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STUDY ON DIVERSITY AND HOST PLANTS OF BUTTERFLIES IN LOWER SHIWALIK HILLS, HIMACHAL PRADESH

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ABSTRCT : During present studies a total of 40 butterfly species were collected from different study sites of lower Shiwalk hills(extend from 29°-33° N latitude to 74°-80.5° E longitude, altitude 1500m), which belonged to six families i.e. Nymphalidae, Pieridae, Papilionidae, Lycaenidae, Satyridae and Riodinidae and thirty genera. The Nymphalidae family was the most diverse family in the study area having ten genera and followed by Lycaenidae family with eight genera. But the abundance of Pierids was more in the study area. During sampling of specimens in the study areas, a total of 91 plants belonging to 44 families were reported. A total 40 species of butterflies were collected as flower visitors on 91 species of flowering plants (garden, cultivated, semiwild and wild) in Shiwalik hills.

INTRODUCTION

Among insects, butterflies are suitable for ecological studies, as the taxonomy, geographic distribution and status of many species is relatively well known. Those insects, which are mostly phytophagous, serve as primary herbivores in the food chain. As many butterflies are food bio-indicators of the environment, they can be used to identify ecologically important landscapes for conservation purposes (Sudheendrakumar et al., 1999). Butterflies show distinct pattern of habitat utilization. The nature of vegetation is an important factor, which determines the dependence and survival of a species on a particular habitat. Being highly sensitive to environmental changes, they are easily affected by even relatively minor disturbances in the habitat so much that they have been considered as indicators of environmental quality (Williams and Gaston, 1998) and are also treated as indicators of the health of an ecosystem. The presence of butterflies emphasizes availability of larval food plants in great abundance.

Host plant is one that supplies food resources and substrate for certain insects or other faunal species. Host plants are of two types such as primary host plants (Nectar/food plants) and secondary host plants (Larval host plants). Butterfly host plants are those plants, on which specific butterfly species lay eggs, and caterpillars will then hatch and use plant as their sole food source. Though butterflies form the most important group of pollinators (4%).

MATERIALS AND METHODS

A present study was carried out in lower Shiwalik hills of Himachal Pradesh. Shiwalik hills symbolize one of the most fragile ecosystems and have been identified as one of the eight most degraded rains fed agro systems of the country. To know butterfly diversity and distribution, butterflies were sampled using the transect walk method (Pollard and Yates, 1993). Sampling was carried out in two rounds, one between January and May and the second between June and September. Five transects measuring 500 m each, were randomly marked for sampling. Each transect was surveyed two times, twice in each round. All butterflies seen within twenty metres on either side of the transect were recorded. Transects were walked between 10:00 AM hrs and 13:00 PM hrs which corresponds to the peak activity period for most butterflies. Butterfly species were categorized as ‘rare’, ‘uncommon’ and ‘common’ based on a total species occurrence in each site according to (Davidar et al., 1996).

To study the butterfly host plants, regular marked trails in different localities were transversed after regular intervals of fifteen days in the mornings and evenings. 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 was made on scientific lines. All the plant samples were identified and got authenticated at Forest Research Institute (F.R.I.) and Botanical Survey of India (B.S.I.) Dehradun. Butterflies were grouped into three feeding guilds based on literature and field observations. The three guilds were: Nectar-feeders, Fruit-feeders and Omni-feeders. Nectar-feeders primarily feed on floral nectar; fruit-feeders on rotting, alcohol-rich fruits and omni-feeders on both nectar and fruits, as well as on other resources such as animal and bird droppings, rotting carrion etc.

RESULTS AND DISCUSSION

During present studies a total of 40 butterfly species were collected from different study sites of lower Shiwalk hills, which belonged to six families i.e. Nymphalidae, Pieridae, Papilionidae, Lycaenidae, Satyridae and Riodinidae and thirty genera. The Nymphalidae family was the most diverse family in the study area having ten genera and followed by Lycaenidae family with eight genera. But the abundance of Pierids was more in the study area, *Pieris brassicae nepalensis* was most abundant followed by *Pieris canidia indica* and *Pieris napi, Colias erate erate* and *Colias electo fieldi* was also very common and present in large numbers. *Artemissia* sp., *Vindula erota erota, Limentis trivena, Childrena children, Junonia atlites* and *Junonia almana* were rare in the study area, as they only appeared during transect walk in a few numbers or almost with one or two specimens each. Rest of butterflies were uncommon, common and fond hovering here and there in the study areas during the transect walk. Most of the studied butterflies were nectar feeders when their guilds were studied. Some butterflies like *Junonia atilites, Junonia almana, Gandaca harina, Mycalesis mineus mineus, Ypthima asterope mahratta ,Ypthima ceylonica hubneri, Terias hecabe fimbriata* and *Terias laeta laeta* were found both nectar feeders and fruit feeders as well. *Papilo polyctor, P. polytes romulus, Papilio demolus demolus Heliophorus sena, Childrena children, Symbrithia niphanda* and *Phalanta phalantha* were found omni feeders. They were also seen in mud puddles for their water and mineral collection (Table1).

During sampling of specimens in the study areas, a total of 91 plants belonging to 44 families were reported. A total 40 species of butterflies were collected as flower visitors on 91 species of flowering plants (garden, cultivated, semiwild and wild) in Shiwalik hills. Species such as *Mycaelis* sp., *Ypthima astrope* and *Eurem*a sp. that were encountered in bait traps and *Vindula erota* and *Papilio* spp. that were encountered in transects. These plants were grouped in to herbs, shrubs, scrubs, lianas, ivies and trees. The habitat/vegetation types were also recorded. These habitat/vegetation types were pine forests, mixed tree forests, grass lands and agriculture lands/cropland. It has also been observed that the occurrence and abundance of butterflies was more in Agriculture /Cropland and grass land followed by mixed tree forests. But in pure pine forests, their occurrence was very few. Only *Papilo polyctor* and some *Papilo* spp. were found in pure pine forests in the study areas. *Pieris brassicae nepalensis, Pieris canidia indica* and *Pieris napi* were present mostly in agriculture/croplands (*Brassica compestris* and *Triticum aestivumi* fields). *Neptis hylas astola* was very common in grass lands where as *Vindula erota* and *Limentis trivena* were seen in open grass lands and mixed tree forests (Near ravines and rivulets). The dominant family in the study sites was Asteraceae as it is representing maximum number of genera (8) and species (8) of plants, followed by Lamiaceae, Solanaceae, Rosaceae (7) in second position Fabaceae, Acanthaceae, Ranunculaceae (3-4) in third position and rest of families in fourth position(1-2) (Table 2).

It has been observed that the number of butterflies decreased from natural vegetation to domestic vegetation. Among the various habitat characteristics, canopy cover emerged as a major determinant of species richness and abundance. However, this could not be related to shade categories because canopy cover was not significantly different among them. The observed results may hold good only for the dry season because climatic conditions and food-plant availability among shade types may change after the monsoon. Most butterfly species appear to be tolerant of habitat changes associated with different shade types.

Table 1: Diversity and Distribution of butterflies in lower Shiwalik hills, Himachal Pradesh

Sl. No.	Family	Name of Butterflies	*Occurrence	#Butterfly Guild
1	**Nymphalidae**	*Artemissia sp.*	*R*	NF
		Neptis hylas astola Fabr.	*C*	NF
		Junonia atlites Linn.	*R*	NF/FF
		Junonia almana (Linn.)	*R*	NF/FF
		Vindula erota erota Fabr.	*R*	NF
		Limentis trivena Moore	*R*	FF
		Childrena childreni Gray	*R*	OF
		Symbrinthia niphanda Moore	*UC*	NF/OF
		Phalanta phalantha Drury	*C*	OF/NF
		Pantoporia sp.	*C*	NF
		Precis iphita (Cramer)	*UC*	NF
2	**Pieridae**	*Terias blenda Wallace*	*C*	NF
		Pieris canidia indica Sparrman	*C*	NF
		P.brassicae nepalensis Linn.	*C*	NF
		Pieris napi Linn.	*C*	NF
		Ixias marianne (Cramer)	*C*	NF
		Ixias pyrene kausala (Moore)	*C*	NF
		Catopsilia crocale Cramer	*C*	NF
		Catopsilia pyranthe (Linn.)	*C*	NF
		Terias laeta laeta (Boisduval)	*C*	NF/FF
		Terias hecabe fimbriata (Wallace)	*C*	NF/FF
		Colias erate erate (Esper)	*C*	NF
		Colias electo fieldi Fabr.	*C*	NF
		Gandaca harina Horsefield	*UC*	NF/FF
3	**Papilionidae**	*Papilio polytes romulus CramerPapilionidae*	*UC*	NF/OF
		Papilio demoleus demoleus Linn.	*UC*	NF/OF
		Graphium sarpedon luctatius Fruhst.	*UC*	NF
		Papilio polyctor Biosduval	*UC*	NF/OF
4	**Satyridae**	*Mycalesis mineus mineus (Linn.)Satyridae*	*UC*	NF/FF
		Ypthima asterope mahratta Moore	*C*	NF/FF
		Ypthima ceylonica hubneri Kirby	*UC*	NF/FF
5.	**Lycaenidae**	*Castalius rosimon (Fabr.)*	*C*	NF
		Tarucus nara (Kollar)	*UC*	NF
		Freyeria putli (Kollar)	*C*	NF
		Pseudozizeeria maha (Kollar)	*C*	NF
		Prosotas nora Felder	*C*	NF
		Charana jalindra indra Moore	*C*	NF/OF
		Heliophorus sena Evans	*C*	NF/OF
		Lycaena pavana Linn.	*C*	NF
6.	**Riodinidae**	*Dodona durga Kollar*	*C*	NF

*C= Common UC= Uncommon R= Rare # NF= Nectar Feeder FF = Fruit Feeder OF= Omni Feeder

Table 2: List of Flower Visiting Butterflies of Lower Shiwalik Hills, H.P.

FAUNA		FLORA			
Family	**Species**	**Species**	**Family**	**Habit**	**Habitat**
Nymphalidae	*Artemissia* sp.	*Adhatoda vasica* Nees.	Acanthaceae	Shrub	MTF,GL,PF
		Andrographis paniculata (Burm.f.)	Acanthaceae	Herb	MTF,GL
	Neptis hylas astola Fabr	*Dicliptera bupleuroides Nees*	*Acanthaceae*	Herb	GL
		Achyranthes aspera L.	*Amaranthaceae*	Herb	GL
		Urginia indica Kunth.	*Amaryllidaceae*	Herb	GL
	Junonia atlites Linn.	*Rhus cotinus L.*	*Anacardiaceae*	Shrub	MTF
		Rhus succedanea L.	*Anacardiaceae*	Tree	MTF
		Crassa aphaca L.	*Apocyanaceae*	Shrub	GL,MTF,PF
		Asparagus officinalis L.	*Asparagaceae*	Ivy	GL,MTF
	Junonia almana (Linn.)	*Asparagus adscendens* Roxb.	Asparagaceae	Herb	GL,MTF
		Artemisia scoparia Waldst.	Asteraceae	Shrub	GL,MTF
		Bidens tripartite L.	Asteraceae	Herb	GL
		Erigeron linifolius Willd.	Asteraceae	Herb	GL
		Gnaphalium luteoalbum L.	Asteraceae	Herb	GL
	Vindula erota erota Fabr.	*Inula royleana* DC.	Asteraceae	Herb	GL
		Launea nudicaulis Less.	Asteraceae	Herb	GL
	Limentis trivena Moore	*Morina longifolia* Wall.	Asteraceae	Herb	GL
		Parthenium hysterophorus L.	Asteraceae	Herb	GL,AL
	Childrena childreni Gray	*Spilanthes acmela* L.	Asteraceae	Herb	GL, AL,
		Berberis lyceum Royle.	Berberidaceae	Shrub	MTF
		Berberis aristata DC.	Berberidiaceae	Shrub	MTF,GL
		Terminaliabellerica (Gaertn.)	Boraginaceae	Tree	MTF,GL
					MTF
	Symbrinthia niphanda Moore	*Celastrus paniculatas* Willd.	Celalustraceae	Herb	MTF,GL,AL
		Chenopodium album L.	Chenopodiaceae	Liana	AL
		Commelina benghalensis L.	Commelinaceae	Herb	AL
	Phalanta phalantha Drury	*Desmodium gyrans* DC.	Fabaceae	Herb	GL
		Indigofera hebepetala Benth.	Fabaceae	Shrub	GL
		Albizia chinensis (Osbeck)	Fabaceae	Tree	MTF, GL, AL
	Pantoporia sp.	*Ficus palmate* Forsk.	Fagaceae	Tree	MTF,AL,GL
		Fumaria sp. L.	Fumariaceae	Herb	AL,GL
		Geranium sp. L.	Geraniaceae	Herb	GL
	Precis iphita (Cramer)	*Impatiens sulcata* Wall.	Geraniaceae	Herb	AL,GL
		Hydrangea macrophylla L.	Hydrangeaceae	Shrub	AL
		Hypericum cernnum Roxb.	Hypericaceae	Shrub	(Domestic)
					GL
Pieridae	*Terias blenda* Wallace	*Colebrookia oppositifolia* Sm.	Lamiacaeae	Shrub	GL,AL

	Pieris canidia indica Sparrman	*Brassica compestris* L. *Opuntia ovata* Mill. *Bauhinia variegate* L.	Brassicaceae Cactaceae Caesalpiniaceae	Herb Succul Shrub	AL GL,MTF MTF
	P.brassicae nepalensis Linn.	*Brassica compestris* L. *Opuntia ovata* Mill. *Bauhinia variegate* L. *Cannabis sativa* L. *Dianthus caryophyllus* L.	Brassicaceae Cactaceae Caesalpiniaceae Canabinaceae Caryophyllaceae	Herb Succul Shrub Tree Shrub	AL GL,MTF MTF GL,AL AL (Domestic)
	Pieris napi Linn.	*Plectranthus rugosus* Wall. *Scutellaria angulosa* Benth.	Lamiaceae Lamiaceae	Shrub Shrub	GL GL
	Ixias marianne (Cramer)	*Prinsepia utilis* Royle *Prunus persica* L. *Pyrus cerasoides* Buch.-Ham. *Pyrus pashia* Buch.-Ham. *Rosa microphylla* Lindl. *Rosa moschata* Mill.	Rosaceae Rosaceae Rosaceae Rosaceae Rosaceae Rosaceae	Shrub Tree Tree Tree Scrub Liana	AL,GL AL AL,GL AL,GL,MTF GL GL
	Ixias pyrene kausala (Moore)	*Plumbago zeylanica* L. *Lantana camara* L. *Viola serpens* L.	Plumbaginaceae Vebenaceae Violaceae	Shrub Shrub Herb	GL,MTF,AL GL, MTF GL,MTF,PF
	Catopsilia crocale Cramer	*Acacia catechu* Willd. *Albizia lebbeck* Benth.	Mimosaceae Mimosaceae	Tree Tree	MTF,GL MTF,GL
	Catopsilia pyranthe (Linn.)	*Acacia catechu* Willd. *Albizia lebbeck* Benth.	Mimosaceae Mimosaceae	Tree Tree	MTF,GL MTF,GL
	Terias laeta laeta (Boisduval)	*Solanum erianthum* D.Don *Withania somnifera* L. *Grevia optiva* L. *Celtis australis* L.	Solanaceae Solanaceae Tiliaceae Ulmaceae	Shrub Shrub Tree Tree	GL,AL,MTF AL AL,GL,MTF MTF, GL, AL
	Terias hecabe fimbriata (Wallace)	*Syzygium cumini* L. *Jasminum dispermum* Wall. *Jasminum humile* L. *Lantana camara*	Myrtaceae Oleaceae Oleaceae Verbenaceae	Tree Ivy Ivy Tree	GL GL,MTF GL,MTF PF
	Colias erate erate (Esper)	*Zanthoxylum armatum* DC. *Datura stramonium* L. *Nicotiana tabacum* L.	Rutaceae Solanaceae Solanaceae	Scrub Scrub Shrub	GL,MTF GL,AL AL
	Colias electo fieldi Fabr.	*Zanthoxylum armatum* DC. *Datura stramonium* L. *Nicotiana tabacum* L.	Rutaceae Solanaceae Solanaceae	Scrub Scrub Shrub	GL,MTF GL,AL AL
	Gandaca harina Horsefield	*Solanum surathense* Burm.	Solanaceae	Shrub	GL

Papilionidae	*Papilio polytes romulus* Cramer	*Brassica compestris* L. *Zanthoxylum armatum* DC.	Brassicaceae Rutaceae	Herb Scrub	AL GL,MTF
	Papilio demoleus demoleus Linn.	*Brassica compestris* L. *Zanthoxylum armatum* DC	Brassicaceae Rutaceae	Herb Scrub	AL GL,MTF
	Graphium sarpedon luctatius Fruhst.	*Acacia catechu* Willd.	Mimosaceae	Tree	MTF,GL
	Papilio polyctor Biosduval	*Solanum surathense* Burm.	Solanaceae	Shrub	GL
Satyridae	*Mycalesis mineus mineus* (Linn.)	*Zanthoxylum armatum* DC. *Datura stramonium* L. *Nicotiana tabacum* L.	Rutaceae Solanaceae Solanaceae	Scrub Scrub Shrub	GL,MTF GL,AL AL
	Ypthima asterope mahratta Moore	*Debregeasia hypoleuca* Wedd. *Vitex negundo* L. *Duranta repens* L.	Urticaceae Verbenaceae Verbenaceae	Scrub Scrub shrub	GL,MTF AL,GL,MTF AL, GL
	Ypthima ceylonica hubneri Kirby	*Debregeasia hypoleuca* Wedd. *Duranta repens* L.	Urticaceae Verbenaceae	Scrub Scrub	GL,MTF AL,GL,MTF
Lycaenidae	*Castalius rosimon* (Fabr.)	*Ajuga parviflora* Benth. *Brunella vulgaris* L. *Ocimum basilicum* L.	Labiatae /Lamiacaea Lamiaceae	Herb Herb Herb	AL,GL GL AL
	Tarucus nara (Kollar)	*Salvia coccinea* Juss. ex. Murr.*Mimosa pudica* L.	Lamiaceae Mimosaceae	Herb Herb	AL GL
	Freyeria putli (Kollar)	*Euphorbia antiquorum* L. *Euphorbia hirta* L.	Euphorbiaceae Euphorbiaceae	Herb Shrub	GL,MTF GL,AL
	Pseudozizeeria maha (Kollar)	*Euphorbia antiquorum* L. *Euphorbia hirta* L.	Euphorbiaceae Euphorbiaceae	Herb Shrub	GL,MTF GL,AL
	Prosotas nora Felder	*Plantago tibetica* Hook. F. *Solanum nigrum* L.	Plantaginaceae Solanaceae	Herb Herb	GL GL,AL
	Charana jalindra indra Moore	*Polygonum alatum* Buch.-Ham. *Rumex hestatus* Don *Rumex obtusifolia* Willd. *Clematis connata* DC. *Ranunculus laetus* Wall. *Thalictrum foliolosum* DC. *Fragaria indica* Andr.	Polygonaceae Polygonaceae Polygonaceae Ranunculaceae Ranunculaceae Ranunculaceae Rosaceae	Herb Herb Herb Ivy Herb Herb Herb	GL AL,GL GL,AL MTF,GL AL,GL GL,MTF GL
	Heliophorus sena Evans	*Galium rotundifolium* L. *Rubia cordifolia* L.	Rubiaceae Rubiaceae	Herb Herb	GL,AL GL,MTF
	Lycaena pavana Linn.	*Aloe barbedensis* Mill. *Narcissus poeticum* L. *Malva verticillata* L. *Tinospora cordifolia* DC.	Liliaceae Liliaceae Malvaceae Menispermaceae	Herb Herb Herb Climbe r herb	GL AL (Domestic) GL,AL GL,MTF
Riodinidae	*Dodona durga* Kollar	*Physalis minima* L.	Solanaceae	Herb	GL,AL

AL: Agriculture land/Cropland GL: Grass land MTF: Mixed Tree Forest PF: Pine Forest

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