

THE ROLE OF BUTTERFLIES AS FLOWER VISITORS, POLLINATORS AND FLORA CONSERVATION IN HIMACHAL PRADESH, WESTERN HIMALAYA, INDIA

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ABSTRACT : During the present investigation, 113 species of butterflies were collected as flower visitors on 87 species of flowering plants (garden, cultivated, semi wild and wild) in Himachal Pradesh. Of these flowering plants, 07 species visited by papilionids, 56 by pierids, 07 by danaiids, 21 by satyrids, 22 by nymphalids, 54 by lycaenids, 05 by hesperiids & 06 by erycinids. Among all the flowering plants studied, flowers of the family Asteraceae were most attracted to different butterfly's species.

Key words : Butterflies, flower visitors, pollinators, flora conservation.

INTRODUCTION

Butterflies are the most important component of our biodiversity. Apart from being aesthetically attractive, they act as indicator to depict the health of a habitat. The larvae of butterflies are associated with plants but cause only little damage to the hosts. The adults act as incidental, wild pollinators and help in pollination of many native plants. The larvae as well as adults are food for many predators like lizards and birds. The butterfly diversity in an ecosystem tells how much healthy it is, as butterflies are very sensitive to any change in the environment. Due to short life cycles they are more sensitive than other groups to changes in their habitats and as they are breeding in small habitat patches they are likely reflect changes occurring at a fine scale (Oostermeijer *et al*, 1998). They can be used to identify ecologically important landscapes for conservation purposes.

Most flowering plants are pollinated by animals, especially insects, and it is argued that

the success of the angiosperms related to the development of these interactions. The insects visit flowers primarily to obtain nectar or pollen but play a vital role in maintaining the healthy ecosystem. The association between butterflies and plants is highly specific. Unlike bees, butterflies feed entirely on nectar, which they obtain through long proboscis and also, the nectar –pollen wastage by butterflies is virtually absent. Pollination, a crucial link in the survival of ecosystems, is one such factor that needs to be well understood to develop appropriate strategies for conservation of Himalayan biodiversity. This study may be the land mark beginning to identify the effective butterfly species as pollinators in wild and its role for conservation of floral diversity (Mehta *et al*, 2003).

A considerable numbers of papers have been published on the important observations on butterfly pollinators by Levin *et al* (1967), Subba Reddi & Meera Bai (1984) and Jennerston (1984). On the contrary, very few studies on the

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butterfly visitors or pollinators have been made in the Himalayan regions (Mehta *et al*, 2003 and Thakur *et al*, 2010, 2012). In present studies, an attempt were made to bring out a comprehensive list of visiting butterflies of Himachal Himalaya along with their visited plants, foraging activity and abundance of the species in different altitudes.

MATERIALS AND METHODS

Surveys of various butterfly species were made in different parts of the Himachal Pradesh, having different altitude, latitude and climatic conditions. Abundance of some economically important species was determined following the method of Julka *et al* (1982). Studies will also be conducted on the habit, habitat and interaction of butterfly fauna with flora of Himachal Himalayas. All butterflies sighted on different flowers of different plant species were collected and identified. Different plants species visited by butterflies during surveys were also collected and the herbarium were made on scientific lines. All the plant samples will be identified and got authenticated at Forest Research Institute (F.R.I.), Shimla and Biodiversity & Ethnobotany Research Laboratory, Department of Biosciences, Himachal Pradesh University, Shimla. Those specimens which have not been identified were identified with the help of Taxonomists at and Forest Research Institute (F.R.I.) and Botanical Survey of India (B.S.I.) Dehradun.

Study area

Himachal Pradesh is mainly a hilly state of the Indian Himalayas lying between 30° 22' to 33° 12' North latitude and 75° 47' to 79° 04' East longitude. The physiography of this state is almost mountainous with elevations ranging from 350 to 6500 metres above mean sea level and total area of the state is 55,673 sq km. Its northern border is bounded by Tibet, whereas, in the

Northwest, it has a common border with Kashmir and the eastern border of the state is common with the hills of Uttarakhand (Mani, 1986). The state has been divided into four physiographic regions.

- i) Shiwalik or Outer Himalayas (450-1500m)
- ii) Lower or Lesser Himalayas (1500-3500m)
- iii) Higher or Greater Himalayas (3500-4500m)
- iv) Trans – Himalaya (Above-4500m)

RESULTS AND DISCUSSION

In the present studies detailed observations on butterfly as flower visitors and pollinators were made. A total 113 species of the butterflies were recorded in different ecological zones of Himachal Pradesh (table 1).

Present studies were conducted regarding the different flowering plants (garden, cultivated, semi wild & wild) visited by butterflies, foraging activity and abundance at different elevations of Himachal Pradesh. During the present investigation, 113 species of butterflies were collected as flower visitors on 87 species of flowering plants (garden, cultivated, semi wild and wild) in Himachal Pradesh. Of these flowering plants, 07 species visited by papilionids, 56 by pierids, 07 by danaiids, 21 by satyrids, 22 by nymphalids, 54 by lycaenids, 05 by hesperiids & 06 by erycinids. Among all the flowering plants studied, flowers of the family Asteraceae were most attracted to different butterfly's species (table 1).

Studies on food plants visited by butterflies showed that among lycaenids *Lampides boeticus* visited maximum number of plant species (22) followed by *Celastrina cardia dilecta* (15), *Celastrina hugelii orena* (14), *Heliophorus sena* (12), *Pseudozizeeria maha* & *Lycaenopsis limbata* (10 each) and

Table 1 : List of flower visiting butterflies of Himachal Pradesh, Western Himalaya.

Taxon	Plant species	Remarks	Family
FAMILY: PAPILIONIDAE			
1. <i>Chilasa clytia clytia</i> (Linn.)	<i>Berberis jaechsiana</i>	Yellow flower, Thorny bush	Berberidaceae
2. <i>Atrophaneura philoxenus philoxenus</i> (Gray)	<i>Argemone maxicana</i> <i>Cirsium wallichii</i>	Purple Flower, wild shrub White Flower, wild shrub	Asteraceae Asteraceae
3. <i>Atrophaneura dasarada ravana</i> (Moore)	<i>Argemone maxicana</i>	Purple Flower, wild herb	Asteraceae
4. <i>Papilio protenor protenor</i> Cramer	<i>Salvia officinalis</i>	Red Flower, wild herb	Acanthaceae
5. <i>Papilio polyctor polyctor</i> Boisduval	<i>Argemone maxicana</i>	Purple Flower, wild shrub	Asteraceae
6. <i>Papilio polytes romulus</i> Cramer	<i>Murraya koenigii</i> <i>Lantana camara</i>	White Flower, wild shrub Yellow Flower, wild shrub	Rutaceae Verbenaceae
7. <i>Papilio demoleus demoleus</i> Linn.	<i>Murraya koenigii</i>	White Flower, wild shrub	Rutaceae
8. <i>Papilio machaon punjabensis</i> Eimer	<i>Cirsium arvensis</i>	Purple Flower, wild shrub	Asteraceae
9. <i>Graphium cloanthus</i> (Westwood)	<i>Argemone maxicana</i> <i>Cirsium wallichii</i>	Purple Flower, wild herb White Flower, wild shrub	Asteraceae Asteraceae
10. <i>Graphium sarpedon luctatius</i> (Fruhstorfer)	<i>Cirsium arvensis</i>	Purple Flower, wild shrub	Asteraceae
FAMILY : PIERIDAE			
1. <i>Metaporia leucodice soracta</i> (Moore)	<i>Fagopyrum esculentum</i>	Brown Flower, wild herb	Polygonaceae
2. <i>Metaporia agathon</i> (Gray)	<i>Fagopyrum esculentum</i>	Brown Flower, wild herb	Polygonaceae
3. <i>Delias belladonna horsfieldi</i> (Gray)	<i>Gnaphalium</i> sp. <i>Aster</i> sp. <i>Potentilla atrosanguinea</i> <i>Androsace</i> sp. <i>Cirsium wallichii</i>	Yellow Flower, wild herb Purple Flower, wild herb Yellow Flower, wild herb Purple Flower, wild herb White Flower, wild shrub	Asteraceae Asteraceae Rosaceae Primulaceae Asteraceae
4. <i>Delias eucharis</i> (Drury)	<i>Lantana camara</i>	Yellow Flower, wild shrub	Verbenaceae
5. <i>Pieris canidia indica</i> Evans	<i>Lotus corniculata</i> <i>Lotus</i> spp. <i>Lucas cephalotos</i> <i>Woodfordia fruticosa</i> <i>Lucas lanta</i> <i>Randia tetraspermum</i> <i>Debregeasia hypoleuca</i> <i>Salvia officinalis</i> <i>Aconitum tetrasepala</i>	Yellow Flower, wild herb Blue Flower Pink Flower, wild herb Brown Flower, wild herb Brown Flower, wild herb Green Fruit, wild herb Pink Flower, wild herb Purple Flower, wild herb White Flower, wild herb	Fabaceae Lamiaceae Lythraceae Lamiaceae Rubiaceae Urticaceae Lamiaceae Ranunculaceae Fabaceae

Table 1 continued...

Table 1 continued...

	<i>Caltha palustris</i> <i>Geranium pretense</i> <i>Pimpinolla</i> sp. <i>Potentilla strossanguinea</i> <i>Ranunculus</i> sp. <i>Rosa webbiana</i> <i>Taraxacum officinale</i> <i>Thymus serphyllum</i>	Yellow Flower, wild herb Blue Flower, wild herb White Flower, wild herb Red Flower, wild herb Yellow Flower, wild herb Pink Flower, wild shrub Yellow Flower, wild herb Purple Flower, wild herb	Ranunculaceae Geraniaceae Asteraceae Apiaceae Rosaceae Ranunculaceae Rosaceae Lamiaceae
6. <i>Pieris brassicae nepalensis</i> Doubleday	<i>Debregeasia hypoleuca</i> Grass <i>Origanum vulgare</i> <i>Hypercium</i> sp. <i>Astragalus</i> sp. <i>Trifolium pratense</i> <i>Pisum sativum</i> <i>Malva sylvestris</i> <i>Trifolium repens</i> <i>Cirsium arvensis</i> <i>Aconitum tetrasepala</i> <i>Caltha palustris</i> <i>Geranium pretense</i> <i>Pimpinolla</i> sp. <i>Potentilla strossanguinea</i> <i>Ranunculus</i> sp. <i>Rosa webbiana</i> <i>Taraxacum officinale</i> <i>Thymus serphyllum</i> <i>Aster molliusculus</i> <i>Brassica campestris</i> <i>Delphinium denudatum</i> <i>Fagopyrum botrytis</i> <i>Lactuca</i> sp. <i>Solanum chaksoense</i> <i>Sonchus</i> sp. <i>Physolaena praelata</i>	Pink Flower, wild herb White Flower, wild herb Yellow Flower, wild shrub Purple Flower, wild shrub Purple Flower, wild herb Pink, White Flower Purple Flower, wild shrub White Flower, wild herb Purple Flower, wild shrub White Flower, wild herb Yellow Flower, wild herb Blue Flower, wild herb White Flower, wild herb Red Flower, wild herb Yellow Flower, wild herb Pink Flower, wild shrub Yellow Flower, wild herb Purple Flower, wild herb White Flower, wild herb Yellow Flower, cultivated Blue Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb White Flower, wild shrub	Urticaceae Lamiaceae Clusiaceae Fabaceae Asteraceae Fabaceae Malvaceae Asteraceae Asteraceae Ranunculaceae Ranunculaceae Geraniaceae Apiaceae Rosaceae Ranunculaceae Rosaceae Asteraceae Lamiaceae Asteraceae Brassicaceae Ranunculaceae Polygonaceae Asteraceae Solanaceae Asteraceae Solanaceae
7. <i>Pontia daplidice moorei</i> (Fabr.)	<i>Aster molliusculus</i> <i>Brassica campestris</i> <i>Delphinium denudatum</i> <i>Fagopyrum botrytis</i> <i>Lactuca</i> sp. <i>Solanum chaksoense</i> <i>Sonchus</i> sp. <i>Physolaena praelata</i>	Yellow Flower, wild herb White Flower, wild shrub White Flower, wild herb Yellow Flower, cultivated Blue Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb White Flower, wild shrub	Asteraceae Brassicaceae Ranunculaceae Polygonaceae Asteraceae Solanaceae Asteraceae Solanaceae

Table 1 continued...

Table 1 continued...

8. <i>Ixias marianne</i> (Cramer)	<i>Lantana camara</i>	Yellow Flower, Wild shrub	Verbenaceae
9. <i>Ixias pyrene kausala</i> (Moore)	<i>Ageratum conyzoides</i> <i>Lantana camara</i>	Blusih Flower, wild herb Yellow Flower, wild shrub	Asteraceae Verbenaceae
10. <i>Catopsilia crocale</i> Cramer	<i>Ageratum conyzoides</i>	Blusih Flower, wild herb	Asteraceae
11. <i>Catopsilia pyranthe</i> (Linn.)	<i>Ageratum conyzoides</i> <i>Ipomaea purpurea</i>	Blusih Flower, wild herb Blusih Flower, wild bael	Asteraceae Convolvulaceae
12. <i>Gonepteryx rahmni nepalensis</i> (Doubleday)	<i>Ranunculatus muricatus</i> <i>Oxalis corniculata</i> <i>Thymus linearis</i> <i>Epilobium hirsutum</i>	Yellow Flower, wild herb Yellow Flower, wild herb Pink Flower, wild herb Pink Flower, wild shrub	Ranunculaceae Oxalidaceae Lamiaceae Onagraceae
13. <i>Eurema brigitta rubella</i> (Wallace)	<i>Dodonia viscosa</i>	Pink Flower wild herb	Sapindaceae
14. <i>Terias laeta laeta</i> (Boisduval)	<i>Jasminum humile</i> <i>Zizypus</i> sp. <i>Lotus corniculata</i>	Yellow flower wild herb No Flower, wild shrub Flower wild herb	Oleraceae Rhamnaceae Fabaceae
15. <i>Terias hecabe fimbriata</i> (Wallace)	<i>Ageratum conyzoides</i> <i>Lantana camara</i> <i>Dodonia viscosa</i> <i>Indigofera cassicoides</i> <i>Bidens triparitate</i>	Bluish Flower wild herb Yellow Flower wild shrub Pink Flower wild herb Brown flower, wild shrub Pink Flower, wild herb	Asteraceae Verbenaceae Sapindaceae Fabaceae Asteraceae
16. <i>Colias erate erate</i> (Esper)	<i>Trifolium pratense</i> <i>Pisum sativum</i> <i>Malva sylvestris</i> <i>Cicerbita</i> sp. <i>Convolvulus arvensis</i> <i>Coreopsis lanceolata</i> <i>Oenothera</i> sp. <i>Thymus serpyllum</i> <i>Trifolium repens</i> <i>Cirsium arvensis</i> <i>Aconitum tetrasepala</i> <i>Caltha palustris</i> <i>Geranium pretense</i> <i>Pimpinolla</i> sp. <i>Potentilla strossanguinea</i> <i>Ranunculus</i> sp. <i>Rosa webbiana</i> <i>Taraxacum officinale</i> <i>Aster molliusculus</i> <i>Brassica campestris</i> <i>Delphinium denudatum</i> <i>Fagopyrum botrytis</i>	Purple Flower, wild herb Pink, White Flower Purple Flower, wild shrub Blue Flower, wild herb White Flower, wild herb Yellow Flower, wild shrub Yellow Flower, wild shrub Blue Flower, wild herb White Flower, wild herb Purple Flower, wild shrub White Flower, wild herb Yellow Flower, wild herb Blue Flower, wild herb White Flower, wild herb Red Flower, wild herb Yellow Flower, wild herb Pink Flower, wild shrub Yellow Flower, wild herb White Flower, wild herb Yellow Flower, cultivated Blue Flower, wild herb White Flower, wild shrub	Asteraceae Fabaceae Malvaceae Asteraceae Convolvulaceae Asteraceae Onagraceae Lamiaceae Asteraceae Asteraceae Asteraceae Ranunculaceae Ranunculaceae Geraniaceae Apiaceae Rosaceae Ranunculaceae Rosaceae Asteraceae Asteraceae Brassicaceae Ranunculaceae Polygonaceae

Table 1 continued...

Table 1 continued...

	<i>Lactuca</i> sp. <i>Solanum chaksoense</i> <i>Sonchus</i> sp. <i>Physolaena praelata</i>	Yellow Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb White Flower, wild shrub	Asteraceae Solanaceae Asteraceae Solanaceae
17. <i>Colias electo fieldi</i> Menetries	<i>Gnaphalium</i> sp. <i>Aster</i> sp. <i>Mazus susculosus</i> <i>Trifolium pratense</i> <i>Pisum sativum</i> <i>Malva sylvestris</i> <i>Cicerbita</i> sp. <i>Convolvulus arvensis</i> <i>Coreopsis lanceolata</i> <i>Oenothera</i> sp. <i>Thymus serpyllum</i> <i>Trifolium repens</i> <i>Cirsium arvensis</i> <i>Aconitum tetrasepala</i> <i>Caltha palustris</i> <i>Geranium pretense</i> <i>Pimpinolla</i> sp. <i>Potentilla strossanguinea</i> <i>Ranunculus</i> sp. <i>Rosa webbiana</i> <i>Taraxacum officinale</i> <i>Aster molliusculus</i> <i>Brassica campestris</i> <i>Delphinium denudatum</i> <i>Fagopyrum botrytis</i> <i>Lactuca</i> sp. <i>Solanum chaksoense</i> <i>Sonchus</i> sp. <i>Physolaena praelata</i>	Yellow Flower, wild herb Yellow Flower, wild herb Purple Flower, wild herb Purple Flower, wild herb Pink, White Flower Purple Flower, wild shrub Blue Flower, wild herb White Flower, wild herb Yellow Flower, wild shrub Yellow Flower, wild shrub Blue Flower, wild herb White Flower, wild herb Purple Flower, wild shrub White Flower, wild herb Yellow Flower, wild herb Blue Flower, wild herb White Flower, wild herb Red Flower, wild herb Yellow Flower, wild herb Pink Flower, wild shrub Yellow Flower, wild herb White Flower, wild herb Yellow Flower, cultivated Blue Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb White Flower, wild shrub	Asteraceae Asteraceae Scophulariaceae Asteraceae Fabaceae Malvaceae Asteraceae Convolvulaceae Asteraceae Onagraceae Lamiaceae Asteraceae Asteraceae Ranunculaceae Ranunculaceae Ranunculaceae Apiaceae Rosaceae Ranunculaceae Rosaceae Asteraceae Asteraceae Brassicaceae Brassicaceae Polygonaceae Asteraceae Solanaceae Asteraceae Solanaceae
FAMILY : DANAIDAE			
1. <i>Danaus chrysippus</i> <i>chrysippus</i> (Linn.)	<i>Lantana camara</i> <i>Malva sylvestris</i>	Yellow Flower wild shrub Purple Flower wild shrub	Verbenaceae Malvaceae
2. <i>Danaus genutia</i> Cramer	<i>Lantana camara</i> <i>Malva sylvestris</i>	Yellow Flower wild shrub Purple Flower wild shrub	Verbenaceae Malvaceae
3. <i>Parantica aglea</i> <i>melanoides</i> Moore	<i>Argemone maxicana</i> <i>Cirsium wallichii</i>	Purple Flower, wild shrub White Flower, wild shrub	Asteraceae Asteraceae
4. <i>Parantica sita sita</i> (Kollar)	<i>Hamiltonia</i> sp. <i>Berberis lyceum</i> <i>Berberis aristata</i>	Bluish Flower, wild shrub No Flower Wild shrub	Vabenaceae Berberidaceae Berberidaceae

Table 1 continued...

Table 1 continued...

5. <i>Euploea core core</i> (Cramer)	<i>Lantana camara</i> <i>Malva sylvestris</i>	Yellow Flower wild shrub Purple Flower wild shrub	Verbenaceae Malvaceae
FAMILY: SATYRIDAE			
1. <i>Mycalasis francica santana</i> Moore	<i>Lantana camara</i> Grasses	Yellow Flower, wild shrub	Verbenaceae
2. <i>Mycalasis mineus mineus</i> (Linn.)	Grasses		
3. <i>Lethe confusa confusa</i> Aurivillius	<i>Quercus</i> spp.		
4. <i>Lethe insana insana</i> (Kollar)	Grasses		
5. <i>Lethe verma verma</i> (Kollar)	<i>Argemone maxicana</i> <i>Cirsium wallichii</i>	Purple Flower, wild shrub White Flower, wild shrub	Asteraceae Asteraceae
6. <i>Lasiommata schakra schakra</i> (Kollar)	<i>Argemone maxicana</i> <i>Cirsium wallichii</i> <i>Gnaphalium</i> sp. <i>Aster</i> sp. <i>Rumex nepalensis</i> <i>Cyperus</i> sp. <i>Astragalus</i> sp. <i>Trifolium pratense</i> <i>Pisum sativum</i> <i>Coreopsis lanceolata</i> <i>Duchesena indica</i> <i>Spiraea canescens</i> <i>Taraxacum officinale</i>	Purple Flower, wild shrub White Flower, wild shrub Yellow Flower, wild herb Yellow Flower, wild herb Purple Flower, wild shrub Grass Purple Flower, wild shrub Purple Flower, wild herb Pink, White Flower Yellow Flower, wild shrub Yellow Flower, wild herb Yellow Flower, Thorny Shrub Yellow Flower, wild herb	Asteraceae Asteraceae Asteraceae Asteraceae Polygonaceae Fabaceae Asteraceae Fabaceae Asteraceae Rosaceae Rosaceae Asteraceae
7. <i>Aulocera padma padma</i> (Kollar)	Grasses		
8. <i>Aulocera brahminus</i> (Blanchard)	<i>Argemone maxicana</i> <i>Cirsium wallichii</i>	Purple Flower, wild shrub White Flower, wild shrub	Asteraceae Asteraceae
9. <i>Aulocera saraswati</i> (Kollar)	<i>Argemone maxicana</i> <i>Cirsium wallichii</i> <i>Vicia silara</i>	Purple Flower, wild shrub White Flower, wild shrub White Flower, wild herb	Asteraceae Asteraceae Fabaceae
10. <i>Callierbia scanda scanda</i> (Kollar)	<i>Bidens tripartite</i> <i>Ageratum conyzoides</i> <i>Astragalus</i> sp. <i>Trifolium pratense</i> <i>Pisum sativum</i> <i>Coreopsis lanceolata</i>	Pink Flower, wild herb Purple Flower, wild herb Purple Flower, wild shrub Purple Flower, wild herb Pink, White Flower Yellow Flower, wild shrub	Asteraceae Asteraceae Fabaceae Asteraceae Fabaceae Asteraceae
11. <i>Ypthima asterope mahratta</i> Moore	<i>Cynodon dactylon</i>	No Flower, wild herb	Poaceae
12. <i>Ypthima hubneri</i> Kirby	<i>Bidens tripartite</i>	Pink Flower, wild herb	Asteraceae

Table 1 continued...

Table 1 continued...

	<i>Ageratum conyzoides</i>	Purple Flower, wild herb	Asteraceae
13. <i>Ypthima baldus baldus</i> (Fabr.)	<i>Lantana camara</i> Grasses	Yellow Flower, wild shrub	Verbenaceae
14. <i>Ypthima sakra nikaia</i> Moore	<i>Debregeasia hypoleuca</i> <i>Indigofera cassioides</i> <i>Ageratum conyzoides</i>	No Flower, wild shrub Brown Flower, wild shrub Purple Flower wild herb	Urticaceae Fabaceae Asteraceae
15. <i>Ypthima</i> spp.	Grasses		
16. <i>Melanitis phedima bela</i> Moore	Grasses		
17. <i>Melanitis leda ismene</i> (Cramer)	Grasses		
18. <i>Elymnias hypermnestra undularis</i> (Drury)	<i>Ageratum conyzoides</i> <i>Lantana camara</i> <i>Parthenium</i> sp.	Purple Flower, wild herb Pink Flower, wild herb White Flower, wild herb	Asteraceae Verbenaceae Asteraceae
FAMILY: NYMPHALIDAE			
1. <i>Athyma opalina</i> (Kollar)	Sun Flower <i>Argemone maxicana</i> <i>Cirsium wallichii</i>	Yellow Flower, Cultivated Purple Flower, wild shrub White Flower, wild herb	Asteraceae Astreaceae Astreaceae
2. <i>Neptis mahendra</i> Moore	<i>Hemilmonia</i> sp. <i>Lantana camara</i> Grasses <i>Cirsium wallichii</i>	Blue flower, wild shrub Yellow Flower, wild shrub White Flower, wild herb	Verbenaceae Verbenaceae Asteraceae
3. <i>Neptis hylas astola</i> (Moore)	<i>Lantana camara</i>	Yellow Flower, wild shrub	Verbenaceae
4. <i>Parathyma</i> sp.	<i>Cirsium wallichii</i> <i>Dicliptera bupleuroides</i>	White Flower, wild herb Yellow Flower, wild herb	Asteraceae Acanthaceae
5. <i>Pseudergolis wedah</i> (Kollar)	<i>Lantana camara</i>	Yellow Flower. wild shrub	Verbenaceae
6. <i>Hypolimnas bolina</i> (Linn.)	<i>Lantana camara</i>	Yellow Flower. wild shrub	Verbenaceae
7. <i>Hypolimnas misippus</i> (Linn.)	<i>Lantana camara</i>	Yellow Flower. wild shrub	Verbenaceae
8. <i>Kallima inachus</i> (Boisduval)	<i>Quercus</i> spp.		
9. <i>Junonia hierta</i> (Fabr.)	<i>Lotus corniculata</i> <i>Lotus</i> spp.	Yellow Flower wild herb Pink Flower Blue Flower, wild herb	Fabaceae Fabaceae Fabaceae
10. <i>Junonia orithyia</i> (Linn.)	Grasses		
11. <i>Junonia lemonias</i> (Linn.)	<i>Lantana camara</i>	Yellow Flower. wild shrub	Verbenaceae
12. <i>Junonia almana</i> (Linn.)	<i>Lantana camara</i>	Yellow Flower, wild shrub	Verbenaceae
13. <i>Junonia atlites</i> (Johanssen)	<i>Lantana camara</i>	Yellow Flower, wild shrub	Verbenaceae
14. <i>Precis iphita</i> (Cramer)	<i>Lantana camara</i>	Yellow Flower. wild shrub	Verbenaceae

Table 1 continued...

Table 1 continued...

15. <i>Cynthia cardui</i> (Linn.)	<i>Cirsium wallichii</i> <i>Coreopsis lanceolata</i> <i>Trifolium repens</i> <i>Cirsium arvensis</i>	White Flower, wild herb Yellow Flower, wild shrub White Flower, wild herb Purple Flower, wild shrub	Asteraceae Asteraceae Asteraceae Asteraceae
16. <i>Vanessa indica</i> (Herbst)	<i>Impatiens amphorata</i> <i>Cirsium wallichii</i> <i>Habeneria</i> sp.	Purple Flower, wild herb White Flower, wild herb Purple Flower, wild shrub	Balsaminaceae Asteraceae Orchidaceae
17. <i>Kaniska canace</i> (Linn.)	<i>Quercus</i> spp.		
18. <i>Aglais cashmirensis</i> (Kollar)	<i>Gnaphalium</i> sp. <i>Aster</i> sp. <i>Coreopsis lanceolata</i> <i>Trifolium repens</i> <i>Cirsium arvensis</i> <i>Aconitum tetrasepala</i> <i>Caltha palustris</i> <i>Geranium pretense</i> <i>Pimpinolla</i> sp. <i>Potentilla strossanguinea</i> <i>Ranunculus</i> sp. <i>Rosa webbiana</i> <i>Taraxacum officinale</i> <i>Thymus serpyllum</i>	Yellow Flower, wild herb Pink Flower, wild herb Yellow Flower, wild shrub White Flower, wild herb Purple Flower, wild shrub White Flower, wild herb Yellow Flower, wild herb Blue Flower, wild herb White Flower, wild herb Red Flower, wild herb Yellow Flower, wild herb Pink Flower, wild shrub Yellow Flower, wild herb Purple Flower, wild herb	Asteraceae Asteraceae Asteraceae Asteraceae Asteraceae Ranunculaceae Ranunculaceae Geraniaceae Apiaceae Rosaceae Ranunculaceae Rosaceae Asteraceae Lamiaceae
19. <i>Argyreus hyperbius</i> (Johanssen)	<i>Argemone maxicana</i> <i>Cirsium wallichii</i>	Purple Flower, wild shrub White Flower, wild shrub	Asteraceae Asteraceae
20. <i>Childrena childreni</i> (Gray)	<i>Argemone maxicana</i> <i>Cirsium wallichii</i>	Purple Flower, wild shrub White Flower, wild shrub	Asteraceae Asteraceae
21. <i>Fabriciana kamala</i> (Moore)	<i>Gnaphalium</i> sp. <i>Aster</i> sp.	Yellow Flower, wild herb Pink Flower, wild herb	Asteraceae Asteraceae
22. <i>Issoria lathonia</i> (Linn.)	<i>Gnaphalium</i> sp. <i>Aster</i> sp.	Yellow Flower, wild herb Pink Flower, wild herb	Asteraceae Asteraceae
23. <i>Phalanta phalantha</i> (Drury)	<i>Lantana camara</i>	Yellow Flower, wild shrub	Verbenaceae
24. <i>Ariadne merione</i> (Cramer)	<i>Lantana camara</i>	Yellow Flower, wild shrub	Verbenaceae
25. <i>Symbrenthia lilea khasiana</i> Moore	<i>Lantana camara</i>	Yellow Flower, wild shrub	Verbenaceae
26. <i>Symbrenthia hypselis contanole</i>	<i>Lantana camara</i>	Yellow Flower, wild shrub	Verbenaceae
27. <i>Euthalia phemius</i> (Doubleday)	<i>Lantana camara</i>	Yellow Flower, wild shrub	Verbenaceae
FAMILY: LYCAENIDAE			
1. <i>Castalius rosimon</i> (Fabr.)	<i>Parthenium</i> sp.	White flower, wild herb	
2. <i>Prosotas nora</i> Felder	<i>Sapium sabiferum</i>	Yellow Flower, wild herb	Euphorbiceae

Table 1 continued...

Table 1 continued...

	<i>Lantana camara</i> <i>Zizypus</i> sp.	Yellow Flower, wild shrub No Flower, wild shrub	Verbenaceae Rhamnaceae
3. <i>Syntarucus plinius</i> (Fabr.)	<i>Ageratum conyzoides</i>	Blue Flower, wild shrub	Asteraceae
4. <i>Lycaenopsis limbata</i>	<i>Berberis lyceum</i> <i>Berberis aristata</i> <i>Ageratum conyzoides</i> <i>Impatient sulcata</i> <i>Aster</i> sp. <i>Polygonium bistorta.</i> <i>Habenaria</i> spp. <i>Arterisia vulgaris</i> <i>Microneria</i> sp. <i>Cyanotis vaga</i>	No Flower, wild shrub No Flower, wild shrub Blue Flower, wild shrub Voilet Flower, wild herb Yellow Flower, wild herb Brown Flower, wild herb Purple Flower, wild herb Yellow Flower, wild shrub Pink Flower, wild herb Purple Flower, wild herb	Berberidaceae Berberidaceae Asteraceae Balsaminaceae Asteraceae Polygonaceae Orchidaceae Asteraceae Labiatae Commelinaceae
5. <i>Lycaenopsis transpectus</i> (Moore)	<i>Trifolium pretense</i> <i>Trifolium repens</i>	Purple Flower, wild herb White Flower, wild herb	Asteraceae Asteraceae
6. <i>Lycaenopsis</i> sp.	<i>Trifolium pretense</i> <i>Trifolium repens</i>	Purple Flower, wild herb White Flower, wild herb	Asteraceae Asteraceae
7. <i>Celastrina cardia dilecta</i> (Moore)	<i>Prunus persica</i> <i>Prunus domestica</i> <i>Rosa brunonii</i> <i>Gnaphalium</i> sp. <i>Ageratum conyzoidse</i> <i>Aster molliusculus</i> <i>Brassica campestris</i> <i>Delphinium denudatum</i> <i>Fagopyrum botrytis</i> <i>Lactuca</i> sp. <i>Solanum chaksoense</i> <i>Sonchus</i> sp. <i>Trifolium pretense</i> <i>Trifolium repens</i> <i>Physolaena praelata</i>	Pink Flower, Cultivated Pink Flower, wild shrub Pink Flower, wild shrub Yellow Flower, wild herb Blue Flower, wild herb White Flower, wild herb Yellow Flower, cultivated Blue Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb Purple Flower, wild herb White Flower, wild herb White Flower, wild shrub	Rosaceae Rosaceae Rosaceae Asteraceae Asteraceae Asteraceae Brassicaceae Ranunculaceae Polygonaceae Asteraceae Solanaceae Asteraceae Asteraceae Asteraceae Asteraceae Solanaceae
8. <i>Celastrina hugelii oreana</i> (Moore)	<i>Rosa brunonii</i> <i>Gnaphalium</i> sp. <i>Ageratum conyzoidse</i> <i>Desmodium elegans</i> <i>Aster molliusculus</i> <i>Brassica campestris</i> <i>Delphinium denudatum</i> <i>Fagopyrum botrytis</i> <i>Lactuca</i> sp. <i>Solanum chaksoense</i> <i>Sonchus</i> sp. <i>Trifolium pretense</i> <i>Trifolium repens</i> <i>Physolaena praelata</i>	Pink Flower, wild shrub Yellow Flower, wild herb Blue Flower, wild herb White Flower, wild shrub White Flower, wild herb Yellow Flower, cultivated Blue Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb Purple Flower, wild herb White Flower, wild herb White Flower, wild shrub	Rosaceae Asteraceae Asteraceae Papilionaceae Asteraceae Brassicaceae Ranunculaceae Polygonaceae Asteraceae Solanaceae Asteraceae Asteraceae Asteraceae Asteraceae Solanaceae

Table 1 continued...

Table 1 continued...

9. <i>Celastrina</i> spp.	<i>Trifolium pretense</i> <i>Trifolium repens</i>	Purple Flower, wild herb White Flower, wild herb	Asteraceae Asteraceae
10. <i>Freyeria putli</i> (Kollar)	<i>Lotus corniculata</i> <i>Lotus</i> spp.	Yellow Flower wild herb Blue Flower wild herb	Fabaceae Fabaceae
11. <i>Zizeeria</i> sp.	<i>Trifolium pretense</i> <i>Trifolium repens</i>	Purple Flower, wild herb White Flower, wild herb	Asteraceae Asteraceae
12. <i>Pseudozizeeria maha</i> (Kollar)	<i>Zizypus</i> sp. Grasses <i>Lotus corniculata</i> <i>Gnaphalium</i> sp. <i>Ageratum conyzoidse</i> <i>Cynodon dactylon</i> <i>Argemone maxicana</i> <i>Cirsium arvensis</i> <i>Oxalis corniculata</i> <i>Epilobium hirsutum</i>	No Flower, wild shrub Pink Flower, wild herb Yellow Flower, wild herb Blue Flower, wild herb No Flower, wild herb Purple Flower, wild herb White Flower, wild herb Yellow Flower, wild herb Pink Flower, wild shrub	Rhamnaceae Fabaceae Asteraceae Asteraceae Poaceae Asteraceae Asteraceae Oxalidaceae Ongraceae
13. <i>Catochrysops strabo</i> (Fabr.)	<i>Sapium sabiferum</i> <i>Lantana camara</i>	Yellow Flower, wild shrub No Flower, wild shrub	Euphorbiceae Verbenaceae
14. <i>Lampides boeticus</i> (Linn.)	<i>Bidens tripartite</i> <i>Gnaphalium</i> sp. <i>Aster</i> sp. <i>Ranunculutus muricatus</i> <i>Oxalis corniculata</i> <i>Thymus linearis</i> <i>Epilobium hirsutum</i> <i>Astragalus</i> sp. <i>Trifolium pratense</i> <i>Pisum sativum</i> <i>Malva sylvestris</i> <i>Trifolium repens</i> <i>Cicerbita</i> sp. <i>Convolvulus arvensis</i> <i>Coreopsis lanceolata</i> <i>Oenothera</i> sp. <i>Thymus serpyllum</i> <i>Trifolium repens</i> <i>Delphinium denudatum</i> <i>Fagopyrum botrytis</i> <i>Lactuca</i> sp. <i>Solanum chaksoense</i>	Yellow Flower, wild herb Yellow Flower, wild herb Yellow Flower, wild herb Yellow Flower, wild herb Yellow Flower, wild herb Pink Flower, wild herb Pink Flower, wild shrub Purple Flower, wild shrub Purple Flower, wild herb Pink, White Flower Purple Flower, wild shrub White Flower, wild herb Blue Flower, wild herb White Flower, wild herb Yellow Flower, wild shrub Yellow Flower, wild shrub Blue Flower, wild herb White Flower, wild herb Blue Flower, wild herb White Flower, wild shrub Yellow Flower, wild herb White Flower, wild shrub	Asteraceae Asteraceae Asteraceae Ranunculaceae Oxalidaceae Lamiaceae Onagraceae Fabaceae Asteraceae Fabaceae Malvaceae Asteraceae Asteraceae Convolvulaceae Asteraceae Onagraceae Lamiaceae Asteraceae Ranunculaceae Polygonaceae Asteraceae Solanaceae
15. <i>Jamides bochus stoll</i> (cramer)	<i>Lucas cephalotos</i>	Dry flower wild	Lamiaceae
16. <i>Nacaduba beroe gythion</i> Fruhstorfer	<i>Zizypus</i> sp.	No Flower, wild shrub	Rhamnaceae

Table 1 continued...

Table 1 continued...

16. <i>Nacaduba</i> spp.	<i>Trifolium pretense</i> <i>Trifolium repens</i>	Purple Flower, wild herb White Flower, wild herb	Asteraceae Asteraceae
18. <i>Heliophorus epicles indicus</i> Fruhstrofer	<i>Dodonia viscosa</i> <i>Lucas cephalotos</i> <i>Taraxacum officinale</i>	Yellow Flower, wild herb Yellow Flower, wild herb Yellow Flower, wild herb	Sapindaceae Lamiaceae Asteraceae
19. <i>Heliophorus brahma</i> Moore	<i>Ipomoea purpurea</i> <i>Oenothera roseus</i>	Purple Flower, wild herb Purple Flower, wild herb	Convolvulaceae Onagraceae
20. <i>Heliophorus hybrida</i> Tytler	<i>Desmodium elegans</i>	Yellow Flower, wild herb	
21. <i>Heliophorus androcles moorei</i> (Hewitson)	<i>Berberis lyceum</i> <i>Berberis aristata</i> <i>Ageratum conyzoides</i> <i>Tegetes erecta</i> <i>Arterisia vulgaris</i>	No Flower, wild shrub No Flower, wild shrub Blue Flower, wild shrub Yellow Flower cultivated Yellow Flower, wild shrub	Berberidaceae Berberidaceae Asteraceae Asteraceae Asteraceae
22. <i>Heliophorus sena</i> (Kollar)	<i>Berberis lyceum</i> <i>Berberis aristata</i> <i>Ageratum conyzoides</i> <i>Impatient sulcata</i> <i>Aster</i> sp. <i>Polygonium bistorta</i> <i>Habenaria</i> spp. <i>Arterisia vulgaris</i> <i>Ranuncululus muricatus</i> <i>Oxalis corniculata</i> <i>Thymus linearis</i> <i>Epilobium hirsutum</i>	No Flower, wild shrub No Flower, wild shrub Blue Flower, wild shrub Voilet Flower, wild herb Yellow Flower, wild herb Brown Flower wild herb Purple Flower, wild herb Yellow Flower, wild shrub Yellow Flower, wild herb Yellow Flower, wild herb Pink Flower, wild herb Pink Flower, wild shrub	Berberidaceae Berberidaceae Asteraceae Balsaminaceae Asteraceae Polygonaceae Orchidaceae Asteraceae Ranunculaceae Oxalidaceae Lamiaceae Ongraceae
23. <i>Curetis bulis</i> Westwood	<i>Trifolium pretense</i> <i>Trifolium repens</i>	Purple Flower, wild herb White Flower, wild herb	Asteraceae Asteraceae
24. <i>Virachola socrates</i> (Fabr.)	<i>Cirsium wallichii</i>	White Flower, wild shrub	Asteraceae
25. <i>Edales pandava</i> (Horsfield)	<i>Trifolium pretense</i> <i>Trifolium repens</i>	Purple Flower, wild herb White Flower, wild herb	Asteraceae Asteraceae
FAMILY: HESPERIIDAE			
1. <i>Celaenorrhinus leucocera</i> (Kollar)	<i>Argemone maxicana</i> <i>Cirsium wallichii</i>	Purple Flower, wild shrub White Flower, wild shrub	Asteraceae Asteraceae
2. <i>Caladenia dan</i> (Fabr.)	<i>Berberis aristata</i>	No Flower, wild shrub	Berberidaceae
3. <i>Caladenia</i> sp.	Akhe Unidentified Lun (3)	Yellow Fruit, wild shrub Purple Flower, wild herb	
4. <i>Spialia galba</i> (Fabr.)	<i>Jasminum</i> sp. <i>Randia tetraspermum</i>	Yellow flower, wild herb Wild fruit, shrub	Oleraceae Rubiceae
5. <i>Pelopidas</i> sp.	<i>Jasminum</i> sp.	Yellow flower, wild herb	Oleraceae
6. <i>Borbo cinnara</i> (Moore)	Grasses		
7. <i>Barois</i> sp.	Akhe Unidentified Lun(3)	Yellow Fruit, wild shrub Purple Flower, wild herb	Akhe Unidentified Lun (3)

Table 1 continued...

Table 1 continued...

8. <i>Hyarotis adrastus</i> (Cramer)	Akhe Unidentified Lun (3)	Yellow Fruit, wild shrub Purple Flower, wild herb	Akhe Unidentified Lun (3)
FAMILY : ERYCINIDAE			
1. <i>Libythea lepita</i> Moore	<i>Lantana camara</i> Grasses	Yellow Flower, wild shrub	Verbenaceae
2. <i>Dodona durga</i> (Kollar)	<i>Ranunculutus muricatus</i> <i>Oxalis corniculata</i> <i>Thymus linearis</i> <i>Epilobium hirsutum</i>	Yellow Flower, wild herb Yellow Flower, wild herb Pink Flower, wild herb Pink Flower, wild shrub	Ranunculaceae Oxalidaceae Lamiaceae Ongraceae
3. <i>Dodona eugenes</i> Bates	<i>Ranunculutus muricatus</i> <i>Oxalis corniculata</i> <i>Thymus linearis</i> <i>Epilobium hirsutum</i> <i>Commelina paludosa</i>	Yellow Flower, wild herb Yellow Flower, wild herb Pink Flower, wild herb Pink Flower, wild shrub Blue Flower, wild shrub	Ranunculaceae Oxalidaceae Lamiaceae Ongraceae Commelinaceae

Heliophorus androcles moorei (05). Among the pierids, *Colias electo fieldi* visited maximum number of plant species (29) followed by *Pieris brassicae nepalensis*, *Colias erate erate* (26 each), *Pieris canidia indica* (17) *Pontia daplidice moorei* (08) and *Delias belladonna horsfieldi* & *Terias hecabe fimbriata* (05 each). All the other species were also observed to visit on single plant species.

In family Nymphalidae, a total of 27 species were recorded during different seasons on different flowering plants. Of these, *Aglais cashmirensis* was found to visit maximum number of plant species (14). Observations were also made that *Cynthia cardui* mostly visited herbs of shorter heights whereas *Junonia orithya* visited on grasses (table 1).

During this study, 10 papilionids were found visiting on the flowers in the different altitude areas of Himachal Pradesh as flower visitors. Only one species, *Papilio polytes romulus* was collected from the plants of *Murraya koenigii* at the elevation of 700m., and all others species were mostly collected on the herb of *Argemone*

maxicana & *Cirsium wallichii*.

In the previous various studies, it had found that satyrids mostly visited on grasses, but in present study 18 species of butterflies were recorded on 21 species of flowering plants, majority of the species were attracted by the flowers of family Asteraceae followed by Fabaceae, Verbenaceae & Poaceae. *Lasiommata schakra schakra* visited maximum number of plant species (13), which is followed by *Callerbia scanda scanda* (06) and *Ypthima sakra nikaia*, *Aulocera saraswati*, *Elymnias hypermnestra* (03 each) (table1).

Moreover, recently the state of Himachal Pradesh has come under a strong threshold of development. As a result, several animal species are under tremendous stress because of increasing human population, deforestation, pollution, construction of river valley projects, etc. Many natural habitats have been over-exploited, degraded and even destroyed. Most of large animals in the area are highly endangered and are protected under the Indian Wildlife (Protection) Act, 1972. Conservation of already

depleted biological resources is perhaps the only option left to overcome this situation.

No conservation measure could be efficient in protecting these threatened and endangered species from extinction if we do not have any reliable information on the current status, species richness, habitat, habitats-use pattern and ecology of these butterflies.

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REFERENCES

- Jennerston O (1984) Flower visitation and pollination efficiency of some northern European butterflies. *Oecologica* (Berlin) **63**(1), 80-89.
- Julka J M, Tandon S K, Halder P and Shishodia M S (1982) Ecological observation on grasshopper (Orthoptera : Acridoidea) at Solan, Himachal Pradesh. *Oriental Insect* **16**(1), 63-75.
- Levin D A, Butler G D and Rubis D D (1967) Pollination of Sunflower by insects other than honey bees. *Jr. Econ. Ent.* **60**(5), 1481-1482.
- Mani M S (1986) *Butterflies of the Himalaya*. Oxford and I. B. H., New Delhi. 181 pp.
- Mehta H S, Sharma R M, Mitra B and Thakur M S (2003). A Preliminary Study on the butterflies of Himachal Pradesh as flower visitor and pollinators. *Annals of Entomology* **21**(1-2), 1-3.
- Oostermeiyer J G B and VanSwaay C A M (1998) The relationship between butterflies and environmental indicator value : a tool for conservation in a changing landscape. *Biol. Consev.* **86**(3), 27-280.
- Reddi S and Bai M (1984) Butterflies and Pollination Biology. *Proc. Indian Acad. Sci.* **93**(4), 391-396.
- Thakur M S and Mattu V K (2010) The Role of Butterflies as Flower Visitors and Pollinators in Shivalik Hills of Western Himalaya. *Asian J. Exp. Biol. Sci.* **1**(4), 822-825.
- Thakur M S and Bhardwaj S (2012) Study on diversity and host plants of butterflies in lower Shiwalik hills, Himachal Pradesh. *Int. J. Plant Sci.*
- Wynter-Blyth M A (1940) A list of butterflies of the Shimla hills. *J. Bombay Nat. Hist. Soc.* **41**(4), 716-741.
- Wynter-Blyth M A (1941-1947) A list of butterflies of the Shimla hills. *J. Bombay Nat. Hist. Soc.* **42**, 448; **43**, 672-673; **45**, 256-257; **46**, 735-736.
- Wynter-Blyth M A (1957) *Butterflies of the Indian region*. Today and Tomorrow's Printers and Publishers, New Delhi. 523pp.