal margin, another large but irregular black spot above it towards apex, yellowish bars between these black spots, a large black spot between 1A+2A and Cu1b with some part touching Cu1a, one small black spot between Cu1b and Cu1a, another one between Cu1a and M₃, a whitish spot near apex; underside forewing brown, basal half clouded with dark purplish-brown, the outer margin of the dark portion defined by a highly sinuous jet-black transverse line, most distinct on the

hind wing, upperside black, yellow and orange-red colouration represented only by impressions. Hindwing with upperside basal area dusky brown, covered posteriorly with light brown, shining hairs, inner margin light brown and dusted with golden scales, marginal area light brown with an irregular blackish band centered with blue from tornus upto vein R_s and $Sc+R_1$, a light brown submarginal band, a broad red band turning yellow towards costal margin; underside similar to that of forewing. Wing span: 42-60 mm.

(iii). Hosts and Localities: On *Achillea millefolium*, Pah, 2500 m, 28-vi-2004, 2♂, Dense forest; *Carduus edelbergi*, Tan, 2220 m, 25-v-2005, 1♂, 3♀, Forest along general road; *Cersium wattutus*, Uri, 1400 m, 05-vii-2007, 4♂, 2♀, Forest and mountainous area; *Cerastium cerastoides*, Han, 1680 m, 11-viii-2007, 2♂, 5♀, Orchids near forest; *Digitalis purpurea*, Bar, 1600 m, 10-v-2004, 3♂, 1♀, Forest; *Euphorbia helioscopia*, Gan, 2084 m, 11-iv-2004, 3♂, 1♀, Mixed vegetation along road; *Medicago polymorpha*, Ban, 1582 m, 28-vi-2005, 2♂, 1♀, Hilly area with mixed vegetation; *Mentha longifolia*, Dnp, 1670 m, 29-vii-2007, 4♂, 1♀, Mixed dense vegetation; *Tagetes petula*, Qaz, 1900 m, 29-vi-2004, 1♂, Forest near agricultural land; *Trifolium rupenes*, Pul, 1690 m, 08-ix-2007, 2♂, Open field; *Urtica dioica*, Dod, 2700 m, 07-ix-2007, 2♂, Forest.

(iv). Distribution: Kashmir, China, India, Nepal, Pakistan, Tibet.

(v). Field Observations: Flying of this butterfly was observed from March to November both in groups as well as singly. Among Nymphalidae, first to arrive after a very cold winter was found widely distributed in different habitats of all the districts of Kashmir Himalayas. It was seen attracted to rocks, open dusty roads, dead plants, twigs or leaves, moist and damp soil and animal excreta and shows a prominent mud puddling behaviour. During summer it preferred to fly during early hours of the day.

(vi). Remarks: As a very common species in Kashmir Himalayas. Earlier, Bingham (1905), Evans (1932), Thomas-Glover (1936), Wynter-Blyth (1957), Malik *et al.* (1972), and Varshney (1994) gave its distribution in Kashmir. Malik *et al.* (1972) reported it a pest of Knettle grasses occurring from March to October in Kashmir Valley. Joshi *et al.* (2008) reported it common from Western Himalayas. Insects like ants and aphids were seen associated with the larvae. Birds, *viz.* sparrows, mynahs, were seen acting as predators, devouring both larvae and adults. *Achillea millefolium*, *Carduus edelbergi*, *Cerastium cerastoides*, *Cersium wattutus*, *Digitalis purpurea*, *Erodium cicutarium*, *Euphorbia helioscopia*, *Medicago polymorpha*, *Mentha longifolia* and *Trifolium repens* are the new hostplants of this species and are reported for the first time from Kashmir Himalayan regions.

XIII. *Vanessa indica* (Herbst)

(Figs. 15, 16, 155, 156; Plates- IV, XXXXIV)

Papilio atlanta indica Herbst, 1794, *Natursyst Schmett.* vii, pl. 180, p. 171.

Vanessa indica, Bingham, 1905, *Fauna British India, Butterflies.* Vol. I. p. 366.

Vanessa indica indica, Evans, 1932, *The Identification Indian Butterflies.* p. 177.

Vanessa indica, Wynter-Blyth, 1957, *Butterflies Indian Reg.* p. 212, plate, 37.

Vanessa indica, Varshney, 1994, *Oriental Insts.* 28:175.

(i). Common Name: The Indian Red Admiral

(ii). Diagnostic Features: Antennae black to blackish brown, with some whitish clouration in between and nearly larger than discal cell of forewing, club black, elongated and prominent and tip yellowish. Head dark brown. Eyes with long hairs. Thorax blackish brown on upperside and covered with dark brown hairs which are more towards the abdominal side, underside brownish and covered with brownish hairs; Abdomen blackish brown on upperside and light brown on underside with some dull creamish area. Forewing dusky brown and densely suffused with orange scales at base and along inner margin, black in distal part and two parts separated by a discal orange band spotted with three black spots of different shapes and sizes, black area with four postdiscal and a few smaller submarginal white spots between costal margin and M₃; under surface coloured lighter than upper surface, with black and white spots seen through. Hindwing dusky brown, suffused with dull orange scales and brownish hair at base, an orange band along termen carrying a row each of black spots within and along its inner margin; under surface mottled with patches of light brown and dark brown and some of them margined with white, most veins also scaled white, a postdiscal row of four ocelli with one between Cu1a and Cu1b largest of all. Wing span: 52-62mm.

(iii). Hosts and Localities: On *Digitalis purpurea*, Bar, 1600 m, 10-v-2004, 1♂, 1♀, Forest; *Urtica dioica*, Tan, 2220 m, 04-viii-2007, 2♂, 1♀, Forest.

(iv). Distribution: Kashmir, India, Pakistan, Nepal.

(v). Field Observations: The butterfly species was found in the forest-habitat, active from May to September, and remained confined to very few places of Kashmir Himalayas. It was also attracted towards moist places, dusty roads and animal droppings. The mud puddling behavior of this species was also observed.

(vi). Remarks: It is not common in Kashmir Himalayas and as compared to other parts of India, and also as per previous findings from this region, it showed a decline in its

distribution. Earlier, Haribal (1992), Shull (1963) and Wynter-Blyth (1957), reported it from Kashmir. *Digitalis purpurea* is the newly recorded host-plant of this species from this region.

4.1.1.6. Family: Papilionidae

4.1.1.6.1. Genus: *Papilio* Linnaeus

Papilio Linnaeus 1758, *Syst. Nat.*, ed. 10, 1: 458.

Key to the species of genus *Papilio* Linnaeus:

1. Upperside of forewings brownish-black; wing expanse varies from 119-126 mm *arcturus*
Upperside of forewings black or cream coloured; wing expanse varies from 80-110 mm 2
2. Hindwing tailed at vein 4; antennae dark reddish-brown; head, thorax and abdomen dusky black *demoleus*
Hindwing evenly arched; antennae black; head, thorax and abdomen cream coloured with medial streak above *machoan*

I. *Papilio arcturus arius* Rothschild

(Fig., 89, 90; Plates- XXVIII)

Papilio arcturus arius Rothschild, 1908, *Nov. Zool.*, p. 174.

Papilio arcturus arius, Evans, 1932, *The Identification Indian Butterflies*. p. 50.

Papilio arcturus arius, Talbot, 1939, *Fauna British India, Ceylon, Burma. Butterflies*. Vol. I. p. 152.

Papilio arcturus, Wynter-Blyth, 1957, *Butterflies Indian Reg.* p. 387-388.

Princeps arcturus arcturus, Haribal, 1992, *The Butterflies of Sikkim Himalaya*. p.75.

Papilio arcturus, Varshney, 1993. *Oriental Insts.*, 27:352.

(i). Common Name: The Blue Peacock

(ii). Diagnostic Features: Upper side of forewing with a submarginal green band which fades out anteriorly, Hind wing with a large discal blue patch extended towards the base; a small submarginal row of red spots and a red anal ring. Underside of forewing distally grey and posteriorly before the outer margin broadly grey-white. Hindwing with a complete row of red submarginal spots. Wing span: 110-120 mm.

(iii). Hosts and Localities: On unknown host plant, Kas, 28-vii-2004, 1♂, Mixed vegetation.

(iv). Distribution: Kashmir, Iran, India, China, Sri Lanka, Taiwan

(v). **Field Observations:** It was not found widely distributed in Kashmir Valley, prevalent in only very few places, especially high-altitude forest zones and showed fast flight. Its flight activity was seen from May to September.

(vi). **Remarks:** Haribal (1992), Evans (1932), Talbot (1939) and Wynter-Blyth (1957) earlier reported it from Kashmir.

II. *Papilio demoleus* Linnaeus

(Figs. 91, 92; Plate- XXVIII)

Papilio demoleus Linnaeus, 1758, *Syst. Nat.* (ed.10), 1:464.

Papilio demoleus, Bingham, 1907, *Fauna British India, Butterflies*, Vol. II. p. 39-41.

Papilio demoleus demoleus, Evans, 1932, *The Identification Indian Butterflies*, p. 52 .

Papilio demoleus, Talbot, 1939, *Fauna British India, Butterflies*, Vol. I. p. 187-189.

Papilio demoleus, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 395.

Papilio demoleus, Varshney, 1981, *Rec. Zool. Surv, India. Occ. Pap. No. 31:1- 65.*

(i). **Common Name:** The Lime Butterfly

(ii). **Diagnostic Features:** Antennae black; club gradual, pointed at apex; eyes without hairs. Forewing black, with many rows of yellow striae in basal area, its termen dotted with yellow patches accompanied by a submarginal row of yellow spots, a curved row of irregular yellow discal spots and a few irregular yellow spots scattered between apex and discal row; under surface coloured like upper except basal area showing yellow longitudinal lines and a few golden spots near apex. Hindwing black, its basal part densely suffused with yellow scales, a broad yellow band of uneven outer margin carrying a black margined bluish ocellus touching costal margin, with five yellow scattered submarginal spots and yellow marginal crescents along termen, an oval reddish spot along inner margin present near tornus; under surface dominantly yellow with veins coloured black, with several golden and black postdiscal spots, golden spots margined with black on outside and blue on inside, a reddish spot on inner margin near tornus and golden blue-centred ocellus touching costal margin seen through, its termen carrying a series of yellow submarginal crescents. Wing Span: 80-100mm.

(iii). **Hosts and Localities:** On unknown host plant, Kas, 28-vii-2004, 1♂, 1♀, Mixed vegetation.

(iv). **Distribution:** Kashmir, Iran, India, Burma, China, Sri Lanka, Taiwan

(v). **Field Observations:** It was seen as a fast flier and flied at medium to high heights. It usually kept the wings stretched when at rest. It was not widely distributed in

Kashmir Valley and found restricted to few places. Its flight period was from May to September.

(vi). **Remarks:** Earlier, Bingham (1907) reported it from Kashmir (British). It was not common in Kashmir Valley.

III. *Papilio machaon asiatica* Menetries

(Figs. 47, 48, 87, 88; Plates- XII, XXVII)

Papilio machaon var. *asiatica*, Menetries, 1885, p.70.

Papilio machaon asiatica, Evans, 1932, *The Identification Indian Butterflies*. p.53 .

Papilio machaon asiatica, Talbot, 1939, *Fauna British India, Ceylon, Burma. Butterflies*. Vol. I. p. 192-194.

Papilio machaon, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 395-396.

Papilio machaon asiatica, Mathur & Srivastava, 1967, *Indan For.*, 93(7-2):668.

Papilio machaon, Varshney, 1993, *Oriental Inst.*, 27:352.

(i). **Common Name:** The Common Yellow Swallowtail.

(ii). **Diagnostic Features:** Antennae brownish black with club elongated. Head brownish to blackish brown. Thorax black and shining on upper side having a line of yellowish hairs on sides, underside yellowish with yellow hair and having a small blackish dot in the centre. Abdomen black on upperside and yellowish on underside with four (4) narrow lateral ill- defined black lines. Forewing upperside with basal area black, dusted with yellow scales. Marginal area black with a complete series of regular small eight yellow spots near the termen. Costal margin of forewing have a poorly- defined yellowish line which runs beyond the cell area. Cell larger than rest of the area. Sc, R₁ R₂ and R₃ run close to each other; Sc ends far beyond the cell and runs parallel to R₁. Forewing underside pale- cream with two transverse black bands across the cell, and one black band on the discocellulars. Basal area of forewing lemonish-yellow. Hindwing upperside with basal half yellow with black veins, outer half black with the series of obscure blue spots and a marginal series of yellow crescents. A large terminal red spot separated from blue lunule by a black line. Hindwing with a precostal cell in addition to normal cell and with a precostal spur (vein) direct distad. Hindwing UDC larger than MDC and LDC. Hindwing tailed at M₃ and tail black slender and 2 to 3 times as long as wide. Discal area yellow with black veins. Wing Span: 66-80 mm.

(iii). **Hosts and Localities:** On *Taraxacum officinale*, Uri, 1400 m, 5-vii-2007, 1♂, Forest; Dod, 2700 m, 16-vii-2007, 1♀, Forest; Dnp, 1670 m, 21-ix-2007, Mixed forest with diverse flora; Bar, 1600 m, 29-vi-2006, 1♂, Open field near forest.

(iv). **Distribution:** Kashmir, India, Japan, Jordan, Myanmar, Nepal, North America, Pakistan, South America, Spain.

(v). **Field Observations:** This species was found confined to areas like Dachigam National Park, Uri, Boniyar, Baramulla, and Dodhpathri. It is a very quick flier and difficult to catch. It flies from April to September and usually prefers hot sunny days. It sits on open roads, moist and dry places, and shows mud puddling behavior, which was very prominent at Dachigam.

(vi). **Remarks:** Earlier, Talbot (1939), Wynter-Blyth (1957) and Mani (1962), reported *P. m. asiatica* from Kashmir. Recently, Singh (2009), observed it as uncommon species from Kadarnath Musk Deer Reserve, Garhwal, India. Mathur and Srivastava (1967) described it a highly polyphagous pest of medicinal and aromatic plants in India. Maes and Van Swaay (1997) reported it susceptible in Netherlands. This species has already been listed in the Indian Wildlife Protection (1972) Act. The present study revealed that it is not common in Kashmir Himalayas.

4.1.1.7. Family: Pieridae

Key to the genera of family Pieridae:

1. Forewing with R₁ free 2
 Forewing with R₁ anastomosed with Sc *Anaphaeis*
2. Forewing with R₂ arising from Sc 3
 Forewing with R₂ arising from R₅ *Colias*
3. Hindwing with precostal present 5
 Hindwing without precostal 4
4. Termen of hindwing evenly rounded *Eurema*
 Termen of hindwing more or less acutely angulated at M₃ *Gonepteryx*
5. Forewing with vein M₁ from middle of R₅ *Aporia*
 Forewing with vein M₁ from closer to base of R₅ 6
6. Forewing with R₁ originating from Sc closer to its apex than base 7
 Forewing with R₁ from Sc equidistant from its base and apex *Catopsilia*
7. Forewing carrying eleven veins, M₁ starting from common stalk of R₃+R₅.... *Pieris*

Forewing carrying ten veins, M_1 starting from a vein representing R_3 to R_5 .

..... *Pontia*

4.1.1.7.1. Genus: *Anaphaeis* Huebner

Anaphaeis Huebner 1819, *Verz. bekannt, Schmett.*,(6):93.

I. *Anaphaeis aurota* (Fabricius)

(Fig., 137, 138, Plate- XXXX)

Papilio aurota Fabricius, 1793, *Ent. Syst.*, iii, I: 197.

Anaphaeis mesentina, Bingham, 1907, *Fauna British India, Butterflies*, Vol. II. p.

Anaphaeis aurota, Varshney, 1979, *J. Bombay Nat. Hist. Soc.*, 76(1):38-39.

Anaphaeis aurota, Varshney, 1983, *Rec. Zool. surv. India*, Occ. Pap. No. 43. 1- 49.

(i). **Common Name:** The Pioneer.

(ii). **Diagnostic Features:** Antennae black; club gradual, blunt at apex; eyes without hairs. Forewing white with margin along termen broadly black but irregular narrowing towards tornus and enclosing five to six white spots, with a hook-shaped black area along costal margin and discocellulars more prominent in female; under surface more or less similar to upper in black markings, with base of cell, costal margin and marginal spots yellow in female and enclosing four white spots; under surface white in male and yellow in female, with veins black, margins along termen broadly black in both sexes and enclosing five yellow spots in female, white in male. Wing Span: 52-58mm.

(iii). **Distribution:** Kashmir, India, Africa, Burma

(iv). **Field Observations:** It flew low and was found to be a fairly strong flier. Its flight period was from June to August.

(v). **Hosts and Localities:** On unknown host plant, Kas, 28-vii-2004, 1♂, 1♀, Mixed vegetation.

(vi). **Remarks:** Bingham (1907) earlier reported it from Kashmir. The present study showed that this species is not common in Kashmir Himalayan region.

4.1.1.7.2. Genus: *Aporia* Huebner

Aporia Huebner 1819, *Verz. bekannt, Schmett.*,(6):90.

II. *Aporia leucodice* (Eversmann)

(Figs. 45, 46, 127, 128; Plates- XII, XXXVII)

Aporia soracta, Bingham, 1907, *Fauna British India, Butterflies*. Vol. II. p. 161-162.

Aporia leucodice soracta, Evans, 1932, *The Identification Indian Butterflies*. p. 86.

Aporia leucodice soracta, Talbot, 1939, *Fauna British India, Ceylon, Burma. Butterflies*, Vol. I. p. 313- 314.

Aporia leucodice, Varshney, 1979, *J. Bombay nat. Hist. Soc.*, 76(1):40.

(i). Common Name: The Himalayan Blackvein

(ii). Diagnostic Features: Head brownish; Antennae black, club tipped with white; Thorax black on upper side and covered with whitish scales, under surface creamish white and covered with whitish or creamish scales; Abdomen creamish white and dusted with creamish scales on upperside; Forewing upperside milky-white, with all veins black, the black edging to the discocellulars and apical portion of the median vein broader; except anal vein all the veins are black marked at the apices, underside white, apex and costal edge narrowly suffused with pale-yellow, all veins uniformly black, discocellulars more black; Hindwing upperside creamish white with veins less blackish than forewing, edge of termen black, underside pale yellow, precostal chrome-yellow, the discocellulars somewhat prominently defined with black, all veins prominently marked with black and clearly visible as compared to upper side of Hindwing. Female is similar to male but is more heavily marked. Wing expanse: 50-55mm.

(iii). Hosts and Localities: On *Calamintha umbrosa*, Sha, 1583 m, 06-vi-2006, 2♂, 1♀, Vegetable garden and agricultural land; *Cedrus deodara*, Gul, 2644 m, 24-vii-2007, 2♂, Forest; *Origanium vulgare*, Sri, 1583 m, 10-vii-2007, 1♂, 2♀, Mixed vegetation; *Thymus serpyllum*, Dnp, 1670 m, 29-vii-2007, 1♀, Mixed diverse flora; *Trifolium repens*, Uri, 1400 m, 20-vii-2005, 2♀, Forest and mountainous area; *Viola tricolor*, Dod, 2700 m, 16-vii-2007, 1♀, Forest.

(iv). Distribution: Kashmir, India, Pakistan

(v). Field Observations: Remained active from April to October and was found usually a moderate to fast flier. It was usually active during mid days and preferred to fly when there was enough sun light. It may arrive immediately after a mild or moderate or heavy rainfall or when there was fall in the sunlight, a phenomenon mostly noticeable during summer days. Found flying singly and in groups, both very nearer the ground as well as higher.

It was mostly found at places having a mixed type of vegetation, having different types of grasses, forest, small as well as large trees, herbs, shrubs, etc. At Dachigam National Park, the individuals of *A. leucodice*, were seen on moist soil along with other butterfly species viz., *Aricia agestis*, *Libythea lepita lepita*, *Lycaena phlaeas*, *Papilio machaon*

asiatica and *Pieris brassicae* and a prominent puddling behaviour was also observed. At Gantmulla (Uri) which is a very hilly and forest area it was observed that after a continuous moderate rainfall of about 30 minutes nearly all the insect activity remained suspended for about 30 to 40 minutes. However, this butterfly along with *Pieris brassicae* emerged immediately after rain stopped. They both started flying very higher, sometimes above the 2 to 3 storied buildings, larger trees like *Cedrus deodara*, *Juglans regia*, *Pinus* sp., *Salix* sp., etc. They were in high population density than than *Pieris brassicae*. Their flights were seen fast and caused difficulty in collecting them. However, in shadows of trees like *Cedrus deodara*, *Pinus* sp., their collection was quit easy. It was highly distributed at Gantmulla (Uri).

(vi). **Remarks:** Bingham (1905), Evans (1932), Talbot (1939) and Wynter-Blyth (1957) earlier reported it from Kashmir. It is not common in Kashmir Himalayas and the present investigations found a decline in its overall distribution. *Calamintha umbrosa*, *Cedrus deodara*, *Origanium vulgare*, *Thymus serpyllum*, *Trifolium repens*, and *Viola tricolor* are the newly reported host plants for this butterfly species.

4.1.1.7.3. Genus: *Catopsilia* Huebner

Catopsilia Huebner 1819, *Verz. Bekannt. Schmett.*, (6):98.

Key to the species of genus *Catopsilia*

Forewing upperside sulphur yellow at bases; below apex with a macular marginal narrow black border. Wing span 66-86 mm *pomona*

Forewing upperside below apex with marginal dark, broad and continuous border. Wing span: 54-62 mm *pyranthe*

III. *Catopsilia pomona* (Fabricius)

(Fig., 141-144; Plate- XXXXI)

Papilio pomona Fabricius, 1775, *Syst. Ent.* : 479.

Catopsiila pomona, Talbot, 1939, *Fauna British India, Butterflies*. Vol. I. p. 493- 495.

Catopsilia pomona, Varshney, 1993. *Oriental Inst.*, 27:362.

(i). **Common Name:** The Lemon Emigrant

(ii). **Diagnostic Features:** Antennae variably scaled with pink dusted with black; club very gradual; eyes without hairs. Forewing of female yellow, with black border on distal one-thirds of costal margin and termen extended inwards into dents, with a circular conspicuous black discal spot and an oval less dark spot to its anterior, with an incomplete arch of black diffused submarginal spots present between costal margin and Cu1a; Male forewing light

greenish white with base sulphur yellow and coastal margin apex black; Undersurface light greenish white in male and light yellow in female, with a pinkish yellow discocellular spot ringed with dark brown. Hindwing yellow with a black marginal spot at end of each vein in female, light greenish white with sulphur yellow base continuing along inner margin and half of termen in male; Undersurface coloured like forewing in both sexes, with two unequal silvery white centered ocelli at end of cell with double margin of reddish brown scales, with postdiscal and marginal series of specks black and tinged with pink. Wing span: 66-86 mm.

(iii). Hosts and Localities: On unknown host plant, Kas, 28-vii-2004, 1♂, 1♀, Mixed vegetation.

(iv). Distribution: Kashmir, China, India, Pakistan, Sri Lanka, Burma

(v). Field Observations: Found as a fast flying species which flies both at high and low heights. It closes its wings while resting on flowers. It was seen flying from June to August.

(vi). Remarks: This species was not commonly found and is being recorded for the first time from this region. Recently, Pajni *et al.* (2006) described it from Punjab and Chandigarh regions.

IV. *Catopsilia pyranthe* (Linnaeus)

(Fig., 145, 146; Plate- XXXXII)

Papilio pyranthe Linnaeus, 1758, *Syst. Nat.* (ed. 10), 1:469.

Catopsilia pyranthe, Bingham, 1907, *Fauna British India, Butterflies*. Vol. II. p. 221-223.

Catopsilia pyranthe, Varshney, 1993. *Oriental Insts*, 27:362.

(i). Common Name: The Mottled Emigrant

(ii). Diagnostic Features: Antennae dark brown, sparsely clothed with white scales; club gradual, blunt and pale brown at apex; eyes without hairs. Forewing light greenish white with a prominent black discocellular spot in both sexes, with costal margin towards apex and termen narrowly black; under surface ochraceous and white, a pink-centered brownish margined spot on discocellular prominent in female, indistinct in male. Hindwing light greenish white, with a series of obscure marginal blackish specks in both sexes; under surface completely ochraceous with faint light brownish strigae, with three unequal pinkish white discocellular spots margined with light brown in female, absent in male. Wing span: 54-62mm.

(iii). Hosts and Localities: On unknown host plant, Kas, 28-vii-2004, 1♂, 1♀, Mixed vegetation.

(iv). Distribution: Kashmir, China, India, Borneo, Burma, Sri Lanka, Java, Sulawesi, and Phillipines.

(v). Field Observations: Like *Catopsilia pomona*, it is a fast flying species, observed both at low to considerable height. It always closes its wings while at rest. It was seen flying from June to August.

(vi). Remarks: It is not common in Kashmir and recently, Singh (2009) also reported it uncommon from Kadarnath Musk Deer Reserve, Garhwal, India. This butterfly species is being recorded for the first time from Kashmir Valley.

4.1.1.7.4. Genus: *Colias* Fabricius

Colias Fabricius 1807, *Mag. f. Insektenk. (Illiger)*, 6:284.

Key to the species of genus *Colias*:

Wings with prominent colour yellow; Upper Forewing lemon yellow to creamy white, Under Hindwing lemon yellow to pale yellow *erate*

Wings with prominent colour orange; Upper Forewing orange, Under Hindwing greenish yellow *fieldi*

V. *Colias erate* Esper

(Fig. 37, 38, 56, 58, 129-132; Plates-X, XV, XXXVIII)

Papilio erate Esper, 1805, *Die Schmetterlinge*, p. 13.

Colias hyale, Bingham, 1907, *Fauna British India, Butterflies*. Vol. II. p. 234-236.

Colias hyale hyale, Evans, 1932, *The Identification Indian Butterflies*. p. 80.

Colias erate, Talbot, 1939, *Fauna British India, Ceylon, Burma. Butterflies*, Vol. I. p. 551-552.

Colias erate, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 454-455.

Colias erate, Varshney, 1983, *Rec. Zool. Surv. India. Occ. Pap. No. 43*.

(i). Common Name: The Pale Clouded Yellow

(ii). Diagnostic Features: Antennae dark brown, clothed with pinkish scales; club gradual, blunt at apex. Eyes without hairs. Forewing lemon yellow in male, creamy white in female, with costal and apical margins pinkish, dusted with black at base and along costal margin, a black discocellular spot and broad black marginal band, latter broader along costal margin and narrowing towards tornus and containing submarginal spots of ground colour; under surface lemon yellow in male and creamy white in female except yellow apical region,

with a black discocellular yellow-centred spot and three to four blackish submarginal dots between M₁ and inner margin. Hindwing lemon yellow in male, pale white and profusely dusted with black in female, with part or whole of termen having a black border or sometimes broken into series of blackish spots, with two orange discocellular spots; under surface lemon yellow in male, pale yellow in female, with two unequal-sized discocellular silver white ocelli margined with pinkish brown and orange yellow circles, also carrying a pinkish brown spot on costal margin and diffused submarginal spots, with costal margin and termen pink. Wing Expanse: 36-52 mm.

(iii). Hosts and Localities: On *Calamintha umbrosa*, Dod, 2700 m, 16-vii-2007, 2♂, 1♀, Forest; *Cersium wattutus*, Tan, 2220 m, 03-viii-2007, 2♂, 2♀, Forest along general road; *Digitalis purpurea*, Bar, 1600 m, 10-v-2004, 1♂, 2♀, Forest; *Epilobium laxum*, Bot, 1667 m, 28-vii-2004, 1♂, 3♀, Garden with mixed vegetation; *Medicago polymorpha*, Dod, 2700 m, 16-vii-2007, 6♂, 9♀, Forest; *Ranunculus* sp., Qaz, 1900 m, 29-vi-2004, 2♂, 1♀, Mountainous area with mixed flora; *Tagetes petula*, Jaw, 2858 m, 01-vi-2006, 2♂, 2♀, Mountainous and hilly area with mixed flora; *Taraxacum officinale*, Shl, 1583 m, 05-iv-2006, 8♂, 4♀, Garden; *Thymus serpyllum*, Gan, 2084 m, 11-iv-2004, 15♂, 18♀, Mixed vegetation along road; *Trifolium repens*, Sal, 1290, 03-viii-2007, 4♂, 3♀, Mountainous and hilly area,

(iv). Distribution: Kashmir, India, Myanmar, Nepal, Pakistan, Sri Lanka.

(v). Field Observations: *C. erate* remained active from April to November in number of areas and localities of Kashmir Valley. It is usually a fast flier and took a long flight before landing. The peak activity of this butterfly was observed during mid days and when there was enough sun light. It also did not show its activity immediately after a mild or moderate or heavy rainfall or when there was fall in the sunlight even if the temperature was favourable for flight. It preferred to fly singly. It was seen to fly both very nearer the ground as well as higher. It was observed to be the fastest flier among pierids.

The butterfly showed its occurrence in different types of habitats like vegetable gardens, orchids, gardens, parks, house lawns, open places, rice fields, forests, and along the roads. It did not show puddling behaviour. It preferred little association with other butterflies and prefers undisturbed places and does not come at the same place again and again. During its stay on different host plants it mostly keeps its wings folded and is very difficult to trace or locate.

The *C. erate* showed wide distribution in number of localities in different districts of the Valley. Among these the localities showed high distribution were Batpora (Magam) Handwara, Ganderbal, Gulmarg, HMT, Mirgund, and Sopore.

(vi). **Remarks:** It is common in Kashmir Himalayas. Bingham (1907), Thomas-Glover (1936), Das and Verma (1965), Das *et al.* (1964), and Home (1938) earlier reported it from Kashmir. Host plants like *Calamintha umbrosa*, *Cersium wattutus*, *Epilobium laxum*, *Medicago polymorpha*, *Ranunculus* sp., *Tagetes petula*, *Taraxacum officinale*, *Thymus serpyllum*, *Trifolium repens*, and *Digitalis purpurea* are reported for the first time from Kashmir for this pierid species.

VI. *Colias electo fieldi* Menetries

(Figs., 14, 43, 44, 57, 59, 133-136; Plates- IV, XI, XV, XXXIX, L)

Colias fieldi Menetries, 1855, *Enum. Corp. Anim. Mus. Petr.*, p. 79, plate, i.

Colias croceus race *fieldi*, Bingham, 1907, *Fauna British India, Butterflies*. Vol. II. p. 243-244.

Colias crocus fieldi, Evans, 1932, *The Identification Indian Butterflies*. p. 81.

Colias fieldi, Talbot, 1939, *Fauna British India, Ceylon, Burma. Butterflies*, Vol. I. p. 561-562.

Colias electo fieldi, Varshney, 1979, *J. Bombay nat. Hist. Soc.*, 76(1):33-40.

Colias electo fieldi, Mandal, 1984, *Rec. Zool. Surv. India, Occ. Pap. No. 57*. p. 1-32.

(i). **Common Name:** The Dark Clouded yellow

(ii). **Diagnostic Features:** Antennae pink with club brown and gradual. Eyes without hairs, pinkish. Head pinkish brown. Thorax black on upper side covered with yellowish to lemonish-green hairs, underside yellow. Abdomen black on upperside and yellowish green on underside. Forewing upperside deep cadmium orange yellow, its base and costal margin dusted with black and greenish yellow scales, with a prominent black discocellular spot, having a black marginal band broader near apex and narrowly continued along inner margin upto distal half in male, marginal band without spots in male but having six yellow spots in female; under surface orange in basal part and broadly greenish yellow along costal margin and termen, having a black discocellular spot with white centre and 3 to 4 submarginal black spots between M_3 and $1A+2A$ in both sexes. Hindwing orange, suffused with black scales more densely in female, with inner margin yellowish green below $1A+2A$, with a broad black marginal band, spotless in male but with yellow spots in female and continued broadly along costal margin upto base in female and only upto distal one-half in male, also marked with a

large irregular bright orange discocellular spot, with an oval light yellow spot above anterior margin of cell in male; under surface greenish yellow with all margins pink, with two unequal shining white-centred discocellular spots margined with pinkish brown, with a series of obscure pinkish brown submarginal spots. Hind wing at the base with the thin covering of soft hairs. Wing Expanse: 38-48 mm.

(iii). Hosts and Localities: On *Calamintha umbrosa*, Han, 1680 m, 11-viii-2007, 15♂, 25♀, Forest; *Cerastium cerastoides*, Pan, 1587 m, 10-viii-2007, 5♂, 8♀, Mountainous area; *Cersium wattutus*, Tan, 2220 m, 15-v-2005, 6♂, 9♀, Forest along general road; *Digitalis purpurea*, Bar, 1600 m, 10-v-2004, 10♂, 17F, Forest; *Epilobium laxum*, Bot, 1667 m, 28-vii-2007, 7♂, 3♀, Garden with mixed vegetation; *Medicago polymorpha*, Dod, 2700 m, 16-vii-2007, 5♂, 4F, Forest; *Ranunculus* sp., Qaz, 1900 m, 29-vi-2004, 6♂, 1♀, Mountainous area with mixed flora; *Tagetus petula*, Jaw, 2858 m, 01-vi-2006, 1♂, 1♀, Mountainous and hilly area with mixed flora; *Taraxacum officinale*, Shl, 1583 m, 05-iv-2006, 7♂, 6♀, Garden; *Thymus serpyllum*, Gan, 2084 m, 11-iv-2004, 15♂, 11♀, Mixed vegetation along road; *Trifolium repens*, Sal, 1290m, 03-viii-2007, 4♂, 1♀, Mountainous and hilly area.

(iv). Distribution: Kashmir, Bhutan, India, Nepal, Pakistan.

(v). Field Observations: The butterfly remained active in the field from April to November. It was usually seen flying nearer the ground but can be seen flying higher when chasing each other or when singly or when disturbed or during hot mid days. It was found usually a moderate to fast flier but moved slowly especially when present in groups or when newly emerged or during the early morning. It was noticed as active during very hot and sweltering mid days, however preferred to fly before noon and afternoon when there was a moderate decrease/fall in the temperature.

It did not arrive immediately after a mild or moderate or heavy rainfall or when there was fall in the sunlight even if the temperature was favourable for flight. It was found flying both singly as well in groups but preferred to fly in groups. It was found to be a slower flier than *Colias erate*.

It was seen present in different types of habitats like vegetable gardens, orchids, gardens, parks, house lawns, open places, rice fields, forests, muddy places and along the roads. *C. e. fieldi* was very much attracted to damp places, animal excreta and rotten fruits, and showed a prominent mud puddling behaviour. It was seen highly attracted to flowers of *Tagetus petula*.

It was abundantly distributed both at lowland as well at the high-altitude areas of the Kashmir Valley. During the months of June, July and August of 2007, it was found in hundreds at Gulmarg and this phenomenon was not visible either in the previous years or at other places. Among Pieridae family, *C. e. fieldi* comes next to *Pieris brassicae* in distribution and dominance in Kashmir.

(vi). Remarks: It is very common in Kashmir. Thomas-Glover (1936), Home (1938), Das and Verma (1965), Das *et al.* (1964), Nadkerny (1970), and Varshney (1998), earlier reported it from Kashmir Valley. For the first time 10 new host plants, viz. *Calamintha umbrosa*, *Cerastium cerastoides*, *Cersium wattutus*, *Digitalis purpurea*, *Epilobium laxum*, *Medicago polymorpha*, *Ranunculus* sp., *Tagetes petula*, *Thymus serpyllum*, and *Trifolium repens* are being reported from Kashmir Himalayan Regions, under the present investigation.

4.1.1.7.5. Genus: *Eurema* Huebner

Eurema Huebner 1819, *Verz. Bekannt. Schmett.*, (6):96.

VII. *Eurema hecabe* (Linnaeus)

(Fig., 139, 140; Plate- XXXX)

Papilio hecabe Linnaeus, 1758, *Syst. Nat.*, ed. x: 479.

Eurema hecabe simulate, Singh & Koshta, 1983, *Rec. Zool. surv. India*, 96(1-4):15-23.

Eurema hecabe, Varshney, 1983, *Rec. Zool. surv. India*, Occ. Pap. No. 47. 1- 49.

(i). Common Name: The Common Grass Yellow

(ii). Diagnostic Features: Antennae black, sparsely spotted with white; club gradual, blunt and marked with white at apex; eyes without hairs. Forewing bright yellow, with a broad black band along distal half or whole of costal margin and termen and forming a figure of 'C' between M_3 and $Cu1b$; under surface yellow, with two black streaks near base of cell and a black ring on discocellulars, with a few blackish spots along apex and termen, showing a sex brand on both sides of lower margin of discal cell to the origin of $cu1b$. Hindwing bright yellow, with unequal marginal black band minutely dentate on inner margin along veins ; under surface yellow; black markings including three small ocelli or specks near base, an irregular discocellular ring, diffused postdiscal streaks and specks along termen. Wing span: 40-56mm.

(iii). Hosts and Localities: On unknown host plant, Kas, 28-vii-2004, 1♂, 1♀, Mixed vegetation.

(iv). Distribution: Kashmir, India, Pakistan, Sri Lanka,

(v). **Field Observations:** It flew close to ground or bushes and closes its wings at rest. It was seen flying from June to August.

(vi). **Remarks:** It was observed not common in Kashmir Himalayas and is being recorded for the first time from Kashmir Valley.

4.1.1.7.6. Genus: *Gonepteryx* Leach

Gonepteryx Leach 1815, *Brewster's Edinburg Ency.*, 9(1):127

VIII. *Gonepteryx rhamni* (Linnaeus)

(Figs. 33, 34, 125, 126; Plates- IX, XXXVII)

Papilio rhamni Linnaeus, 1758, *Syst. Nat.* ed. X, p. 470.

Gonepteryx rhamni, Bingham, 1907, *Fauna British India, Butterflies*. Vol. II. p. 229-230.

Gonepteryx rhamni rhamni, Evans, 1932, *The Identification Indian Butterflies*. p. 76.

Gonepteryx rhamni, Talbot, 1939, *Fauna British India, Ceylon, Burma. Butterflies*, Vol. I. p. 306-307.

Gonepteryx rahmani, Varshney, 1993, *Oriental Insts.*, 27:363.

(i). **Common Name:** The Common Brimstone

(ii). **Diagnostic Features:** Antennae brownish, club dusted with white and tipped with white; Head brownish; Thorax blackish on upperside and fully covered with lemonish shining hairs and underside lemonish yellow; Abdomen blackish on upperside and yellowish on underside in male and white on the sides in female; Both forewing and hindwing upperside pale, clear sulphur or cadmium-yellow in male and pale creamy white in female; Forewing apex falcate. Hindwing upperside with lemonish-yellow hairs from basal area towards inner margin (dorsum), forewing without hairs, underside of hindwing pale-yellow in male and greenish-white or white with greenish yellow wash over white area in female, discal cell more than half the length of the wing; precostal vein absent. LDC (Lower Discocellularis) larger than MDC (Middle Discocellularis) and UDC (Upper Discocellularis). A deep orange discocellular spot on upperside of both wings, that on hindwing much larger than forewing, upperside discocellular spots seen through on underside of both wings and are dull ferruginous. Wing Expanse: 60-64 mm.

(iii). **Hosts and Localities:** On rocks and moist soil and road, Dnp, 1670 m, 06-vi-2006, 1♂, Mixed Forest; Gul, 2644 m, 24-vii-2007, 2♂, open dusty area in golf field.

(iv). **Distribution:** Kashmir, India, Myanmar, Pakistan,

(v). **Field Observations:** *Gonepteryx rhamni* was found active from April to November, mostly singly and observed sitting on moist soil or sand, dull and dusty places and animal droppings. Puddling behavior was also noticed in case of this butterfly.

(vi). **Remarks:** The present study revealed that this species was not common in Kashmir Himalayas and needs some attention from conservation point of view. Varshney (1993) earlier gave its distribution in Kashmir.

4.1.1.7.7. Genus: *Pieris* Schrank

Pieris Schrank 1801, *Faun. Boic.* 2(1):152, 162.

Key to the species of *Pieris*:

HW with no black spots on the border. Wing-span 58-76 mm*brassicae*

HW with black spots on the border. Wing-span 40-54 mm*canidia*

IX. *Pieris brassicae* (Linnaeus)

(Fig. 3, 4, 61, 117-120, 201-211; Plate- I, XVI, XXXV, LVI, LVII, LVIII)

Papilio brassicae Linnaeus, 1758, *Syst. Nat.* ed. X, p. 467.

Pieris brassicae, Bingham, 1907, *Fauna British India, Butterflies.* Vol. II. p. 170-171.

Pieris brassicae, Evans, 1932, *The Identification Indian Butterflies.* p. 67.

Pieris brassicae, Talbot, 1939, *Fauna British India, Ceylon, Burma. Butterflies,* Vol. I. p. 426- 427.

Pieris brassicae, Varshney, 1993, *Oriental Inst.* 27:345.

(i). **Common Name:** The Large Cabbage White

(ii). **Diagnostic Features:** Antennae black, dusted with white, club gradual, well formed, tipped with white, eyes without hairs, brownish. Head black to brownish black. Abdomen black on upperside with creamish hairs, underside whitish or creamish white with creamish hairs. Thorax blackish on upper side and whitish to creamish white on upperside. Forewing white, dusted with grey and black scales at base and along costal margin more densely in female, a broad black border from apex to Cu1b becoming narrower towards tornus, with two black spots in female, one between M₃ and Cu1a and other between Cu1b and 1A+2A; under surface white with costal margin and apical area pale, with a rectangular black spot between M₃ and Cu1a and smaller black spot below Cu1b in both sexes. Hindwing white dusted with grey and black scales in basal area, with a prominent black spot on costal margin beyond middle; under surface pale, densely suffused with black, basal half of costal margin bright yellow in both sexes and costal black spot of upper surface faintly seen through. Upper side hindwing with costal black spot much longer in female than male.

Under side black discal spots on fore wing much longer in female than in male. Wing Expanse: 58-76 mm.

(iii). Hosts and Localities: On *Brassica oleracea*, Sri, 1583 m, 26-vii-2004, 10♂, 15♀, vegetable and kitchen gardens; *Calamintha umbrosa*, Aha, 2200 m, 10-vii-2006, 7♂, 5♀, Forest; *Calendula trifolium*, Sho, 2146 m, 22-viii-2007, 10♂, 8♀, Mountainous area; *Carduus edelbergi*, Kha, 1596 m, 02-v-2004, 10♂, 20♀, Hilly area with mixed vegetation; *Cerastium cerastoides*, Tan, 2220 m, 04-viii-2007, 11♂, 18♀, Forest along general road; *Cedrus deodara*, Pah, 2500 m, 28-vi-2004, 9♂, 10♀, Dense Forest; *Cersium wattutus*, Sal, 1290 m, 05-vii-2007, 5♂, 4♀, Mountainous and hilly area; *Epilobium laxum*, Shn, 1853 m, 05-iv-2006, Mountainous area with mixed vegetation; *Erodium cicutarium*, Kul, 1647 m, 15-vi-2006, Mixed vegetation; *Euphorbia helioscopia*, Ban, 1582 m, 28-vi-2005, 30♂, 20♀, Hilly area with mixed vegetation; *Medicago polymorpha*, Bar, 1600 m, 10-v-2005, 15♂, 20♀, Mountainous area; *Mentha longifolium*, Dnp, 1670 m, 29-vii-2007, 1♂, 1♀, Mixed dense vegetation; *Phaseolus lunatus*, Bud, 1615.5 m, 28-vii-2005, 35♂, 21♀, Mixed dense vegetation near to road; *Rubus ulimefolius*, Che, 1667 m, 15-vi-2007, 2♂, 4♀, Dense mixed vegetation; *Tagetes petula*, Jaw, 2858m, 29-vi-2004, 4♂, 3♀, Forest and hilly mountainous area along National Highway, *Taraxacum officinale*, Pul, 1690 m, 08-ix-2007, 6♂, 1♀, Open field; *Thymus serpyllum*, Gan, 2084 m, 11-iv-2004, 8♂, 10♀, Mixed vegetation along road; *Trifolium repens*, Pat, 1580 m, 14-vii-2006, 4♂, 2♀, Mixed vegetation near orchids; *Verbena officinale*, Uri, 1400 m, 22-vi-2007, 6♂, 9♀, Forest and Mountainous area; *Vigna aconitifolia*, Qaz, 1900 m, 29-vi-2004, 5♂, 2♀, Forest near agricultural land; *Viola tricolor*, Han, 1680 m, 21-iv-2004, 30♂, 26♀, Orchids near Forest; moist and muddy soil, Nis, 1583 m, 26-vii-2004, 5♂, 10♀; opn area along national highway, Pam., 1586.5m, 5-ix-2007, 3♂, 4♀; Saffron field.

(iv). Distribution: Kashmir, India, Jordan, Pakistan, Burma, Sri Lanka, Nepal, China, Britain, Russian, America, Africa, Turkey, Malaysia.

(v). Field Observations: *Pieris brassicae*'s flight was observed very nearer to ground as well very higher, with slow, fast and very fast flight. When both the sexes chased each other or when disturbed or when flying singly, they showed very fast and take a zigzag type of flight, sometimes even go very high in the air. At many places like Dachigam, Nishat, Batpora it was seen flying continuously for 10 to 15 minutes without taking any rest, flight activity witnessed from early morning upto dusk. At Aru, Gulmarg, Dodhpathri, Sopore and Uri, it immediately emerged after a heavy rainfall in the months of May to August. In the

forest areas, it usually showed flight activity very high in the air, both in groups as well as singly, from February to November.

During the present study it was observed that among all the butterfly species, this pierid along with *Vanessa cashmiriensis*, was the first to emerge after a long and very cold winter. The active flight of *Pieris brassicae* was also seen during the very hot mid days of summer. It aside showed occurrence in almost all types of habitats like vegetable gardens, orchids, gardens, parks, house lawns, open places, rice fields, forests, muddy places and along the roads. Also, *Pieris brassicae* was very much attracted to damp places, animal excreta and rotten fruits and prominent mud puddling behaviour was observed during the present study. It was found to be a very serious pest of many Brassicaceous vegetables like cabbage, knolkhol. The adult butterflies laid yellowish/lemonish yellow eggs in groups of 30-155, usually on the underside of the plant (Figs. Plate). The eggs hatched in 4-9 days. The caterpillars feed gregariously during the early instars and disperse as they approach maturity. They passed through five stages and were full grown in 15-21 days. The larvae pupated at some distance from the food-plant and remained attached with a firm whitish/ lemonish white cremaster. The pupal stage lasted for 8-15 days. The adult butterflies lived for 3-11 days. The total life cycle was completed in 30-56 days. The adults of this butterfly keep their wings either closed or spread during sitting, sucking sap from flowers or basking in the sun light. The adults were seen very much attracted to flowers of *Tagetes petula*.

It was widely distributed in all the districts surveyed in the Valley. In the months of June, July and August at Dachigam National Park and Batpora (Handwara) the individuals of this butterfly were seen in groups, 30 to 50 individuals per group, either flying or sitting on damp soil. The butterfly existed in high population densities in wide areas and localities at lowland and high-altitude regions of the Kashmir Valley.

(vi). Remarks: It was seen to be very common butterfly in Kashmir Himalayas. Among Pieridae family and also in other butterfly families this species was the highly dominant and widely distributed species in Kashmir. It may be due to its migratory nature, large number of both larval and adult host plants and also being a polyphagous pest. Earlier, Thomas-Glover (1936), Home (1938), Wynter-Blyth (1957), Das and Verma (1965), Malik *et al.* (1972), and Jamdar (1991 & 92), reported it from Kashmir Himalayas. *Calamintha umbrosa*, *Calendula trifolium*, *Carduus edelbergi*, *Cedrus deodara*, *Cerastium cerastoides*, *Cersium wattutus*, *Digitalis purpurea*, *Epilobium laxum*, *Erodium cicutarium*, *Euphorbia helioscopia*, *Medicago polymorpha*, *Mentha longifolium*, *Phaseolus lunatus*, *Ranunculus* sp.,

Rubus ulimefolius, *Tagetes petula*, *Taraxacum officinale*, *Thymus serpyllum*, *Trifolium repens*, *Verbena officinale*, and *Vigna aconitifolia*, are the newly recorded host-plants, of this species from Kashmir Himalayan Region.

X. *Pieris canidia* (Sparrman)

(Figs., 49, 50, 121, 122; Plates-XIII, XXXVI)

Papilio canidia Sparrman, 1768, *American Acad.* VII, p. 504.

Pieris canidia, Bingham, 1907, *Fauna British India, Butterflies*. Vol. II. p. 172-173.

Pieris canidia canis, Evans, 1932, *The Identification Indian Butterflies*. p. 67.

Pieris canidia, Talbot, 1939, *Fauna British India, Ceylon, Burma. Butterflies*, Vol. I. p. 425.

Pieris canidia, Wynter-Blyth, 1957, *Butterflies Indian Region*, P. 433-434, plate 64.

Pieris canidia, Varshney, 1993, *Oriental Inst.*, 27:357.

(i). Common Name: The Indian Cabbage White

(ii). Diagnostic Features: Antennae black, spotted with white; club gradual but well formed, with apex blunt and marked with white; eyes without hairs. Forewing white, dusted with grey and black near base, with black border along apex narrowly extending along termen, a black spot between M₃ and Cu1a in male and an additional black spot between Cu1b and inner margin in female; under surface white with dusting of grey and black scales near base, with black spots between M₃ and Cu1a and between Cu1b and 1A+2A in both sexes. Hindwing white with dusting of grey and black scales near base, a black spot along costal margin beyond middle and four minute black spots along termen in male and bigger in female; under surface pale white dusted with black, spotless, its costal margin orange at base. Wing Expanse: 40-54 mm.

(iii). Hosts and Localities: On *Brassica oleracea*, Han. 1680 m, 11-viii-2007, 4♂, 8♀, Vegetable garden and orchids; Gul, 2644 m, 22-vi-2006, 10♂, 8♀, Forest.

(iv). Distribution: Kashmir, Bhutan, China, India, Myanmar, Pakistan

(v). Field Observations: Observed to take a slow to moderate flight, either in groups or singly. It avoided flying during very hot days, rain, low light and temperature conditions. It preferred flight quite low when not disturbed and kept its wings vertically upwards while resting on flowers. It fled from May to October.

(vi). Remarks: This species showed common occurrence in the valley. Earlier, Bingham (1905) and Thomas-Glover (1936) gave its distribution in Kashmir (British).

4.1.1.7.8. Genus: *Pontia* Fabricius

Pontia Fabricius 1807, *Mag. f. Insektenk. (Illiger)*, 6:283.

XI. *Pontia daplidice* (Linnaeus)

(Figs., 51, 52, 123, 124, 215, 217; Plates- XIII, XXXVI, LIX, LX)

Pieris daplidice Linnaeus, 1758, *Syst. Nat. ed. X*, p. 468.

Pieris daplidice, Bingham, 1907, *Fauna British India, Butterflies*. Vol. II. p. 175-176.

Pieris daplidice moorei, Evans, 1932, *The Identification Indian Butterflies*. p. 66.

Pontia daplidice, Talbot, 1939, *Fauna British India, Ceylon, Burma. Butterflies*, Vol. I. p. 430.

Pontia daplidice, Varshney, 1993, *Oriental Inst.* 27:358.

(i). **Common Name:** The Bath White

(ii). **Diagnostic Features:** Antennae black, dusted with white; club sudden, tipped with white, flattened, blunt at apex; Eyes without hairs, dark brown. Head fuscous black. Thorax black on upper side having creamish hairs; underside creamish white with light creamish hairs. Abdomen blackish on upper side and whitish to creamish white on underside. Forewing upperside white with a broad black apical patch containing white spots, a large, broad and somewhat quadrate discocellular spot and smaller one between Cu1b band 1A+2A (missing in male), its base dusted with black scales in female; under surface white, with black spots of upper surface seen, yellowish green except partially black discocellular spot and two postdiscal patches in both sexes. Hindwing upperside white, dusted with black, more prominently in female, marked with black spots-one on costal margin, a row along termen and irregular black area on its inside, male only with a diffused black costal spot; Hind wing under surface green with costal margins yellow, with green or yellowish green and white sinuate bands in female, less prominently seen in male; a rounded white spot seen in the middle of the cell. Wing Expanse: 40-47 mm.

(iii). **Hosts and Localities:** On *Brassica oleracea*, Nis, 1583 m, 26-vii-2004, 5♂, 2♀, vegetable and kitchen gardens; *Carduus edelbergi*, Kha, 1596 m, 02-v-2004, 5♂, 8♀, Hilly area with mixed vegetation; *Cerastium cerastoides*, Tan, 2220 m, 04-viii-2007, 4♂, 8♀, Forest along general road; *Cedrus deodara*, Pah, 2500 m, 28-vi-2004, 5♂, 3♀, Dense Forest; *Cersium wattutus*, Sal, 1290 m, 03-viii-2007, 4♂, 6♀, Mountainous and hilly area; *Erodium cicutarium*, Kul, 1647 m, 15-vi-2005, 10♂, 4♀, Mixed vegetation; *Rubus ulimefolius*, Che, 1667 m, 15-vi-2007, 8♂, 2♂, Dense mixed vegetation; *Tagetes petula*, Pul, 1690 m, 25-ix-2007, 10♂, 18♀, Open field; *Thymus serpyllum*, Gan, 2084 m, 11-iv-2004, 7♂, 5♀, Mixed

vegetation along road; *Trifolium repens*, Pat, 1580 m, 14-vii-2006, 9♂, 8♀, Mixed vegetation near orchids; *Verbena officinale*, Uri, 1400 m, 05-vii-2007, 6♂, 5♀, Forest and mountainous area.

(iv). **Distribution:** Kashmir, Africa, China, Europe, India, Pakistan, Tibet.

(v). **Field Observations:** *P. daplidice* population reached highest during the months of June, July and August. It usually and mostly showed flight activity nearer the ground but could be seen flying higher when chasing each other. It was found usually a moderate to fast flier but could move slowly especially when present in groups or when newly emerged or during the early morning. It was not very active during very hot and sweltering mid days but preferred to fly before noon and afternoon when there was a moderate decrease/fall in the temperature. It did not arrive immediately after a mild or moderate or heavy rainfall or when there was fall in the sunlight even if the temperature was favourable for flight. This phenomenon was mostly found during summer. Its flying was seen mostly singly but at rare occasions, flight found in groups.

It was also seen present in almost every type of habitat like vegetable gardens, orchids, gardens and parks, house lawns, open places, rice fields, forests and along the roads. It was not found much attracted to damp places, animal excreta and rotten fruits and very little puddling behaviour was observed during the present study. Its flight activity was seen from April to November. It was highly distributed in Baramulla, Gulmarg, Handwara, Harwan, Sopore and Awantipora. It was mostly seen at lowland areas and occasionally at higher elevations of Kashmir. It was seen highly attracted to flowers of *Tagetes petula*.

(vi). **Remarks:** It is common in Kashmir Himalayas. Bingham (1907), Thomas-Glover (1936), Talbot (1939), Wynter-Blyth (1957) and Mani (1962), earlier gave its distribution in Kashmir. Recently, Singh (2009) reported it as ‘uncommon’ from Kadarnath Musk Deer Reserve, Garhwal, India. Eleven new hostplants, viz. *Carduus edelbergi*, *Cedrus deodara*, *Cerastium cerastoides*, *Cersium wattutus*, *Erodium cicutarium*, *Rubus ulimefolius*, *Tagetes petula*, *Taraxacum officinale*, *Thymus serpyllum*, *Trifolium repens*, and *Verbena officinale*, are being reported for the first time for this species from this part of Himalayas.

4.1.1.8. Family: Satyridae

Key to the genera of family Satyridae:

1. Eyes hairy2
 Eyes glabrous *Pararge*
2. Forewing with Sc swollen..... 3

- Forewing without swollen veins..... *Melanitis*
3. Vein 1A+2A thickened at base in forewing *Maniola*
 Vein 1A+2A not thickened at base in forewing 4
4. Wings crossed by pale or white band on both sides; hindwing with outer margin
 dentate *Aulocera*
 Wings not crossed by white or pale yellow band; hindwing with outer margin
 convex or rounded *Callerebia*

4.1.1.8.1. Genus: *Aulocera* Butler

Aulocera Butler 1867, *Ent. mon. Mag.*, 4: 121.

Key to the species of genus *Aulocera*

Wings rounded, outer margin convex; Upperside of Fore wing with the inner edge of
 discal white spots in area, 1 to 4 in line; Hind wing upper side with the band narrow
 and even *brahminus*

Wings produced, Forewing with outer margin straight; Upperside of Fore wing with
 bands white; inner edge of discal spots in areas 1 to 3 placed nearer the base and not
 in line with the spot in 4; Hind wing upper side with band of uneven width
 throughout, the veins crossing it black. *padma*

I. *Aulocera brahminus brahminus* (Blanchard)

(Figs. 35, 36, 113, 114, 178, 220, 221, 222; Plates-IX, XXXIV, L, LX, LXI)

Satyrus brahminus Blanchard, 1844, *In Jacquemont, Voy. dans l'Inde, iv, Ins.*, p. 22,
 plate, 2.

Aulocera brahminus, Marshall and De Niceville, 1883, *Butterflies India, Burma and
 Ceylon*. p. 199.

Aulocera brahminus, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 126.

Aulocera brahminus brahminus, Evans, 1932, *The Identification Indian Butterflies*. p.
 116.

Aulocera brahminus brahminus, Talbot, 1947, *Fauna British India, Butterflies*. Vol.
 II. p. 288-289.

Aulocera brahminus brahminus, Mandal, 1984, *Rec. Zool. surv. India, Occ. Pap. No.*
 57. p. 17.

(i). **Common Name:** The Narrow-Banded Satyr

(ii). Diagnostic Features: Antennae black to blackish brown. Head light brown. Thorax shining and blackish on upperside and black and covered with yellowish hairs on underside. Abdomen upperside shining and black, underside light brown. Forewing upperside blackish brown to dark brown; a post discal series of small, irregular row of whitish spots in the form of a band, a small ill-defined blackish spot near apex surrounded by small whitish spots; marginal area with arrow of light brown and whitish hairs arranged alternatively from apex to tornus; forewing underside fuscous, bronzy-brown; marginal area as that of upperside; white spots of upperside seen through, black spot well defined and eyed with white. Hindwing upperside coloured like forewing, with whitish band in continuation with forewing but not touching inner margin, basal area and innerside margin covered with dark brownish hairs; underside hindwing with basal area covered with lemonish green hairs; upperside whitish band more prominent and touching inner margin; marginal area like that of forewing. Forewing less shiny as compared to *Aulocera padma*. Hindwing MDC 'L' shaped and larger than UDC and LDC. Wing Span: 54-58mm.

(ii). Hosts and Localities: On *Carduus edelbergi*, Peh, 2500 m, 28-vi-2004, 2♂, Dense Forest; *Dryopteris* sp. Dod, 2700 m, 07-ix-2007, 2♂, Forest; *Mentha longifolia*, Han, 1680 m, 2♂, 1♀, Forest.

(iv). Distribution: Kashmir, India, Nepal, Tibet.

(v). Field Observations: It showed slow, moderate and fast flight, and remained active either singly or in groups, even during rain. It was seen flying from May to September, and mostly preferred forest, hilly and mountainous areas. Found sitting on moist soil, muddy places, and animal excreta and showed a prominent mud puddling behaviour. On deodar trees, this butterfly species was found resting with its wings closed and nearly became unnoticed (**Fig. p**). It was widely distributed at Gulmarg and Kokernag regions of Valley.

(vi). Remarks: Earlier, Bingham (1905), Evans (1932), Wynter-Blyth (1957), Mandal, (1984), Haribal (1992) reported it from Kashmir. Varshney (1994) designated it as endangered in Indian region. It has already been listed in the Indian Wildlife Protection (1972) Act. However, *A. b. brahminus* was found common in less disturbed forest areas of Kashmir Himalayas. The new host-plants, reported for the first time from Kashmir for this species include *Carduus edelbergi*, *Dryopteris* sp., and *Mentha longifolia*.

II. *Aulocera padma* (Kollar)

(Figs.31, 32, 105, 106, 177, 214, 219, 229; Plates- VIII, XXXII, L, LIX, LX, LXIII)

Satyrus padma Kollar, 1844, In Hugel: *Kaschmir und das Reich der Siek*, p. 445, plate, 35.

Aulocera padma, Bingham, 1905, *Fauna British India, Butterflies*. Vol. I. p. 127-128.

Aulocera padma padma, Evans, 1932, *The Identification Indian Butterflies*. p. 116.

Aulocera padma padma, Talbot, 1947, *Fauna British India, Ceylon, Burma -II*. p. 290-291.

Aulocera padma, Wynter-Blyth, 1957, *Butterflies Indian Region*, p. 109, plate 12.

Aulocera padma, Varshney, 1994, *Oriental Inst.*, 28:161.

(i). Common Name: The Great Satyr

(ii). Diagnostic Features: Antennae blackish brown. Head chocolate brown. Thorax blackish brown and shinny on upperside, covered with few brown hairs, more towards abdominal side, upperside brown covered with greenish brown hairs. Abdomen black on upperside and light brown on underside. Forewing upperside chocolate brown or dark brown and shinny; marginal area dusted with creamish or whitish spots arranged alternatively; a row of seven to eight yellowish or lemonish yellow spots on postdiscal area which show increase from inner margin towards apex and gave a band like appearance; a blackish spot near apex bordered by four small yellowish or lemonish yellow spots; underside forewing light dull and dark brown with veins prominent, upperside band seen through, black spot eyed with white. Hindwing upperside basal area and most of inner marginal area light brown and covered with chocolate brown hairs which give a shinny look; marginal area that of forewing, a light creamish or light whitish conical band in postdiscal area continues with that of forewing without touching the inner margin; hindwing underside dark brown finished with whitish colouration, more on submarginal and postdiscal area; upperside band seen through and nearly touches inner margin; underside basal area covered with light greenish hairs, marginal area that of upperside. Wing Span: 48-58mm.

(iii). Hosts and Localities: On *Carduus edelbergi*, Bar, 1600 m, 10-v-2004, 1♂, 2♀, Forest; *Cedrus deodara*, Aha, 2200 m, 10-vii-2006, 1♂, 1♀; *Cersium wattutus*, Uri, 1400 m, 05-v-2007, 2♂, Forest and Mountainous area; *Dryopteris* sp. Dod, 2700 m, 16-vii-2007, 1♂, Forest; *Juglans regia*, Han, 1680 m, 11-vii-2007, 1♂, 2♀, Forest; *Trifolium repens*, Gul, 2644 m, 24-vii-2007, 8♂, 10♀, Forest.

(iv). Distribution: Kashmir, China, India, Myanmar, Tibet.

(v). Field Observations: It also showed slow, moderate and fast flight and active either singly or in groups, even during rain. It mostly preferred forest, hilly and mountainous

areas. Found siting on moist soil, muddy places, open roads and fields and animal excreta and showed a prominent mud puddling behaviour. It was widely distributed at Dodhpathri, Gulmarg, Handwara and Kokernag. It flew from May to September.

(vi). **Remarks:** It was common in Kashmir Valley. Evans (1932), Thomas-Glover (1936), Talbot (1947), Haribal (1992) and Varshney (1994), earlier reported it from Kashmir (British & Indian). Talbot (1947), treated it as not rare in the Indian region. *Carduus edelbergi*, *Cedrus deodara*, *Cersium wattutus*, *Dryopteris* sp., *Juglans regia* and *Trifolium repens* are the new host-plants and are reported for the first time for this species from Kashmir Himalayan Regions.

4.1.1.8.2. Genus: *Callerebia* Butler

Callerebia Butler 1867, *Ann. Mag. Nat. Hist.*, (3)20: 217.

III. *Callerebia mani mani* (De Niceville)

(Figs. 17, 18, 111, 112; Plates- V, XXXIII)

Erebia mani De Niceville, 1880, *J. Asiatic. Soc. Bengal.*, Vol. XLIX, p. 247.

Erebia mani, Bingham, 1905, *Fauna British India, Ceylon, Burma -I.*, p. 148-149.

Erebia mani, Evans, 1932, *The Identification Indian Butterflies*. p.117.

Erebia mani mani, Talbot, 1947, *Fauna British India, Butterflies*. Vol. II. p. 300-301.

Callerebia mani, Varshney, 1994, *Oriental Insts.*, 28:160.

(i). **Common Name:** The Yellow Argus.

(ii). **Diagnostic Features:** Antennae dark brown; Head light brown; Thorax black, shining and covered with small blackish brown hairs on upperside and light brown on underside; Abdomen shining, black on upperside, light brown on underside; Forewing upperside brown, with a very large subtriangular yellow patch, larger in the male than in the female, extending from apex of cell to a narrow marginal brown border, and from a narrow costal brown border to vein 1A+2A, enclosing a black subapical ocellus markings as on upperside, but ocellus with a broader pale yellow ring, with one or two minute white centres and a much paler yellow ring; underside of forewing with basal area to apex of cell brown tinged with ochraceous-red, ocelli prominent and covered with yellow; marginal area of both wings lined with light brown hairs; Hindwing uniform with a small white spot between Cu1a and M₃; underside hindwing pale reddish-brown dusted with white; a series of small six to seven white post discal spots, one ocelli bordered with yellow and eyed with white; Hindwing LDC (Lower Discocellularis) larger and broken than MDC (Middle Discocellularis) and UDC (Upper Discocellularis). Wing Expanse: 42-50 mm.

(iii). Hosts and Localities: On moist soil near link road, Dnp, 1670 m, 06-vi-2006, 2♂, 4♀, Mixed dense flora; *Datisca annabina*, Dod, 2700 m, 07-ix-2009, 3♂, Forest; *Organum vulgare*, Bar, 1600 m, 29-vi-2006, 1♂, 2♀, Dense forest.

(iv). Distribution: Kashmir, China, India, Turkey,

(v). Field Observations: Found as a slow flier, flying both singly and in groups close to ground and was usually easy to catch. The butterfly species preferred shady places and remained hidden in grasses and shrubs. Found resting on rocks matching dark ground colour, dark places, open grounds, damp and moist soil, and showed puddling behavior. Remained active in the field from April to September and their population was most abundant from May to August. However, it showed restricted distribution, mostly confined to areas like Dodhpathri, Dachigam National Park, Uri, Baramulla, and Batpora.

(vi). Remarks: It was found not common in Kashmir Himalayas, It was the most predominant species active during dim light. Earlier, Bingham (1905), Evans (1932), Talbot (1947), reported it from Kashmir (British) and Varshney (1994) listed the species from this region. Evans (1932), designated it as rare while Varshney (1994), described it as endangered in the Indian region and has been listed in the Indian Wildlife Protection (1972) Act. *Datisca annabina* and *Organum vulgare* are the new host-plants and are reported for the first time from this Himalayan Region.

4.1.1.8.3. Genus: *Maniola* Schrank

Maniola Schrank 1801, *Faun. Boic.* 1:152, 170.

IV. *Maniola pulchella* (C & R Felder)

(Figs. 39, 40, 109, 110, 176; Plates-X, XXXIII, XXXIX)

Epinephele pulchella Felder, 1867, *Reise Novara, Lep. II.* p. 49, plate lxix.

Epinephele pulchella, Marshall and De Niceville, 1883, *Butterflies India, Burma and Ceylon*, p. 208.

Maniola pulchella race *pulchra*, Bingham, 1905, *Fauna British India, Butterflies.* Vol. I. p. 121.

Maniola pulchella, Evans, 1932, *The Identification Indian Butterflies.* p. 111.

Maniola pulchella, Talbot, 1947, *Fauna British India, Ceylon, Burma -II.* p. 255.

Maniola pulchella, Wynter-Blyth, 1957, *Butterflies Indian Reg.* p. 105.

Maniola pulchella, Varshney, 1994, *Oriental Insts.*, 28:161.

(i). Common Name: The Tawny Meadowbrown

(ii). Diagnostic Features: Antennae dark brown or dark grayish brown. Head light brown. Thorax upperside blackish brown and shining, underside light brown. Abdomen dark brown on upperside and light brown on underside, area between thorax and abdomen covered with dark brown hairs. Forewing upperside ochraceous-yellow; costa and outer and inner margins broadly grayish-brown; a subapical round black spot or non-pupilled ocellus. Hindwing uniform, grayish brown on upperside; outer margin very slightly scalloped. Forewing underside with paler borders; subapical ocellus white-centred, and surrounded by a broad zone of yellow paler than the ground-colour. Hindwing ground-colour paler than on upperside, speckled and striated with dark brown; a discal, obscure, angulate broken line. Female resembled the male; upperside of forewing usually with an additional round black spot near tornus. Hindwing LDC (Lower Discocellularis) larger than MDC (Middle Discocellularis) and UDC (Upper Discocellularis). Wing Expanse: 34-48 mm.

(iii). Hosts and Localities: On *Cersium wattutus*, Gul, 2644 m, 27-viii-2005, 10♂, 5♀, Forest; *Tagetus petula*, Dod, 2700 m, 07-ix-2007, 2♂, 1♀, Forest.

(iv). Distribution: Kashmir, India.

(v). Field Observations: It flew from June to September and showed slow to moderate flight and their flying was found, either singly or in groups. It mostly preferred forest, hilly, mountainous and shady areas. Frequent resting of this butterfly on dusty places, open roads and fields has been seen and keeping its wings closed which gave it protection from predators as its underside colouration matches with the ground colour. It was widely distributed at Gulmarg forest areas and preferred other hilly and mountainous areas.

(vi). Remarks: Bingham (1905), Evans (1932), Talbot (1947), Wynter-Blyth (1957) and Mani (1962), earlier reported this butterfly species from Kashmir. It was found to be common in Kashmir Himalayas especially in less human populated areas. *Cersium wattutus* and *Tagetus petula*, are the new host-plant records for this species from this part of world.

4.1.1.8.4. Genus: *Melanitis* Fabricius

Melanitis Fabricius 1807, *Mag. f. Insektenk. (Illiger)*, 6:282.

V. *Melanitis phedima* (Stoll)

(Fig., 115, 116; Plate- XXXIV)

Papilio phedima Stoll 1732, in Cramer, *Pap. Exot.* 4:165-252.

Melanitis phedima galkissa, Evans, 1932, *The Identification Indian Butterflies*. p. 126.

Melanitis phedima galkissa, Talbot, 1947, *Fauna British India, Butterflies*. Vol. II. p. 371-372.

Melanitis phedima, Wynter-Blyth, 1957, *Butterflies Indian Reg.* p. 123-124.

Melanitis phedima, Varshney, 1979, *J. Bombay nat. Hist. Soc.* 76(1):33-40.

Melanitis phedima, Varshney, 1994, *Oriental Insts.*, 28:152.

(i). Common Name: The Dark Evening Brown

(ii). Diagnostic Features: Upperside with outer borders ash-grey, especially in male, Forewing with ochraceous markings extended; Hindwing with more produced at V3 than at vein 1b. Under side of male marbled with grey; ocelli blind. Wing span 60-80mm.

(iii). Hosts and Localities: On *Oryza sativa*, Kas, Han, 1680 m, 11-vii-2004, 1♂, 1♀, mixed vegetation.

(iv). Distribution: Kashmir, India, Burma, China, Philipines, Sri Lanka,

(v). Field Observations: It usually took a slow to moderate fluttering flight and flied from June to September. It was noticed as a jungle or forest species and preferred to fly near the ground occured in dry and wet forms, the former being more than the latter.

(vi). Remarks: Bingham (1907), Evans (1932), and Talbot (1947) earlier reported it from Kashmir. Present survey revealed it as uncommon in the valley. Recently, Singh (2009) reported it rare from Kadarnath Musk Deer Reserve, Garhwal, India.

4.1.1.8.5. Genus: *Pararge* Huebner

Pararge Huebner 1819, *Samml. Exot. Schmett.*, II.

VI. *Pararge everesmanni cashmirensis* Eversmann

(Figs. 7, 8, 107, 108; Plates- II, XXXII)

Pararge everesmanni Eversmann, 1847, *Moscow Bulletin* 2, plate 2.

Pararge cashmirensis, Bingham, 1905, *Fauna British India, Ceylon, Burma* -I. p. 112.

Pararge everesmanni cashmirensis, Evans, 1932, *The Identification Indian Butterflies*, I p. 110.

Pararge everesmanni cashmirensis, Talbot, 1947, *Fauna British India, Butterflies*. Vol. II. p. 245-246.

Lasiommata everesmanni, Varshney, 1994, *Oriental Insts.*, 28:155.

Pararge everesmanni cashmirensis, Rose and Sharma, 1999, *J. Bombay Nat. Hist. Soc.*, 96(3):433-435.

(i). Common Name: The Yellow Wall.

(ii). Diagnostic Features: Antennae pale brown, last few segments along with club more brownish, head pale brown, abdomen pale brown, slightly shining, covered with light

brownish hair on upper side, underside dull brownish, covered with more light brownish hair; Thorax pale brown on upper side and light brownish or creamish brown on underside; Forewing upper side dark ochraceous brown, end cell with a prominent dark brown spot, marginal area dark brown, brownish area more towards apex, brownish spot at M₃ which touches the marginal area, two brownish spots at the apex one larger one nearer to the costal margin and other smaller one towards the termen, margins whitish underside of forewing lighter than upper side, end cell with a prominent brown spot visible, inside cell has two brownish irregular lines, costal margins along the cell more brownish, a brownish line which runs nearly parallel to the end cell area from Sc to Cula, between this line and end cell brownish spot more brownish, prominent and thicker, margins dusted with creamish scales; termen and apex light brownish, termen irregular, a prominent blackish brown spot centred with white present on the median near the apex and is away from the light brown medial area, one light brownish spot on the radius, one dark brownish small spot between these two spots, one circular light brownish spot between cubitus and touches the marginal area, inner area more lighter than discal area; upper surface of hindwing with marginal area dark brown, having 3-4 dark brown spots surrounded by ochraceous brown scales on the submarginal area, the one between M₃ and Cu1a is larger than other, distal area dusted with light brownish hairs, end cell not with a spot, margins creamish white like that of forewing, underside of hindwing with basal part of Sc highly swallowed, Sc, R₁ and R₂ run parallel to each other. LDC (Lower Discocellularis) larger than UDC (Upper Discocellularis) and MDC (Middle Discocellularis) in both wings. LDC in hindwing comparatively thinner than UDC and MDC, M₃ first shows slight closeness towards M₂ but then runs away from it, precostal vein directed towards distad. Wing Span: 40-60mm.

(iii). Hosts and Localities: On grasses, Gul, 2644 m, 03-viii-2007, 3♂, 4♀, open area in Forest.

(iv). Distribution: Kashmir, India.,

(v). Field Observations: It was found usually a moderate to fast flier but when in groups it took slow flight and became easy to catch. Remained active in the field from May to August and showed abundance in June and July. It preferred forests and less disturbed areas. It was widely distributed at Gulmarg and Pahalgam.

(vi). Remarks: Marshall and De Niceville (1883), Rose and Sharma (1999), and Talbot (1947), had reported it being rare and Varshney (1994), put it in the category of endangered species of the Indian region. Due to its decline, it has been listed in the Indian

Wildlife Protection (1972) Act. The present study has also revealed that this species is either not common or is showing declining trend. Earlier, Marshall and De Niceville (1886), Rose and Sharma (1999), Talbot (1947), and Varshney (1994) reported its distribution in Kashmir (British & India).

4.2. Life Cycle Studies of Nymphalidae.

4.2.1. Life cycle of *Cynthia cardui*:

It completed its life cycle in 31 to 45 days depending upon the climatic conditions in four different stages namely egg, larva, pupa and adult. Its larvae feed on *Tagetes petula*.

(i). Eggs: Eggs were laid in groups of 5 to 15 on the underside of the leaves. Eggs were yellowish when newly laid. They turned whitish or colourless before turning to larval stage. They are spherical, larger than broader and have 14-16 longitudinal ribs. They change into larvae in 4 to 6 days. (Figs., 60, 233-235, Plate- XVI, LXIV)

(ii). 1st Instar Larva: Head, cheeks, clypeus, frons and vertex are black. Head looks larger than other body segments. Upper side of the body is blackish to brownish black. Underside (Ground colour) of the body brown or light yellowish brown or light lemonish brown. Thoracic legs (True legs) are three (3) pairs; light brownish, developed & functional. Abdominal legs (Prolegs) are four pairs (4), yellowish brown, not fully developed yet & are not functional. Anal legs (Anal Clasper) is one (1) pair, yellowish brown to lemonish brown, not fully developed & is functionless. Anal segment is smaller than others. Tender and soft leaves served as host for the butterfly species, preferred upper portion of the host plant and mostly starts living singly from first instar. Body covered with few, small brownish or yellowish hairs (setae). Mid-dorsal line yellowish. They made silken cocoon or folded the leaves together to make a cave like structure and lived inside it (Figs., 237, 243; Plates- LXV, LXVI). It gives protection from enemies, heat loss, rainfall, strong winds, cold weather etc. The host plant has very sharp thorns and is avoided by nearly all domestic as well as wild animals. the butterfly species found distributed both at low as well as high-altitude areas. At areas, like roads and highways, industrial areas, stone crushing areas, dust prone areas, etc both leaves and larvae look darker, which made it difficult to easily recognize them. Body has few yellowish dots. This stage lasted for about 4 to 6 days. Size: 4-6mm. (Figs., 235, 236, 239; Plates- LXIV, LXV).

(iii). 2nd Instar Larva: Head, cheeks, clypeus, frons and vertex are black. Thoracic legs turn more brownish. Anal legs (claspers) increase in size, start functioning and turn more yellowish. Mid-dorsal line yellowish or brownish. The number of yellowish spots on the

body increases. Upper side of the body turns more blackish to brownish black. They start coming out of the silken cocoons or folded leaves and move to other fresh leaves or portions of the plant mostly on the middle or lower portions. They were quick and eat more than 1st instar larvae. Hairs on the body increase in size and number. This stage lasts for about 5 to 6 days. Size: 8-12 mm. (Figs., 238; Plates- LXV).

(iv). 3rd Instar Larva: Head complete black. Body covered with small black or brownish black and whitish hairs the latter being small and more in the head region. Thoracic legs become more brownish. Anal legs increase in size and become fully functional. Mid-dorsal line becomes more yellowish to brownish yellow and more prominent. Size of body hairs (setae) on upper side increase in size and number and may be brownish to yellowish or both. They ate more, live singly, and were more quick and fast. When disturbed they shrink their body, coil themselves like coiled wire and behave like a dead or immovable thing. Yellowish dots on the body increase in size and number. Body starts turning thickest at mid abdominal segments. This stage lasted for about 4 to 5 days. Size: 14-20 mm. (Figs., 238, 243; Plates- LXV, LXVI).

(v). 4th Instar Larva: Head black but looks smaller than other body segments. Number of whitish hairs increased and are along with blackish or brownish black hairs. Head had more whitish hairs than other body segments. However, frons has less whitish hairs but more blackish or brownish black hairs. Mid-dorsal line more yellowish to brownish yellow and more prominent. They also ate more, and lived singly, are were quick and fast and mostly preferred to live at middle areas of the host plants. Body turned thickest at mid abdominal segments. This stage lasted for about 5 to 6 days. Size: 22-32 mm

(vi). 5th Instar Larva: Head black and smaller than other body segments. Whitish hairs increased in size and number and covered whole body along with blackish or brownish black hairs. Head has more whitish hairs than other body segments. However, frons had less whitish hairs but more blackish or brownish black hairs. Mid-dorsal line was yellowish to brownish yellow and more prominent. They started eating less and move slowly. During last days it stopped feeding and moved to a suitable undisturbed place for pupation. This stage lasted for about 4 to 6 days. Size: 34- 40 mm. (Figs., 242; Plates- LXVI).

(vii). Pre-Pupa: Size: 20-22 mm. Larva hangs or sticks itself to a suitable place with its posterior end. For pupation larva preferred middle portion of the plant. Cremaster whitish to creamish white. Wing case greenish and has numerous lemonish spots. This stage lasted for about 1 to 3 days. (Figs., 240; Plates- LXV).

(viii). **Pupa:** Body brownish, greenish brown or golden brown. Cremaster turn blackish brown. Wing case turned brownish or greenish brown. Lemonish spots on the wing case turned golden or golden brown. Spiracles golden brown. Pupa was observed as free and hanging. This stage lasted for about 4 to 7 days. After breaking of pupa, adult was formed. Size: 15-16 mm. (Figs., 241; Plates- LXVI).

4.2.2. Life cycle of *Vanessa cashmirensis*:

It completed its life cycle in 26 to 38 days depending upon the climatic conditions in four stages namely egg, larvae, pupa and adult. Its larvae feed on plant *Urtica dioica* (Urticaceae) which is distributed both at low land and high-altitude areas of Kashmir Himalayas. The life cycle of this species is described for the first time.

(i). **Eggs:** They are laid either in groups or singly usually on the upperside/ portion of the plant. They are brownish to yellowish brown in colour and dome or oval shaped. They changed into first instar larvae in 4-6 days. (Figs., 62; Plate- XVI)

(ii). **1st Instar Larva:** Size 4-6 mm. Head black to brownish black, frons brownish black and shining, vertex and cheeks blackish. Ground colour yellowish to lemonish or greenish yellow, upper side/ surface light lemonish or yellowish green and first 5-6 segments more densely coloured. First thoracic segment has a brownish spot on the upper side which is not found in other segments. Thoracic legs are small, blackish, developed and functional. Abdominal legs and anal clasper/legs are light lemonish or colourless, not fully developed and functionless. Mid-dorsal line visible, complete and black to brownish black in colour. All body segments except anal segment covered with small brownish to blackish hairs. Anal segment covered with yellowish hairs. They are slow movers and live in groups, mostly on the upper part of the plant. They eat soft and tender leaves. They also secreted a whitish silken like substance and make cocoon or web like structures in which they live until they change into next instar. The silken web is used as a bridge to move from one place or plant to another. Duration: 3-5 days. (Figs., 63, 181, 182; Plates- XVI, LI)

(iii). **2nd Instar Larva:** Size, 9-14 mm. Head more prominent, vertex and frons turn more shining, cheeks brownish black or black and covered with small brownish hairs. Body colour starts changing to black. Hairs on body start growing and increase in size and number. The greenish areas or colouration on the body start disappearing. First segment is smaller than others. The larva comes out of the silken cocoon and starts living mostly in groups or singly. Thoracic legs increase in size and are more blackish, fully developed and functional. Both abdominal and anal legs increase in size. Abdominal legs are lemonish yellow and

become fully functional. Anal legs also start functioning and start changing to brownish. The larva becomes quicker and increases in size and shape. Mid-dorsal line becomes more prominent. Duration: 4-6 days. (Figs., 183; Plates- LI).

(iv). **3rd Instar Larva:** Size, 16-22 mm. Head brownish black, vertex and frons more brownish. Anal legs increase in size, turn brownish and become fully functional. Thoracic legs are blackish, developed and functional. Abdominal legs increase in size and are more yellowish. Head and first thoracic segment are of same size but smaller than other body segments. The larva shows drastic increase in size and becomes more quicker and voracious eater. It starts living singly, eats nearly any part of the plant and moves freely from one place to another. The larva sticks itself to the object on which it is placed or on which it rests. Hairs on the body increase in size and number. The hairs on the lower side are yellowish and on upper side are black with few yellowish in between. Duration: 5-7 days. (Figs.,183; Plates-LI).

(v). **4th Instar Larva:** Size, 20-26 mm. Head brownish or blackish brown, smaller than other segments; cheeks and frons complete brownish. Thoracic legs blackish, Abdominal legs yellowish and Anal legs brownish. All legs are fully functional. Upper side of the body black, ground surface black to brownish black. Mid-dorsal is prominent and black. It becomes less quick and eats less as compared to the previous instars. Duration: 4-6 days. (Figs.,184; Plates- LI).

(vi). **5th Instar Larva:** Size, 26-32 mm. Head blackish brown, cheeks and frons brownish. Thoracic legs blackish, abdominal legs yellowish and anal legs brownish and all legs are fully functional. It is a very slow mover and lives singly. Upper side of the body black, ground surface black to brownish black. Mid-dorsal is prominent and black. It stops feeding during its last larval stages of development and moves to a suitable place where it pupates. Duration: 5-6 days. (Figs., 185; Plates- LII).

(vii). **Pre-Pupa:** The larva stops feeding and shrinks its size which varies from 18-22 mm. It sticks itself to the substratum with its anal end. The cremaster is whitish. Wing case is light brown to light green. Duration: 1-2 days. (Figs., 186, 188; Plates- LII).

(viii). **Pupa:** Pupa is variously coloured (brownish, dark brown and greenish brown). When the pupation takes place in dim light the pupa is usually dark brown and if it takes place in bright light the pupa is light brown to greenish brown. Eyes, palpus and antenna are golden brown. Wing case dark brown and spiracles on the wing case golden to golden brown. Pupa is free and hanging. Size: 17-20 mm. Duration: 5-6 days.

The pupa breaks from lower side and first head region comes out and then rest of the body follows (Figs., 189, 190; Plate- LIII). The adult butterfly comes out slowly and leaves the pupal part aside and sits on any desirable object (Figs., 191- 196; Plates- LIII, LIV). Before emergence of the adult the pupa breaks and a red colour fluid is secreted (Fig., 200; Plate- LV)

4.3. Bioecological Studies of some butterfly species.

During the present course of investigations four types of diversity indices namely Shannon-Weiner Index, Shannon Equability Index, Margalef's Index and Simpson's Index were used. Relationship between temperature and species abundance of 10 species was calculated using Correlation Coefficient Technique.

The calculated values of Shannon-Weiner Index at different districts (Tables 1- 4) ranged from 3.065 (Anantnag for the year 2007) to 3.821 (Baramulla for the year 2004). The lowest diversity was calculated from 3.065 (Anantnag-2007), 3.099 (Pulwama-2004), and 3.099 (Anantnag-2005). The highest diversity was calculated from 3.821 (Baramulla-2004), and 3.809 (Srinagar-2007). The calculated values of this index shows that butterflies are more or less equally distributed at all districts because the calculated values did not show the much difference among the districts.

The Shannon Equability Index values (Tables 1- 4) ranged from 0.741 (Baramulla-2007) to 0.799 (Srinagar-2005). Both the values indicate that the butterfly fauna is more or less evenly distributed at all districts of Kashmir Valley. This index showed that the butterflies at all the districts are even.

The calculated values (Table 1-4) of Margalef's Index ranged from 2.044 (Anantnag-2007) to 6.245 (Kupwara- 2004) which indicate that species richness was slightly higher at Kupwara (2004), Baramulla (2005, 06, & 07), where as it was slightly lower at Anantnag (2004, 05, 06, & 07). The remaining places/districts showed more or less same butterfly abundance.

The values of Simpson's Index ranged from 0.824 (Pulwama- 2004) to 0.895 (Baramulla-2004) (Table 1-4). This index showed that the lowest abundance was obtained from Pulwama (2004), Budgam (2005, 06 & 07) and the highest abundance was obtained from Baramulla (2004, 05 & 06) and Srinagar (2007). All the values obtained from this Index showed that butterfly abundance is more or less same for all the districts surveyed during the present work. All the calculated values obtained from different Indices showed that the butterfly abundance and species richness is more or less same or even for all the districts.

Places like Gulmarg, Pahalgam, Dachigam, Awantipora, Baramulla, Batpora, Dodhpathri, Uri, Gantmulla, and Kokernag, have highest species richness and are the paradise for butterfly fauna of Kashmir Himalayas. All these areas have diverse flora and vegetation, less pollution, mostly undisturbed hilly areas which support a wide range of Insect diversity including butterflies.

(Table 1). Calculated values of diversity indices for the year 2004.

District	Shannon-Weiner Index	Shannon Equability Index	Margalef's Index	Simpson's Index
Anantnag	3.573	0.939	2.096	0.858
Baramulla	3.821	0.795	4.091	0.897
Budgam	3.15	0.789	2.249	0.833
Kupwara	3.176	0.836	6.245	0.842
Pulwama	3.099	0.795	2.249	0.824
Srinagar	3.667	0.388	3.804	0.875

(Table 2). Calculated values of diversity indices for the year 2005.

District	Shannon-Weiner Index	Shannon Equability Index	Margalef's Index	Simpson's Index
Anantnag	3.099	0.815	2.068	0.845
Baramulla	3.782	0.797	3.954	0.889
Budgam	3.111	0.763	2.567	0.828
Kupwara	3.177	0.836	2.082	0.846
Pulwama	3.277	0.840	2.263	0.859
Srinagar	3.749	0.799	3.895	0.878

(Table 3). Calculated values of diversity indices for the year 2006.

District	Shannon-Weiner Index	Shannon Equability Index	Margalef's Index	Simpson's Index
Anantnag	3.141	0.826	2.061	0.848
Baramulla	3.813	0.795	4.116	0.890
Budgam	3.241	0.794	2.566	0.841
Kupwara	3.203	0.843	2.063	0.846
Pulwama	3.219	0.825	2.220	0.847
Srinagar	3.67	0.782	2.856	0.877

(Table. 4). Calculated values of diversity indices for the year 2007.

District	Shannon-Weiner Index	Shannon Equability Index	Margalef's Index	Simpson's Index
Anantnag	3.065	0.807	2.044	0.834
Baramulla	3.516	0.741	3.928	0.888
Budgam	3.227	0.791	2.561	0.832
Kupwara	3.214	0.846	2.071	0.843
Pulwama	3.255	0.835	2.242	0.848
Srinagar	3.809	0.812	3.878	0.891

Relationship between temperature and species abundance was observed/studied in 10 butterfly species by using Correlation Coefficient technique. The species are namely *Aulocera padma*, *Colias erate*, *Colias electo fieldi*, *Cynthia cardui*, *Junonia orithya*, *Libythea lepita lepita*, *Pelopidas mathias*, *Pieris brassicae*, *Pontia daplidice* and *Vanessa caschmirensis*. The calculated values of Correlation Coefficient varied from 0.42 to 0.87 (Table- 5, Figs., 71- 80, Plates- XX- XXV). All these species more or less showed a positive relationship with temperature. Among them, species like *Pieris brassicae*, *Cynthia cardui*, and *Vanessa caschmirensis* showed highest positive relationship with temperature followed by *Colias erate*, *Colias electo fieldi*, and *Junonia orithya* while as species like *Pontia daplidice*, *Pelopidas mathias*, *Libythea lepita lepita*, and *Aulocera padma* sp. showed less positive relationship with temperature. The highest positive relationship with temperature was shown by *Junonia orithya* at Srinagar and least positive relation was shown by *Libythea lepita lepita* at Kupwara.

Species like, *Colias erate*, *Cynthia cardui*, *Junonia orithya*, *Libythea lepita lepita*, *Pelopidas mathias*, *Pieris brassicae*, *Pontia daplidice* and *Vanessa caschmirensis* showed highest abundance at Srinagar followed by Baramulla and Kupwara Others like *Aulocera padma* and *Colias electo fieldi* were abundant at Baramulla followed by Kupwara and Srinagar. Due to very low temperature, there was no occurrence/abundance of any species during the months of January, February, and December. With the increase in temperature, the abundance of butterflies start increasing and it was highest abundance in the months of June, July and August from all the districts (Fig., 68, Plate- XIX). As the temperature started decreasing, the movement of butterflies also declined. The butterflies were found sensitive to

temperature and whenever there were any fluctuations in temperature, they responded accordingly.

(Table. 5). Correlation Coefficient Values of some butterfly species of of Kashmir Valley.

S.No	Butterfly Species	Family	Values of Correlation Coefficient		
			Baramulla	Kupwara	Srinagar
1.	<i>Aulocera padma</i>	Satyridae	0.67	0.63	0.67
2.	<i>Colias electo fieldi</i>	Pieridae	0.76	0.80	0.78
3.	<i>Colias erate</i>	Pieridae	0.77	0.75	0.76
4.	<i>Cynthia cardui</i>	Nymphalidae	0.81	0.74	0.72
5.	<i>Junonia orithya</i>	Nymphalidae	0.79	0.69	0.87
6.	<i>Libythea lepita lepita</i>	Libytheidae	0.70	0.00	0.60
7.	<i>Pelopidas mathias</i>	Hesperiidae	0.52	0.64	0.60
8.	<i>Pieris brassicae</i>	Pieridae	0.81	0.82	0.80
9.	<i>Pontia daplidice</i>	Pieridae	0.70	0.67	0.67
10.	<i>Vanessa cashmirensis</i>	Nymphalidae	0.80	0.80	0.81

5. CONCLUSION, CHECKLISTS, SUMMARY AND FIGURE PLATES:

5.1. Conclusion: During the course of present thorough field survey in different habitats, localities, areas in 10 different districts namely Anantnag, Bandipora, Baramulla, Budgam, Ganderbal, Kulgam, Kupwara, Pulwama, Shopian, and Srinagar, 40 butterfly species have been monitored. These were found to be belonging to 29 genera, under 8 families, given below (Table 6). Various families including number of genera and species are: Danaidae (1 gen., 2 spp.), Hesperidae (1 gen., 1 sp.), Libytheidae (1 gen., 1 sp.), Lycaenidae (3 genn., 3 spp.), Nymphalidae (9 genn., 13 spp.), Papilionidae (1 gen., 3 spp.), Pieridae (8 genn., 11 spp.) and Satyridae (5 genn., 6 spp.).

(Table 6). Number of genera and species under various families monitored.

S. No.	Family	Genus/Genera(no.)	Total number of species
1.	Danaidae	1	2
2.	Hesperidae	1	1
3.	Libytheidae	1	1
4.	Lycaenidae	3	3
5.	Nymphalidae	9	13
6.	Papilionidae	1	3
7.	Pieridae	8	11
8.	Satyridae	5	6
Total	8	29	40

Different genera, including their species under each family encountered in Kashmir Valley are given as under:

Family Danaidae includes milkweeds and was found to be represented by one genera *Danaus* and two species- *D. chrysippus* and *D. genuta*. Hesperidae, commonly known as skippers, is represented by one genus *Pelopidas* and one species *P. mathias*. Libytheidae commonly called the beaks was also represented by one genus *Libythea* and one species/subspecies *L. lepita lepita*. Family Lycaenidae included blues and was represented by three genera and three species. The species are: *Aricia agestis*, *Lampides boeticus* and *Lycaena phlaeas*. Nymphalidae is represented by 9 genera and 13 species. The nymphalids include *Argyreus hyperbius*, *Childrena childreni*, *Cynthia cardui*, *Neptis hylas astola*, *Phalanta phalanta*, *Junonia almana*, *J. iphita*, *J. orithya*, *Hypolimnas missipus*, *Issoria gemmata gemmata*, *I. lathonia*, *Vanessa cashmirensis*, and *V. indica*. Papilionidae commonly

known as swallowtails and is represented by one genus *Papilio* and its three species as *Papilio arcturus arius*, *Papilio demoleus* and *Papilio machaon asiatica*. The whites and yellows, are the members of the family Pieridae, are represented by 8 genera and 11 species in the Kashmir Valley. The species under Pieridae are: *Anaphais aurota*, *Aporia leucodice*, *Catopsilia pomona*, *C. pyranthe*, *Colias electo fieldi*, *C. erate*, *Eurema hecabe*, *Gonepteryx rhamni*, *Pieris brassicae*, *P. canidia* and *Pontia daplidice*. Satyridae includes satyrs and is represented by 5 genera and 6 species. They are *Aulocera brahminus brahminus*, *A. padma*, *Callerebia mani mani*, *Maniola pulchella*, *Melanitis phedima* and *Parage eversmanni cashmirensis*.

The widely prevalent genera/ species included *Pelopidas mathias* (Hesperiidae), *Lampides boeticus* and *Lycaena phlaeas* (Lycaenidae), *Cynthia cardui*, *Junonia orithya* and *Vanessa cashmirensis* (Nymphalidae), *Colias electo fieldi*, *C. erate*, *Pieris brassicae*, *P. canidia* and *Pontia daplidice* (Pieridae), *Aulocera brahminus brahminus* and *A. padma* (Satyridae).

The butterfly species being recorded for the first time from Kashmir region are: Danaid, *Danaus genivita*; Nymphalids, *Issoria gemmata gemmata*, *Junonia orithya*, *J. almana*, and *Phalanta phalanta*; Pierids, *Catopsilia pomona*, *C. pyranthe* and *Eurema hecabe* and Papilionids, *Papilio arcturus arius*.

The present study has revealed that *Pieris brassicae* (Pieridae) as the butterfly species, emerging first in the month of February after a long severe cold winter season and its emergence was followed by *Vanessa caschmirensis* (Nymphalidae), showed its activity in the month of March. *Pelopidas mathias* (Hesperiidae), found to emerge in the month of June. The butterfly activity in general was observed from 7.30 am to 7.00 pm, depending upon weather, month, season, temperature and type of the species, concerned.

Nymphalidae was found to be the dominant family, represented by 9 genera and 13 species. Pieridae was the second largest family, having 8 genera and 11 species followed by the families, viz., Satyridae, Lycaenidae, Papilionidae, Danaidae, Hesperiidae, and Libytheidae in decreasing order (Figs., 66, 67, plate- XVIII).

The majority of the butterfly species were witnessed in different habitats of the regions and localities surveyed to be active from May to September i.e., from late spring to early autumn seasons. The highest number of butterfly species was present in summer season (40 spp.), whereas least number (1 sp.) in winter (Table- 7, Fig., 69, Plate- XIX). Pieridae was the first family to emerge while as Hesperiidae was last to do so. The peak butterfly

activity was observed in the months of June, July and August, incorporating all the 8 families under 29 genera, covering 40 species, studied during the course of present thorough field work. The next peak butterfly activities in the areas/ localities surveyed was seen in the months of September, May, October, April, November, March and February, however, there was no butterfly activity during the months of January and December (Table 8; Fig., 68, Plate- XIX).

(Table 7): Number of families/genera/species in different seasons.

Season	Family(ies)	Genus/Genera	Species
Winter	1	1	1
Spring	7	22	32
Summer	8	29	40
Autumn	7	24	33

(Table 8): Number of families/genera/species reported in each month.

Months	Families	Genera	Species
January	0	0	0
February	1	1	1
March	2	2	2
April	6	11	12
May	7	22	32
June	8	29	40
July	8	29	40
August	8	29	40
September	7	25	35
October	4	15	17
November	2	7	8
December	0	0	0

The butterfly species like *Colias electo fieldi*, *Pieris brassicae*, *Pontia daplidice* (Pieridae), *Vanessa cashmiriensis*, *Cynthia cardui*, *Junonia orithya*, (Nymphalidae), *Lycaena phlaeas*, (Lycaenidae), were observed to be widely prevalent both at low- land as well as at high- altitude areas Kashmir. *Aulocera brahminus brahminus*, *A. padma*, *Danaus chryssipus*, *Papilio machaon asiatica*, and *Paraege evermanni cashmirensis*, mostly remained confined to forest or hilly/ mountainous areas. The highest population densities of butterfly species was found in Dachigam followed by regions Gulmarg, Handwara, Uri and Awantipora. *Callerebia mani mani* was observed to be the most shy butterfly species, preferred places with shade and dense vegetation and next in the line was *Neptis hylas astola*, *Junonia iphita*. Species like *Colias erate*, *Danaus chryssipus*, *Hypolimnas missipus*, *Issoria lathonia*, *Papilio arcturus arius*, *Papilio machaon asiatica*, and *Phalanta phalanta* were witnessed to be the quick fliers. Some important and famous tourist places like Botanical Garden, Nishat Bagh, Shalimar Bagh, Kokernag Park, were having low species richness and less abundance of butterflies. Many newly identified tourist places like Dodhpathri, and Baisairen, were found to have rich species richness and diversity of butterfly-fauna.

For the first time, mud puddling behaviour was studied in some butterfly of Kashmir Himalayas (Figs., 198, 199, 221, 222, 225, 226, 227; Plates- LV, LXI, LXII). It was observed that 19 butterfly species, under 17 genera, covering 8 families show this type of behavior in this region. The various species falling in this category include *Aporia leucodice*, *Colias erate*, *C. electo fieldi*, *Gonepteryx rhamni*, *Pieris brassicae*, and *Pontia daplidice*, (Pieridae), *Cynthia cardui*, *Junonia orithya* and *Vanessa caschmirensis* (Nymphalidae), *Papilio machaon asiatica* (Papilionidae), *Aricia agestis*, *Lampides boeticus*, and *Lycaena phlaeas* (Lycaenidae), *Danaus chrysippus* (Danaiidae), *Pelopidas mathias* (Hesperiidae), *Libythea lepita lepita* (Libytheidae), and *Aulocera brahmiinus brahminus*, *A. padma*, and *Callerebia mani mani* (Satyridae). Highest puddling behavior was observed in the members of Pieridae followed by Nymphalidae, Satyridae, Lycaenidae, Papilionidae, Libytheidae, Hesperiidae and Danaiidae (Fig., 70, Plate- XX).

Many species like *Pieris brassicae*, *Pelopidas mathias*, and *Vanesaa cashmirensis*, etc were found to attack many economically important plants and act as serious pests. *Pieris brassicae* was observed to be a polyphagous pest and caused considerable damage to Knolkhol, reddish, carrot, peas, cauliflower, etc plants. Our findings coincided with the findings of Atwal and Dhaliwal (1999), Mathur and Srivastava (1967), Varshney (1978) and Wynter-Blyth (1957). The present field observations revealed that a lot of plant species

distributed over 20 families were visited by 40 butterfly species. The members of family Nymphalidae visited highest number of plant families i.e., (13) followed by Pieridae (9), Satyridae (8), Lycaenidae (4), Hesperidae (3), Libytheidae, (2) and Danaidae (1). The butterfly species reported to be the pests of food-plants belong to three families viz., Hesperidae, Nymphalidae, and Pieridae.

Species like *Aulocera padma*, *Danaus chrysippus*, *Gonepteryx rhamni*, *Hypolimnas missipus*, *Libythea lepita lepita*, *Maniola pulchra* and *Melanitis phedima* showed the phenomenon of protective colouration/ mimicry/ camaoflage and these make them unnoticed before predators (Figs., 176, 178, 226; Plates- XXXXIX, L, LXII).

The life- cycles of Nymphalids, *Cynthia cardui* and *Vanessa cashmiriensis*, have been described for the first time from Kashmir. Many insects like ants, aphids were seen highly associated with the larvae of these species on *Urtica* leaves. This relationship seems to be symbiotic but needs further intensive studies. The life- cycle of *V. cashmirensis* and *C. cardui*, showed some contrasting features. The larvae of *V. cashmirensis* were mostly gregarious and large in number whereas they were usually not so in *C. cardui*. The pupae of *Cynthia cardui* entered diapause stage to withstand the extreme cold climatic conditions during severe winter season during the month of November but this phenomenon was not observed in case of *V. cashmirensis*.

Many species like *Anaphaeis aurota*, *Aporia leucodice*, *Catopsilia pomona*, *C. pyranthe*, *Danaus chrysippus*, *D. genuita*, *Gonepteryx rhamni*, *Hypolimnas missipus*, *Issoria gemmata gemmata*, *Junonia orithya*, *J. almana*, *Melanitis phedima*, *Papilio machaon asiatica*, *Papilio arcturus arius*, *Papilio demoleus*, *Pararge eversmani cashmirensis*, and *Phalanta phalanta*, showed decline in their number and restricted distribution.

5.2: Systematic, updated, and annotated checklist of butterflies of Kashmir Himalayan regions.

Table 9:

Taxonomic Position/Scientific Name	Common Name (s)	Distribution	Present Occurrence	Status	Author(s)/ Reference(s)
(a)	(b)	(c)	(d)	(e)	(f)
I. Family: Danaidae					
1. <i>Danaus aglea</i> (Stoll) (= <i>Danaus aglea melanoides</i> , Talbot) (= <i>Danais aglea</i> , Wynter-Blyth)	The Glassy Tiger	BK, IK	-	C	1,5, 8, 22,27
2. <i>Danaus chrysippus</i> Linnaeus (= <i>Danais chrysippus</i> , Bingham) (= <i>Danais chrysippus</i> , Evans)	The Plain Tiger	BK, IK, POK	+	VC	3, 27
3. <i>Danaus genutia</i> (Crammer) (= <i>Danais plexippus</i> , Bingham) (= <i>Danaus plexippus</i> , Talbot)	The Common Tiger	BK, IK, POK	+, *	VC	3,27

4. <i>Danaus sita sita</i> (Kollar) (= <i>Danais tytia sita</i> , Evans) (= <i>Danaus sita sita</i> , Varshney)	The Chestnut Tiger	BK, IK	-	NR	1, 5, 8, 22,27
II. Family: HesperIIDae					
1. <i>Calaenorrhinus leucocera</i> (Kollar) (= <i>Calaenorrhinus leucocera</i> , Wynter-Blyth)	The Spotted Snow Flat	BK	-	C	27
2. <i>Pelopidas mathias</i> (Fabricius) (= <i>Pelopidas mathias</i> , Wynter-Blyth)	The Small Branded Swift	BK, IK	+	VC	13, 27
3. <i>Tagiades menaka</i> (Moore) (= <i>Tagiades menaka</i> , Evans) (= <i>Tagiades menaka</i> ,Wynter-Blyth)	The Common Spotted Flat	BK	-	NR	5, 27
A	b	c	d	e	F
4. <i>Teractrocera danna</i> (Moore) (= <i>Teractrocera danna</i> , Evans)	The Himalayan Grass Dart	BK	-	NR	5, 27
III. Family: Libytheidae					
1. <i>Libythea lepita lepita</i> Moore (= <i>Libythea lepita lepita</i> , Evans)	The Common Beak	BK, IK	+	R, ¥	5, 7, 8, 17, 27

(=Libythea lepita, Wynter-Blyth)						
2. <i>Libythea myrha</i> Godart	The Club Beak	BK, IK	-	C	8	
(=Libythea myrrha, Haribal)						
IV. Family: Lycaenidae						
1. <i>Albulina galathea</i> Blanchard	The Large Green Underwing	BK	-	NR	2, 5, 27	
(=Polyommatus galathea galathea, Evans)						
(=Polyommatus galathea, Wynter-Blyth)						
2. <i>Albulina omphisa</i> (Moore)	The Dusky Green Underwing	BK	-	NR	5	
(=Lycaena omphisa, Evans)						
3. <i>Albulina orbitulus</i> Moore	The Greenish Mountain Blue	BK	-	¥	2, 5	
(=Lycaena orbitulus race jaloka, Bingham)						
(=Polyommatus orbitulus jaloka, Evans)						
4. <i>Albulina pheretes lehana</i> Moore	The Mountain Blue	BK	-	NR	2	
(=Lycaena pheretes race lehana, Bingham)						
(=Lycaena pheretes lehana, Mani)						
5. <i>Aricia agestis</i> (Denis and	The Orange-Bordered	BK	+	C	2, 5, 27	

Schiffermuller) (= <i>Lycaena astrarche</i> , Bingham) (= <i>Polyommatus astrarche</i> , Evans)	Argus					
6. <i>Arletta vardhana</i> (Moore) (= <i>Lycaenopsis vardhana</i> , Evans) (= <i>Lycaenopsis vardhana</i> , Wynter-Blyth)	The Dusky Hedge Blue	BK	-	NR	5, 27	
7. <i>Celastrina huegelii</i> (Moore) (= <i>Lycaenopsis huegelii huegelii</i> , Evans) (= <i>Lycaenopsis huegelii</i> , Wynter-Blyth)	The Large Hedge Blue	BK, IK	-	VC	5, 8, 27	
8. <i>Heliophorus androcles</i> Hewitson (= <i>Heliophorus androcles</i> , Wynter-Blyth)	The Dark Himalayan Oakblue	BK	-	NR	5, 25, 27	
9. <i>Heliophorus sena</i> Kollar (= <i>Heliophorus sena</i> , Mandal)	Sorrel Sapphire	BK, IK	-	VC	14	
10. <i>Lampides boeticus</i> Linnaeus (= <i>Lampides boeticus</i> , Varshney)	The Pea Blue	BK, IK	+	¥	13	
11. <i>Lycaena panava</i> (Westwood) (= <i>Lycaena pavana</i> , Evans)	The White-Bordered Copper	BK	-	C	5, 27	

12. <i>Lycaena phlaeas</i> (Linnaeus) (= <i>Lycaena phlaeas indicus</i> , Evans)	The Common Copper	BK, IK	+	C	5, 14
13. <i>Lycaeides christophi</i> Moore (= <i>Polyommatus christophi</i> , Wynter-Blyth)	The Small Jewel Blue	BK, IK	-	NR	5, 25, 27
14. <i>Narathura rama</i> (Kollar) (= <i>Amblypodia rama rama</i> , Evans) (= <i>Amblypodia rama</i> , Wynter-Blyth)	The Dark Himalayan Oakblue	BK	-	C	5, 27
15. <i>Polyommatus devanica</i> Moore (= <i>Lycaena devanica</i> , Bingham)	The Dusky Meadow Blue	BK	-	R, ¥	2, 5
16. <i>Polyommatus eros</i> Moore (= <i>Polyommatus eros ariana</i> , Evans) (= <i>Polyommatus eros</i> , Wynter-Blyth)	The Common Meadow Blue	BK	-	C	5, 27
17. <i>Polyommatus stoliczkana</i> Felder (= <i>Lycaena stoliczkana</i> , Bingham)		BK	-	NR	2
18. <i>Rapala nissa</i> (Kollar) (= <i>Rapala nissa nissa</i> , Evans) (= <i>Rapala nissa</i> , Wynter-Blyth)	The Common Flash	BK, IK	-	C	5, 8, 27
19. <i>Virachola isocrates</i> (Fabricius)	The Common Guava	BK, IK	-	C	13

(= <i>Virachola Isocrates</i> , Varshney)	Blue/Anar Butterfly				
V. Family: Nymphalidae					
1. <i>Aglais urticae rizana</i> (Linnaeus) (= <i>Vanessa rizana</i> , Bingham) (= <i>Vanessa urticae</i> , Wynter-Blyth)	The Mountain Tortoiseshell	BK	-	R, ¥	1, 25, 27
2. <i>Argynnis aglaia</i> Moore (= <i>Argynnis aglaia vitatha</i> , Mani)	The Dark-green Silverspot	BK, IK	-	R	5, 15
3. <i>Argynnis pales</i> Dennis & Schifferrmueller (= <i>Argynnis pales</i> , Bingham) (= <i>Argynnis pales korla</i> , Evans)	The Straight-wing Silverspot	BK	-	R	1, 5
4. <i>Ariadne merione tapestrina</i> (Cramer) (= <i>Ergolis merione tapestrina</i> , Evans)	The Common Castor	BK	-	C	5
5. <i>Apatura ambica ambica</i> (Kollar) (= <i>Apatura ambica ambica</i> , Evans)	The Indian Purple Emperor	BK	-	NR	1, 5
6. <i>Apatura ambica chitralensis</i> Evans	The Indian Purple Emperor	BK	-	NR	5
7. <i>Argyreus hyperbius</i> (Johanssen)	The Indian Fritillary	BK, POK	+	C	11, 12, 17

<i>(=Argyreus hyperbius, Varshney)</i>						
8. <i>Athyma opalina</i> (Kollar)	The Himalayan Sergeant	BK	-	VC	5, 27	
<i>(=Pantoporia opalina, Wynter-Blyth)</i>						
9. <i>Childrena childreni</i> (Gray)	The Large Silverstripe	BK	+	C	1	
<i>(=Childrena childreni, Varshney)</i>						
10. <i>Clossiana jerdoni</i> Lang	The Jerdon's Silverspot	BK	-	NR	1, 5, 27	
<i>(=Argynnis jerdoni, Bingham)</i>						
<i>(=Argynnis jerdoni, Wynter-Blyth)</i>						
11. <i>Cynthia cardui</i> (Linnaeus)	The Painted Lady	BK, IK, POK	+	C, ¥	11, 12, 27	
<i>(=Vanessa cardui, Wynter-Blyth)</i>						
12. <i>Cyrestis thymodamas</i> Biosduval	The Common Map	BK	-	NR	5, 27	
<i>(=Cyrestis thymodamas ganescha, Evans)</i>						
<i>(=Cyrestis thymodamas, Wynter-Blyth)</i>						
13. <i>Dilipa morgiana</i> Westwood	The Golden Emperor	BK, IK	-	R, ¥	5, 8, 25, 27	
<i>(=Dilipa morgiana, Wynter-Blyth)</i>						
<i>(=Dilipa morgiana, Varshney)</i>						
14. <i>Fabriciana kamala</i> (Moore)	The Common Silverstrip	BK, POK	-	C	1	
<i>(=Argynnis kamala, Bingham)</i>						

15. <i>Hypolimnas misippus</i> (Linnaeus) (= <i>Hypolimnas misippus</i> , Varshney)	The Danaid Eggfly	BK	+	C, ¥	25
16. <i>Issoria gemmata gemmata</i> Butler (= <i>Argynnis gemmata gemmata</i> , Evans)	The Gem Silverspot	BK	+, *	NC	
17. <i>Issoria lathonia lathonia</i> (Linnaeus) (= <i>Issoria lathonia</i> , Varshney)	The Queen of Spain Fritillary	BK, IK	+	C	3, 4, 17
18. <i>Junonia orithya</i> (Linnaeus) (= <i>Junonia orithya</i> , Varshney)	The Blue Pansy	BK, POK	+, *	NC	11
19. <i>Junonia almana</i> (Linnaeus) (= <i>Junonia almana</i> , Varshney)	The Peacock Pansy	BK, POK	+, *	NC	
20. <i>Junonia hierta</i> (Fabricius) (= <i>Junonia hierta</i> , Mathur & Srivastava)	The Yellow Pansy	BK, IK, POK	-	VC	11
21. <i>Junonia iphita</i> (Crammer) (= <i>Precis iphita</i> , Wynter-Blyth)	The Chocolate Pansy	BK, IK	-	C	17, 27
22. <i>Junonia lemonias</i> (Linnaeus) (= <i>Junonia lemonias</i> , Bingham) (= <i>Precis lemonias</i> , Wynter-Blyth)	The Lemon Pansy	BK	-	C	5, 27

23. <i>Kallima inachus</i> (Boisduval) (= <i>Kallima inachus</i> Bingham)	The Orange Oakleaf	BK, IK	-	NR	1, 5, 8, 27
24. <i>Kaniska canace canace</i> (Linnaeus) (= <i>Vanessa canace</i> race <i>harmonica</i> , Bingham)	The Blue Admiral	BK	-	NR	1
25. <i>Limenitis trivena</i> Moore (= <i>Liminitis trivena</i> , Bingham) (= <i>Limenitis trivena hydaspes</i> , Evans)	The Indian White Admiral	BK	-	C	1, 5, 27
26. <i>Melitaea arcesia</i> Bremer (= <i>Melitaea arcesia balbita</i> , Evans) (= <i>Melitaea sindura balbita</i> Moore, Mani, 1962)	The Black Vein Fritillary	BK	-	C	1, 5, 15
27. <i>Neptis hylas astola</i> (Linnaeus) (= <i>Neptis hylas astola</i> , Evans)	The Common Sailor	BK, IK, POK	+	VC	5, 8, 11, 12
28. <i>Neptis soma</i> Moore (= <i>Neptis soma</i> , Wynter-Blyth)	The Sullied Sailor	BK, IK	-	R, ¥	5, 8, 27
29. <i>Neptis yerburyi yerburyi</i> Butler (= <i>Neptis yerburyi yerburyi</i> , Evans)	The Yurbury's Sailor	BK, IK	-	NR	5, 8, 27
30. <i>Neptis sankara</i> (Kollar)	The Broad-Branded Sailor	BK, IK	-	NR	1, 5, 8, 27

(=<i>Neptis sankara</i>, Wynter-Blyth)						
31. <i>Nymphalis xanthomelaena</i> Denis & Schiffermuller	The Large Tortoiseshell	BK	-	NR	1	
(=<i>Vanessa xanthomelaena</i>, Bingham)						
32. <i>Nymphalis polychlorus</i> (Linnaeus)	The Blackleg Tortoiseshell	BK, POK	-	VR, ¥	11	
(=<i>Nymphalis polychlorus</i> Varshney)						
33. <i>Phalanta phalanta</i> (Drury)	The Common Leopard	BK	+, *	NC		
(=<i>Phalanta phalanta</i>, Varshney)						
34. <i>Sephisia dichroa</i> (Kollar)	The Western Courtier	BK	-	NR	1	
(=<i>Sephisia dichora</i>, Bingham)						
35. <i>Symbrenthia hypselis brabira</i> (Moore)	The Spotted Jester/ The Himalayan Jester	BK, IK	-	NR	1, 5, 8, 27	
(=<i>Symbrenthia hypselis brabira</i>, Evans)						
(=<i>Symbrenthia hypselis</i>, Wynter-Blyth)						
36. <i>Symbrenthia niphanda</i> (Moore)	The Blue-Tail Jester	BK, IK	-	R	5, 8, 27	
(=<i>Symbrenthia niphanda</i> Wynter-Blyth)						
37. <i>Vanessa cashmirensis</i> (Kollar)	The Indian Tortoiseshell	BK, IK	+	VC	1, 5, 13, 25, 27	

(=*Aglais cashmirensis*, Varshney)

38. <i>Vanessa indica</i> (Herbst)	The Indian Red Admiral	BK, IK	+	C	8, 27
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(=*Vanessa indica*, Wynter-Blyth)

VI. Family: Papilionidae

1. <i>Atrophaneura dasarada dasarada</i> (Moore)	The Great Windmill	BK, IK	-	NR	8
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(=*Polydorus dasarada dasarada*,
Haribal)

2. <i>Atrophaneura dasarada ravana</i> (Moore)	The Great Windmill	BK, IK	-	NR	2, 5, 8, 21, 27
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(=*Polydorus dasarada ravana*, Talbot)

3. <i>Atrophaneura philoxenus philoxenus</i> (Gray)	The Common Windmill	BK, POK	-	NR	11, 21
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(=*Polydorus philoxenus philoxenus*,
Talbot)

4. <i>Atrophaneura philoxenus polyeuctes</i> (Doubleday)	The Common Windmill	BK, IK	-	R	2, 5, 8, 21, 27
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(=*Parides philoxenus polyeuctes*,
Varshney)

5. <i>Atrophaneura philoxenus punchi</i>, (O. Bang-Haas)	The Common Windmill	BK, IK	-	R	15, 21,
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(=*Polydorus philoxenus punchi*,

Talbot)						
(=<i>Polydorus philoxenus punchi</i>, Mani)						
6. <i>Chilasa agestor agestor</i> (Gray)	The Tawny Mime	BK, IK	-	NR	8	
(=<i>Chilasa agestor agestor</i>, Haribal)						
7. <i>Chilasa agestor chiraghshahi</i> (O. Bang-Haas)	The Tawny Mime	BK	-	C	21	
(=<i>Chilasa agestor chiraghshahi</i>, Talbot)						
8. <i>Chilasa agestor govindra</i> Moore	The Tawny Mime	BK	-	NR	2, 5, 27	
(=<i>Chilasa agestor govindra</i>, Talbot)						
9. <i>Graphium cloanthus cloanthus</i> (Westwood)	The Glassy Bluebottle	BK, IK	-	NR	2, 5, 8, 21, 27	
(=<i>Graphium cloanthus cloanthus</i>, Talbot)						
(=<i>Graphium cloanthus cloanthus</i>, Varshney)						
10. <i>Graphium sarpedon sarpedon</i> (Linnaeus)	The Common Bluebottle	BK, IK	-	C	5, 8, 21, 27	
(=<i>Graphium sarpedon sarpedon</i>, Talbot)						
11. <i>Papilio arcturus arius</i> Rothschild	The Blue Peacock	BK, IK	+, *	NR	5, 8, 27	

(=*Papilio arcturus arius*, Evans)

(=*Papilio arcturus arius*, Talbot)

12. <i>Papilio demoleus</i> Linnaeus	The Lime Butterfly	BK, POK	+	VC	2
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(=*Papilio demoleus*, Bingham)

13. <i>Papilio machaon asiatica</i> Menetries	The Common Yellow Swallowtail	BK	+	NR, ¥	21, 27
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(=*Papilio machaon asiatica*, Talbot)

(=*Papilio machaon asiatica*, Mathur & Srivastava)

14. <i>Papilio polyctor</i> Boisduval	The Common Peacock	BK, POK	-	C	2
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(=*Papilio polyctor*, Bingham)

15. <i>Papilio protenor euprotenor</i> (Fruhstofer)	The Spangle	BK	-	NR	8
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(=*Papilio protenor euprotenor*, Haribal)

16. <i>Papilio protenor protenor</i> Cramer	The Spangle	BK, IK	-	NR	5, 8, 21, 27
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(=*Papilio protenor protenor*, Talbot)

17. <i>Parnassius actius yelyangi</i>		BK	-	R	21
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O.Bang-Hass

(=*Parnassius actius yelyangi* Talbot)

18. <i>Parnassius charltonius cardinalina</i> Gray	The Regal Apollo	BK	-	R	21
<i>(=Parnassius charltonius cardinalina,</i> Talbot)					
19. <i>Parnassius charltonius charltonius</i> Gray	The Regal Apollo	BK	-	R, ¥	21
<i>(=Parnassius charltonius,</i> Talbot)					
20. <i>Parnassius charltonius deckerti</i> Verity	The Regal Apollo	BK, IK	-	R	15
<i>(=Parnassius charltonius deckerti,</i> Mani)					
21. <i>Parnassius delphius atkinsoni</i> Moore	The Pir Panjal Banded Apollo	BK	-	VR	5, 15
<i>(=Parnassius delphius atkinsoni,</i> Evans)					
<i>(=Parnassius delphius atkinsoni,</i> Mani)					
22. <i>Parnassius delphius cardinalina</i> Avinoff	The Astor Banded Apollo	BK	-	VR	5, 21
<i>(=Parnassius delphius nicevillei,</i> Evans)					
23. <i>Parnassius hardwickei hardwickei</i> (Gray)	The Common Blue Apollo	BK	-	NR	2, 21

<i>(=Parnassius hardwickei hardwickei, Talbot)</i>						
24. <i>Parnassius epaphus cachemiriensis</i> Oberthur	The Common Red Apollo	BK	-	NR	21	
<i>(=Parnassius epaphus cachemiriensis, Talbot)</i>						
25. <i>Parnassius epaphus hinducucica</i> Bang-Hass	The Common Red Apollo	BK	-	NR	21	
<i>(=Parnassius epaphus hinducucica, Talbot)</i>						
26. <i>Parnassius jacquemontii jacquemontii</i> Boisduval	The Keeled Apollo	BK	-	R, ¥	2, 5, 21	
<i>(=Parnassius jacquemontii jacquemontii, Talbot)</i>						
<i>(=Parnassius jacquemontii jacquemontii, Mani)</i>						
27. <i>Parnassius simo saserensis</i> Bang-Haas	The Black-edged Apollo	BK	-	VR	21	
<i>(=Parnassius simo saserensis, Talbot)</i>						
28. <i>Parnassius simo zarraensis</i> Bang-Haas	The Black-edged Apollo	BK	-	VR	21	
<i>(=Parnassius simo zarraensis, Talbot)</i>						

29. <i>Parnassius stoliczkanus</i> C & R Felder (= <i>Parnassius stoliczkanus</i> , Varshney)		BK, IK	-	NR	24
30. <i>Parnassius stoliczkanus atkinsoni</i> (Moore) (= <i>Parnassius stoliczkanus atkinsoni</i> , Talbot)		BK	-	NR	21
31. <i>Parnassius stoliczkanus nicevillei</i> Avinoff (= <i>Parnassius stoliczkanus nicevillei</i> , Talbot)		BK	-	NR	21
32. <i>Parnassius stoliczkanus zogilaica</i> Tytler (= <i>Parnassius stoliczkanus zogilaica</i> , Talbot)		BK	-	NR	21
33. <i>Pazala eurous sikkimica</i> (Heron) (= <i>Graphium eurous</i> , Varshney)	The Sixbar Swordtail	BK, IK	-	NC	5, 8, 27
34. <i>Pazala euros caschmirensis</i> (Rothschild) (= <i>Pathysa eurous cashmirensis</i> , Evans) (= <i>Graphium eurous caschmirensis</i> Talbot)	The Sixbar Swordtail	BK	-	NR	5, 21

VII. Family: Pieridae

1. <i>Anaphaeis aurota</i> (Fabricius) (= <i>Anaphaeis mesentina</i> , Bingham)	The Pioneer	BK, POK	+	NC	2
2. <i>Aporia leucodice</i> (Eversmann) (= <i>Aporia soracta</i> , Bingham) (= <i>Aporia leucodice soracta</i> , Talbot)	The Himalayan Blackvein	BK	+	C	2, 5, 21, 27
3. <i>Catopsilia pomona</i> (Fabricius) (= <i>Catopsilia pomona</i> , Talbot)	The Lemon Emigrant	BK, IK, POK	+, *	NC	21
4. <i>Catopsilia pyranthe</i> (Linnaeus) (= <i>Catopsilia pyranthe</i> , Varshney)	The Mottled Emigrant	BK, IK, POK	+, *	NC	
5. <i>Colias electo fieldi</i> Menetries (= <i>Colias electo fieldi</i> , Varshney)	The Dark Clouded Yellow	BK, IK	+	C	3, 4
6. <i>Colias eogene francesca</i> Watkins (= <i>Colias eogene francesca</i> , Talbot)	The Fiery Clouded Yellow	BK	-	NR	2, 5
7. <i>Colias erate</i> Esper (= <i>Colias hyale</i> , Bingham)	The Pale Clouded Yellow	BK, IK, POK	+	C	2, 3, 4
8. <i>Colias ladakensis</i> C & R Felder (= <i>Colias ladakensis</i> , Bingham)	The Ladakh Clouded Yellow	BK	—	R, ¥	2, 21

<i>(=Colias ladakensis, Talbot)</i>						
9. <i>Colias stoliczkana stoliczkana</i> Moore	The Orange Clouded Yellow	BK	-		NR, ¥	2, 5, 21
<i>(=Colias stoliczkana stoliczkana, Talbot)</i>						
<i>(=Colias stoliczkana stoliczkana, Mani)</i>						
10. <i>Colotis etrida etrida</i> (Biosduval)	The Little Orange Tip	BK	-		C	2
<i>(=Colotis etrida, Bingham)</i>						
11. <i>Eurema hecabe</i> (Linnaeus)	The Common Grass Yellow	BK, IK, POK	+, *		NC	
<i>(Eurema hecabe Varshney)</i>						
12. <i>Gonepteryx mahaguru mahaguru</i> (Gistel)	The Lesser Brimstone	BK	-		NR	5, 21, 27
<i>(=Gonepteryx mahaguru, Wynter-Blyth)</i>						
13. <i>Gonepteryx rhamni</i> (Linnaeus)	The Common Brimstone	BK, IK, POK	+		NR	24
<i>(=Gonepteryx rhamni, Varshney)</i>						
14. <i>Metaporía agathon phryxe</i> (Boisduval)	The Great Blackvein	BK, IK	-		C, ¥	2, 5, 8, 21, 27
<i>(=Aporía agathon, Wynter-Blyth)</i>						
15. <i>Metaporía nabellica nabellica</i> (Boisduval)	The Dusky Blackvein	BK	-		R, ¥	2, 5, 21, 27

(=<i>Aporia nabellica</i>, Bingham)						
16. <i>Pieris brassicae</i> (Linnaeus) (=<i>Pieris brassicae</i>, Wynter-Blyth)	The Large Cabbage White	BK, IK, POK	+		VC	3, 10, 11, 13
17. <i>Pieris canidia</i> (Sparrman) (=<i>Pieris canidia</i>, Bingham)	The Indian Cabbage White	BK, POK	+		C	2, 11,12
18. <i>Pieris deota</i> (De Niceville) (=<i>Pieris deota</i>, Talbot) (=<i>Pieris deota</i>, Mani)	The Kashmir White	BK	-		R, ¥	21
19. <i>Pieris krueperi devta</i> De Niceville) (=<i>Pieris krueperi devta</i>, Talbot) (=<i>Pieris krueperi devta</i>, Mani)	The Green Banded White	BK	-		VR	21
20. <i>Pieris rapae iranica</i> Le Cerf) (=<i>Pieris rapae</i>, Bingham) (=<i>Pieris rapae</i>, Wynter-Blyth) (=<i>Pieris rapae iranica</i> , Mani)	The Small Cabbage White	BK, POK	-		C	11, 15, 21, 27
21. <i>Pontia chlorodice</i> (Linnaeus) (= <i>Pontia chlorodice</i> Khan <i>et al.</i>)	The Peak White	BK, POK	-		NC	11
22. <i>Pontia daplidice</i> (Linnaeus)	The Bath White	BK, IK, POK	+		NR	2, 11, 21, 27

<i>(=Pieris daplidice, Bingham)</i>						
<i>(=Pontia daplidice Talbot)</i>						
23. <i>Pontia glauconome</i> Klug	The Desert BathWhite	BK, IK	-	NC, ¥	13	
<i>(=Pontia glauconome, Malik et al.)</i>						
VIII. Family: Riodinidae						
1. <i>Dodona durga</i> (Kollar)	Common Punch	BK	-	VC, ¥	1, 5	
<i>(=Dodona durga, Bingham)</i>						
<i>(=Dodana durga, Evans)</i>						
2. <i>Dodona egeon</i> (Westwood)	Orange Punch	BK	-	R, ¥	1	
<i>(=Dodona egeon, Bingham)</i>						
IX. Family: Satyridae						
1. <i>Aulocera brahminus brahminus</i> (Blanchard)	The Narrow-Banded Satyr	BK, IK	+	C, ¥	1, 5, 8, 14, 25, 27	
<i>(=Aulocera brahminus brahminus, Talbot)</i>						
2. <i>Aulocera padma padma</i> (Kollar)	The Great Satyr	BK, IK	+	C	5, 8, 22, 25	
<i>(=Aulocera padma padma, Talbot)</i>						
3. <i>Aulocera saraswati</i> (Kollar)	The Straited Satyr	BK	-	C	1, 25	
<i>(=Aulocera saraswati, Bingham)</i>						

4. <i>Aulocera swaha</i> (Kollar) (= <i>Aulocera swaha</i> , Varshney)	The Common Satyr	BK, IK	-	C	1, 5, 14, 22, 25
5. <i>Callerebia annada</i> Moore (= <i>Erebia annada caeca</i> , Talbot)	The Ringed Argus	BK	-	NR, ¥	1, 5, 22
6. <i>Callerebia hyagriva</i> (Moore) (= <i>Erebia hyagriva</i> , Talbot)	The Brown Argus	BK, IK	-	R, ¥	1, 5, 8, 22, 25, 27
7. <i>Callerebia kalinda kalinda</i> (Moore) (= <i>Erebia kalinda kalinda</i> , Evans) (= <i>Erebia kalinda kalinda</i> , Talbot)	The Scarce Mountain Argus	BK	-	R, ¥	5, 22
8. <i>Callerebia kalinda kamriana</i> Tytler (= <i>Erebia kalinda kamriana</i> , Talbot)	The Scarce Mountain Argus	BK	-	R	22
9. <i>Callerebia mani mani</i> (De Niceville) (= <i>Erebia mani mani</i> , Talbot)	The Yellow Argus	BK	+	R, ¥	1, 5, 22, 25
10. <i>Callerebia scanda scanda</i> (Kollar) (= <i>Erebia scanda scanda</i> , Talbot)	The Pallid Argus	BK, IK	-	NR	1, 5, 14, 22, 27
11. <i>Callerebia shallada shallada</i> Marshall & De Niceville (= <i>Erebia shallada shallada</i> , Evans) (= <i>Erebia shallada shallada</i> , Talbot)	The Mountain Argus	BK	-	NR	5, 22

12. <i>Erebia nirmala</i> Moore (= <i>Erebia nirmala daksha</i> , Talbot)	The Common Argus	BK	-	C	1, 5, 22
13. <i>Hipparchia parisatis</i> (Kollar) (= <i>Eumenis parisatis parsis</i> , Evans) (= <i>Eumenis parisatis</i> , Wynter-Blyth)	The White-Edged Rockbrown	BK	-	NR	5, 22, 27
14. <i>Hipparchia schandura</i> Marshall (= <i>Nytha schandura</i> , Bingham)	The Shandur Rockbrown	BK	-	R	1, 5, 22
15. <i>Hipparchia thelephassa</i> Huebner (= <i>Eumenis thelephassa</i> , Wynter-Blyth)	The Baluchi Rockbrown	BK	-	C	27
16. <i>Lasiomata menava menava</i> (Moore) (= <i>Pararge menava menava</i> , Talbot)	The Dark Wall	BK, IK	-	C	1, 5, 22, 25, 27
17. <i>Lethe rohria rohria</i> (Fabricius) (= <i>Lethe rohria rohria</i> , Talbot)	The Common Treebrown	BK, IK, POK	-	C	1, 5, 8, 11, 22, 27
18. <i>Lethe verma verma</i> (Kollar) (= <i>Lethe verma verma</i> , Talbot)	The Straight-Banded Treebrown	BK, IK	-	C	1, 5, 8, 22, 27
19. <i>Maniola caenonympha</i> (Felder) (= <i>Maniola caenonympha</i> , Evans)	The Spotted Meadowbrown	BK	-	NR	1, 5, 22

(=<i>Maniola caenonympha</i>, Talbot)						
20. <i>Maniola lupines kashmirica</i> Moore (=<i>Maniola lupines kashmirica</i> Evans)	The Branded Meadowbrown	BK	-	NR	5, 22	
21. <i>Maniola pulchella</i> (Felder) (=<i>Maniola pulchella</i>, Wynter-Blyth)	The Tawny Meadowbrown	BK	+	NR	1, 5, 22, 27	
22. <i>Maniola pulchra</i> (Felder) (=<i>Maniola pulchra</i>, Wynter-Blyth)	The Dusky Meadowbrown	BK	-	NR	1, 5, 27	
23. <i>Melanitis phedima</i> (Stoll) (=<i>Melanitis phedima</i>, Wynter-Blyth)	The Dark Evening Brown	BK,	+	NR	2, 5, 22	
24. <i>Pararge everesmanni cashmirensis</i> Eversmann (=<i>Pararge everesmanni cashmirensis</i>, Talbot)	The Yellow Wall	BK, IK	+	R, ¥	1, 5, 22, 25	
25. <i>Pararge maerula maerula</i> (C. & R. Felder) (=<i>Pararge maerula maerula</i>, Talbot)	The Scarce Wall	BK, IK	-	R, ¥	1, 22, 25	
26. <i>Ypthima avanta</i> Moore (=<i>Ypthima avanta avanta</i> Evans)	The Jewel Fourring	BK	-	NR	1, 5, 22, 27	
27. <i>Ypthima bolanica</i> Marshall	The Desert Fourring	BK	-	R	5, 22	

(= <i>Ypthima bolanica</i> , Evans)						
(= <i>Ypthima bolanica</i> , Talbot)						
28. <i>Ypthima indecora</i> Moore	The Western Fivering	BK	-	NR	5, 27	
(= <i>Ypthima indecora</i> Evans)						
(= <i>Ypthima indecora</i> Talbot)						
29. <i>Ypthima nareda nareda</i> (Kollar)	The Large Threewing	BK	-	C	1, 5, 22, 27	
(= <i>Ypthima nareda nareda</i> , Talbot)						

Abbreviations/numbers/symbols used in the above table. 1. Bingham (1905), 2. Bingham (1907), 3. Das & Verma (1965), 4. Das *et al.* (1964), 5. Evans (1932), 6. Gupta & Shukla (1987), 7. Gupta & Shukla (1988), 8. Haribal (1992), 9. Home (1938), 10. Jamdar (1991), 11. Khan *et al.* (2003), 12. Khan *et al.* (2004), 13. Malik *et al.* (1972), 14. Mandal (1984) 15. Mani (1964) 16. Marshall & De Niceville (1883) 17. Marshall & De Niceville (1886) 18. Marshall & De Niceville (1889) 19. Nadkerny (1970) 20. Shull (1963) 21. Talbot (1939) 22. Talbot (1947) 23. Thomas-Glover (1936) 24. Varshney (1993) 25. Varshney (1994) 26. Varshney (1997) 27. Wynter-Blyth (1957); C- Common; E- Endangered; NR- Not Rare; R- Rare; VC- Very Common; ¥ Included in the Wildlife Protection Act of India (1972); * New record; + Species reported during present work; - Species not reported during present work, BK- British Kashmir, POK- Pakistan Occupied Kashmir, IK- Indian Kashmir.

Note: The species given in the parantheses in the above table are synonyms of the species.

5.3: Checklist of Host-plants of butterflies of Kashmir Himalayan Regions.

Table 10:

S.No. (a)	Butterfly Species (b)	Host Plant (s) (c)	Reference (s) (d)
<i>Family: Danaidae</i>			
1.	<i>Danaus genuita</i>	<i>Adelocaryum</i> sp., ^ <i>Asclepias curasavica</i> , <i>Calotropis</i> sp. <i>Celosia</i> sp., <i>Ceropegia intermedia</i> , <i>Cosmos</i> sp., <i>Cyanchum dalhousie</i> , ^ <i>Lantana</i> sp., ^ <i>Marsdenia tenacissima</i> , <i>Raphistemma pulchellum</i> , <i>Stephanotis floribunda.</i> , ^ <i>Tylophora tenuis</i> , <i>Zinnia</i> sp.	Gupta and Shukla (1987), Kunte (2006)
2.	<i>Danaus chrysippus</i>	^ <i>Asclepias curasavica</i> , ^ <i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carissa spinarum</i> , ^ <i>Cryptolepis buchmani</i> , ^ <i>Cydonia carissa</i> , ^ <i>Dragea</i> <i>volubilis</i> , ^ <i>Hoya carnosa</i> , <i>Jatropha pandurraeflia</i> , ^ <i>Lantana</i> sp., ^ <i>Marsdenia tenacissima</i> , * <i>Tagetes</i> <i>petula</i> , ^ <i>Tylophora indica</i>	Ambrose & Raj (2005), Dar <i>et al.</i> (2002), Gupta and Shukla (1987), Haribal (1992), Kunte (2006), Pajni <i>et al.</i> (2006), Wynter-Blyth (1957)
<i>Family: Hesperiiidae</i>			
3.	<i>Pelipidas mathias</i>	* <i>Carduus edelbergi</i> , * <i>Digitalis purpurea</i> , Grasses, <i>Oryza</i> sp., <i>Saccharum</i> sp. * <i>Tagetes petula</i> ,	Pajni <i>et al.</i> (2006), Wynter-Blyth (1957), Varshney (1978)

Family: Libytheidae			
4.	<i>Libythea lepita lepita</i>	<i>Celtis australis</i> (Urticaceae), * <i>Rubus ulimefolius</i>	Gupta and Shukla (1988), Wynter-Blyth (1957)
Family: Lycaenidae			
5.	<i>Aricia agestis</i>	* <i>Mentha longifolia</i>	
6.	<i>Lampides boeticus</i>	<i>Alysicarpus vaginalis</i> , <i>Butea monosperma</i> , <i>Butea frondosa</i> , <i>Cajanus cajan</i> , ^ <i>Crotolaria capensis</i> , ^ <i>C. incana</i> , ^ <i>C. juncea</i> , ^ <i>C. saltiana</i> , ^ <i>C. striata</i> , <i>Dolichos lablab</i> , Grams, <i>Melilotus</i> sp., <i>Pisum sativum</i> , <i>Vigna sinensis</i> ,	Gupta and Shukla (1987, 88), Haribal, 1992, Kunte, 2006, Pajni <i>et al.</i> 2006, Wynter-Blyth, 1957, Varshney (1978)
7.	<i>Lycaena phlaeas</i>	* <i>Digitalis purpurea</i> , * <i>Mentha longifolia</i> , <i>Rumex nepalensis</i> , * <i>Tagetes petula</i> ,	Wynter-Blyth, 1957
Family: Nymphalidae			
8.	<i>Argyreus hyperbius</i>	<i>Antirrhinum majus</i> , <i>Fagopyrum</i> sp., <i>Tagetes petula</i> , ^ <i>Viola tricolor</i> , <i>Zinnia</i> sp.	Gupta and Shukla (1988), Haribal (1992), Kunte (2006), Wynter-Blyth (1957)
9.	<i>Cynthia cardui</i>	<i>Argemone maxicana</i> , ^ <i>Artemisia vulgaris</i> , ^ <i>Blumea</i> sp., <i>Brassica</i> sp., * <i>Carduus edelbergi</i> , * <i>Cerastium cerastoides</i> , * <i>Cersium wattutus</i> , ^ <i>Debregeasia bicolor</i> , <i>D. hypolieca</i> , * <i>Digitalis purpurea</i> , * <i>Erodium cicutarium</i> , * <i>Euphorbia</i>	Dar <i>et al.</i> (2002), Gupta and Shukla (1987), Haribal (1992), Kunte (2006), Pajni <i>et al.</i> (2006), Singh & Koshta (1997), Wynter-Blyth (1957)

		<i>helioscopia, Girardinia heterophylla, Gnaphalium</i> sp., * <i>Medicago polymorpha</i> , * <i>Mentha longifolia</i> , <i>Sonchus</i> sp., * <i>Tagetes petula</i> , * <i>Thymus serpyllum</i> , <i>Tricholepis</i> sp., <i>Urtica dioica</i> , ^ <i>Zornia diphylla</i> , <i>Zornia gibbosa</i>	
10.	<i>Childrena childreni</i>	* <i>Budlegia asiatica</i> , * <i>Mentha longifolia</i> , *^ <i>Rubus niveus</i> , <i>Viola</i> sp.	Gupta and Shukla (1988),
11.	<i>Hypolimnas misippus</i>	<i>Abelmoschus</i> sp., <i>Abutilon</i> sp., <i>Asystasia lawiana</i> , <i>Barleria cristata</i> , <i>Hibiscus esculentus</i> sp., <i>Portulaca oleracea</i> , <i>Portulaca grandiflora</i>	Gupta and Shukla (1987), Haribal, 1992, Kunte, 2006, Pajni <i>et al.</i> 2006, Singh & Koshta, 1997
12.	<i>Issoria gemmata gemmata</i>	<i>Aster</i> sp., <i>Taraxacum officinale</i> , <i>Viola</i> sp., <i>Waldheimia</i> sp	Haribal (1992), Wynter-Blyth (1957)
13.	<i>Issoria lathonia</i>	<i>Aster</i> sp., <i>Gentiana</i> sp., <i>Primula denticulata</i> , <i>Taraxacum officinale</i> , <i>Viola</i> sp.,	Haribal (1992), Wynter-Blyth (1957)
14.	<i>Junonia almana</i> (Linnaeus)	<i>Asteracantha longifolia</i> , ^ <i>Barleria</i> sp., ^ <i>Gloxinia</i> sp., ^ <i>Hygrophila auriculata</i> , <i>Lantana</i> sp., <i>Oryza sativa</i> , ^ <i>Osbeckia</i> sp., <i>Tridax</i> sp.	Gupta and Shukla (1987, 88), Haribal (1992), Varshney (1978)
15.	<i>Junonia iphita</i> (Crammer)	<i>Asteracantha longifolia</i> , ^ <i>Carvia callosa</i> , ^ <i>Hygrophila auriculata</i> , ^ <i>Justicia micrantha</i> , <i>Justicia neesii</i> , <i>Strobilanthes callosus</i> , * <i>Thymus serpyllum</i>	Gupta and Shukla (1987, 88), Haribal, 1992, Kunte, 2006, Pajni <i>et al.</i> 2006, Wynter-Blyth, 1957
16.	<i>Junonia orithya</i> (Linnaeus)	<i>Acanthus</i> sp., <i>Asteracantha longifolia</i> , <i>Antirrhinum orontium</i> , <i>Barleria</i> sp., <i>Heliotropium bacciferum</i> ,	Gupta and Shukla (1987, 88), Haribal, 1992, Kunte, 2006, Pajni <i>et al.</i> 2006,

		Grasses, <i>Hygrophila</i> sp., ^ <i>Justicia micrantha</i> , <i>Justicia neesii</i> , ^ <i>Justicia procumbens</i> , ^ <i>Lepidagathis prostrate</i> , * <i>Medicago polymorpha</i> , * <i>Mentha longifolia</i> , * <i>Rubus ulimefolius</i> , * <i>Thymus</i> <i>serphyllum</i>	Singh and Koshta, 1997, Wynter- Blyth, 1957
17.	<i>Neptis hylas astola</i> (Linnaeus)	<i>Bombax ceiba</i> , ^ <i>Canavalia ensiformis</i> , <i>Canavalia</i> <i>gladiata</i> , <i>Corchorus</i> sp., <i>Cylista</i> sp., <i>Dalbergia</i> <i>sissoo</i> , ^ <i>Flemingia</i> sp., ^ <i>Grewia tiliaefolia</i> , ^ <i>Helicteres isora</i> , <i>Lathyrus</i> sp., <i>Mappia foetida</i> , * <i>Medicago polymorpha</i> , * <i>Mentha longifolia</i> , ^ <i>Mucuna purpurea</i> , <i>Nothapodytes nimmoniana</i> , ^ <i>Paracalyx scariosa</i> , <i>Rubus ulimefolius</i> , <i>Spatholobus roxburghi</i> , ^ <i>Triumfelta corchorus</i> (Tiliaceae), * <i>Thymus serphyllum</i> , <i>Vigna catjang</i> , <i>Vigna cylindrical</i> , ^ <i>V. unguiculata</i> , ^ <i>Xylia</i> <i>xylocarpa</i> sp.	Gupta and Shukla (1987, 88), Haribal, 1992, Kunte, 2006, Wynter-Blyth, 1957
18.	<i>Phalanta phalanta</i> (Drury)	<i>Aberia gardeneri</i> , ^ <i>Flacourita montanta</i> , <i>F.</i> <i>ramontchi</i> , Grasses, <i>Lasntana camara</i> , <i>Salix</i> <i>pentandra</i> , <i>S. tetrasperma</i> , <i>Smilax</i> , <i>Tridex</i> sp.,	Gupta and Shukla (1987, 88), Haribal (1992)
19.	<i>Vanessa cashmirensis</i> (Kollar)	* <i>Achillea millefolium</i> , <i>Aster sikkimensis</i> , * <i>Carduus</i> <i>edelbergi</i> , * <i>Cerastium cerastoides</i> , * <i>Cersium</i> <i>wattutus</i> , * <i>Digitalis purpurea</i> , * <i>Erodium</i> <i>cicutarium</i> , * <i>Euphorbia helioscopia</i> , * <i>Gentiana</i> <i>carinata</i> , <i>Giardinia heterophylla</i> , <i>Medicago</i> <i>polymorpha</i> , * <i>Mentha longifolia</i> , <i>Primula</i>	Gupta and Shukla (1988), Dar <i>et al.</i> (2002), Haribal (1992), Wynter-Blyth (1957)

		<i>denticulate, Tagetes petula, Taraxacum officinale,</i> <i>*Trifolium repens, ^Urtica dioica,</i>	
20.	<i>Vanessa indica</i> (Herbst)	<i>*Digitalis purpurea, Girardinia diversipholia,</i> <i>^Urtica dioica.</i>	Dar <i>et al.</i> (2002), Gupta and Shukla (1988), Haribal (1992), Kunte (2006), Pajni <i>et al.</i> (2006), Wynter-Blyth (1957)
Family: Papilionidae			
21.	<i>Papilio arcturus arius</i> Rothschild	<i>Clausena</i> sp., <i>Zanthoxylum acathipodium, Z. armatum</i>	Haribal (1992),
22.	<i>Papilio demoleus</i> Linnaeus	<i>Aegle marmelos, Anona squamosa, Acronychia laurifolia, Chloroxylon sweitenia, Citrus aurantium, C. aurantifolia, C. hystrix, C. maxima, C. medica, C. sinensis, Feronia elephantum, Glycosmis pentaphylla, Michelia champacea, Murraya keonigii, Psoralia corylifolia, Ruta angustifolia, R. graveolens, Triphasia trifoliata, Zanthoxylum rhetsa, Zizyphus jujube, Zizyphus mauritiana</i>	Gupta and Shukla (1987), Haribal (1992), Pajni <i>et al.</i> (2006), Patal & Rajashekhargouda (1986), Varshney (1978)
23.	<i>Papilio machaon asiatica</i> Menetries	<i>Gentiana cachemirica, Taraxacum officinale</i>	Uniyal (199)
Family: Pieridae			
24.	<i>Aporia leucodice</i> (Eversmann)	<i>Berberis lyceum, *Calamintha umbrosa, *Cedrus deodara, *Origanium vulgare, *Thymus serpyllum,</i>	Wynter-Blyth (1957)

		<i>*Trifolium repens, *Viola tricolor</i>	
25.	<i>Anaphaeis aurota</i> (Fabricius)	<i>^Capparis aphylla, ^C. sepiaria, ^C. spinosa</i>	Haribal (1992), Pajni <i>et al.</i> 2006
26.	<i>Catopsilia pomona</i> (Fabricius)	<i>Bauhinia racemosa, Butea monosperma, Cassia fistula, C. siamea, C. tora,</i>	Haribal (1992), Pajni <i>et al.</i> 2006
27.	<i>Catopsilia pyranthe</i> (Linnaeus)	<i>Bauhinia racemosa, Butea monosperma, Cassia auriculata, C. fistula, C. nodosa, C. occidentalis, C. siamea, C. tora, Sesbania aegyptica</i>	Gupta and Shukla (1987), Haribal (1992), Pajni <i>et al.</i> (2006), Varshney (1978)
28.	<i>Colias electo fieldi</i> Menetries	<i>*Calamintha umbrosa, *Cerastium cerastoides, *Cersium wattutus, *Digitalis purpurea, *Epilobium laxum, Indigofera dosua, Indigofera heterantha sp., Trifolium sp., Caltha palustris, Gentiana carinata, *Medicago polymopha, Primula sp., *Ranunculus sp., *Tagetus petula, Taraxacum officinale, *Thymus serpyllum, *Trifolium repens</i>	Dar <i>et al.</i> (2002), Haribal (1992), Wynter-Blyth (1957)
29.	<i>Colias erate</i> Esper	<i>*Calamintha umbrosa, *Cersium wattutus, *Digitalis purpurea *Epilobium laxum, *Medicago polymopha, Medicago sativa sp., Parochetus communis, *Ranunculus sp., *Tagetus petula, *Taraxacum officinale, *Thymus serpyllum, *Trifolium repens,</i>	Dar <i>et al.</i> (2002), Wynter-Blyth (1957)
30.	<i>Eurema hecabe</i> (Linnaeus)	<i>Acacia sp., Albizzia procera, Caesalpinia sp., Cassia fistula, C. mimosoides, C. siamea, C. tora,</i>	Pajni <i>et al.</i> 2006, Varshney (1978)

Sesbania aculeate

31.	<i>Gonepteryx rhamni</i> Linnaeus	<i>Caltha palustris</i> , <i>Cnicus arvensis</i> , <i>Gentian</i> sp., ^ <i>Rhamnus dahuricus</i> , ^ <i>Vaccinum</i> sp.,	Haribal (1992), Wynter-Blyth (1957)
32.	<i>Pieris brassicae</i> (Linnaeus)	<i>Brassica oleracea</i> , * <i>Calamintha umbrosa</i> , * <i>Calendula trifolium</i> , <i>Capparis spinosa</i> , * <i>Carduus edelbergi</i> , * <i>Cedrus deodara</i> , * <i>Cerastium cerastoides</i> , * <i>Cersium wattutus</i> , * <i>Digitalis purpurea</i> , * <i>Epilobium laxum</i> , * <i>Erodium cicutarium</i> , * <i>Euphorbia helioscopia</i> , * <i>Medicago polymorpha</i> , * <i>Mentha longifolium</i> , * <i>Phaseolus lunatus</i> , * <i>Ranunculus</i> sp., * <i>Rubus ulimefolius</i> , * <i>Tagetes petula</i> , * <i>Taraxacum officinale</i> , * <i>Thymus serpyllum</i> , * <i>Trifolium repens</i> , * <i>Verbena officinale</i> , * <i>Vigna aconitifolia</i>	Dar et al. (2002), Haribal (1992), Pajni et al.(2006), Wynter-Blyth (1957)
33.	<i>Pieris canidia</i> (Sparman)	Cabbage, Cauliflowers, <i>Brassica oleracea</i> , <i>Rorippa dubia</i> , <i>Sisymbrium</i> sp.	Haribal (1992), Kunte (2006), Pajni et al.(2006), Wynter-Blyth (1957)
34.	<i>Pontia daplidice</i> (Linnaeus)	<i>Brassica</i> sp., <i>Brassica oleracea</i> , * <i>Carduus edelbergi</i> , * <i>Cedrus deodara</i> , * <i>Cerastium cerastoides</i> , * <i>Cersium wattutus</i> , * <i>Erodium cicutarium</i> , * <i>Rubus ulimefolius</i> , <i>Reseda</i> sp. * <i>Tagetes petula</i> , * <i>Taraxacum officinale</i> , * <i>Thymus</i>	Dar et al. (2002), Pajni et al.(2006)

serpyllum, **Trifolium repens*, **Verbena officinale*,

Family: Satyridae

- | | | | |
|-----|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 35. | <i>Aulocera brahminus brahminus</i>
(Blanchard) | * <i>Carduus edelbergi</i> , * <i>Dryopteris</i> sp., Grasses,
* <i>Mentha longifolia</i> | Varshney, 1994 |
| 36. | <i>Aulocera padma</i> (Kollar) | * <i>Carduus edelbergi</i> , * <i>Cedrus deodara</i> * <i>Cersium</i>
<i>wattutus</i> , * <i>Dryopteris</i> sp., Grasses, * <i>Juglans regia</i> ,
* <i>Trifolium repens</i> | Varshney, 1994 |
| 37. | <i>Callerebia mani mani</i> (De
Niceville) | * <i>Datisca annabina</i> , * <i>Organum vulgare</i> | |
| 38. | <i>Maniola pulchella</i> (Felder) | * <i>Cersium wattutus</i> , * <i>Tagetus petula</i> | |
| 39. | <i>Melanitis phedima</i> (Stoll) | <i>Apluda</i> sp., <i>Eleusine</i> sp., <i>Oryza sativa</i> , <i>Panicus</i> sp.,
<i>Sorghum</i> sp., <i>Zea</i> sp. | Haribal (1992), |
| 40. | <i>Pararge everesmanni</i>
<i>cashmirensis</i> Eversmann | Grasses | Varshney, 1994 |
-

* New record from Kashmir; ^ Larval host plant;

5.4. Summary: The work of present thesis entitled “Diversity and Bio-ecological Studies of Butterflies of Kashmir Himalayas” was carried out during the years 2004-07. It is divided into 6 different chapters namely (1) Introduction, (2) Review of Literature, (3) Material and Methods, (4) Results and Discussion, (5) Conclusion, Checklist, Summary and Figure Plates and (6) Bibliography.

The “Introduction” forms the first chapter of the thesis and is divided in three parts viz. Study areas, Morphological features of butterflies and Economic Importance. The chapter in general deals with the brief characteristics of Kashmir Valley like, climate, topography, physiography, weather conditions, etc. Brief general characteristic features and economic importance of butterflies is also provided. The most of the examples cited in the chapter are those described in the thesis.

The “Material and Methods” which forms the second chapter of the thesis deals with different methods and techniques for collection, preservation, slide preparation, and data compilation used in the present work. It has three sub-parts viz. Collection and Preservation of butterflies, Mountant and Slide mount (permanent) preparation and Statistical methods and data techniques followed.

The third chapter entitled “Review of Literature” provides a brief summary of work done by different workers from different Zoogeographical regions presently recognized. It also provides detailed information on the work done by previous authors on butterfly fauna of both Kashmir of British India as well as present Kashmir. A brief review of more than 200 research papers has been provided in the present thesis.

The fourth chapter namely “Results and Discussion” is divided into three different parts viz. Systematic account of butterfly fauna, Life cycles, and Bioecological studies of some butterflies. The details of 40 butterfly species distributed in 29 genera and 8 families namely Danaidae, Hesperidae, Libytheidae, Lycaenidae, Nymphalidae, Papilionidae, Pieridae, and Satyridae respectively have been provided. In this chapter key to families, genera and species, necessary nomenclature changes, common name, diagnostic features, distribution, hosts and localities, field observations and remarks are provided with each species. Also biology of two species namely *Cynthia cardui* and *Vanessa cashmiresis* both nymphalids has been described for the first time from Kashmir Valley. Different statistical methods like diversity indices and correlation coefficient have been used and the results have been incorporated accordingly. In the present thesis Correlation Coefficient and four different

diversity indices namely Marglef's Index, Shannon-Weiner Index, Shannon Equitability Index and Simpsons Index have been used.

The fifth chapter i.e., Conclusion, Checklist, Summary, and Figure Plates deals with the main findings/ points derived from the present work. A brief note on bioecological studies, distribution, economic importance, host-plants, mud puddling behaviour, status, and taxonomy has been incorporated. A systematic, updated and annotated checklist of 155 butterfly species distributed in 69 genera and 9 different families viz., Danaidae (1 gen., 4 spp.), Hesperidae (3 genn., 4 spp.), Libytheidae (1 gen., 2 spp.), Lycaenidae (12 genn., 19 spp.), Nymphalidae (25 genn., 38 spp.), Papilionidae (6 gen., 34 spp.), Pieridae (10 genn., 23 spp.), Riodinidae (1 gen., 2 spp.) and Satyridae (10 genn., 29 spp.) reported by previous authors including present work is also given. Also, a checklist of host-plants including many newly recorded ones of 40 butterfly species is also given. Besides this, line drawings, photographs, tables and graphs are also provided in the present thesis. The summary forms the last portion of this chapter and provides a brief description about each chapter pertaining to this thesis.

The "Bibliography" is the last chapter of the thesis which deals with the listing of the main work done by various workers from different parts of the world in the form of books, monographs, papers of monographic significance, etc. A total of 344 references by more than 250 authors on biology, conservation, distribution, diversity, ecology, and taxonomy, etc have been incorporated in the present thesis.

(Explanation of Figs. 1-4, Plate-I)

Fig. 1 : Forewing of *Danaus chrysippus*.

Fig. 2 : Hindwing of *Danaus chrysippus*.

Fig. 3 : Forewing of *Pieris brassicae*.

Fig. 4 : Hindwing of *Pieris brassicae*.

1A+2A : 1st Anal Vein

3A : 2nd Anal Vein

Cu1a : 1st Cubitus

Cu1b : 2nd Cubitus

DC : Discal Cell

LDC : Lower Discocellulars

M₁ : 1st Median

M₂ : 2nd Median

M₃ : 3rd Median

MDC : Middle Discocellulars

PV : Precostal Vein/spur

R₁ : 1st Radius

R₂ : 2nd Radius

R₃ : 3rd Radius

R₄ : 4th Radius

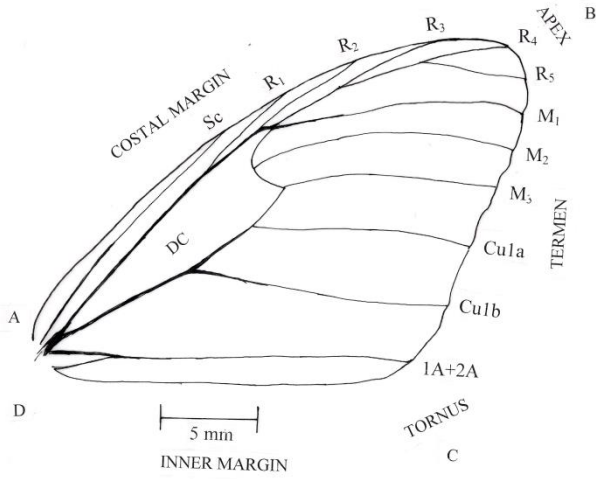
R₅ : 5th Radius

Rs : Radial Sector

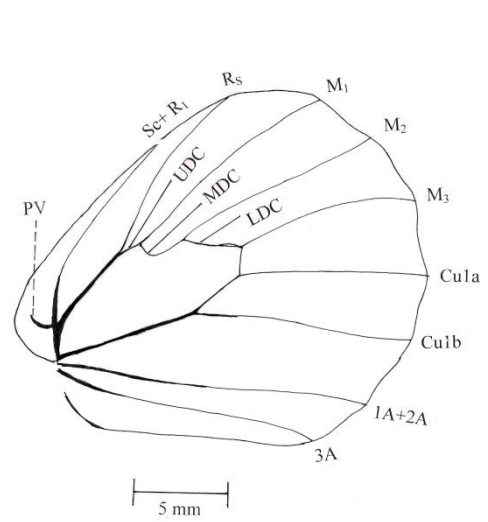
Sc : Subcosta

UDC : Upper Discocellulars

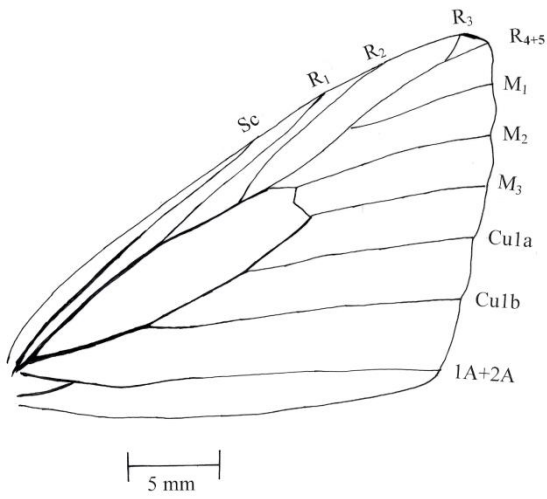
Plate I



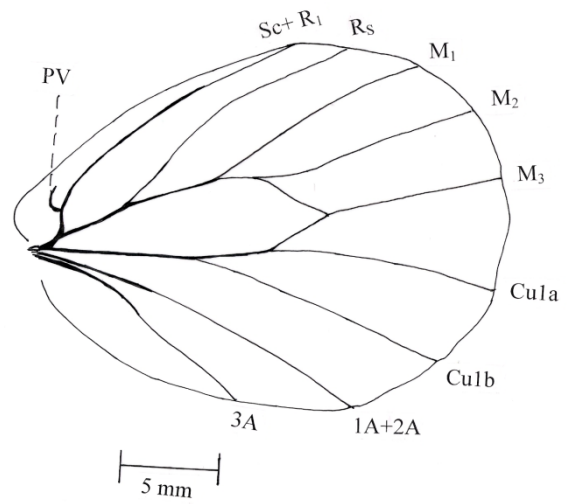
(Fig. 1)



(Fig. 2)



(Fig. 3)

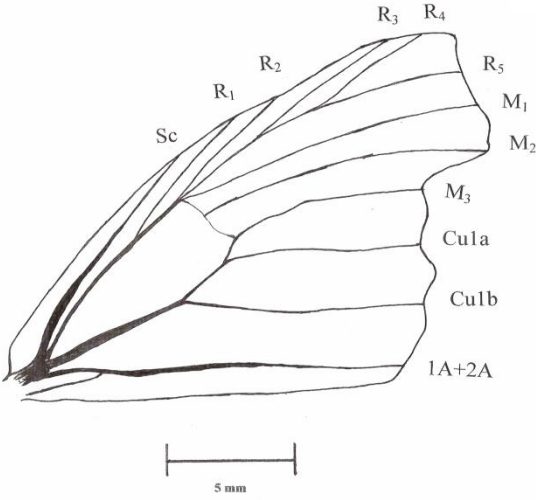


(Fig. 4)

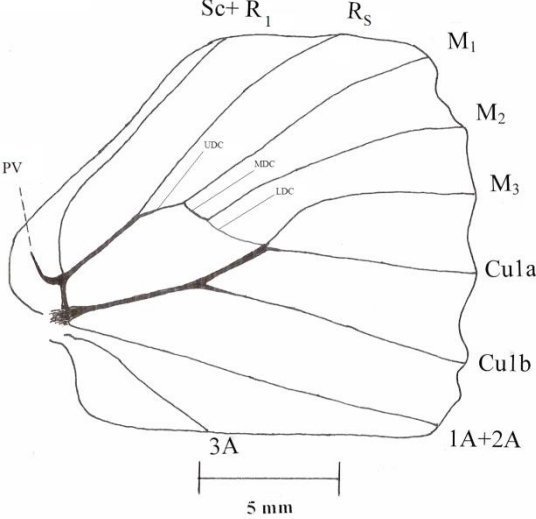
(Explanation of Figs. 5-8, Plate- II)

- Fig. 5 : Forewing of *Libythea lepita lepita*.
Fig. 6 : Hindwing of *Libythea lepita lepita*.
Fig. 7 : Forewing of *Parage eversmanii cashmirensis*.
Fig. 8 : Hindwing of *Parage eversmanii cashmirensis*.

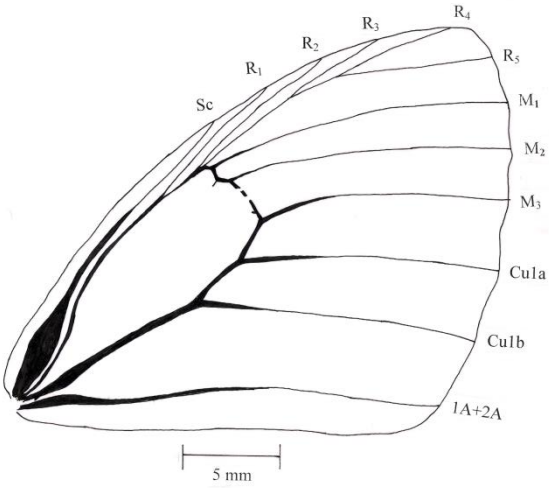
Plate II



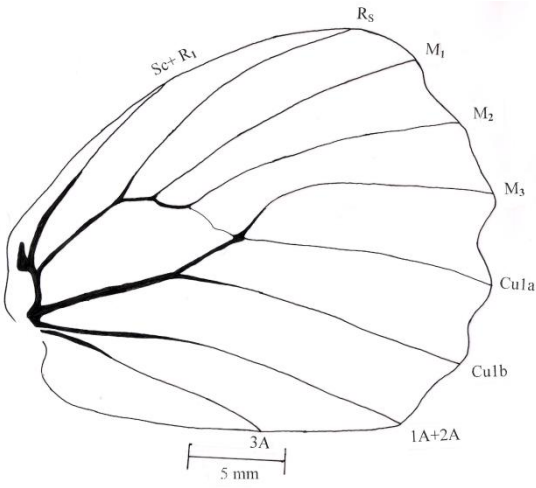
(Fig. 5)



(Fig. 6)



(Fig. 7)

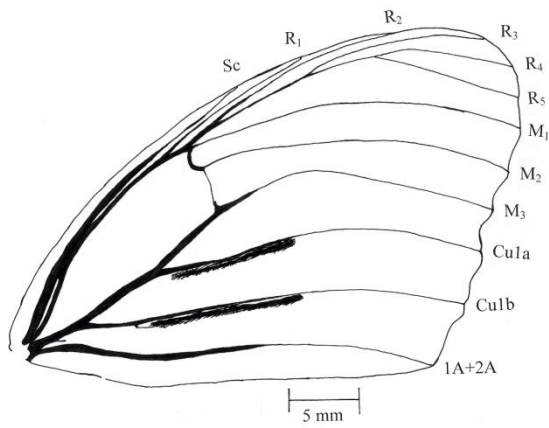


(Fig. 8)

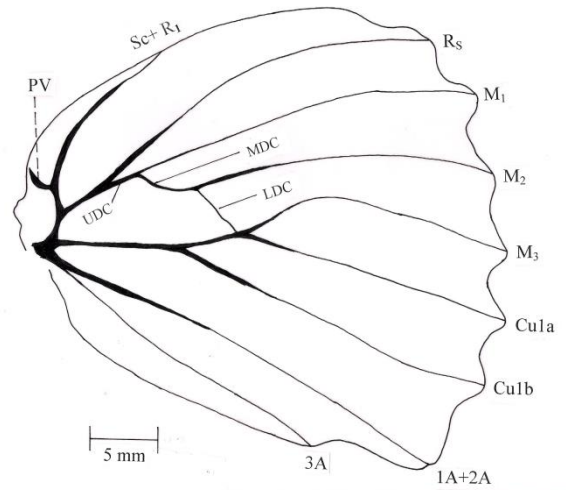
(Explanation of Figs. 9-12, Plate-III)

- Fig. 9 : Forewing of *Childrena childreni*
- Fig. 10 : Hindwing of *Childrena childreni*
- Fig. 11 : Forewing of *Vanessa cashmirensis*
- Fig. 12 : Hindwing of *Vanessa cashmirensis*

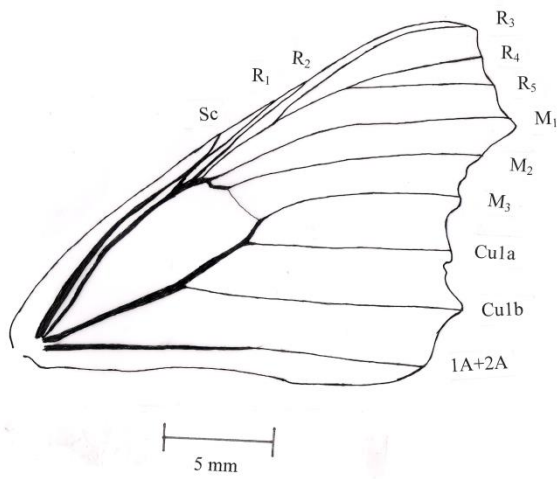
Plate III



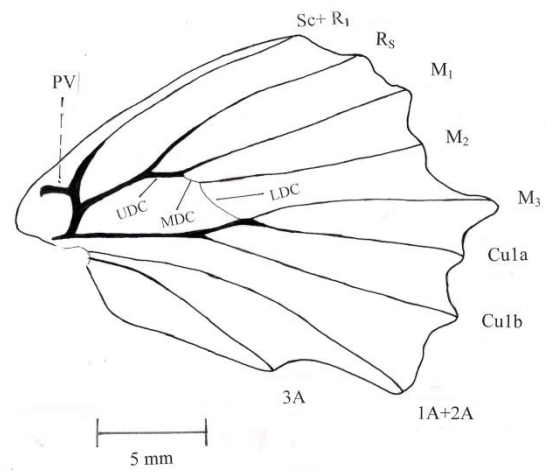
(Fig. 9)



(Fig. 10)



(Fig. 11)

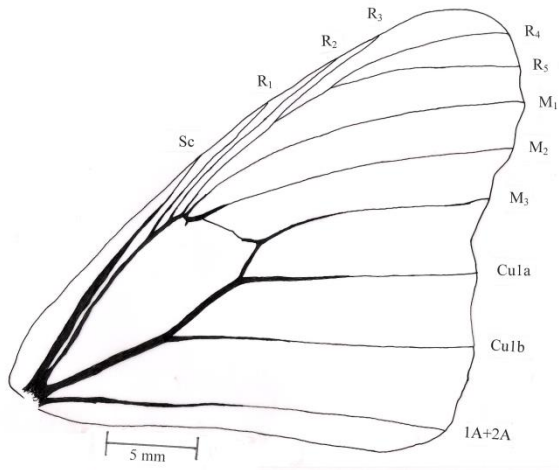


(Fig. 12)

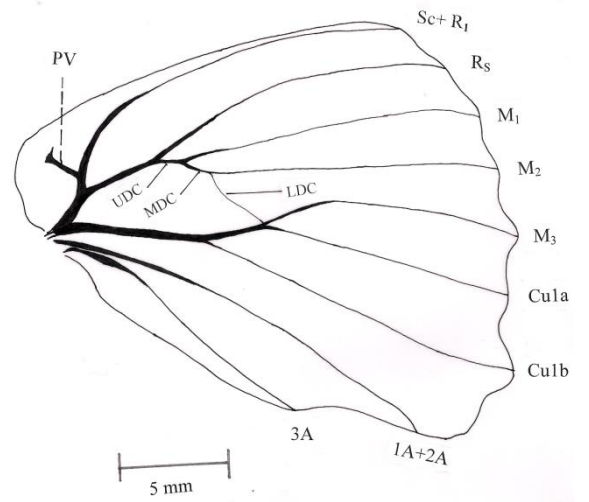
(Explanation of Figs. 13-16, Plate-IV)

- Fig. 13 : Forewing of *Cynthia cardui*.
Fig. 14 : Hindwing of *Cynthia cardui*.
Fig. 15 : Forewing of *Vanessa indica*.
Fig. 16 : Hindwing of *Vanessa indica*.

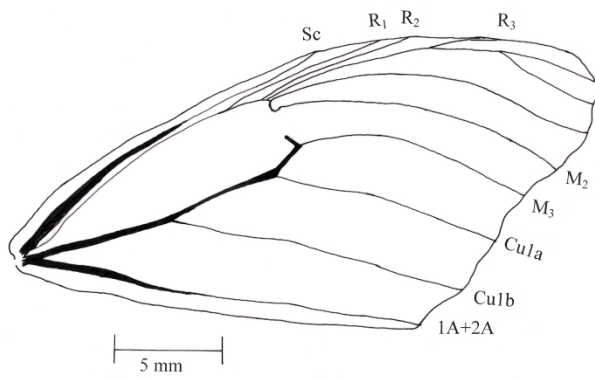
Plate IV



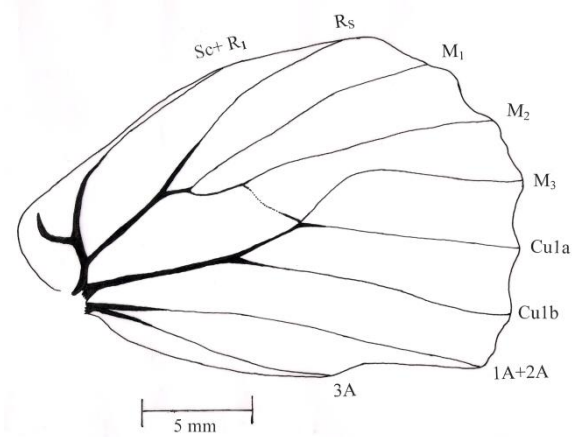
(Fig. 13)



(Fig. 14)



(Fig. 15)

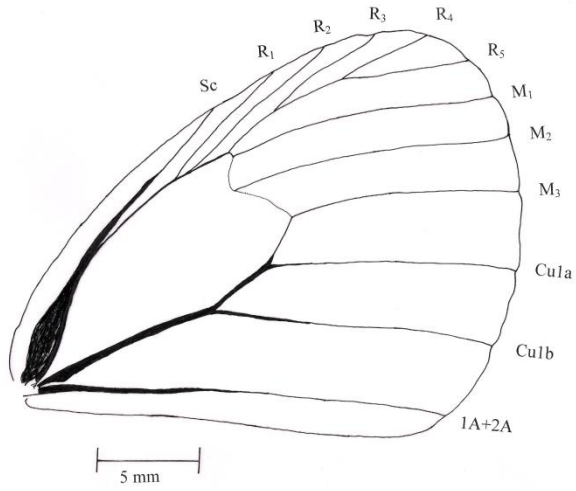


(Fig. 16)

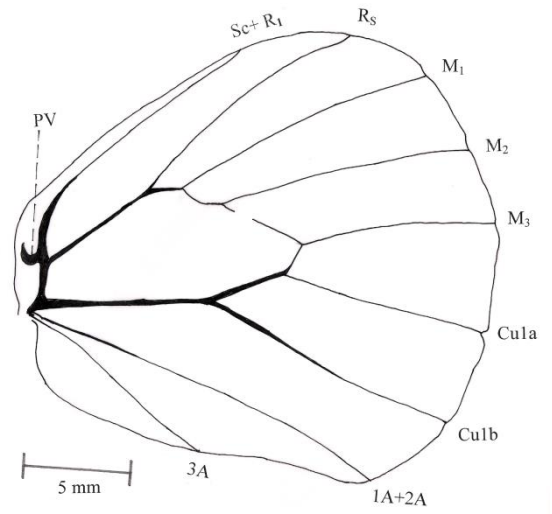
(Explanation of Figs. 17-20, Plate-V)

- Fig. 17 : Forewing of *Callerebia mani mani*.
Fig. 18 : Hindwing of *Callerebia mani mani*.
Fig. 19 : Forewing of *Junonia orithya*.
Fig. 20 : Hindwing of *Junonia orithya*.

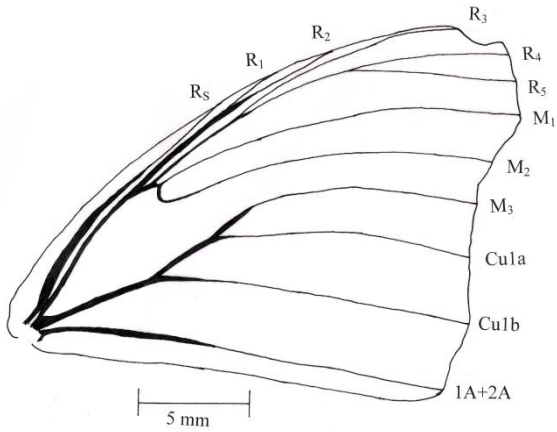
Plate V



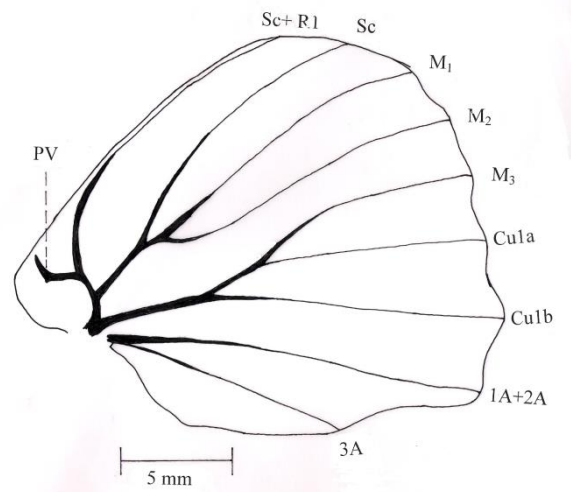
(Fig. 17)



(Fig.18)



(Fig. 19)



(Fig. 20)

(Explanation of Figs. 21-24, Plate-VI)

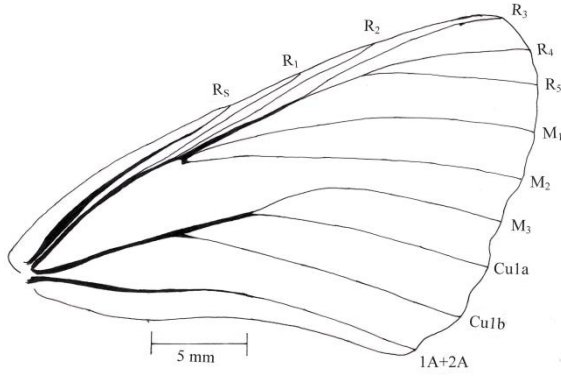
Fig. 21 : Forewing of *Neptis hylas astola*.

Fig. 22 : Hindwing of *Neptis hylas astola*.

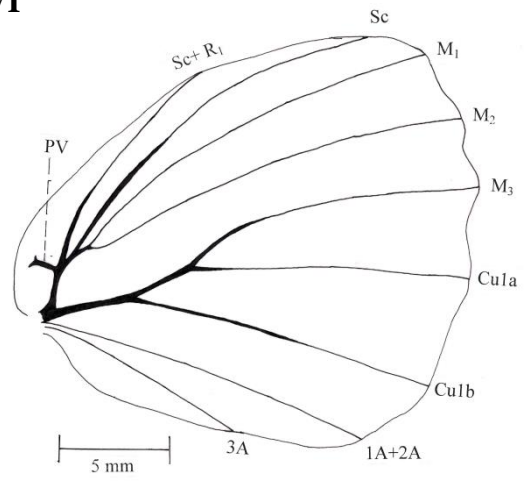
Fig. 23 : Forewing of *Pelopidas mathias*.

Fig. 24 : Hindwing of *Pelopidas mathias*.

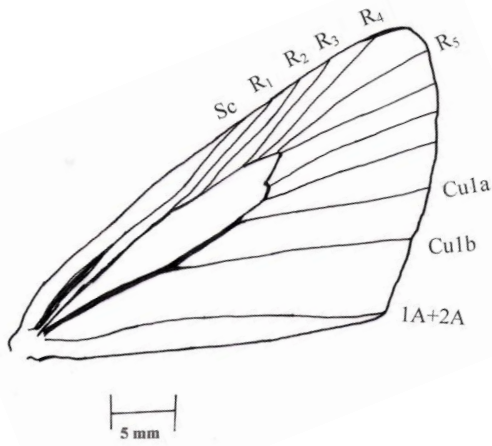
Plate VI



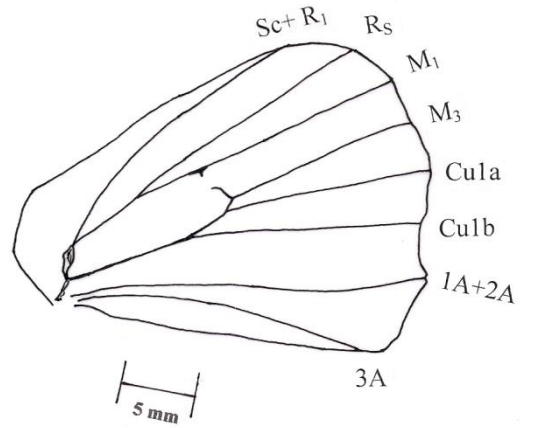
(Fig. 21)



(Fig. 22)



(Fig. 23)

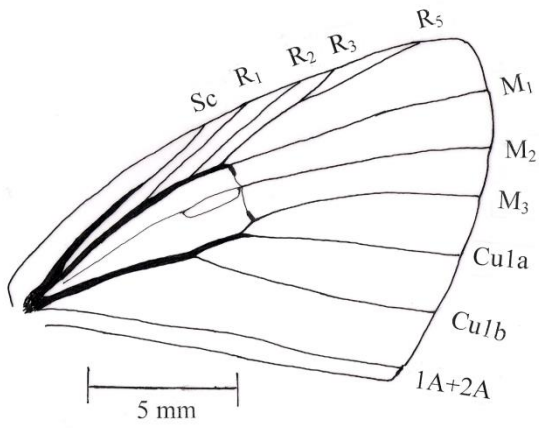


(Fig. 24)

(Explanation of Figs. 25-28, Plate-VII)

- Fig. 25 : Forewing of *Lampides boeticus*.
Fig. 26 : Hindwing of *Lampides boeticus*.
Fig. 27 : Forewing of *Aricia agestis*.
Fig. 28 : Hindwing of *Aricia agestis*.

Plate VII



(Fig. 25)

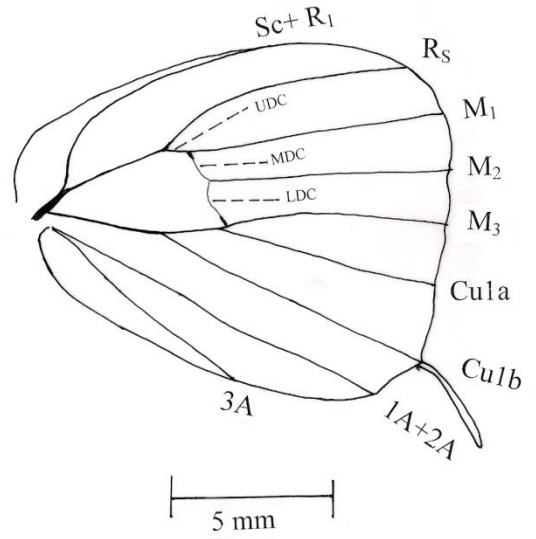
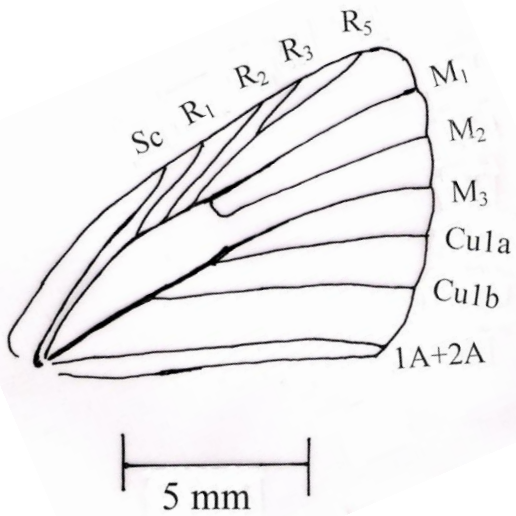
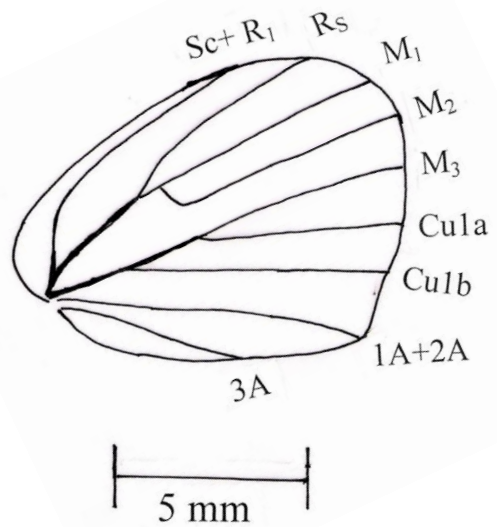


Fig. 26



(Fig. 27)



(Fig. 28)

(Explanation of Figs. 29-32, Plate-VIII)

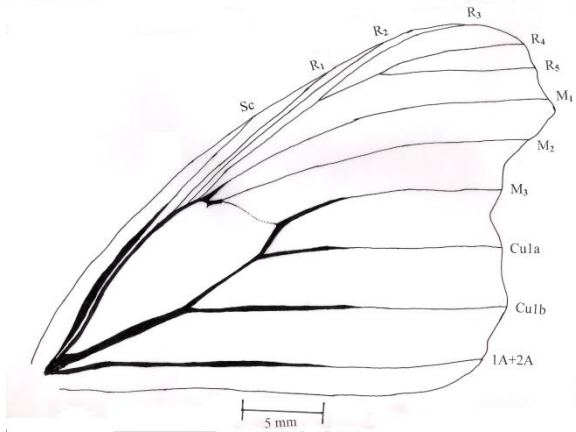
Fig. 29 : Forewing of

Fig. 30 : Hindwing of

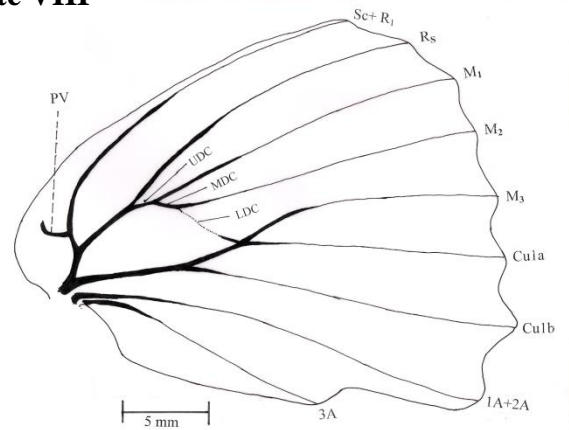
Fig. 31 : Forewing of *Aulocera padma*.

Fig. 32 : Hindwing of *Aulocera padma*.

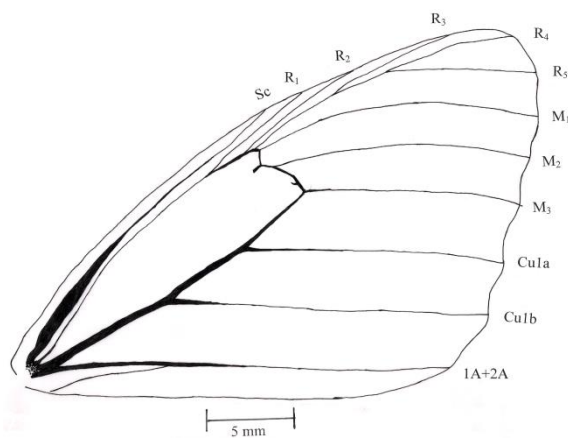
Plate VIII



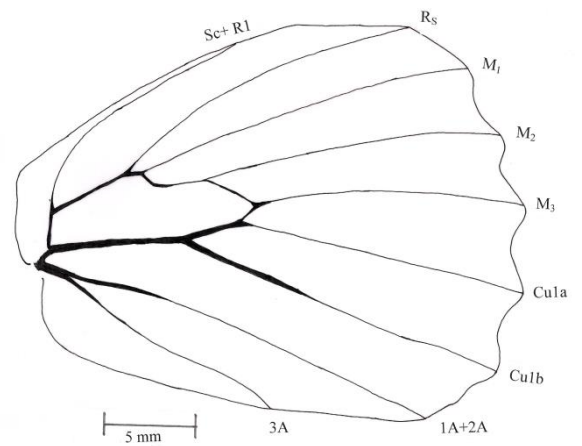
(Fig. 29)



(Fig. 30)



(Fig. 31)



(Fig. 32)

(Explanation of Figs. 33-36, Plate- IX)

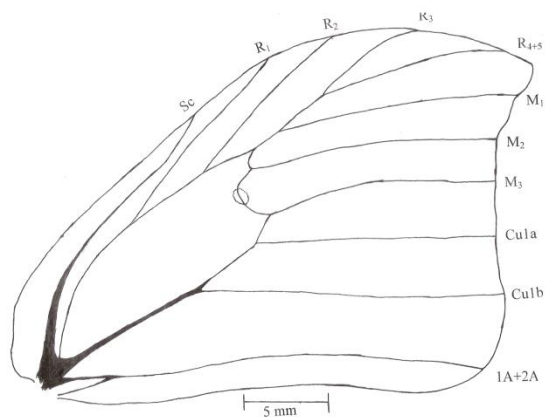
Fig. 33 : Forewing of *Gonepteryx rhamni*.

Fig. 34 : Hindwing of *Gonepteryx rhamni*.

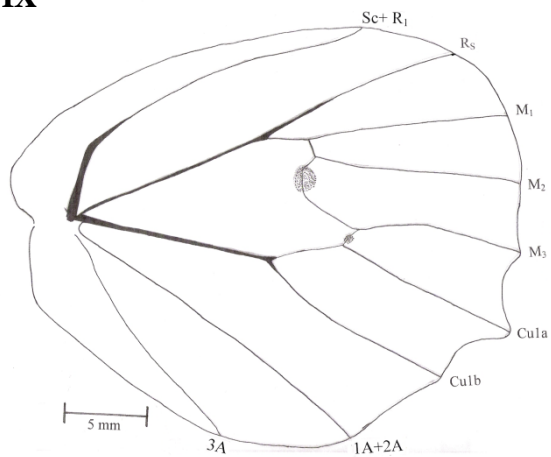
Fig. 35 : Forewing of *Aulocera brahminus brahminus*.

Fig. 36 : Hindwing of *Aulocera brahminus brahminus*.

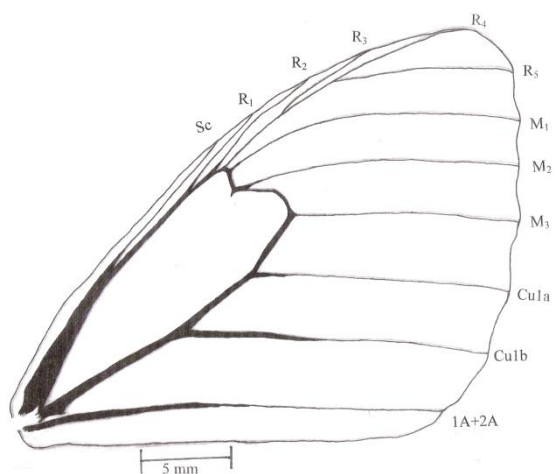
Plate IX



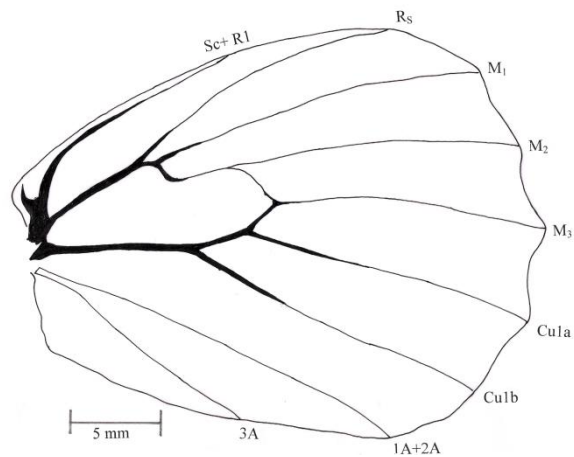
(Fig. 33)



(Fig. 34)



(Fig. 35)



(Fig. 36)

(Explanation of Figs. 37-40, Plate- X)

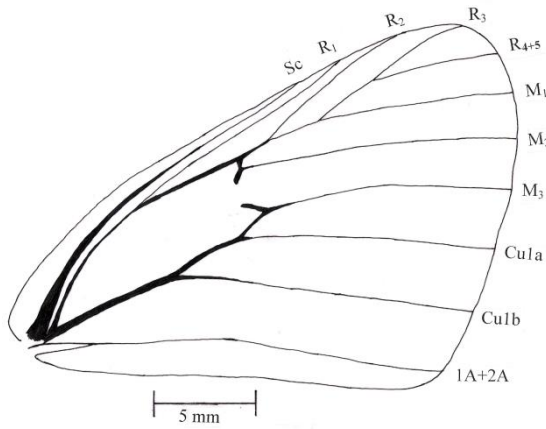
Fig. 37 : Forewing of *Colias erate*.

Fig. 38 : Hindwing of *Colias erate*.

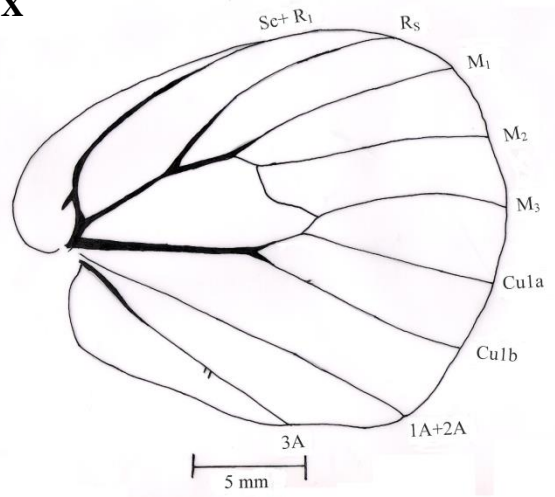
Fig. 39 : Forewing of *Maniola pulchella*.

Fig. 40 : Hindwing of *Maniola pulchella*.

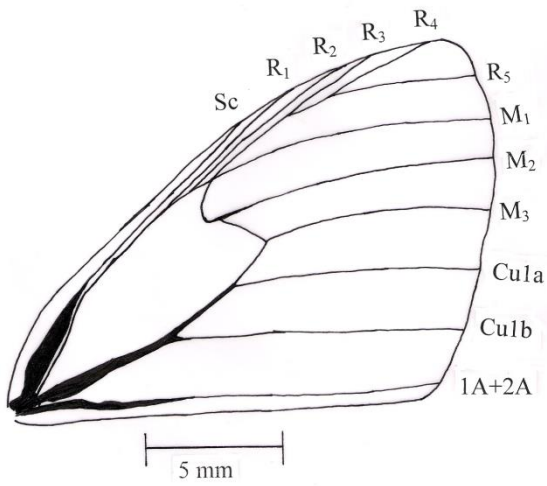
Plate X



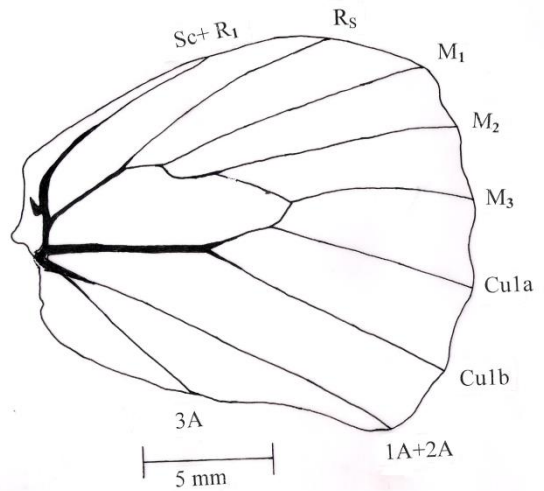
(Fig. 37)



(Fig. 38)



(Fig. 39)



(Fig. 40)

(Explanation of Figs. 41-44, Plate- XI)

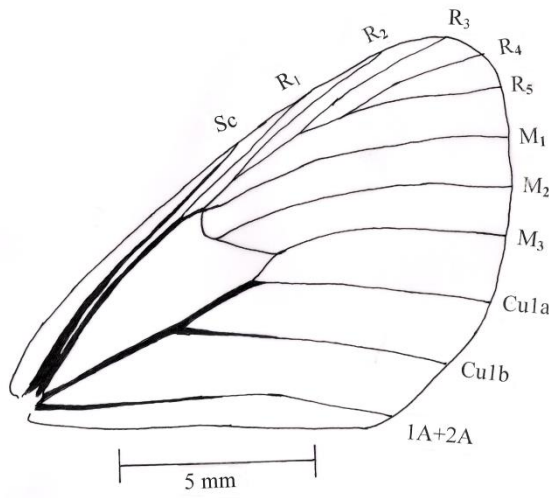
Fig. 41 : Forewing of *Issoria gemmata gemmata*.

Fig. 42 : Hindwing of *Issoria gemmata gemmata*.

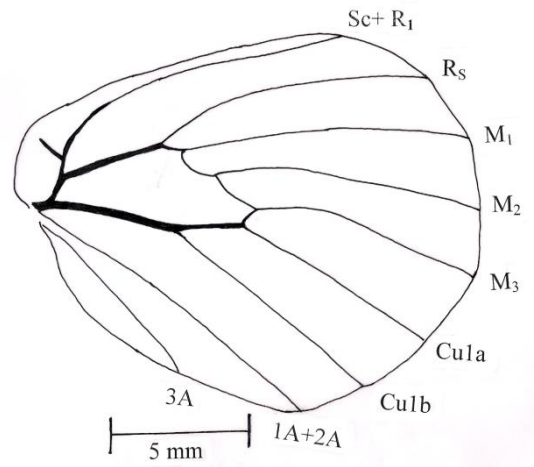
Fig. 43 : Forewing of *Colias electo fieldi*.

Fig. 44 : Hindwing of *Colias electo fieldi*.

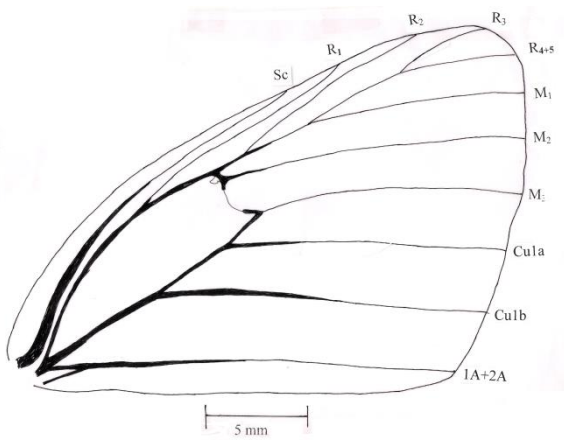
Plate XI



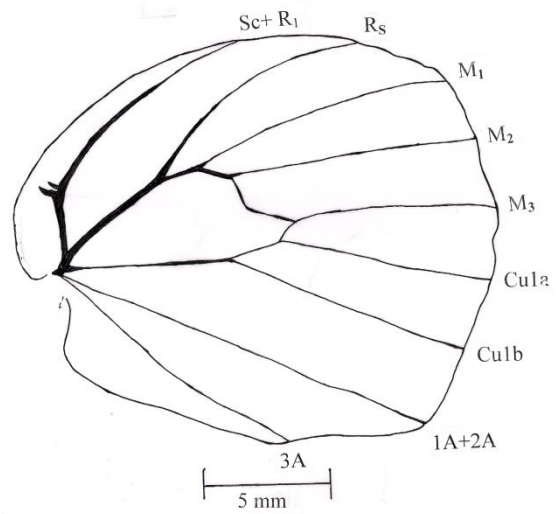
(Fig. 42)



(Fig. 41)



(Fig. 43)



(Fig. 44)

(Explanation of Figs. 45-48, Plate- XII)

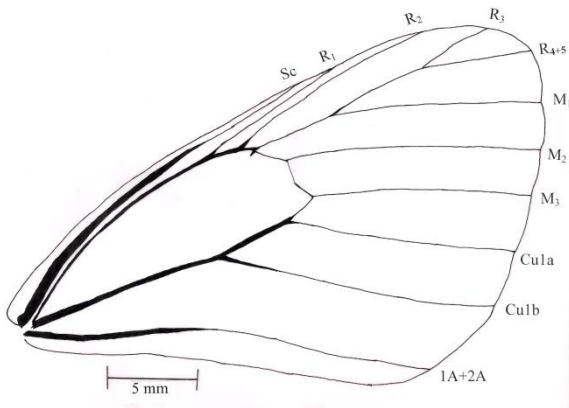
Fig. 45 : Forewing of *Aporia leucodice*.

Fig. 46 : Hindwing of *Aporia leucodice*.

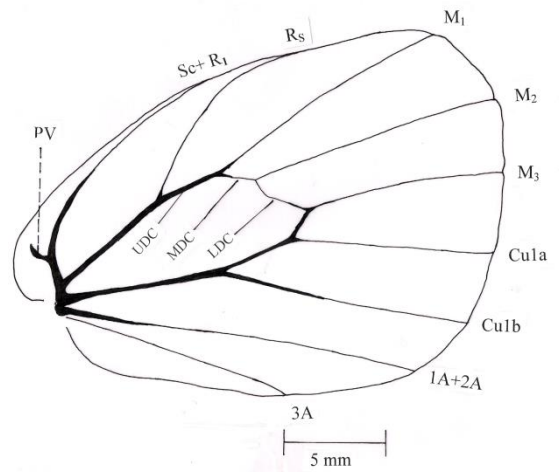
Fig. 47 : Forewing of *Papilio machaon asiatica*.

Fig. 48 : Hindwing of *Papilio machaon asiatica*.

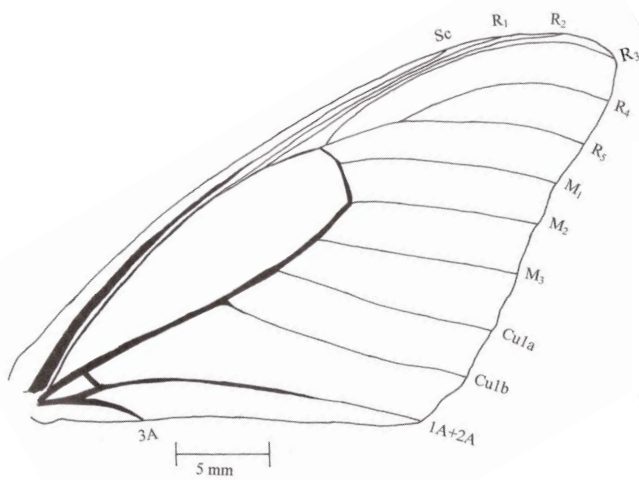
Plate XII



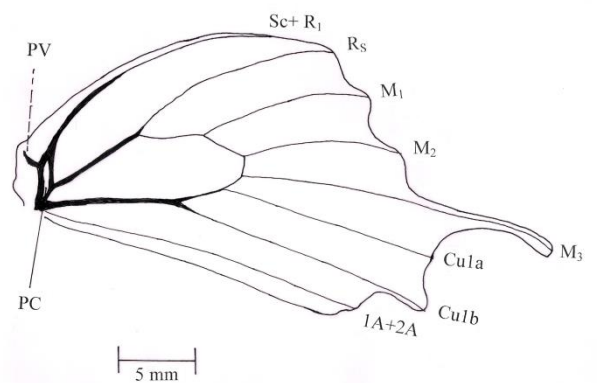
(Fig. 45)



(Fig. 46)



(Fig. 47)

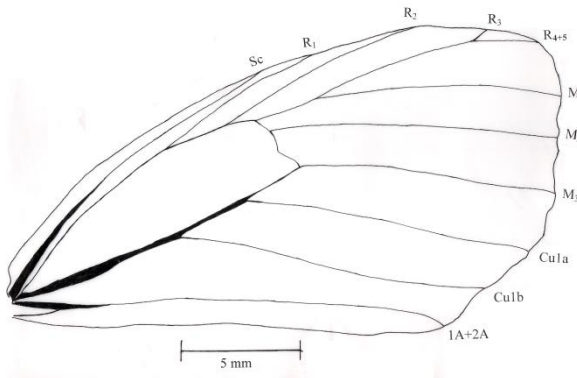


(Fig. 48)

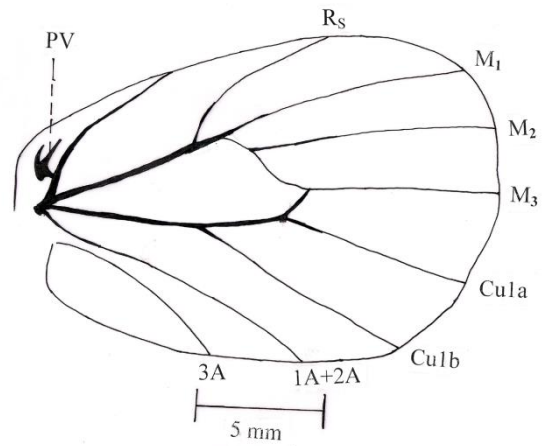
(Explanation of Figs. 49-52, Plate- XIII)

- Fig. 49 : Forewing of *Pieris canidia*.
Fig. 50 : Hindwing of *Pieris canidia*.
Fig. 51 : Forewing of *Pontia daplidice*.
Fig. 52 : Hindwing of *Pontia daplidice*.

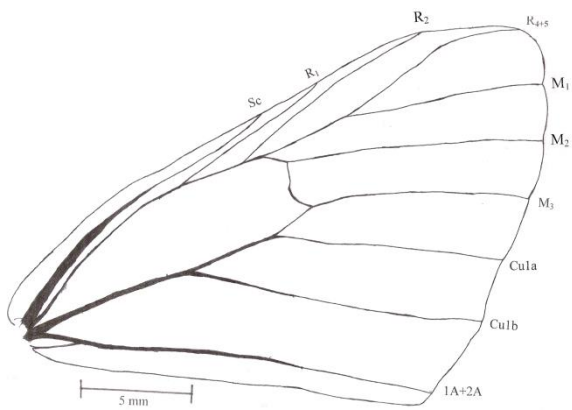
Plate XIII



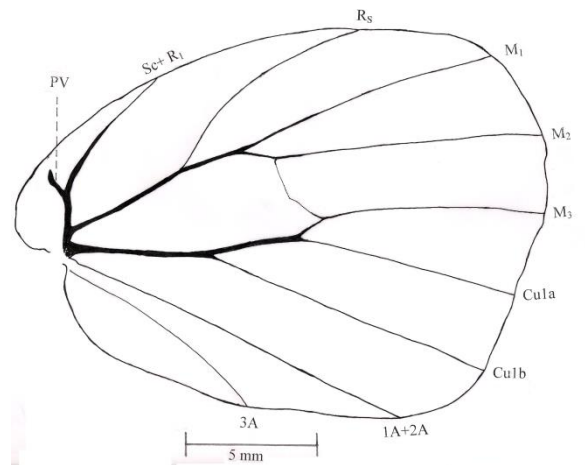
(Fig. 49)



(Fig. 50)



(Fig. 51)



(Fig. 52)

(Explanation of Figs. 53-55, Plate- XIV)

Fig. 53 : Head of *Aricia agestis*.

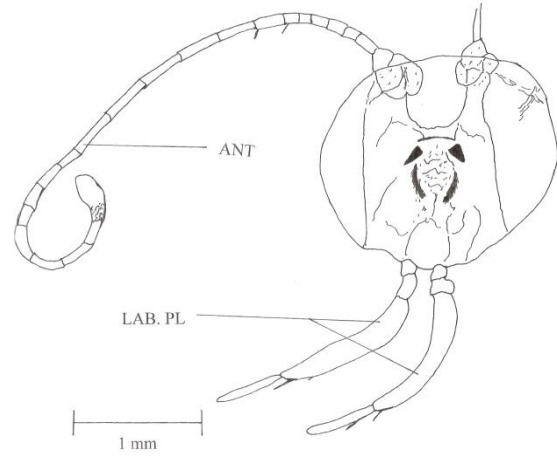
Fig. 54 : Prothoracic leg of *Libythea lepita lepita*.

Fig. 55 : Antenna of *Libythea lepita lepita*.

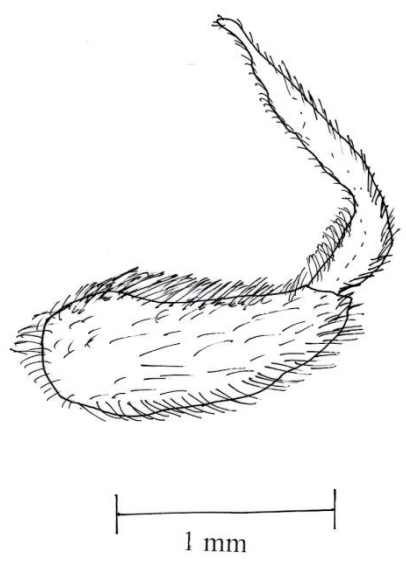
ANT : Antenna

LAB. PL : Labial Palpi

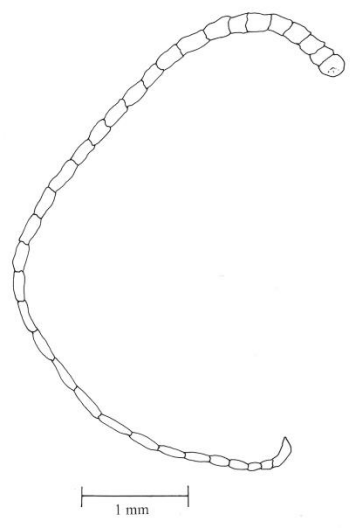
Plate XIV



(Fig. 53)



(Fig. 54)

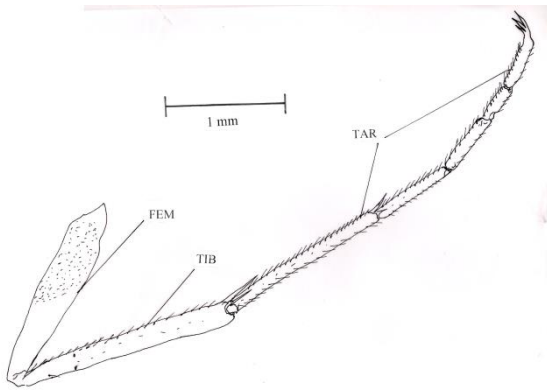


(Fig. 55)

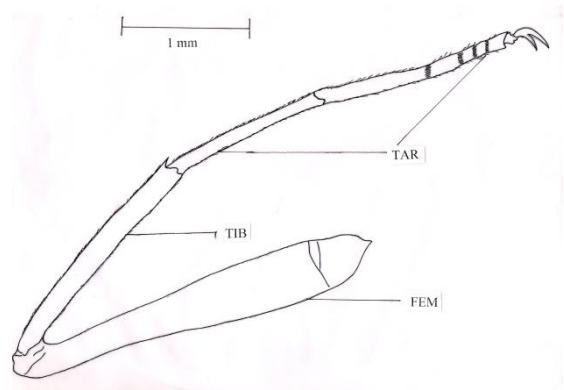
(Explanation of Figs. 56-59, Plate- XV)

- Fig. 56 : Mesothoracic leg of *Colias erate*.
- Fig. 57 : Prothoracic leg of *Colias electo fieldi*.
- Fig. 58 : Prothoracic leg of *Colias erate*.
- Fig. 59 : Mesothoracic leg of *Colias electo fieldi*.
- FEM : Femur
- TAR : Tarsus
- TIB : Tibia

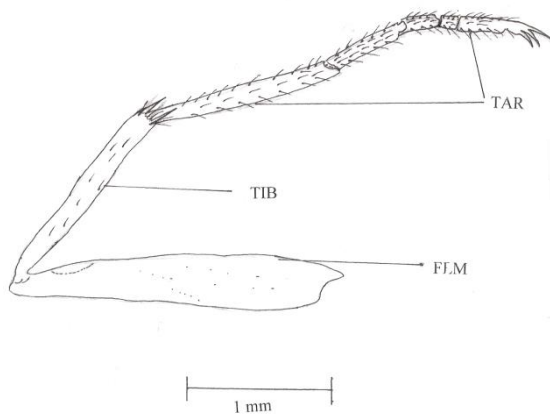
Plate XV



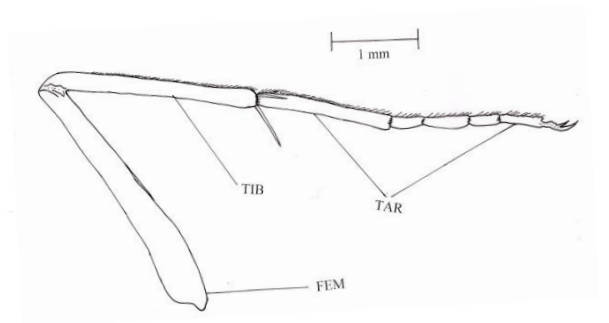
(Fig. 56)



(Fig. 57)



(Fig. 58)

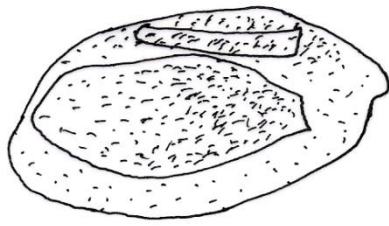


(Fig. 59)

(Explanation of Figs. 60-63, Plate, Plate- XVI)

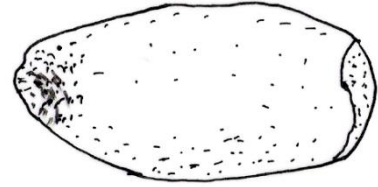
- Fig. 60 : Egg of *Cynthia cardui*.
- Fig. 61 : Egg of *Pieris brassicae*.
- Fig. 62 : Egg of *Vanessa cashmirensis*.
- Fig. 63 : Head of first instar larva of *Vanessa cashmirensis*.
- CEN.GR : Central Groove
- CHE : Cheek
- CLY : Clypus
- HL : Head Lobe

Plate XVI



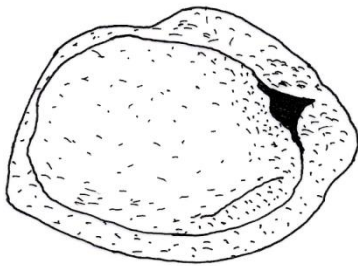
0.5 mm

(Fig. 60)



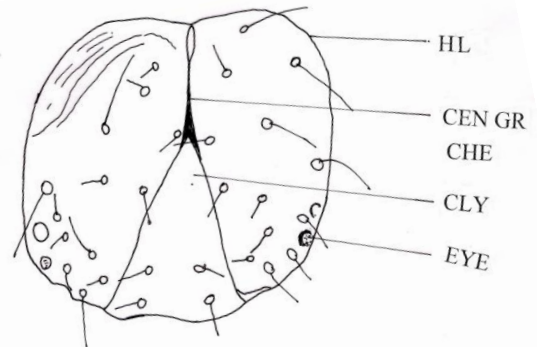
0.5 mm

(Fig. 61)



0.5 mm

(Fig. 62)



0.5 mm

(Fig. 63)

Plate XVII

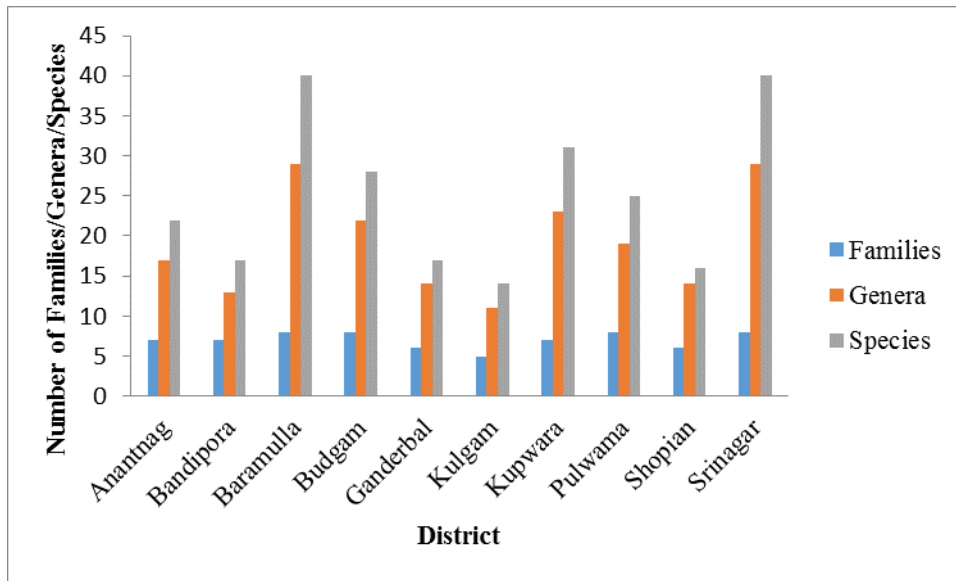


Fig. 64. Number of families/genera/species distributed under each district (2004-07).

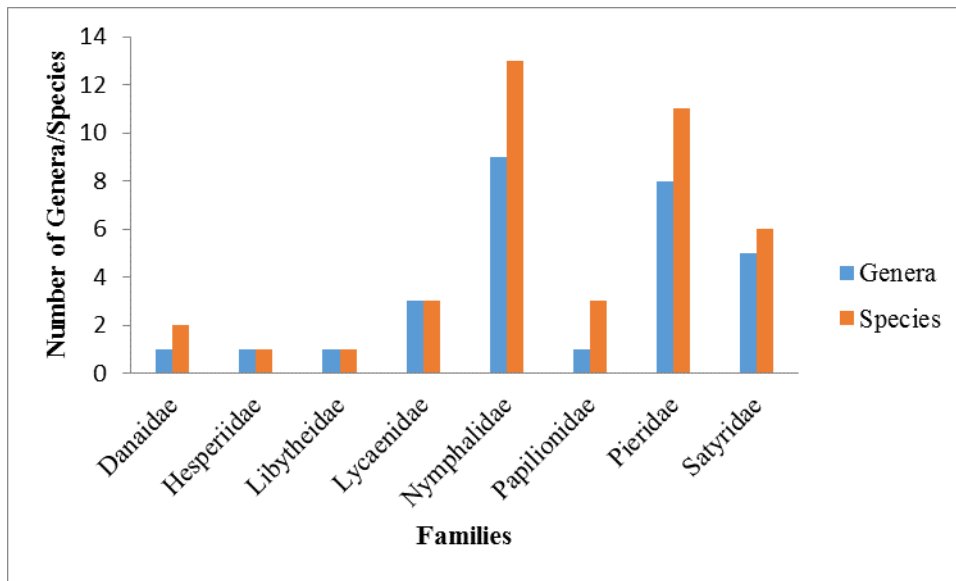


Fig. 65. Number of genera/species distributed under each family (2004-07).

Plate XVIII

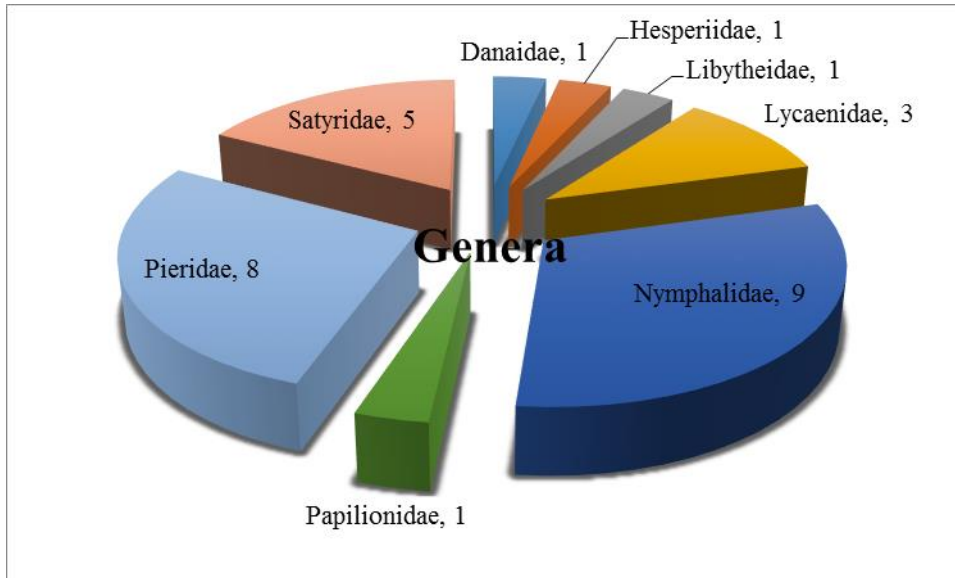


Fig. 66. Number of genera distributed under each family (2004-07).

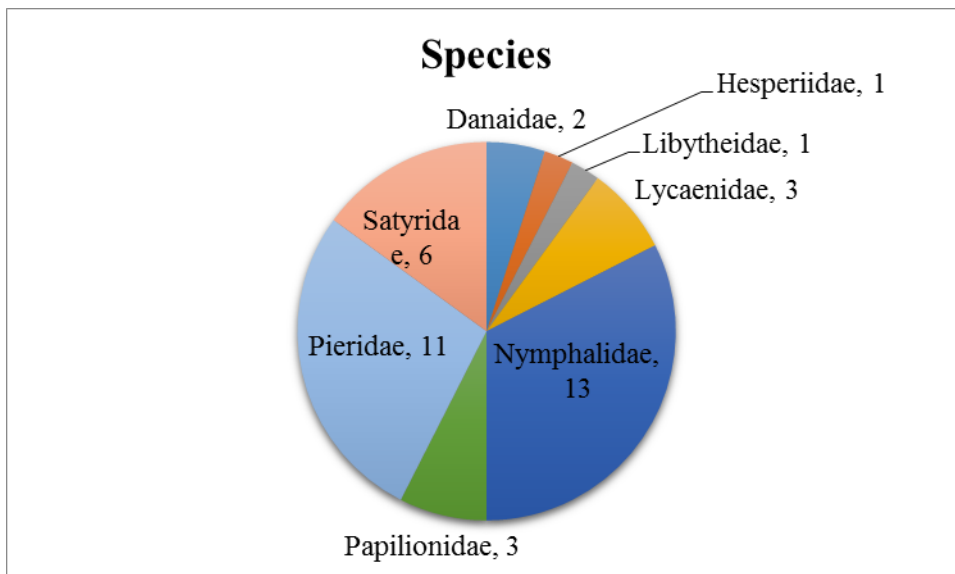


Fig. 67. Number of species distributed under each family (2004-07).

Plate XIX

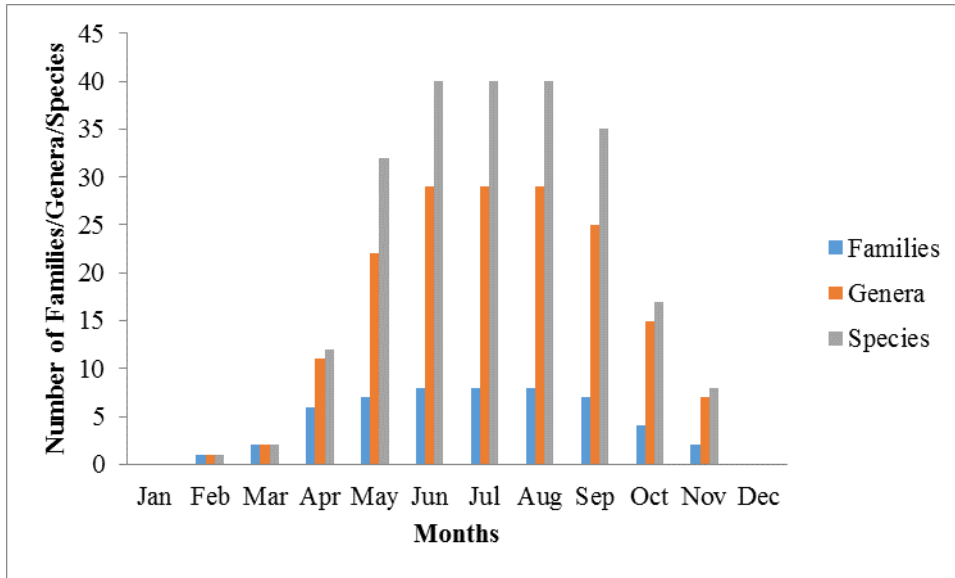


Fig. 68. Number of families/genera/species distributed under each month (2004-07).

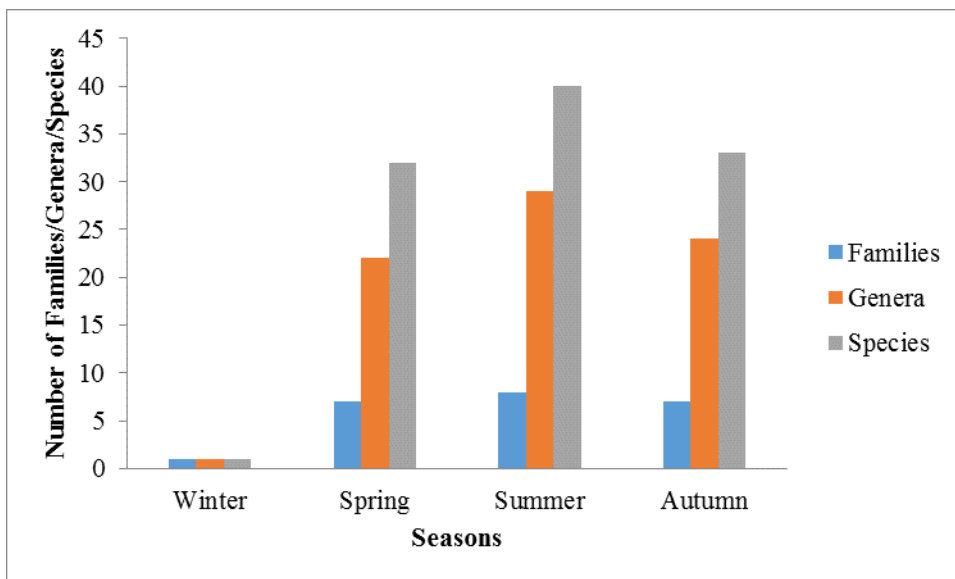


Fig. 69. Number of families/genera/species distributed under each season (2004-07).

Plate XX

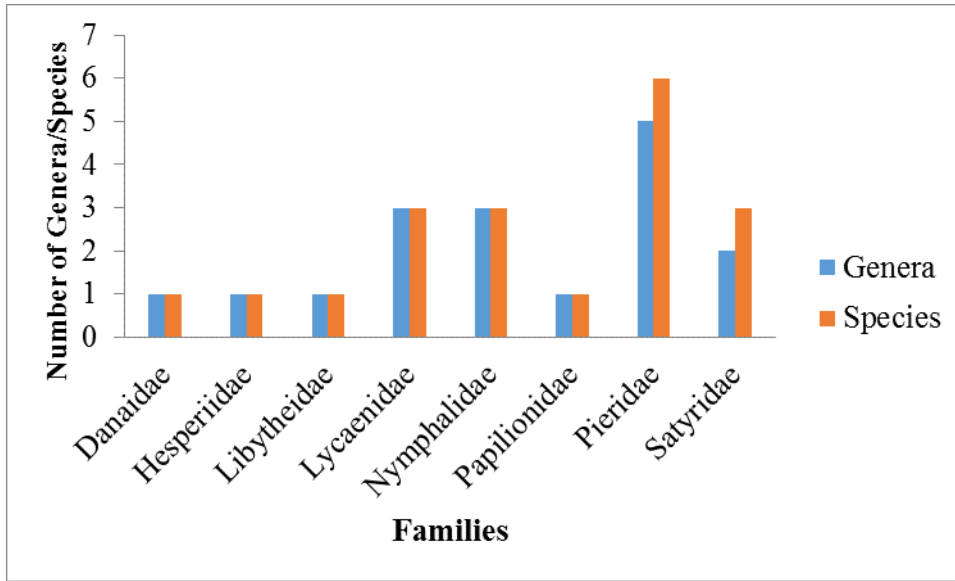


Fig. 70. Number of genera/species in each family showing mud puddling behaviour.

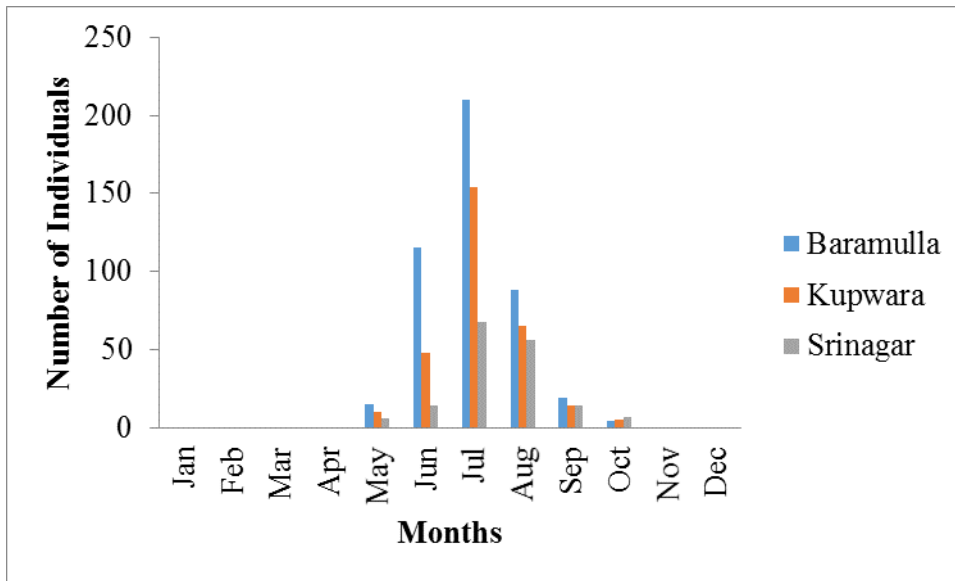


Fig.71. Abundance of *Aulocera padma* at Baramulla, Kupwara and Srinagar for the years 2004-07.

Plate XXI

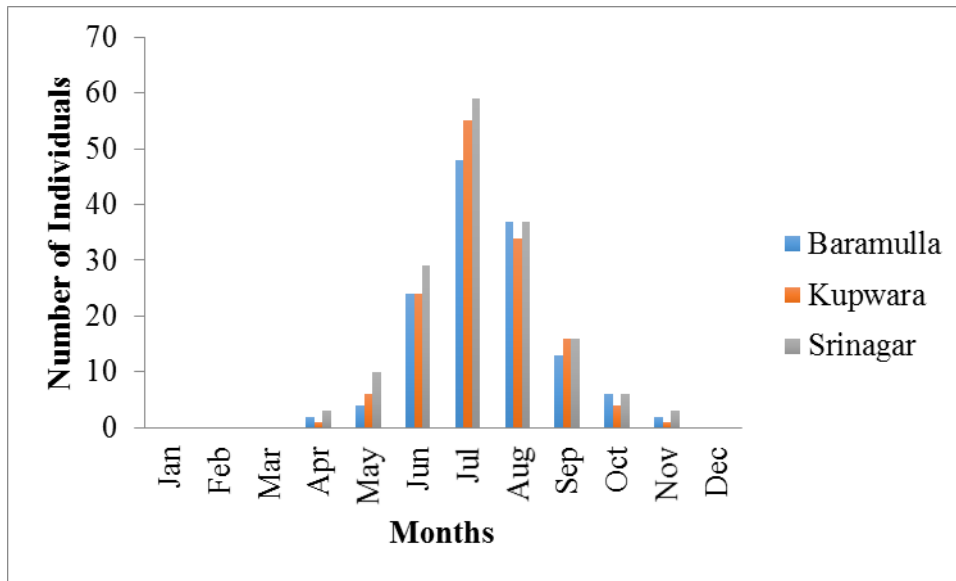


Fig.72. Abundance of *Colias erate* at Baramulla, Kupwara and Srinagar for the years 2004-07.

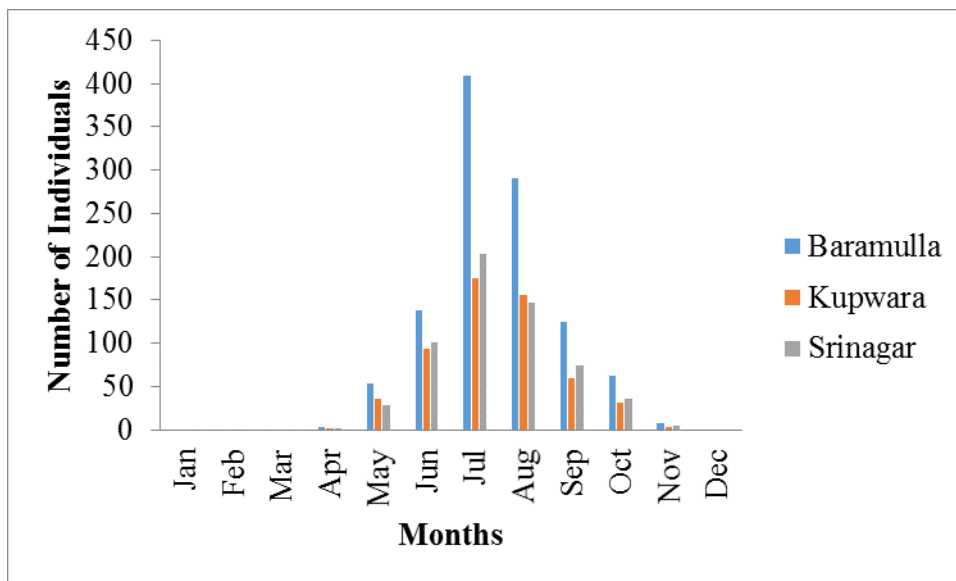


Fig.73. Abundance of *Colias electo fieldi* at Baramulla, Kupwara and Srinagar for the years 2004-07.

Plate XXII

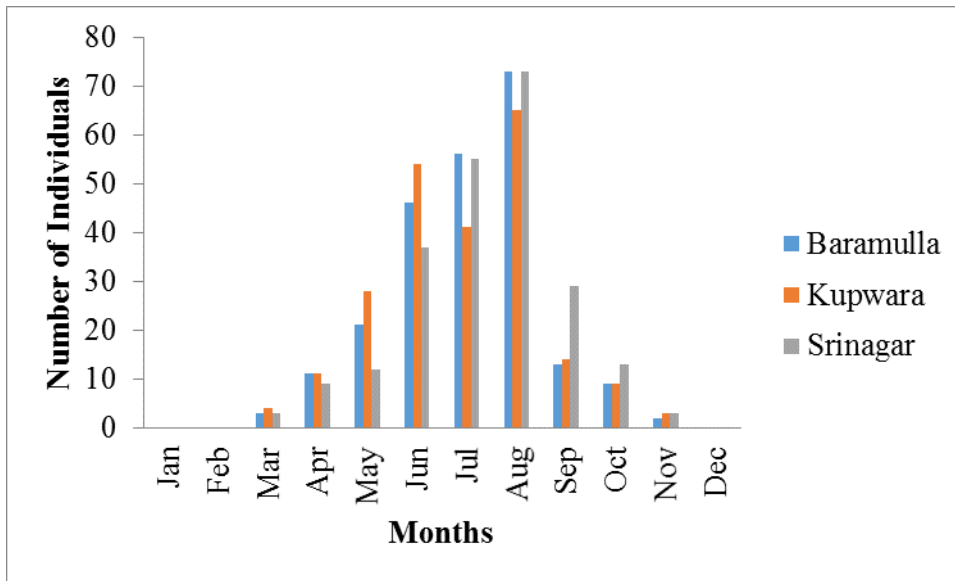


Fig.74. Abundance of *Cynthia cardui* at Baramulla, Kupwara and Srinagar for the years 2004-07.

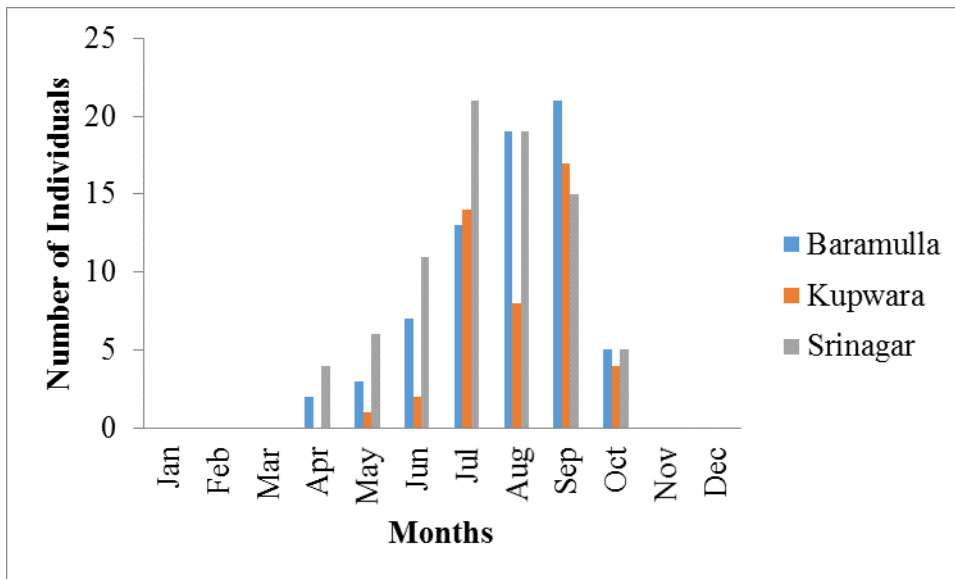


Fig.75. Abundance of *Junonia orithya* at Baramulla, Kupwara and Srinagar for the years 2004-07.

Plate XXIII

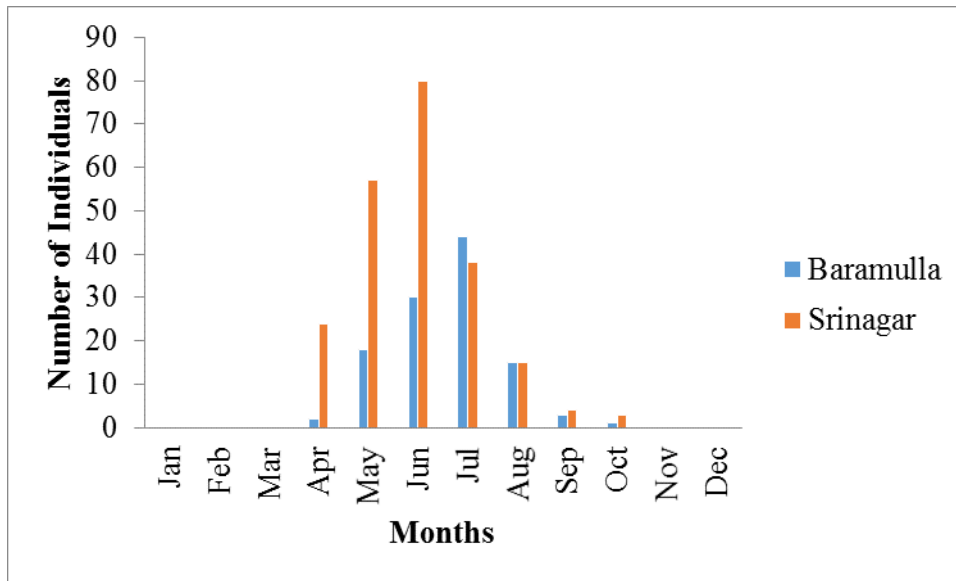


Fig.76. Abundance of *Libythea lepita lepita* at Baramulla and Srinagar for the years 2004-07.

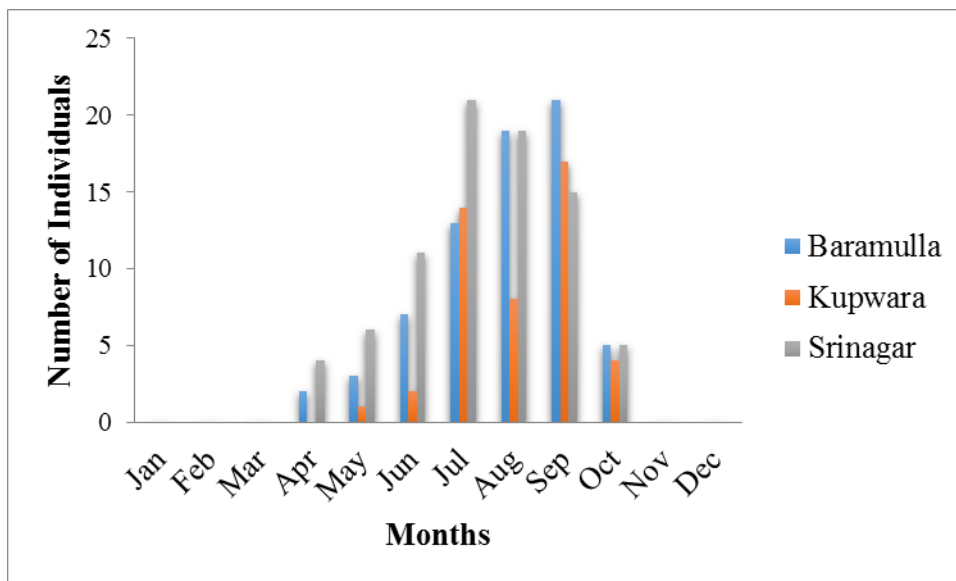


Fig.77. Abundance of *Pelopidas mathias* at Baramulla, Kupwara and Srinagar for the years 2004-07.

Plate XXIV

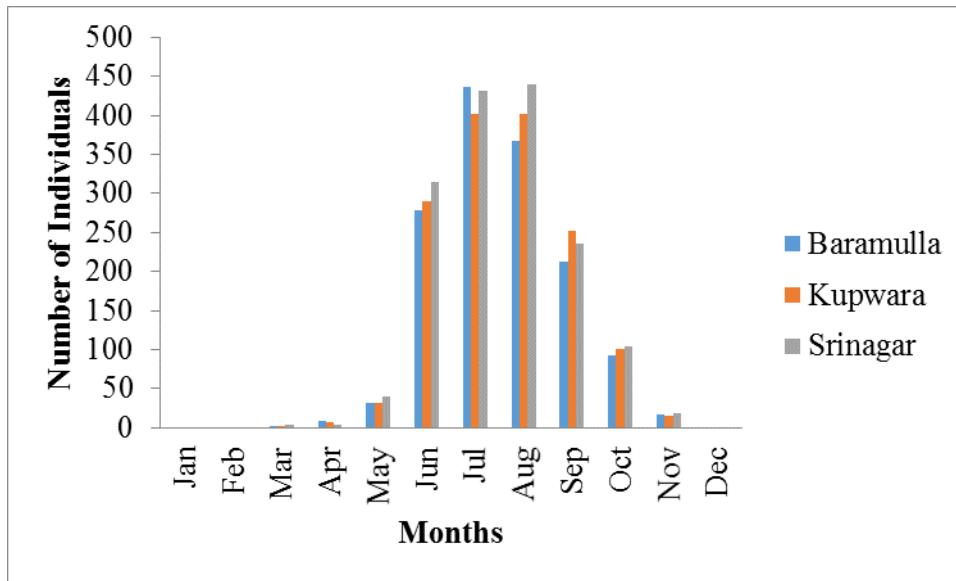


Fig.78. Abundance of *Pieris brassicae* at Baramulla, Kupwara and Srinagar for the years 2004-07.

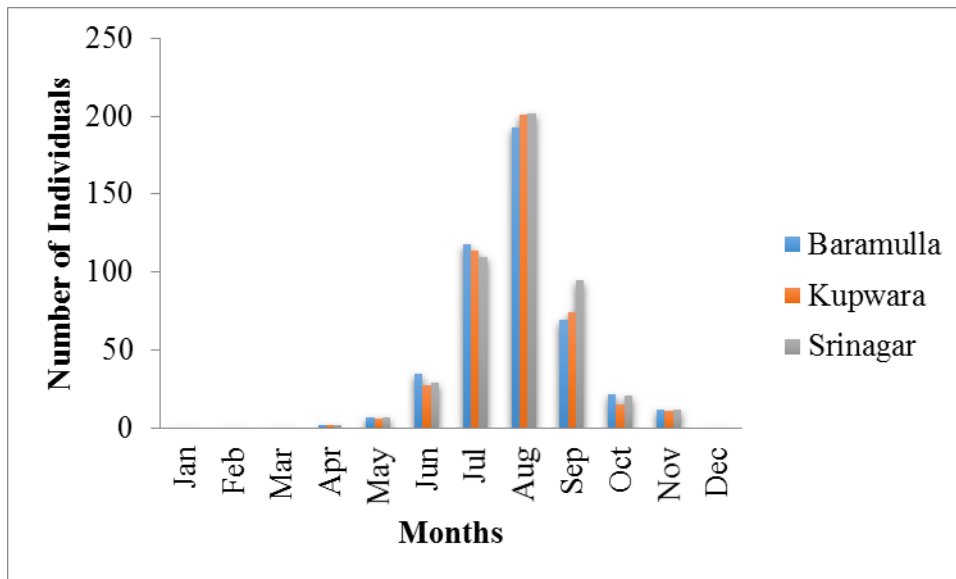


Fig.79. Abundance of *Pontia daplidice* at Baramulla, Kupwara and Srinagar for the years 2004-07.

Plate XXV

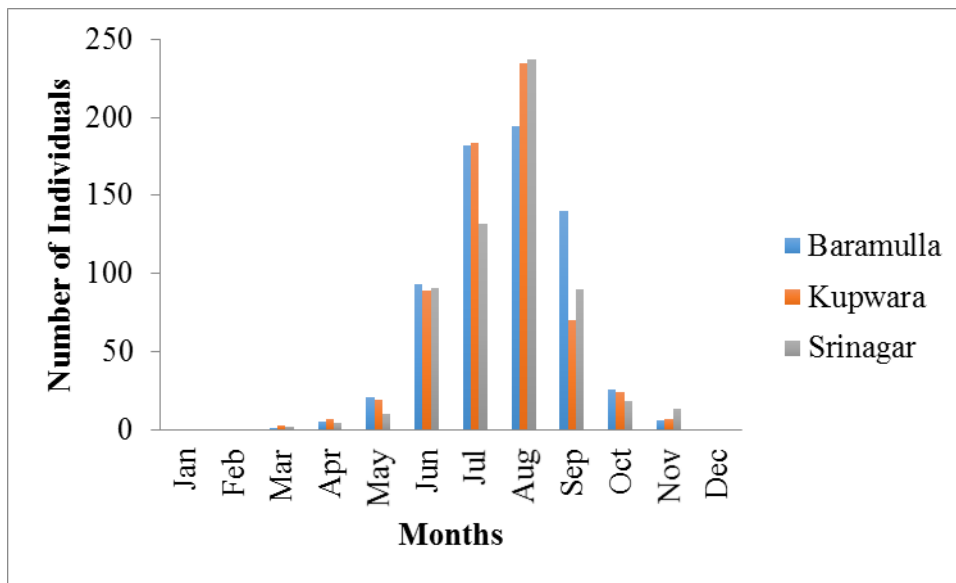


Fig.80. Abundance of *Vanessa cashmirensis* at Baramulla, Kupwara and Srinagar for the years 2004-07.

Plate XXVI



Fig.81. Butterfly pupa along with a plastic scale showing size.



Fig. 82. Adult butterfly specimens kept in the wooden collecting box for preservation after spreading.



Fig. 83. Descaled forewing of a butterfly (*Vanessa cashmirensis*) showing venation.

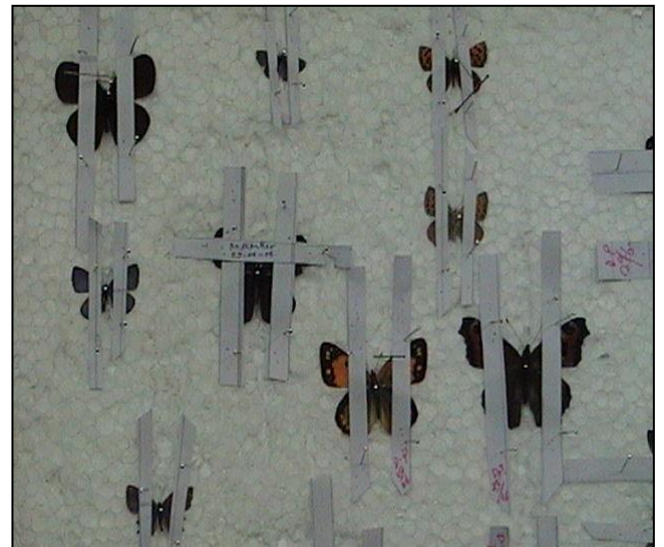


Fig. 84. Spreading of wings.

Plate XXVII



Fig. 85. Upper side of *Pelopidas mathias* (Hesperiidae).



Fig. 86. Lower side of *Pelopidas mathias* (Hesperiidae).



Fig. 87. Upper side of *Papilio machaon asiatica* (Papilionidae).



Fig. 88. Lower side of *Papilio machaon asiatica* (Papilionidae).

Plate XXVIII



Fig.89. Upper side of *Papilio arcturus arius* (Papilionidae).



Fig.90. Lower side of *Papilio arcturus arius* (Papilionidae).



Fig. 91. Upper side of *Papilio demoleus demoleus* (Papilionidae).



Fig. 92. Upper side of *Papilio demoleus demoleus* (Papilionidae).

Plate XXIX



Fig.93. Upper side of *Danaus genuita* (Danaiidae) ♀.



Fig.94. Lower side of *Danaus genuita* (Danaiidae) ♀.



Fig. 95. Upper side of *Danaus chrysippus chrysippus* (Danaiidae) ♂.

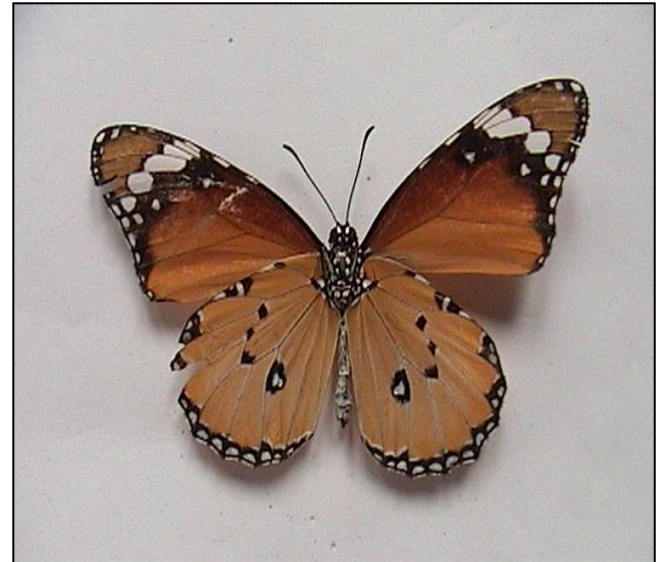


Fig. 96. Lower side of *Danaus chrysippus chrysippus* (Danaiidae) ♂.

Plate XXX



Fig.97. Upper side of *Libythea lepita lepita* (Libytheidae).



Fig.98. Lower side of *Libythea lepita lepita* (Libytheidae).



Fig. 99. Upper side of *Lycaena phlaeas* (Lycaenidae).



Fig. 100. Lower side of *Lycaena phlaeas* (Lycaenidae).

Plate XXXI



Fig.101. Upper side of *Aricia agestis*
(Lycaenidae).



Fig. 102. Lower side of *Aricia agestis*
(Lycaenidae).



Fig.103. Upper side of *Lampides boeticus*
(Lycaenidae).



Fig. 104. Lower side of *Lampides boeticus*
(Lycaenidae).

Plate XXXII



Fig. 105. Upper side of *Aulocera padma* (Satyridae).



Fig. 106. Upper side of *Aulocera padma* (Satyridae).



Fig. 107. Upper side of *Pararge eversmanii cashmirensis* (Satyridae).



Fig. 108. Lower side of *Pararge eversmanii cashmirensis* (Satyridae)

Plate XXXIII



Fig. 109. Upper side of *Maniola pulchra*
(Satyridae)



Fig. 110. Lower side of *Maniola pulchra*
(Satyridae)



Fig. 111. Upper side of *Callerebia mani mani*
(Satyridae)



Fig. 112. Lower side of *Callerebia mani mani*
(Satyridae)

Plate XXXIV



Fig. 113. Upper side of *Aulocera brahminus brahminus* (Satyridae)



Fig. 114. Lower side of *Aulocera brahminus brahminus* (Satyridae)



Fig. 115. Upper side of *Melanitis phedima* (Satyridae)



Fig. 116. Lower side of *Melanitis phedima* (Satyridae)

Plate XXXV



Fig. 117. Upper side of *Pieris brassicae* (Pieridae) ♀.



Fig. 118. Lower side of *Pieris brassicae* (Pieridae) ♀.

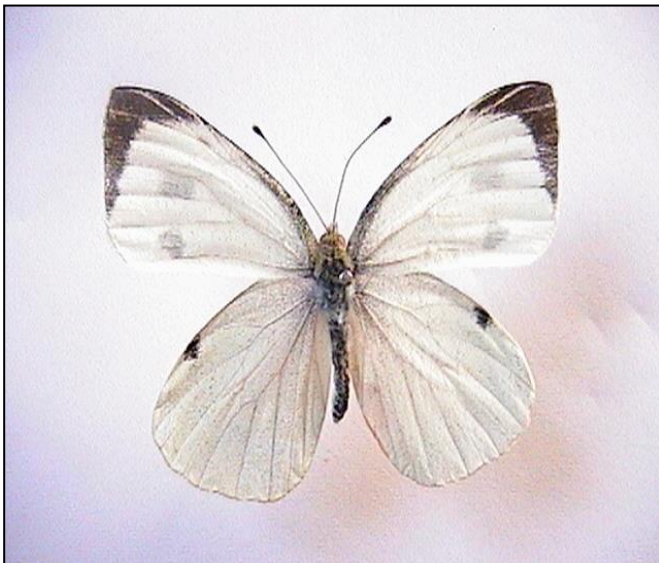


Fig. 119. Upper side of *Pieris brassicae* (Pieridae) ♂.



Fig. 120. Upper side of *Pieris brassicae* (Pieridae) ♂.

Plate XXXVI



Fig. 121. Upper side of *Pieris canidia*
(Pieridae).



Fig. 122. Lower side of *Pieris canidia*
(Pieridae).



Fig. 123. Upper side of *Pontia daplidice*
(Pieridae) ♂.



Fig. 124. Upper side of *Pontia canidia*
(Pieridae) ♂.

Plate XXXVII



Fig. 125. Upper side of *Gonepteryx rhamni* (Pieridae).



Fig. 126. Lower side of *Gonepteryx rhamni* (Pieridae).



Fig. 127. Upper side of *Aporia leucodice* (Pieridae).



Fig. 128. Lower side of *Aporia leucodice* (Pieridae).

Plate XXXVIII



Fig. 129. Upper side of *Colias erate*
(Pieridae) ♂.



Fig. 130. Lower side of *Colias erate*
(Pieridae) ♂.



Fig. 131. Upper side of *Colias erate*
(Pieridae) ♀.



Fig. 132. Lower side of *Colias erate*
(Pieridae) ♀.

Plate XXXIX



Fig. 133. Upper side of *Colias electo fieldi*
(Pieridae) ♂.



Fig. 134. Lower side of *Colias electo fieldi*
(Pieridae) ♂.



Fig. 135. Upper side of *Colias electo fieldi*
(Pieridae) ♀.



Fig. 136. Lower side of *Colias electo fieldi*
(Pieridae) ♀.

Plate XXXX



Fig. 137. Upper side of *Anapheis aurota*
(Pieridae)



Fig. 138. Lower side of *Anapheis aurota*
(Pieridae)



Fig. 139. Upper side of *Eurema hecabe*
(Pieridae)



Fig. 140. Lower side of *Eurema hecabe*
(Pieridae)

Plate XXXXI



Fig. 141. Upper side of *catopsilia pomona* (Pieridae). ♀.



Fig. 142. Lower side of *catopsilia pomona* (Pieridae). ♀.



Fig. 143. Upper side of *Catopsilia pomona* (Pieridae). ♂.



Fig. 144. Lower side of *Catopsilia pomona* Pieridae). ♂.

Plate XXXXII



Fig. 145. Upper side of *Catopsilia pyranthe*
(Pieridae)



Fig. 146. Lower side of *Catopsilia pyranthe*
(Pieridae)



Fig. 147. Upper side of *Junonia almana*
(Nymphalidae)



Fig. 148. Lower side of *Junonia almana*
(Nymphalidae)

Plate XXXXIII



Fig. 149. Upper side of *Junonia orithya*
(Nymphalidae)



Fig. 150. Lower side of *Junonia orithya*
(Nymphalidae)



Fig. 151. Upper side of *Junonia iphita*
(Nymphalidae)



Fig.152 . Lower side of *Junonia iphita*
(Nymphalidae)

Plate XXXIV



Fig. 153. Upper side of *Neptis hylas astola*
(Nymphalidae)



Fig. 154. Upper side of *Neptis hylas astola*
(Nymphalidae)



Fig. 155. Upper side of *Vanessa indica*
(Nymphalidae)



Fig. 156. Upper side of *Vanessa indica*
(Nymphalidae)

Plate XXXXV



Fig. 157. Upper side of *Hypolimnas misippus* (Nymphalidae) ♂.



Fig. 158. Lower side of *Hypolimnas misippus* (Nymphalidae) ♂.



Fig. 159. Upper side of *Cynthia cardui* (Nymphalidae)



Fig. 160. Lower side of *Cynthia cardui* (Nymphalidae)

Plate XXXXVI



Fig. 161 Upper side of *Childrena childreni*
(Nymphalidae)



Fig. 162. Lower side of *Childrena childreni*
(Nymphalidae)



Fig. 163. Upper side of *Issoria gemmata*
gemmata (Nymphalidae)



Fig. 164. Lower side of *Issoria gemmata*
gemmata (Nymphalidae)

Plate XXXXVII

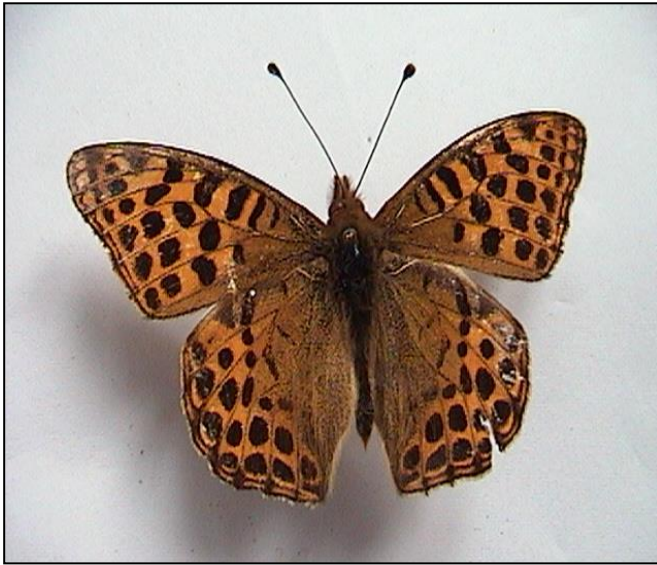


Fig. 165. Upper side of *Issoria lathonia*
(Nymphalidae)



Fig. 166. Lower side of *Issoria lathonia*
(Nymphalidae)



Fig. 167. Upper side of *Vanessa cashmirensis*
(Nymphalidae)



Fig. 168. Lower side of *Vanessa cashmirensis*
(Nymphalidae)

Plate XXXXVIII



Fig. 169. Upper side of *Argyreus hyperbius* (Nymphalidae) ♂.



Fig. 170. Lower side of *Argyreus hyperbius* (Nymphalidae) ♀.



Fig. 171. Upper side of *Argyreus hyperbius* (Nymphalidae) ♀.



Fig. 172. Lower side of *Argyreus hyperbius* (Nymphalidae) ♀.

Plate XXXIX

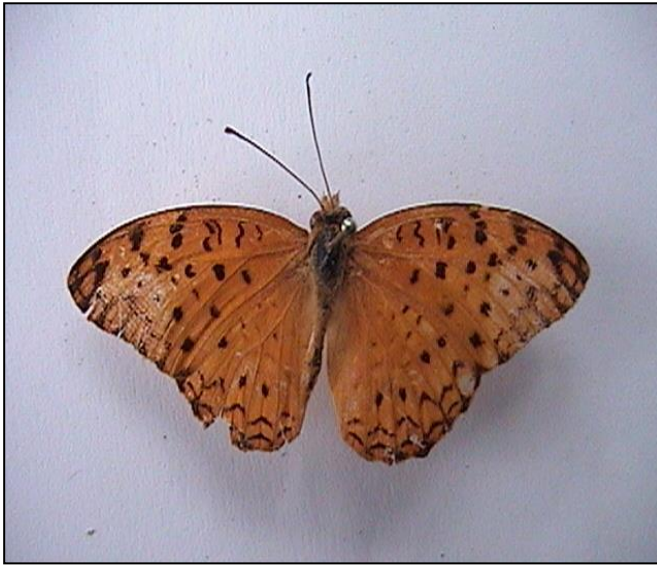


Fig. 173. Upper side of *Phalanta phalanta*
(Nymphalidae)



Fig. 174. Lower side of *Phalanta phalanta*
(Nymphalidae)



Fig. 175. Upper side of *Hypolimnas missipus*
(Nymphalidae) ♀.



Fig. 176. *Maniola pulchra* at Gulmarg taking
rest on soil with its wings closed and nearly
becomes invisible.

Plate L



Fig. 177. *Aulocera padma* sitting on the flowers of *Tagetes petula* and acting as pollinating agent.



Fig. 178. *Aulocera padma* sitting on the stem *Cedrus deodara* tree and almost becoming invisible.

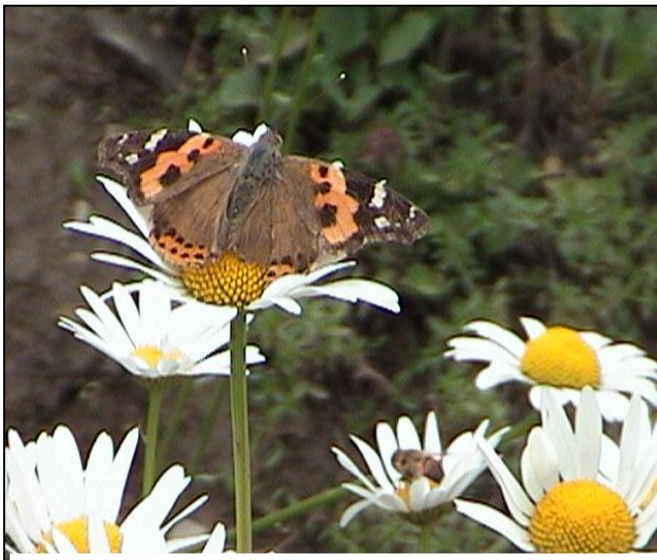


Fig. 179. *Cynthia cardui* basking in the sun.



Fig. 180. *Colias electo fieldi* hiding in grasses during rain.

Plate LI



Fig. 181. Damage caused to *Urtica* plant by first instar larvae of *Vanessa cashmirensis*.



Fig. 182. First instar larvae of *Vanessa cashmirensis*.



Fig. 183. Second and third instar larvae of *Vanessa cashmirensis*.



Fig. 184. Fourth instar larva of *Vanessa cashmirensis*.

Plate LII



Fig. 185. Fifth instar larva of *Vanessa cashmirensis*.



Fig. 186. Pre-pupae and pupae of *Vanessa cashmirensis*.



Fig. 187. Pupa of *Vanessa cashmirensis* inside a folded *Urtica* leaf.



Fig. 188. Pupa of *Vanessa cashmirensis*.

Plate LIII



Fig. 189. Pupa of *Vanessa cashmirensis* is opening like a door for the arrival of adult.



Fig. 190. Pupa of *Vanessa cashmirensis* starts breaking for the arrival of adult.



Fig. 191. Pupa of *Vanessa cashmirensis* is broken and adult comes out.



Fig. 192. Adult with wings closed after coming out from Pupa of *V. cashmirensis*.

Plate LIV



Fig. 193. Adult of *Vanessa cashmirensis* fully comes out.



Fig. 194. Broken out pupa of *Vanessa cashmirensis*.



Fig. 195. Adult of *Vanessa cashmirensis* with wings open immediately after its emergence.



Fig. 196. Newly born adult of *V. cashmirensis* can sit on anything of its choice.

Plate LV



Fig. 197. *Vanessa cashmirensis* basking in the sun while sitting on the rock.



Fig. 198. *Vanessa cashmirensis* sitting on grasses near animal excreta.



Fig. 199. *Vanessa cashmirensis* sitting on moist soil and showing puddling behaviour.

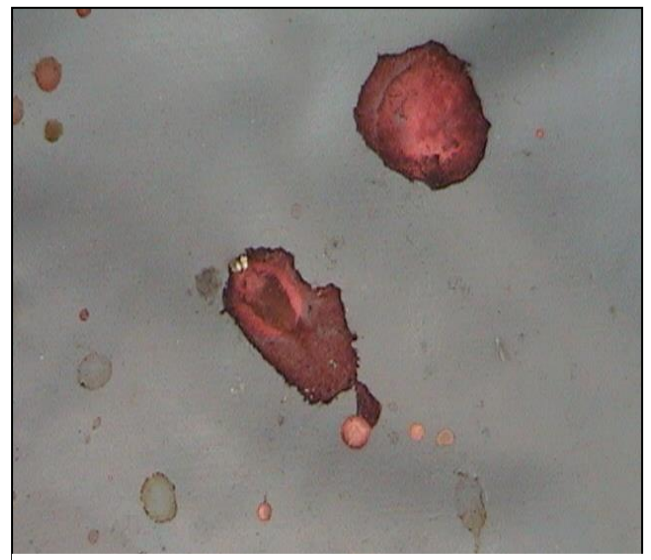


Fig. 200. Secretion from pupae of *Vanessa cashmirensis* before the emergence of adult.

Plate LVI



Fig. 201. Eggs laid by *Pieris brassicae* on *Brassica oleracea* plant at Batpora, Handwara



Fig. 202. Bunch of first and second instar larvae of *Pieris brassicae* in gregarious condition.



Fig. 203. Last instar larvae of *Pieris brassicae*



Fig. 204. Excreta of larvae of *Pieris brassicae*

Plate LVII



Fig. 205. Pupa of *Pieris brassicae*



Fig. 206. Pupa of *Pieris brassicae* showing attachment by cremaster.

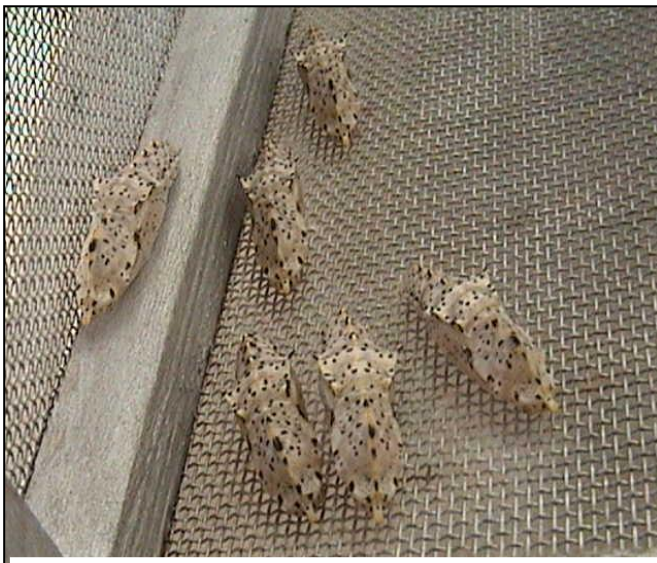


Fig. 207. Pupae of *Pieris brassicae* attached with the rearing cage.



Fig. 208. Newly emerged adult of *Pieris brassicae* inside the rearing cage.

Plate LVIII



Fig. 209. Newly emerged adult of *Pieris brassicae* can sit on anything of its choice.



Fig. 210. Adult of *Pieris brassicae* taking shelter on *Tagetes petula* plant during heavy rain at Baisaren, Pahalgam.



Fig. 211. Adults of *Pieris brassicae* at Dachigam taking shelter in the shadow of different plants during hot sunny days.



Fig. 212. *Junonia orithya* sitting on the ground with its wings open and almost becoming invisible.

Plate LIX



Fig. 213. *Pelopidas mathias*- feeding on nectar and helping in pollination.

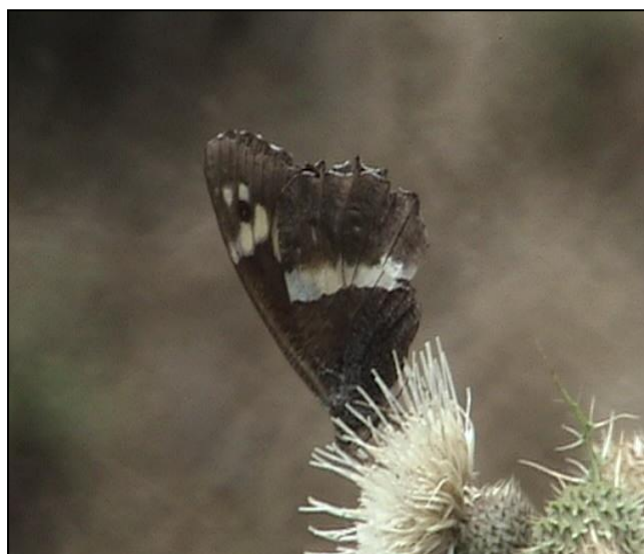


Fig. 214. *Aulocera padma*- feeding on nectar and helping in pollination.



Fig. 215. *Pontia daplidice*- feeding on nectar and helping in pollination.



Fig. 216. *Lycaena phlaeas*- feeding on nectar and helping in pollination.

Plate LX



Fig. 217. Members of *Pontia daplidice* during mating



Fig. 218. Adult butterfly preyed upon by a spider by trapping it in its web.



Fig. 219. Members of *Aulocera padma* during mating



Fig. 220. *Aulocera brahminus brahminus* at Kokernag, sitting on dried and moist plant parts.

Plate LXI



Fig. 221. Members of *Aulocera brahminus brahminus* feeding on animal excreta and showing puddling behaviour.



Fig. 222. *Aulocera brahminus brahminus* sitting on damp soil and showing puddling behaviour.



Fig. 223. *Maniola pulchra* taking rest in the shadow of branches of Deodar tree.



Fig. 224. *Lampides boeticus* taking rest on a dal plant.

Plate LXII



Fig. 225. *Childrena childreni* sitting on moist soil and showing puddling behaviour.



Fig. 226. *Libythea lepita lepita* sitting at a muddy place and showing puddling behaviour. It almost becomes invisible.



Fig. 227. *Childrena childreni* sitting on animal excreta and showing puddling behaviour.



Fig. 228. Pupa of *Childrena childreni* in a hanging condition.

Plate LXIII



Fig. 229. *Aulocera padma* sitting on grasses with its wings open.



Fig. 230. A view of *Urtica dioca* (Urticaceae) plant.



Fig. 231. Larvae of *Vanessa cashmirensis* being attacked by a hymenopteran member.



Fig. 232. A board by J&K Wildlife Department at Bijbehara, insisting on protection of wildlife.

Plate LXIV



Fig. 233. Eggs of *Cynthia cardui*.



Fig. 234. Eggs of *Cynthia cardui*.



Fig. 235. Eggs and newly emerged first instar larvae of *Cynthia cardui*.



Fig. 236. Bunch of first instar larvae of *Cynthia cardui*.

Plate LXV



Fig. 237. Larva of *Cynthia cardui* inside a protective whitish web like structure.



Fig. 238. Second and third first instar larvae of *Cynthia cardui*.



Fig. 239. First instar larva of *Cynthia cardui*.



Fig. 240. Pre-pupa of *Cynthia cardui*.

Plate LXVI



Fig. 241. Pupa of *Cynthia cardui*.



Fig. 242. Last instar larva of *Cynthia cardui*.



Fig. 243. Third instar Larva of *Cynthia cardui* inside a protective whitish web like structure.

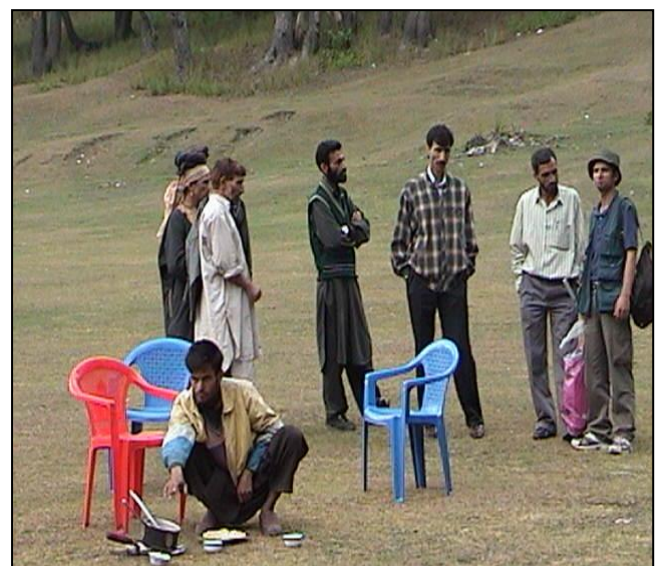


Fig. 244. Interaction between some government officials and locals with Research Scholar at Baisaren, Pehalgam during a field collection trip.

Plate LXVII



Fig. 245. Full grown larva of family Lycaenidae.



Fig. 246. Pupa of family Lycaenidae.



Fig. 247. Damage caused to an Anar fruit by a lycaenid Larva.



Fig. 248. The Lycaenid larva bores into the fruit by making a hole and makes the fruit unfit for use.

Plate LXVIII



Fig. 249. A view at Gulmarg.



Fig. 250. Locals at Dodhpathri, collecting timber/ firewood for domestic use using horses as a means of transport.



Fig. 251. A view at Baisaren, Pahalgam.

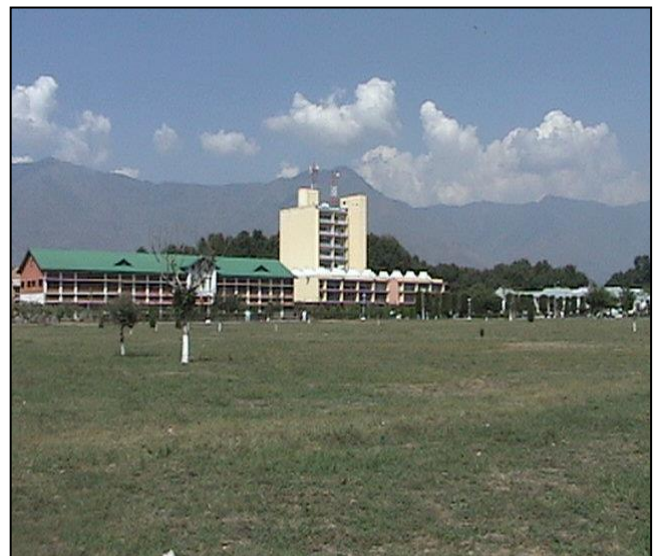


Fig. 252. A view of campus of the University of Kashmir during early spring season.

Plate LXIX

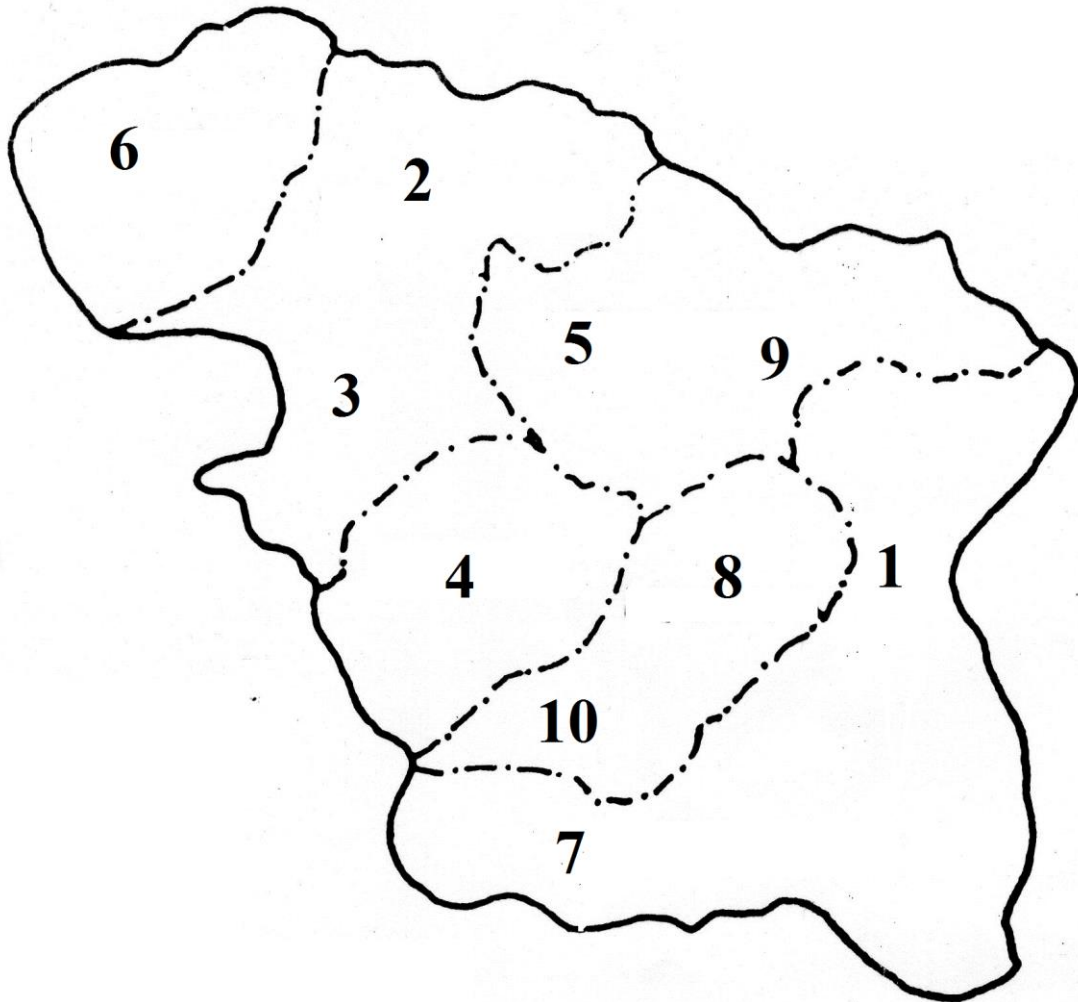


Fig. 253. Map of Kashmir Valley showing different administrative districts surveyed during the course of present investigations. The boundaries of newly established districts viz., Bandipora, Ganderbal, Kulgam and Shopian are not shown. 1. Anantnag 2. Bandipora 3. Baramulla 4. Budgam 5. Ganderbal 6. Kupwara 7. Kulgam 8. Pulwama 9. Srinagar and 10. Shopian).

Plate LXX

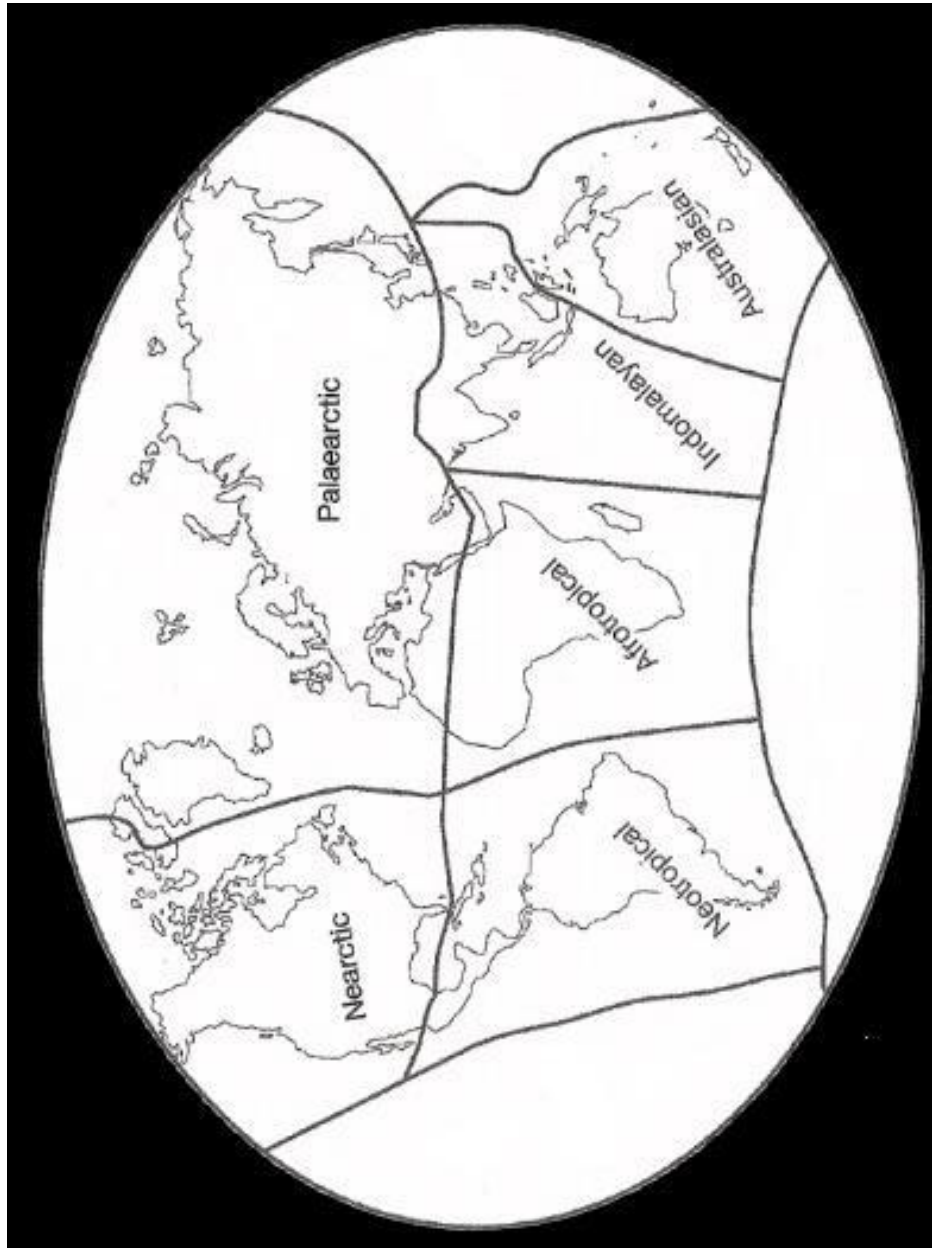


Fig. 254. Map showing different Zoogeographical Regions of the World, pertaining to Review of Literature part.

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