



# **Fauna of Western Himalaya**

**(Part-2)**

**Himachal Pradesh**

**Zoological Survey of India**



# **Fauna of Western Himalaya**

## **(Part-2)**

### **Himachal Pradesh**

*Edited by the Director, Zoological Survey of India, Kolkata*



**Zoological Survey of India**  
**Kolkata**

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# Fauna of Western Himalaya

## Part - 2

2005

1-359

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## **FAUNA OF WESTERN HIMALAYA — AN OVERVIEW**

**H.S. MEHTA**

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### **INTRODUCTION**

The hill state of Himachal Pradesh with an area of about 55.673 sq kms is nearly 10.54 percentage of the Himalayan land mass. The Himalayas due to its varied physiography and altitude ranging from foot hills to the highest peaks of Mount Everest are considered as one of the hotspots of 15 Mega biodiversity centers in the world. The state thus falls within the north-west portion of the Himalayas with a length of 300 kms and width of 80 kms approximately. The region is bifurcated into eastern and western part by one of the three antecedent river *viz.*, the Sutluj. The Sutluj river is the only river which cuts across the Himalayas at right angles to cross over to southern part whereas other two antecedent rivers like the Indus and Brahmaputra to flow some distance in longitudinal valleys before finding gaps near Gilgit syntax and north of Dibrugarh respectively to enter into plains of Pakistan and India. This part of north west Himalaya forms a gigantic physical barrier between the high plateau of Tibet and Central Asia and Indian plains.

The area is with net works of perennial rivers like the Chander bhaga, the Ravi, the Beas, the Sutluj and the Yamuna whereas seasonal rivers originating from Shiwalik hills are Markanda and Ghaggar. These hills are characterised by important hill ranges like Shiwalik, (Lesser Himalayas), Duladhar (Middle Himalayan), Pir Panjal (Great Himalayan), Ladakh, Karakorum (Trans Himalayan), which acts as barriers and filtration zones for the migration of fauna and flora. There are number of glaciers at the sources of rivers and most of these are generally unknown. A few large select glaciers of the Pleistocenes are also found. The important ones are : Brama, Tuan, Sissu, Sonapani and Bara Shingri in Lahaul. The diversified ecological niches like torrential streams, high and low land lakes, hot springs, reservoirs, thick forests coupled with highly specialised and complex environmental and physical factors like temperature, humidity and availability of oxygen at different altitudes have greatly influenced the diversity and distribution of fauna. The morphological and anatomical modification in commensurate with the hostile environment in the living laboratories of this part of the Himalayas have been rise to evolve new species and varieties for the fittest of the survival. The fauna of higher elevations in the state is Palaearctic, the dominant elements being derived from Turkemenian and eastern

extensions of Mediterranean subregions, the oriental species from the east are also represented in the foot hills and very rarely in high hills as in the case of odanate insects where two species of oriental regions are present in high altitudes. The fauna of various regions across the important ranges is significantly important because of high degree of endemism and adaptations to hostile high altitude environment. The Shiwalik Himalayas once harboured rich forests and animal life in the geological past as evidenced by availability of fossils in the region. In the Shiwalik zone there are some important lakes like Renuka, Revolsar and man made lakes like Gobind Sagar and Pong Dam while the later lakes attracts thousands of migratory birds. The animals distributed in Great Himalayas and Trans Himalayas are also unique with limited and restricted distribution.

In view of the importance of distribution of animals of the region various prominent scientists of the past contributed much towards faunal diversity but the studies were confined only to limited groups of animal kingdom. The information was scattered and sporadic, however, some groups of invertebrates like insects of orders Lepidoptera, Coleoptera Hemiptera, Diptera were represented well in Fauna of India whereas in higher vertebrates like fishes, amphibians, reptiles, aves and mammals some information also exists in above Fauna of British India series. The present document is a part of Faunal diversity of Western Himalaya, Himalayan Ecosystem series where part-1 is dealing with the states of Uttar Pradesh and Uttaranchal which enumerates nearly 2734 species belonging to 33 groups of invertebrates and vertebrates of animal kingdom. More than 50% of the invertebrated species are new records for the area. The information will provide additional light on the zoogeographical studies. The details of the fauna of Western Himalaya (Part-2), which deals with Himachal Pradesh is as follows :

<b>Animal Groups</b>	<b>Number of Species of Present Document</b>	<b>Number of species of Renuka wetland Document</b>
PROTOZOA	84	
PORIFERA		01
CNIDARIA		01
BRYOZOA		01
PLANT & SOIL NEMATODES	127	
ANNELIDA		
Oligochaeta	46	
Hirudinea		04
ARTHROPODA		
Crustacea		04
Aracnida (Areneae)		13

<b>Animal Groups</b>	<b>Number of Species of Present Document</b>	<b>Number of species of Renuka wetland Document</b>
Collembola	9	
Chilopoda	19	
<b>INSECTA</b>		
Odonata	77	
Lepidoptera (Butterflies)	268	
Lepidoptera (Moth)	184	
Hemiptera	372	
Hymenoptera	319	
Dermaptera	30	
Coleoptera	167	
Plecoptera	20	
Tics (Acari)	30	
Soil dwelling mites	46	
Parasitic mites	48	
Mantoidia		07
Orthoptera		50
Diptera		14
Ephemeroptera		06
Hemiptera (Aquatic)		10
Coleoptera (Aquatic)		20
<b>VERTEBRATES</b>		
Pisces	104	
Amphibia	17	
Reptilia		14
Aves	447	
Mammalia	107	
<b>Total</b>	<b>2542</b>	<b>141</b>

## PHYSIOGRAPHY

The western Himalaya falling under state of Himachal Pradesh is a part of 2300 kms of the main Himalaya with a width ranging from 1400-400 kms with a varying altitude of 350-6975 meters above main sea level which increases from west to east and south-north. This part of western Himalaya is characterized important hill ranges like Shiwalik, Dhauladhar, PirPanjal, Great Himalaya, Zaskar and Ladakh. These hills are with with a net work of streams and streamlets draining into main mighty rivers of the state with wide range of ecological features *viz.*, pools & puddles, torrential streams, streams with gentle flow, lakes and reservoirs giving rise to diversity of fauna and flora. due to varying altitudes coupled with varying temperature from sub zero to  $-30-70$  degrees C has made the biotic life to exist and fit into into the environment with challenging and morphological and anatomical evolving adaptations and modifications.

**1.1. Geographical Locations :** The state of Himachal Pradesh is located between 30 22' 40 N. Lat to 30 12' 4" N. Lat. and 75 47'55" East Longitude to 79 4' 20" E. longitude with an area of 55,673 sq. kms which is nearly 10.54 % of the total Himalayan land mass.. The land locked state is bordered by Jammu & Kashmir in north, Punjab and Haryana in south-west and northern part of Uttaranchal in south-east. In north-east, the state form the international boundary with Tibetan part of China.

**1.2. Administrative Divisions :** The state is administratively divided into 12 districts *viz.*, Bilaspur, Chamba, Hamirpur, Kangra Kinnaur, Kullu, Lahaul & Spiti, Mandi, Shimla, Solan Sirmour and Una. The neighbouring districts of states Jammu & Kashmir, Punjab, Haryana, Union Territory, Chandigarh, and Uttaranchal are Kathua, Udhampur; Gurdaspur, Hoshiarpur, Nawanshar, Roop Nagar; Ambala Yamuna Nagar; Dehra Dun respectively. Map-1 shows different districts and adjoining areas.

**1.3. Physiographic zones :** The Western Himalayas of Himachal Pradesh shows following distinct physiographic zones i) Shiwalik zone, ii) Lower Himalayan zone, iii) Higher Himalayan zone, and iv) Trans Himalayan zone.

**1.4. Climate :** The climate varies between scorching heat and arctic cold with intermediate subtropical, temperate and alpine grades, depending upon various factors. At higher elevations, it remains cold throughout the year but at lower altitudes four main seasons are recognized : winter (December to February), pre-monsoon or dry Summer (March to June), monsoon (July to September) and post monsoon (October to November). Average rainfall ranges from 1000–2500 mm; the maximum precipitation on the lower slopes of the Dhauladhar in Kangra District. Areas beyond the Pir Panjal Range experience an arid climate with winter temperature plunging to  $-30$  to  $-40^{\circ}\text{C}$ . Precipitation at higher elevations is mostly due to snow occurring during winter. Temperature varies with the location, elevation and the topography of the mountain ranges. For every 1000 m of ascent, the mean temperature drops by as much as  $6^{\circ}\text{C}$ .

**1.5. Forests** : Natural Vegetation in the hills is classified into five broad types of forests.

**1.5.1. Tropical Forests** (Confined to foot hills) : These are of two types *viz.* Scrub of *Acacia and Zizyphus* and dry deciduous forests of Sal (*Shorea robusta*); the latter is best developed in Poanta area of District Sirmour.

**1.5.2. Sub Tropical Forests** (500—1800 m) : Two types of forests can be distinguished a) Sub Tropical Evergreen Forests (Below 1200m) along river Beas dominated with species of *Terminalia, Albizzia, Olea* etc; b) Sub Tropical Forests of Cheer Pine (*Pinus roxburghii*) (Upto 1800m).

**1.5.3. Temperate Forests** (1500-1800 m) : They are distinguished into two subtypes. The main constituent are three species of Oaks (*Quercus incana, Q. Dilatata, Q. semicarpifolia*), Deodhar (*Cedrus deodara*), Fir (*Abies pindrow*), blue pine (*Pinus wallichiana*) and horse chestnut (*Aesculus indica*). The Himalayan dry temperate subtype of Holm Oak (*Quercus ilex*) and edible pine (*Pinus gerardiana*) is best developed at 2000-3000 m in the Trans Himalyan valley of Chnandra-Bhaga river and upper valley of Sutlej river in Kinnaur district of Himachal Pradesh and in the Kashmir Valley.

**1.6. Lakes and Reservoirs** : The state of Himachal Pradesh is bestowed with several natural, fresh water lakes and few large man made reservoirs. These are as an important support system and as habitats for birds, fishes and other aquatic life. Some of the natural lakes are distributed among different climatic zones of Himachal Pradesh *viz.*, Khajjar, Kunteri, Kunarbaha and Riwalisar in Temperate zone (1000-3000 m) and Renuka and Saketi in Sub Tropical Zone (Below 1000 m). Some large reservoirs have been formed due to damming of rivers. E.g. Pong and Pandoh on river Beas and Gobind Sagar on river Sutlej. Renuka lake, Pong Dam and Gobind Sagar are important wetlands which are biologically productive and of national importance.

**1.7. Pastures** : Pastures encompass more area than other ecosystem in North-West Himalaya providing nutrient rich forage for grazing livestock and wildlife. As much as 30% of the geographical area of Himachal Pradesh is under Pastures.

**1.8. Agro-Ecosystem** : The agroecosystem in North West Himalaya, once covered with natural vegetation are the outcome of permanent changes of the ecosystem. Nearly 17.5% and 3.4% of the geographical area of Himachal Pradesh are under Agriculture and Horticulture respectively.

**ACKNOWLEDGEMENTS**

My sincere gratitude is to Dr, J.R.B. Alfred, Director, Zoological Survey of India, Kolkata and Dr. Arun Kumar, Additional Director, Zoological Survey of India, Northern Regional Station, Dehra Dun for the laboratory facilities.

My thanks are to Dr. J.M. Julka, Joint Director (Retd.) and Emeritus Scientist (Ex.), HAZFS, Zoological Survey of India, Solan for the help and encouragements for the preparation of this document. I am thankful to the authors who have whole heartedly contributed to this document.

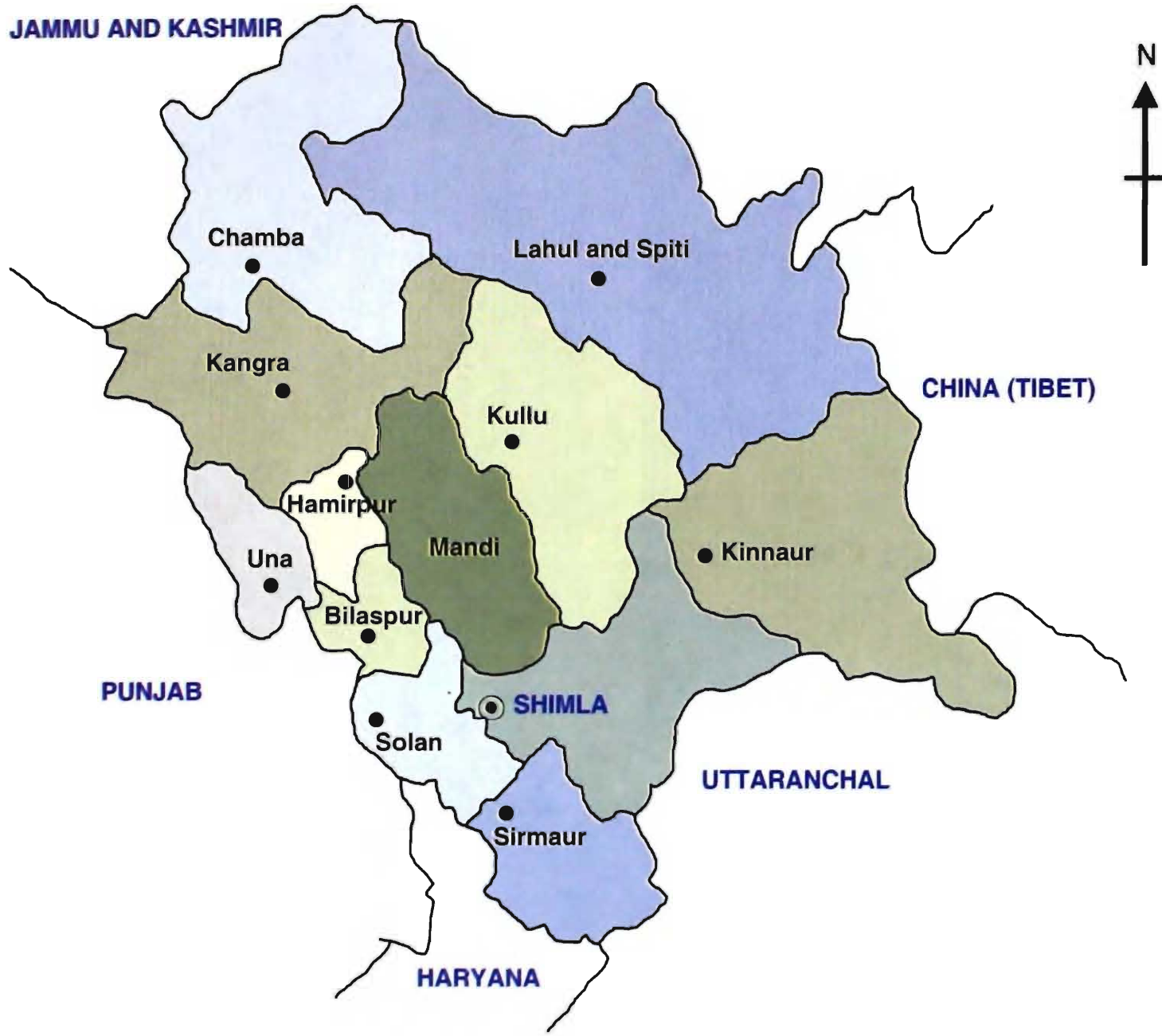
I am thankful to the staff of HAZFS, Zoological Survey of India, Solan especially Dr. R. Paliwal, Sr. Zool. Asstt. Shri T.R. Sharma Sr. Zool. Asstt. and Shri Kulwant Singh, Photographer for the necessary cooperation for the collection of the fauna and for some photographs used in the book.

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PLATE - I



Map of Himachal Pradesh (Western Himalayas)

**PLATE - II**



A view of Shivalik Hills



A view of Shivalik Hills with seasonal nallahs

**PLATE - III**



A typical vegetation of Elephant grass in Shiwalik Hills



*Sacharum bengalensis* in Shiwalik Hills



The river Beas passing through Shiwalik Hills



A view of Shiwalik Hills with sparse vegetation



A view of Pong Dam wetland

**PLATE - IV**

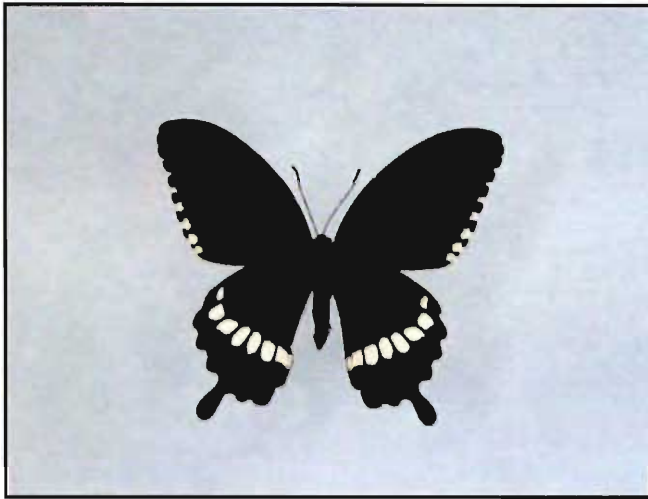


*A High altitude pasture near Rohtang Pass (Himachal Pradesh)*



*A view of trans Himalayas in Spiti areas*

PLATE - V



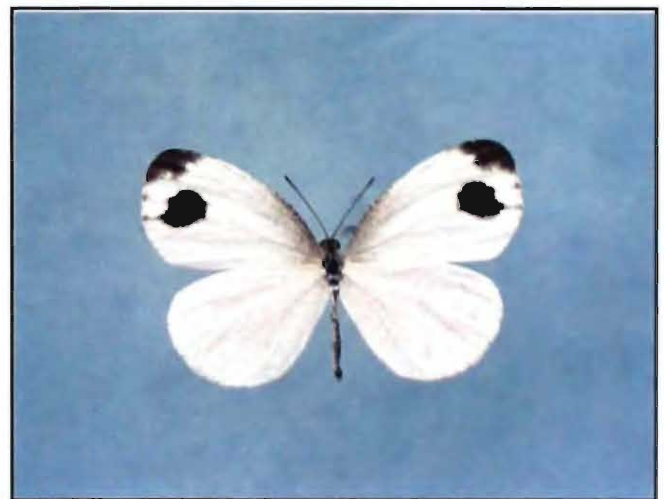
*Papilio polytes romulus* UP



*Papilio demoleus demoleus* UP



*Ixias marianne* UP male



*Leptosia nina nina* UP



*Cepora nerissa phryne* UP male



*Colias erate erate* UP female

**PLATE - VI**



*Deliastichus eucharis* UN female



*Pieris canidia indica* UP male



*Pieris canidia indica* UP female



*Pontia daplidice* UP female

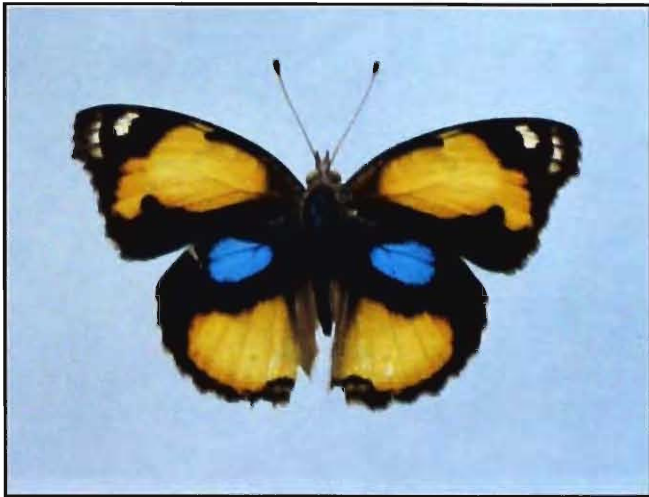


*Neptis hylas astola* UP



*Hypolimnias bolina* UP male

PLATE - VII



*Precis hierta* UP male



*Polyura athamas* UP



*Cynthia indica* UP



*Phalanta phalantha* UP



*Kallima inachus* UP



*Precis orithya* UP

**PLATE - VIII**



*Precis lemonias* UP



*Catochrysops strabo* UP



*Heliophorus sena* UP



*Spindasis vulcanus* UN



*Lampides boeticus* UP



*Danaus chrysippus chrysippus* UP FEMALE

**PLATE - IX**



*Agathia lycaenaria* (Kollar) (Moth)



*Agathia hilarata* (Guenee) MOTH



*Hyposidra talaca* Walker MOTH



*Comibaena cassidara* (Guenee) MOTH



*Pingasa pseudoterpnaria* (Guenee) MOTH



*Rhombohista devaxata* (Walker) MOTH

**PLATE - X**



*Crocothemis s. servilia* (Drury)



*Orthetrum s. sabina* (Drory)



*Ictinogomphus rapax* (Rambur)



*Palpoleura s. sexmaculata* (Fabr.)



*Tramea virginia* (Rmb.)



*Rhyotemis v. variegata* (Linnaeus)

**PLATE - XI**



*Rana cyanophlyctis* Schneider



*Rana tigerina* Daudin



*Bufo melanostictus* Schneider



*Rana liebigeri* Gunther



*Bufo himalaynus* Boulenger



*Bufo viridis* Laurenti

**PLATE - XII**



*Garra gotyla gotyla* (Gray) with Sucker



Mahaseer, *Torputitora* (Ham.)

**PLATE - XIII**



Himalayan Fox (*Vulpes vulpes*, (Linnaeus))



Neel Gai, *Boselephus tragocamelus* (Pallas)

**PLATE - XIV**



Tibetan Wild Ass *Equus kiang*, Moorcraft



Himalayan Marmot *Marmota himalayana* (Hodgson)

**PLATE - XV**



Siberian Weasel *Mustela sibirica* Pallas

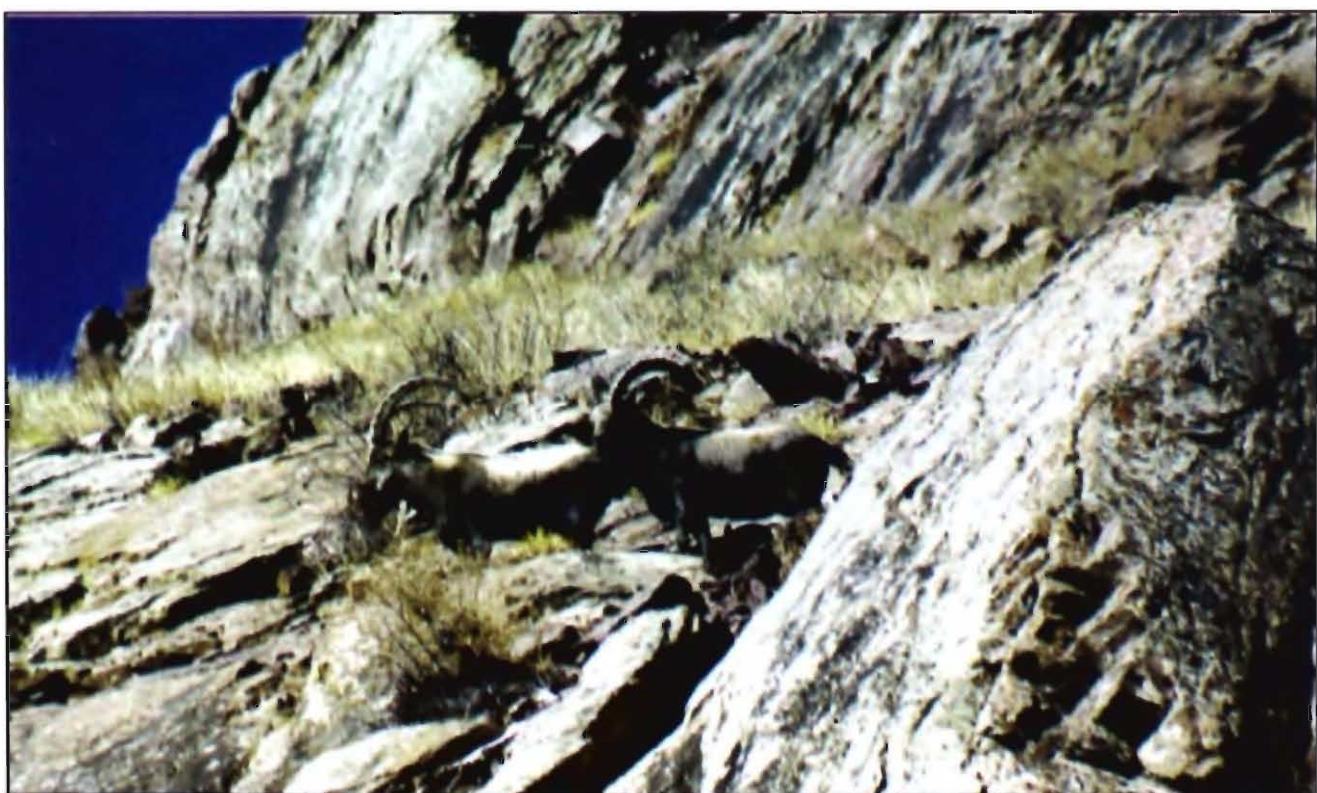


Blue sheep *Pseudois nayaur* (Hodgson)

**PLATE - XVI**



Himalayan Marmot *Marmota himalayana* (Hodgson) in trans Himalaya in Lahul & Spiti



Ibex (*Capra sibirica*, (Pallas)) in Spiti area

## PROTOZOA

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### INTRODUCTION

Protozoa are usually single celled eukaryotic organisms which are, with very few exceptions, visible only under the microscope. Although these organisms are unicellular and appear to be simple in organisation, they are the most complex cells known because all the biological and biochemical mechanisms for a complex life style of a multicellular living being are contained within that single cell.

Protozoa comprise taxonomically so diverse and phylogenetically such distantly related taxa that classification of this group even at the level of phylum is not yet universally settled. In the classical taxonomic scheme under the two kingdom system developed by Carolus Linnaeus, Protozoa which literally means first animal was given the rank of a phylum. But, with the advent of electron microscopes and flow of huge new data of taxonomic significance, the Society of Protozoologists developed a revised classification of protozoa (Levine *et al.*, 1980) and elevated its taxonomic status from phylum to subkingdom under the kingdom Protista. This subkingdom included 7 phyla, *viz.*, Sarcomastigophora, Labyrinthomorpha, Apicomplexa, Microspora, Ascetospora, Myxozoa and Ciliophora. Recently some workers like Cavalier-Smith (1993, 1999) raised protozoa to the rank of a kingdom with 13-18 phyla. However, this proposition is yet to be finalised and accepted. In view of this, classification of Levine *et al.* (1980) is followed in the present work.

Protozoa occur in each and every habitat of all terrestrial and aquatic ecosystems of this biosphere and lead life as freeliving, commensals, parasites and symbiotes. Even then, these are one of the least explored biotic groups in the maximum number of states and all union territories of India, mainly due to lack of expertise. Perusal of available literature reveals that there are only two published accounts on taxonomy of Protozoa from Himachal Pradesh by Mukherjee and Das (2000) and, Chattopadhyay and Das (2003). Mukherjee and Das (*op. cit.*) reported the occurrence of 5 species of ciliates, *viz.*, *Colpoda cucullus*, *Coleps inermis*, *Monochilum ovale*, *Urocentrum turbo* and

*Strobilidium gyrans* from the Renuka lake, located at Sirmour district of the State. However, late R.N. Mukherjee, during his tenure from 1971-86 at High Altitude Zoology Field Station of the Zoological Survey of India (ZSI) at Solan in Himachal Pradesh collected protozoan material from different districts of the State, preserved them on slides, identified up to species level and deposited them in the National Zoological Collections of the said station. His collections comprise 61 species of freeliving and 5 species of parasitic protozoa.

In recent years, the present authors collected and identified 37 species of moss inhabiting protozoa including several species already collected by late Mukherjee mentioned above. The present collections comprise 27 species of rhizopods and 8 species of ciliates recovered only from one tree moss sample and 4 rock moss samples. These samples were collected from Kullu and Shimla districts and processed in the laboratory of ZSI at Calcutta by nonflooded petridish method (*i.e.*, samples were saturated but not flooded with distilled water) as described by Foissner (1987, 1992). Out of these, taxonomy and ecology of 25 species of moss dwelling testacid rhizopods have been published by Chattopadhyay and Das (2003) while those of 2 species of their rhizopods and 8 species of ciliates remain unpublished till date. In this context, the present paper reports all the freeliving and parasitic species of protozoa known so far from Himachal Pradesh (Table 1), including the collections of late R.N. Mukherjee as mentioned above for depicting a holistic picture of protozoan diversity revealed so far in the state.

### FREELIVING PROTOZOA

In all, 84 species of protozoa were collected from freshwater habitats and moss biotopes of Himachal Pradesh. The systematic list and district-wise distribution of these species are presented in Table 1 and their habitat-wise distribution is shown in Table 2. These protozoans comprise 3 species of flagellates, 45 species of rhizopods and 36 species of ciliates and they belong to 2 phyla, 6 classes, 17 orders, 34 families and 50 genera.

Freshwater habitats include ditches, ponds, tanks, lakes and streams. Protozoa collections from those habitats were made from bottom ooze, algal mass, *Sphagnum* and aquatic vegetation. All the flagellate species (3 species) and most of the ciliate species (31 species) were recorded from freshwater. Of the rhizopods, one species of naked amoeba, *viz.*, *Mayorella vespertilio* (identified as *Amoeba vespertilio* by late Mukherjee) was collected from amongst aquatic vegetation while 28 species of testaceans were found in the bottom ooze, *Sphagnum* and aquatic vegetation. *Centropyxis stellata*, *Campuscus cornuatus* and *Leptochlamys ampullacea* were recorded for the first time from India. Out of these, first two were found in the bottom ooze of freshwater tanks of Hamirpur and Shimla districts respectively while the third one was recorded from amongst aquatic vegetation and algal mass in water bodies of Kangra district. Other testaceans collected

exclusively from aquatic habitats are : *A. vulgaris*, *Diffugia lebes*, *D. lobstoma*, *D. muriformis*, *D. oblonga*, *D. rubescens*, *D. urceolata*, *Trigonopyxis arcula*, *Hyalosphenia papilio*, *Euglypha laevis* and *Phryganella hemispherica*.

As mentioned earlier, samples of tree mosses and rock mosses were processed and examined for protozoan species during the present investigation. However, several testacean species from mosses were also collected by late Mukherjee. As such, 32 species of rhizopods and 8 species of ciliates were recorded from moss-covered habitats of this state. These 8 ciliate species are : *Dileptus tenuis*, *Litonotus muscorum*, *Colpoda cucullus*, *Colpoda reniformis*, *Leptopharynx eurystoma*, *Cinetochilum margaritaceum*, *Stylonychia pustula* and *Euplotes muscicola*, all of which were collected from rock mosses.

In the tree moss sample, 10 species, all belonging to rhizopods were found, viz., *Centropyxis aerophila*, *C. minuta*, *C. sylvatica*, *Cyclopyxis arcelloides*, *Plagiopyxis callida*, *P. declivis*, *Euglypha rotunda.*, *E. tuberculata*, *Tracheleuglypha dentata* and *Trinema enchelys*.

Examination of a moss sample collected from a rocky wall near the hot spring of Manikaran in Kullu district, which constantly remains moistened with water vapour arising continuously from that spring yielded only two species of naked amoebae, viz., *Thecamoeba terricola* and *Mayorella vespertilio*. This sample was completely devoid of testaceans which were found to be common and abundant in all other moss samples of the state.

In all, 15 species under the family Centropyxidae were recorded from the state. Amongst these, all but *Centropysix stellata* were found in mosses. Amongst the moss dwelling Centropyxidae of the state, two species, viz., *Centropyxis aculeata* and *C. spinosa* occurred in hydrophilous mosses which grew adjacent to a spring and were found to be wetted often by that spring water. Further, all the members of the family Euglyphidae recorded here (10 species) were also found in mosses and *Sphagnum*.

Fourteen species of testaceans, viz., *Centropyxis aculeata*, *C. constricta*, *C. aerophila*, *C. ecornis*, *C. minuta*, *Cyclopyxis arcelloides*, *Trigonopyxis arcula* (identified as *Diffugia arcula* by late Mukherjee), *Heliopera rosea*, *Nebela collaris*, *Quadrullela symmetrica*, *Euglypha rotunda*, *E. tuberculata*, *Tracheleuglypha dentata* and *Trinema enchelys* were found to occur both in terrestrial mosses and *Sphagnum* in swamp and freshwater.

Interestingly, from soils within the gut contents of some earthworms belonging to the species *Apporrectodea trapezoides*, 4 species of testaceans were recovered. These are : *Arcella discoides*, *Centropyxis ecornis*, *Diffugia lobostoma* and *Euglypha tuberculata*. These protozoan species are often found in moist soils adjacent to water bodies. This is a habitat suitable for earthworms also. Therefore, it is quite inevitable that these earthworms while devouring soils engulfed these soil dwelling testaceans also.

## PARASITIC PROTOZOA

Only 5 species of parasitic protozoa were collected from Himachal Pradesh. Of these, *Opalina obtrigonoidea* was recorded from the gut contents of an amphibian host, *Uperodon systoma*. Remaining 4 species, viz., *Anoplophrya amaleshi*, *A. lumbrici*, *A. marilandensis* and *A. striata* were collected from coelom and gut contents of the following 5 species of earthworms : *Eiseria felida*, *Ramiella bishambari*, *Etyphoeus waltoni*, *Dichogaster bolai* and *Amyntas diffringes* as shown in Table 1. From above, it is quite evident that collections and taxonomic studies of parasitic Protozoa of the State remain almost completely neglected.

## GEOGRAPHIC DISTRIBUTION

District-wise distribution and habitats of each protozoan species known so far from Himachal Pradesh are presented in Table 1. The Table clearly reveals that 3 districts out of 12, viz., Bilaspur, Chamba and Lahul & Spiti are underexplored for Protozoa. The remaining 9 districts are also considerably unexplored although 24-35 species were collected from 4 districts, viz., Solan, Shimla, Sirmour and Kullu. It is needed to mention here that 3 species of rhizopods, viz., *Centropyxis stellata*, *Campuscus cornuatus* and *Leptochlamys ampullacea* and 7 species of ciliates as follows : *Litonotus muscorum*, *Colpoda reniformis*, *Leptopharynx eurystoma*, *Paraholosticha herbicola*, *Oxytricha hymenostoma*, *Pleurotricha lanceolata* and *Stylonychia pustula* are recorded for the first time from India.

## SUMMARY

The paper deals with all the protozoan species collected and recorded so far from Himachal Pradesh. It includes 89 species (84 freeliving and 5 parasitic), belonging to 2 phyla, 6 classes, 17 orders, 34 families and 50 genera. District-wise and habitat-wise distribution of each species in the state are also presented in the paper. A total of 10 species, viz., *Centropyxis stellata*, *Campuscus cornuatus*, *Leptochlamys ampullacea*, *Litonotus muscorum*, *Colpoda reniformis*, *Leptopharynx eurystoma*, *Paraholosticha herbicola*, *Oxytricha hymenostoma*, *Pleurotricha lanceolata* and *Stylonychia pustula* constitute first records from India. Out of these, the first three are rhizopods and the remaining are ciliates.

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**Table-1. District-wise distribution of protozoan species of Himachal Pradesh**

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
<b>A. Freelifving Protozoa</b>												
Phylum SARCOMASTIGOPHORA												
Class PHYTOMASTIGOPHOREA												
Order CRYPTOMONDIDA												
Family CRYPTOMONADIDAE												
1. <i>Chilomonas paramecium</i> Ehrenberg			+							+	+	
Order EUGLENIDA												
Family EUGLENIDAE												
2. <i>Euglena oxyuris</i> Schmadra											+	
3. <i>Euglena viridis</i> Ehrenberg										+		
Class LOBOSEA												
Order AMOEBIDA												
Family THECAMOEBIDAE												
4. <i>Thecamoeba terricola</i> (Greef)						+						
Family PARAMOEBIDAE												
5. <i>Mayorella vespertilio</i> (Penard)			+			+			+			
Order TESTACREALOBOSEA												
Family ARCELLIDAE												
6. <i>Arcella discoides</i> Ehrenberg				+							+	
7. <i>Arcella vulgaris</i> Ehrenberg				+						+		
Family MICROCORYCIIDAE												
8. <i>Diplochlamys timida</i> Penard						+						
9. <i>Leptochlamys ampullacea</i> West				+								

Table 1. continued...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family CENTROPYXIDAE												
10. <i>Centropyxis aculeata</i> (Ehrenberg)				+		+				+		
11. <i>Centropyxis aerophila</i> Deflandre					+	+			+	+		+
12. <i>Centropyxis constricta</i> (Ehrenberg)								+		+		
13. <i>Centropyxis ecornis</i> (Ehrenberg)			+		+	+					+	
14. <i>Centropyxis minuta</i> Deflandre						+			+			
15. <i>Centropyxis platystoma</i> (Penard)						+						
16. <i>Centropyxis spinosa</i> (Cash & Hopkinson)						+						
17. <i>Centropyxis sylvatica</i> (Deflandre)						+			+			
18. <i>Centropyxis stellata</i> Wailes			+									
19. <i>Cyclopyxis arcelloides</i> (Deflandre)			+			+			+	+		
20. <i>Cyclopyxis kahli</i> (Deflandre)									+			
21. <i>Plagiopyxis callida</i> Penard						+			+	+		
22. <i>Plagiopyxis declivis</i> Bonnet & Thomas						+			+			
23. <i>Plagiopyxis minuta</i> Bonnet						+						
24. <i>Trigonopuxis arcula</i> (Leidy)									+			
Family DIFFLUGIIDAE												
25. <i>Diffflugia lebes</i> Penard					+							
26. <i>Diffflugia lobostoma</i> Leidy			+	+					+	+	+	+

Table 1. continued...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
27. <i>Diffugia muriformis</i> Gauthier-Lievre & Thomas									+			+
28. <i>Diffugia oblonga</i> Ehrenberg			+							+		
29. <i>Diffugia rubescens</i> Penard										+		
30. <i>Diffugia urceolata</i> Carter				+								
Family NEBELIDAE												
31. <i>Heleopera rosea</i> Penard						+						
32. <i>Heleopera sylvatica</i> Penard			+		+							+
33. <i>Hyalosphenia papilio</i> Leidy										+		
34. <i>Nebela collalris</i> (Ehrenberg)												
35. <i>Nebela walesi</i> Deflandre												
36. <i>Quardulella symmetrica</i> (Wallich)					+	+						
Family PHRYGANIIDAE												
37. <i>Phrganella hemispherica</i> Penard			+									+
Class FILOSEA												
Order TESTACEAFILOSA												
Family CYPHODERIIDAE												
38. <i>Campuscus cornuatus</i> Leidy									+			
Family EUGLYPHIDAE												
39. <i>Assulina muscorum</i> Greef						+						

Table 1. continued...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spliti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
40. <i>Corythion dubium</i> Taranek						+						
41. <i>Euglypha laevis</i> (Ehrenberg)					+							
42. <i>Euglypha rotunda</i> Wailes & Penard					+	+			+	+		
43. <i>Euglypha strigosa</i> (Ehrenberg)						+						
44. <i>Euglypha tuberculata</i> Dujardin			+		+	+		+	+			
45. <i>Tracheleuglypha dentata</i> (Vejdowsky)						+			+			
46. <i>Trinema complanatum</i> Penard						+			+			
47. <i>Trinema enchelys</i> (Ehrenberg)						+			+	+		
48. <i>Trinema lineare</i> Penard					+	+			+			
Phylum CILIOPHORA												
Class KINETOFRAGMINOPHOREA												
Order PROSTOMATIDA												
Family HOLOPHRYIDAE												
49. <i>Holophrya simplex</i> Schewiakoff										+	+	
Family COLEPIDAE												
50. <i>Coleps hirtus</i> (Muller)				+						+	+	
51. <i>Coleps inermis</i> (Perty)											+	
Family TRACHELIIDAE												
52. <i>Dileptus tenuis</i> Penard						+						
Family DIDINIDAE												
53. <i>Didinium nasutum</i> (Muller)										+		
Family AMPHILEPIDAE												
54. <i>Amphileptus claparedei</i> Stein											+	

Table 1. continued...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Simour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
55. <i>Hemiophrys procera</i> (Penard)											+	
56. <i>Litonotus fasciola</i> (Ehrenberg)											+	
57. <i>Litonotus muscorum</i> (Kahl)						+			+			
Order TRICHOSTOMATIDA												
Family COLPODIDAE												
58. <i>Colpoda cucullus</i> (Mullar)									+	+		
59. <i>Colpoda steini</i> Manupas									+			
60. <i>Colpoda reniformis</i> Kahl.						+						
Family LEPTOPHARYNGIDAE												
61. <i>Leptopharynx eurystoma</i> (Kahl)						+						
Class OLIGOHYMENOPHOREA												
Order HYMENOSTOMATIDA												
Family GLAUCOMIDAE												
62. <i>Monochilum ovale</i> (Schewiakoff)										+		
Family OPHRYOGLENIDAE												
63. <i>Ophryoglena flava</i> (Ehrenberg)										+		
Family PARAMECIIDAE												
64. <i>Paramecium aurelia</i> Ehrenberg										+	+	
65. <i>Paramecium caudatum</i> Ehrenberg										+	+	
Family FRONTONIIDAE												
66. <i>Frontonia atra</i> Ehrenberg			+	+							+	
67. <i>Frontonia leucas</i> Ehrenberg										+		



Table 1. continued...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
77. <i>Oxytricha fallax</i> Stein										+		
78. <i>Oxytricha hymenostoma</i> Stokes									+	+	+	
79. <i>Pleurotricha lanceolata</i> (Ehrenberg)											+	
80. <i>Stylonychia mytilus</i> (Muller)										+		
81. <i>Stylonychia pustulata</i> (Muller)						+						
Family EUPLOTIDAE												
82. <i>Euplotes patella</i> (Muller)											+	
83. <i>Euplotes charon</i> (Muller)										+		
84. <i>Euplotes muscicola</i> (Kahl.)						+						
<b>B. Parasitic Protozoa</b>												
Phylum SARCOMASTIGOPHORA												
Order OPALINIDA												
Family OPALINIDAE												
85. <i>Opalina obtrigonoidea</i> Metcaff			+									
Host <i>Upeperodon systoma</i>												
Phylum CILIOPHORA												
Class OLIGOHYMENOPHOREA												
Order ASTOMATIDA												
Family ANOPLOPHRYIDAE												
86. <i>Anoplophrya amaleshi</i> Dey & Mukherjee											+	
Host <i>Eiseria fetida</i>												
87. <i>Anoplophrya lumbrici</i> Heindreich										+		
Host <i>Ramiella bishambari</i>												

Table 1. continued...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spliti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
88. <i>Anoplophrya marylandensis</i> Conklin Hosts <i>Etyphoeus waltoni</i> <i>Dichogaster bolau</i>										+		
89. <i>Anoplophrya striata</i> Host <i>Amyntas diffringes</i>										+		

**Table 2.** Habitat-wise distribution of Protozoan species (freeliving) of Himachal Pradesh

(Al : algae; Oz : bottom ooze; Rm : rock mosses; Rms : mostly submerged rock mosses; Sg : soil within guts of earthworms; Sph : Sphagnum in water bodies; Ssph : Sphagnum in swamp; Tm : tree mosses; Vg : aquatic vegetation)

Taxon	Habitats								
	Freshwater					Terrestrial			
	Al	Oz	Sph	Ssph	Vg	Rm	Rms	Sg	Tm
<b>Flagellates</b>									
1. <i>Chilomonas paramecium</i>	+								
2. <i>Euglena oxyuris</i>	+								
3. <i>Euglena viridis</i>	+								
<b>Rhizopods</b>									
4. <i>Thecamoeba terricola</i>						+			
5. <i>Mayorella vespertilio</i>					+	+			
6. <i>Arcella discoides</i>		+						+	
7. <i>Arcella vulgaris</i>		+							
8. <i>Diplochlamys timida</i>						+			
9. <i>Leptochlamys ampullacea</i>	+				+				
10. <i>Centropyxis aculeata</i>		+	+			+	+		
11. <i>Centropyxis aerophila</i>				+		+			
12. <i>Centropyxis constricta</i>			+	+		+			
13. <i>Centropyxis ecornis</i>		+	+			+		+	
14. <i>Centropyxis minuta</i>		+		+		+			+
15. <i>Centropyxis platystoma</i>						+			
16. <i>Centropyxis spinosa</i>							+		
17. <i>Centropyxis sylvatica</i>						+			+
18. <i>Centropyxis stellata</i>		+							
19. <i>Cyclopyxis arcelloides</i>			+			+			+
20. <i>Cyclopyxis kahli</i>						+			
21. <i>Plagiopyxis callida</i>						+			+
22. <i>Plagiopyxis declivis</i>						+			+
23. <i>Plagiopyxis minuta</i>						+			
24. <i>Trigonopyxis arcula</i>			+			+			

Table 2. continued

Taxon	Habitats								
	Freshwater					Terrestrial			
	Al	Oz	Sph	Ssph	Vg	Rm	Rms	Sg	Tm
25. <i>Diffugia lebes</i>		+							
26. <i>Diffugia lobostoma</i>		+						+	
27. <i>Diffugia muriformis</i>		+							
28. <i>Diffugia oblonga</i>		+							
29. <i>Diffugia rubescens</i>		+							
30. <i>Diffugia urceolata</i>		+							
31. <i>Heleopera rosea</i>				+		+			
32. <i>Heliopera sylvatica</i>						+			
33. <i>Hyalosphenia papilio</i>			+						
34. <i>Nebela collaris</i>				+		+			
35. <i>Nebela wailesi</i>						+			
36. <i>Quadrullella symmetrica</i>				+			+		
37. <i>Phryganella hemispherica</i>		+							
38. <i>Campuscus cornuatus</i>		+							
39. <i>Assulina muscorum</i>						+			
40. <i>Corythion dubium</i>						+			
41. <i>Euglypha laevis</i>				+					
42. <i>Euglypha rotunda</i>			+			+			+
43. <i>Euglypha strigosa</i>						+			
44. <i>Euglypha tuberculata</i>			+			+		+	+
45. <i>Tracheleuglypha dentata</i>				+		+			+
46. <i>Trinema complanatum</i>						+			
47. <i>Trinema enchelys</i>			+			+			+
48. <i>Trinema lineare</i>						+			
<b>Ciliates</b>									
49. <i>Holophrya simplex</i>					+				
50. <i>Coleps hirtus</i>					+				
51. <i>Coleps inermis</i>					+				
52. <i>Dileptus tenuis</i>						+			
53. <i>Didinium nasutum</i>					+				
54. <i>Amphileptus claparedei</i>					+				

Table 2. continued

Taxon	Habitats								
	Freshwater					Terrestrial			
	Al	Oz	Sph	Ssph	Vg	Rm	Rms	Sg	Tm
55. <i>Hemiphrys procera</i>					+				
56. <i>Litonotus fasciola</i>					+				
57. <i>Litonotus muscorum</i>						+			
58. <i>Colpoda cucullus</i>					+	+			
59. <i>Colpoda steni</i>					+				
60. <i>Colpoda reniformis</i>					+	+			
61. <i>Leptopharynx eurystoma</i>					+	+			
62. <i>Monochilum ovale</i>					+				
63. <i>Ophryoglena flava</i>					+				
64. <i>Paramecium aurelia</i>					+				
65. <i>Paramecium caudatum</i>					+				
66. <i>Frontonia atra</i>					+				
67. <i>Frontonia leucas</i>					+				
68. <i>Urocentrum turbo</i>					+				
69. <i>Cinetichilum margaritaceum</i>						+			
70. <i>Vorticella campanula</i>					+				
71. <i>Blepharisma undulans</i>					+				
72. <i>Spirostomum ambiguum</i>					+				
73. <i>Metopus es</i>					+				
74. <i>Strobilidium gyrans</i>					+				
75. <i>Paraholosticha herbicola</i>					+				
76. <i>Oxytricha bifaria</i>					+				
77. <i>Oxytricha fallax</i>					+				
78. <i>Oxytricha hymenostroma</i>					+				
79. <i>Pleurotricha lanceolata</i>					+				
80. <i>Stylonychia mytilus</i>					+				
81. <i>Stylonychia pustulata</i>						+			
82. <i>Euplotes patella</i>					+				
83. <i>Euplotes charon</i>					+				
84. <i>Euplotes muscicola</i>						+			

## **PLANT AND SOIL NEMATODES**

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### **INTRODUCTION**

Among the metazoan animals, the members of the phylum nematoda constitute one of the largest and most diversified groups. They are found as free living in every kind of habitat or as parasites of plants, arthropods, molluscs and vertebrates. The nematodes may be defined as worm-like invertebrates having appendageless and non-segmented body. Since most of them have cylindrical body, they are also called 'round worms' or 'thread worms'

Nematodes are characterised by a body cavity, complete digestive tract, to some extent a well developed nervous system, excretory system and reproductive system (one or two tubular gonads). The digestive tract or the alimentary canal is like a tube placed within a larger tube (the body wall). The body wall is composed of an outer protective layer of cuticle underlying hypodermis and somatic muscles. The hypodermis is thin and expands into the body cavity (coelom) to form the four longitudinal chords between the somatic muscles, i.e., two lateral, one dorsal and one ventral chords. The sexes are generally separate. However, males may be absent in some groups and reproduction takes place through parthenogenesis. The males and females in plant parasitic forms show marked sexual dimorphism while males in some groups have differently shaped tail or degenerated digestive system. Taxonomically, the nematodes are being classified into two classes, 16 orders, 90 superfamilies and 210 families. However, according to their habitat and feeding habits they are also grouped under five ecological groups, viz., parasites of vertebrates, parasites of invertebrates, parasites of plants, microbotrophic or saprophagous, and predaceous. Baqri & Jairajpuri (1995) have provided a brief historical review of each group.

The present paper reports the terrestrial nematode species (plant parasitic, microbotrophic or saprophagous and predaceous groups) from Himachal Pradesh, a State nestling in the north-western Himalayan mountains.

### **PLANT PARASITIC NEMATODES**

Plant parasitic nematodes generally belong to the following Orders : Tylenchida, Aphelenchida, Dorylaimida and Triplonchida. They are mainly found in the soil except

the species of a few genera like *Aphelenchoides*, *Ditylenchus*, *Anguina*, etc. which attack above ground parts of plants (leaves, stem or flowers). These nematodes are generally divided into two groups according to their parasitic habits, i.e., ectoparasites and endoparasites. The nematodes of former group live in the soil and feed by thrusting the stylet into root tissues without entering the plant. They are mostly migratory in behaviour. The endoparasitic nematodes generally spend their entire life cycle inside the plant tissues. Some of the endoparasitic nematodes have spherical or ovoid females and thus become sedentary and remain within the plant tissues, e.g., *Meloidogyne* spp. The endoparasitic nematodes like *Pratylenchus* spp. are migratory because they move freely within the tissues and form cavities and lesions at the feeding sites but may come out from plant tissues to lead their life in the soil. There are also some semi-endoparasitic nematodes which have only anterior half of their body embedded in the plant tissues. e.g., *Heterodera* spp.

Plant parasitic nematodes are economically very important because they inflict severe yield losses in agricultural and horticultural crops. According to some reports, out of 34% yield losses in agricultural crops annually on global basis due to different weeds and pests, about 10-12% are caused by the phytophagous nematodes. In India, van Berkum and Seshadri (1970) have estimated crop losses of about 10 million dollars in wheat due to seedgall nematode (*Anguina tritici*) and of about eight million dollars in barley and in wheat due to molya disease caused by cereal cyst nematode (*Heterodera avenae*) in Rajasthan State alone. Losses caused by root knot and cyst nematodes (*Meloidogyne* spp. and *Heterodera* spp.) have been estimated from 25 to 90% depending upon the cultivar, season and crop pattern.

It is also an established fact that the damage to plants caused by two or more pathogen is more severe than what the single pathogen causes independently. Similarly, the infestation of plant parasitic nematodes combined with bacteria, fungi and viruses results in severe kind of diseases in agricultural and horticultural crops.

### MICROBOTROPHIC OR SAPROPHAGOUS NEMATODES

Microbotrophic nematodes are generally defined as those which depend upon micro-organisms but don't hunt for food. They are also called as saprophagous or free living and found wherever they find food (in soil, fresh or marine water, hot spring, polar ice) without any parasitic relationship. Among them, the marine nematodes are considered as most primitive members of the phylum Nematoda and numerically one of the most abundant groups in the animal kingdom. These free living nematodes have undoubtedly a major role in maintaining the natural ecological balance in the ecosystem in which they live.

Microbotrophic nematodes have a large mouth opening which is sometimes armed with an odontostyle (stylet) for scraping or crushing micro-organisms. Majority of the

terrestrial microbotrophic nematodes belongs to the orders Rhabditida and Dorylaimida. A large number of stylet bearing nematode species belonging to the Order Aphelenchida have also been confirmed as fungus feeder.

### **PREDATORY NEMATODES**

The nematodes belonging to Order Mononchida and some to the Orders Dorylaimida, Diplogasterida and Aphelenchida are depending for food on micro-organisms like bacteria, fungi, protozoa and other multicellular micro-organisms. However, the nematodes under Mononchida (Mononchs) are considered important because they predominately feed on rotifers, small oligochaets etc. while a few may exhibit cannibalism. As a result they are considered economically important because of their role in the bio-control of phytophagous nematodes. Many species of Mononchs, Dorylaimids and Diplogasterids have been confirmed as predatory in their feeding behaviour while a few species of mononchids have been confirmed as an ideal agent in the biological control of plant-parasitic nematodes in the laboratories.

The main feature of these predatory nematodes is the strongly sclerotized buccal cavity which is armed with tooth or teeth, with or without longitudinal ridges. Sometimes the denticles may be present on the sub-ventral wall of the buccal cavity. The presence of long, cylindrical and strongly muscular oesophagus with greatly thickened lumen is also an added advantage in their predatory behaviour.

### **RANGE OF DIVERSITY INCLUDING ZOOGEOGRAPHICAL RELATIONS OF HIMACHAL PRADESH**

In terms of diversity, the nematodes are considered to be highly diversified and can only be compared with insects amongst the multi-cellular organisms. The terrestrial nematodes are mostly microscopic in size as their body length varies from 0.3-7.0 mm. They generally have cylindrical body while some phytophagous nematodes may be fusiform, spherical, seccate, lemon-shaped or kidney-shaped. In contrast to most saprophagous nematodes, plant parasitic forms may survive under harsh climatic conditions. For instance, the juveniles in *Anguina tritici* can be revived from an abiotic conditions (appearing as dried up pieces) after 20-30 years. The mature females in the family Heteroderidae become dark and later the cuticle becomes a hardwall (cyst) in which the eggs remain protected upto six years.

The distribution of plant parasitic nematodes mainly depends upon temperature, soil texture/pore size, moisture and availability of host plants. The plant parasitic nematodes attack all kind of plants whether in arctic or in desert. Most of them are polyphagous having a large range of hosts as in nematodes like *Ditylenchus* spp., *Rotylenchulus reniformis*, *Helicotylenchus* spp., *Meloidogyne* spp., etc. In a few cases range of host

may be very much restricted as in *Globodera* spp., *Heterodera* spp., *Radopholus similis*. The species of these genera show a remarkable host specificity and thus they are commonly known by their host, viz. *Globodera rostochiensis* as potato cyst nematode, *Heterodera avenae* as cereal cyst nematode, *H. zae* as maize cyst nematode, etc. Though the origin of the cyst nematodes is not certain, they are found in temperate as well as tropical countries, e.g. *Heterodera avenae* is reported from temperate and tropical regions. In India, *H. avenae* has been reported as a destructive pest of wheat from the hills of Himachal Pradesh as well as from Rajasthan which comes under arid or semi-arid zones. *Globodera rostochiensis* has frequently been reported from potato growing mountains.

*Anguina tritici*, the wheat gall nematode, is considered to be a native of Europe but is distributed throughout the world. The origin of *Meloidogyne* species is also not known but they are abundantly found and inflicting severe damages to all kind of agricultural and horticultural crops over the world and are commonly found in Himachal Pradesh. It is observed that there are less number of criconematids reported from arid zone whereas their number is quite high in hilly areas. Though *Hemicycliophora* species are generally found in temperate region but they are also found in the plains of tropical countries. The species of the genus have also been reported from Himachal Pradesh.

Since most of the nematodes are adapted to survive under harsh climate and we know only about 5% terrestrial nematode fauna, it appears beyond the scope of this paper to discuss the zoogeographical relations of Himachal Pradesh fauna with global fauna.

## REVIEW OF LITERATURE

The review of nematological literature reveals that Thirumalachar (1951) was the first to report root-knot nematode species from potato tubers in Shimla. Thereafter, Nirula and his coworkers (1959-1968) conducted intensive surveys for cyst and root-knot nematodes causing severe losses to crops in Himachal Pradesh. Simultaneously, Jairajpuri (1963-1964). Out of 127 known species from Himachal Pradesh, 44 species have been added as new to science. Most of these species are still endemic because they are known only from their type localities. However, they may not remain endemic for ever, since we have yet to explore about 80% area of the country for the fauna of terrestrial nematodes.

Since a few papers in literature have been found providing information on the distribution mentioning only Himachal Pradesh (without mentioning locality or district), we could not furnish information about district in Table-I for some species.

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**Table : District-wise distribution of Nematodes in Himachal Pradesh**

Taxa	Districts												Remarks
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
Order TYLENCHIDA													
Family TYLENCHIDAE													
1. <i>Tylenchus arcuatus</i> - 1									+				
2. <i>Tylenchus ritae</i> *		+							+				Endemic
3. <i>Tylenchus rohtangus</i> *		+											Endemic
4. <i>Tylenchus magnus</i> *													Endemic
5. <i>Coslenchus indicus</i>						+							
6. <i>Coslenchus capsici</i> *						+							Endemic
Family TYLODORIDAE													
7. <i>Cephalenchus leptus</i>									+				
Family DOLICHODORIDAE													
8. <i>Tylenchorhynchus</i> sp.								+					
9. <i>Tylenchorhynchus mashhoodi</i>				+		+					+	+	Exotic
10. <i>Quinisulcius capitatus</i>											+		
11. <i>Nagelus hexagrammus</i>											+		
12. <i>Trophurus lomus</i> *		+											Endemic
13. <i>Merlinius nothus</i>													
Family PSILENCHIDAE													
14. <i>Psilenchus hilarulus</i>									+		+		

Table contd...

Taxa	Districts												Remarks
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
Family HOPLOLAIMIDAE													
15. <i>Hoplolaimus indicus</i>											+		Exotic
16. <i>Hoplolaimus chambus</i> *	+												Endemic
17. <i>Scutellonema brachyurum</i> *									+				Endemic
18. <i>Rotylenchus buxophilus</i>		+											
19. <i>Rotylenchus dalhousiensis</i> *		+											Endemic
20. <i>Rotylenchus neorobustus</i> *		+											Endemic
21. <i>Helicotylenchus dihystra</i>			+	+		+		+					Exotic
22. <i>Helicotylenchus indicus</i>											+		Endemic
23. <i>Helicotylenchus mucronatus</i>									+				
24. <i>Helicotylenchus rohtangus</i> *						+							Endemic
25. <i>Helicotylenchus steiner</i> *		+											
26. <i>Helicotylenchus goldeni</i> *								+					
27. <i>Helicotylenchus girus</i>													
28. <i>Helicotylenchus shakili</i> *		+											Endemic
29. <i>Helicotylenchus valecus</i> *		+											Endemic
30. <i>Varotylus peculiaris</i> *		+											Endemic
31. <i>Varotylus himpurus</i> *		+											Endemic
32. <i>Varotylus symmetricus</i> *		+											Endemic
33. <i>Varotylus helicus</i>		+											
34. <i>Verotylus secundus</i>													
35. <i>Verotylus siddiqui</i>		+						+					

Table contd....

Taxa	Districts												Remarks	
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una		
	1	2	3	4	5	6	7	8	9	10	11	12		
36. <i>Orientylus geraerti</i> *		+												
Family ROTYLENCHULIDAE														
37. <i>Rotylenchulus reniformis</i>		+												
Family PRATYLENCHIDAE														
38. <i>Pratylenchus pratensis</i>			+	+		+								Exotic
39. <i>Pratylenchus penetrans</i>								+				+		Exotic
40. <i>Pratylenchus zaeae</i>									+	+		+		Exotic
41. <i>Pratylenchus neocapitatus</i> *									+					Endemic+
42. <i>Pratylenchus coffeae</i>								+						
43. <i>Pratylenchus manaliensis</i>												+		
Family MELOYDOGINIDAE														
44. <i>Meloidogyne hapla</i>	+	+												Exotic
45. <i>Meloidogyne incognita</i>	+		+		+		+	+			+	+		Exotic
46. <i>Meloidogyne javanica</i>							+				+			Exotic
Family HETERODERIDAE														
47. <i>Heterodera avenae</i>				+							+			
48. <i>Heterodera cajani</i>														
49. <i>Heterodera graminis</i>														
50. <i>Heterodera iri</i>			+											Exotic

Table contd....

Taxa	Districts												Remarks	
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una		
	1	2	3	4	5	6	7	8	9	10	11	12		13
51. <i>Heterodera zeae</i>			+	+										
52. <i>Heterodera</i> sp.									+					
53. <i>Heterodera carotae</i>									+					
54. <i>Globodera rostochiensis</i>												+		
55. <i>Afenestrata sacchari</i>														
Family CRICONEMATIDAE														
56. <i>Criconemoides (Paracriconemoides) neocayeste</i>										+				
57. <i>Ogma (Ogma) fotedari*</i>		+												
58. <i>Ogma (Ogma) similaensis</i>		+								+				Endemic
59. <i>Ogma (Seriespinula) tenuicaudata</i>		+												
60. <i>Macroposthonia antipolitana</i>											+			
61. <i>Macroposthonia xenoplax</i>		+	+											
62. <i>Macroposthonia bilaspurensis*</i>	+													
63. <i>Criconemoides informis</i>														
Family HEMICYCLIOPHORIDAE														
64. <i>Hemicycliophora subaolica*</i>		+												Endemic
65. <i>Loofia robusta</i>														
66. <i>Loofia planiannulata</i>								+						
Family TYLENCHULIDAE														
67. <i>Tylenchulus semipenetrans</i>		+							+	+				Exotic

Table contd....

34

Taxa	Districts												Remarks
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
Family PARATYLENCHIDAE													
68. <i>Paratylenchus curvitalus</i>						+							
69. <i>Paratylenchus nainianus</i>													
70. <i>Paratylenchus minor</i>									+				
71. <i>Paratylenchus prunii*</i>				+		+					+		Endemic
72. <i>Gracilacus peperpotti</i>													
Family ANGUINIDAE													
73. <i>Safianema indicum</i>													
Order APHELENCHIDA													
Family APHELENCHOIDIDAE													
74. <i>Aphelenchoides besseyi</i>				+				+					
75. <i>Aphelenchoides ritzemabosi</i>									+	+			
76. <i>Aphelenchoides fragariae</i>											+		Endemic
77. <i>Aphelenchoides agarici*</i>											+		Endemic
78. <i>Aphelenchoides myceliophagus*</i>													Endemic
79. <i>Aphelenchoides neocomposticola*</i>								+	+				
80. <i>Aphelenchoides swarupi</i>													
Order DORYILYMIDA													
Family QUADSIANEMATIDAE													
81. <i>Labronema loofi</i>						+							

Table contd....

Taxa	Districts												Remarks	
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spleti	Mandi	Shimla	Sirmour	Solan	Una		
	1	2	3	4	5	6	7	8	9	10	11	12		13
Family NORDIIDAE														
82. <i>Longidorella acutis</i>		+												
83. <i>Longidorella xenura</i>		+								+				
84. <i>Pungentus clavatus*</i>														Endemic
85. <i>Enchodelus (Enchodelus) microdoroides*</i>									+	+				Endemic
86. <i>Enchodelus (Enchodelus) distinctus*</i>						+								
87. <i>Enchodelus (Nepalus) maximus*</i>						+								Endemic
88. <i>Enchodelus (Paraenchodelus) longidens*</i>						+								Endemic
89. <i>Enchodelus (Paraenchodelus) satendri*</i>						+								Endemic
90. <i>Enchodelus (Paraenchodelus) thornei*</i>						+								Endemic
91. <i>Enchodelus (Rotundus) parateres*</i>						+								
Family ACTINOLAIMIDAE														
92. <i>Actinolaimoides thornei*</i>			+						+					Endemic
Family LONGIDORIDAE														
93. <i>Longidorus himalayensis*</i>		+												Endemic
94. <i>Longidorus elongatus</i>					+			+			+			
Family XIPHINEMATIDAE														
95. <i>Xiphinema americanum</i>						+								Exotic
96. <i>Xiphinema brevicolle</i>		+												Exotic
97. <i>Xiphinema bergeri</i>					+			+			+			

Table contd....

36

Taxa	Districts												Remarks
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
Family BELONDIRIDAE													
98. <i>Axonchium (Axonchium) manalicum*</i>						+							Endemic
99. <i>Dorylaimellus (Dorylatmellus) himalayensis</i>						+							Endemic
Family TYLENCHOLAIMIDAE													
100. <i>Tylencholaimus (Tylencholaimus) cedari</i>													
Family LEPTONCHIDAE													
101. <i>Tyleptus projectus</i>													
102. <i>Gymnotyleptus</i> sp.													
Family MYDONOMIDAE													
103. <i>Dorylaimoides (Dorylaimoides) indicus</i>													
Family NYGOLAIMIDAE													
104. <i>Nygolaimus harishi</i>						+							
105. <i>Clavicaudoides tenuicaudatum*</i>				+		+							Endemic
106. <i>Aquatides aquaticus</i>		+				+							
107. <i>Aquatides intermedius</i>						+							
108. <i>Aquatides deconincki</i>						+							
109. <i>Aquatides christicki*</i>						+							Endemic
110. <i>Aquatides thornei</i>						+							
111. <i>Laevides laevis</i>						+							
112. <i>Laevides timmi</i>						+		+					
113. <i>Solididens vulgaris</i>						+							

Table contd....

Taxa	Districts												Remarks
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
114. <i>Solididens australis</i>						+							
115. <i>Paravulvulus acuticaudatus</i>						+							
116. <i>Paravulvulus papillatus*</i>						+							Endemic
117. <i>Aetholaimus indicus</i>						+							
Order MONONCHIDA													
Family MYLONCHULIDAE													
118. <i>Mylonchulus amurus*</i>										+			Endemic
119. <i>Mylonchulus apapillatus*</i>							+						Endemic
Family ANATONCHIDAE													
120. <i>Miconchus delhousiensis*</i>		+											Endemic
SAPROPHAGOUS NEMATODES (Misc. Orders)													
121. <i>Tridontus longicaudatus</i>		+											
122. <i>Welcereptus andersoni</i>		+											
123. <i>Amphidelus manalicus*</i>				+									Endemic
124. <i>Etamphidclus japonicus</i>													
125. <i>Cephalobus</i> sp.													
126. <i>Penagrolaimus</i> sp.													
127. <i>Diplogaster</i> sp.													



## MOLLUSCA

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### INTRODUCTION

Western Himalayas form an important zoogeographical zone and there are a good number of species of land and freshwater molluscs, restricted endemic to the Western Himalayas.

Notable earlier works on molluscs of the Western Himalayas in general, include Davis *et al.* (1986); Godwin-Austen (1899); Hora *et al.* (1955); Nevill (1878); Rajagopal and Subba Rao (1968 & 1972); Subba and Mitra (1995) and Theobald (1878).

Systematic studies of molluscs of Himachal Pradesh were made by Agrawal (1975a, 1975b, 1976, 1977, 1979). His reports included a large number of new records and some of them are synonymized. Rajagopal (1953) described a new species, *Kaliella bhasini* from the Shimla Hills.

Other reports on molluscs of Himachal Pradesh include Bhalla and Pawar (1977); Bharadwaj and Thakur (1973); Hora (1928); Rao (1927) and Thakur (1980). Former three of these deal with food and feeding habits of a few species of land snails at Solan and a few other places, the latter two are on observations on hibernation and aestivation of a few species of land snails and slugs at Chamba and Kangra respectively.

### DISCUSSION

The list presented here includes 73 species of freshwater and land molluscs, including a few subspecific categories, (21 freshwater and 52 land) under 39 genera (10 freshwater and 29 land) and 21 families (8 freshwater and 13 land), as occurring in the 12 districts of Himachal Pradesh under study.

Out of the 21 species of freshwater molluscs, 17 have all India range of distribution. Four species *Lymnaea andersoniana*, *L. auricularia*, *L. persica* and *L. stagnalis* have interesting pattern distribution. *L. andersoniana* is restricted to Himachal Pradesh and Kashmir in the north and Manipur in the north-east India, extending further to Nepal,

Myanmar and China. Both *L. auricularia* and *L. stagnalis* are essentially Palaearctic in distribution extending to Kashmir in India. Now both the species are for the first time recorded from Himachal Pradesh. *L. persica* is distributed in north and north-west India excluding to the North-west Frontier and Baluchistan and also Southern Persia.

The Fauna of Land molluscs is more distinctive and out of 52 species only 6 species have all India distributional range. These include the 4 cosmopolitan species, *Subulina octona*, *Kaliella barrakporensis*, *Gulella bicolor* and *Allopeas gracile*, all of which enjoy a very wide range of distribution. As many as 26 species are restricted endemic to the western Himalayas. Eight species, viz., *Bensonina angelica*, *B. theobaldiana*, *Ena (Serina) kuluensis*, *Ena (Subzebrinus) boysiana*, *Pupilla gutta*, *Anadenus dalhousiensis*, *Macrochlamys kuluensis* and *Bradybaena radicecola* are restricted endemic to both Eastern and Western Himalays. Three genera, *Girasia*, *Alycaeus* and *Diplommatina*, abounding in north-east India are represented by a single species each in Himachal Pradesh.

Besides the high-altitude slug genus *Anadenus*, quite a few species like, *Bensonina jacquemonti*, *B. angelica*, *B. convexa*, *Macrochlamys glauca*, *M. vesicula*, *Kaliella fastigiata* etc., are recorded from above 3000 m. in altitude. *Syama splendens* the type locality of which is Shimla is recorded from 3230 m. (Blanford and Godwin-Austen, 1908).

As pointed out by Subba Rao and Mitra (1995), the rigorous climate of the Western Himalayas perhaps act, as a limiting factor for many of the common species of land molluscs of the plains.

However, in comparison to the North-Eastern Himalayas, Western Himalayas record appreciably less number of species of molluscs. In contrast to approximately 250 species of land operculates from the eastern Himalayas, only 3 species under 2 genera, viz., *Alycaeus strangulatus*, *Diplommatina follicula* and *D. huttoni*, are recorded from the Western Himalayas, of these the former two are known from Himachal Pradesh.

Districtwise, Shimla records the highest number of species (35) whereas some of the districts like, Kinnaur and Una draw blank. However, perhaps sufficient efforts were not made in those districts for the collections.

Ariophantidae is represented by 22 species. At the specific level, *Bensonina monticola* (Hutton) is the commonest species being recorded from 6 districts.

Records of *Paludomus tanschauricus*, *Glessula tornensis*, *G. paupercula* and *Laevicaulis frauenfeldi*, so far recorded from Peninsular India, from Himachal Pradesh by Agarwal (1977) need further investigation.

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Table : District-wise distribution of Mollusca of Western Himalaya

Taxon	Districts												Distribution elsewhere	
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu,	Lahaul & Spiti	Mandi	Shimla	Simour	Solan	Una		
	1	2	3	4	5	6	7	8	9	10	11	12		13
Class GASTROPODA														
Order MESOGASTROPODA														
Family VIVIPARIDAE														
1. <i>Bellamyia bengalensis f. typica</i> (Lamarck)	+	-	-	-	-	-	-	-	-	-	-	-	-	Throughout India
2. <i>Bellamyia bengalensis f. mandiensis</i> (Kobelt)	+	-	-	-	-	+	-	+	-	-	-	-	-	Uttar Pradesh, Punjab, Maharashtra
3. <i>B. dissimilis</i> (Mueller)	-	+	-	-	-	-	-	-	-	-	-	-	-	Common throughout India
Family CYCLOPHORIDAE														
4. <i>Alycaeus strangulatus</i> (Pfeiffer)	+	-	-	-	-	-	-	-	-	-	-	-	-	Uttar Pradesh (Restricted to Western Himalayas)
5. <i>Diplomatina follicula</i> (Pfeiffer)	-	-	-	-	-	-	-	-	-	-	-	+	-	Uttar Pradesh (Restricted to Western Himalayas)
Family BITHYNIIDAE														
6. <i>Digoniostoma cerameopoma</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	Common throughout India, Pakistan
7. <i>D. pulchella</i> (Benson)	+	-	+	-	-	-	-	-	-	-	-	-	-	Common throughout India, Malay Archipelago, Myanmar

Taxon	Districts												Distribution elsewhere
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	13
Family THIARIDAE													
8. <i>Thiara (Melanoides) tuberculata</i> (Mueller)	+	+	+	-	-	-	-	-	-	-	-	-	Throughout India except Kashmir. North & South Africa, E. Mediterranean countries, S.E. Asia, China, Malaysia, N. Australia, Pacific Islands, Ryu Kyu Islands of Japan, New Hebrides.
9. <i>Paludomus tanschuaricus</i> (Gmelin)	-	-	+	-	-	-	-	-	-	-	-	-	Peninsular India, Sri Lanka
Order BASOMMATOPHORA													
Family LYMNAEIDAE													
10. <i>Lymnaea (Pseudosuccinea) acuminata</i> <i>f. rufescens</i> Gray	+	-	-	-	-	-	-	-	-	-	-	-	Throughout India
11. <i>Lymnaea (Pseudosuccinea) acuminata</i> <i>f. typica</i> Lamarck	+	+	-	-	-	-	-	-	-	-	-	-	Throughout India
12. <i>Lymnaea (Pseudosuccinea) luteola</i> <i>f. australis</i> Annandale & Rao	+	-	-	-	-	-	-	-	-	-	-	-	Throughout India, Sri Lanka
13. <i>Lymnaea (Pseudosuccinea) luteola</i> <i>f. ovalis</i> Gray	+	+	-	-	-	-	-	-	-	-	-	-	Throughout India, Myanmar, Sri Lanka
14. <i>Lymnaea (Galba) andersoniana</i> Nevill	-	-	-	-	-	+	-	-	-	-	-	+	Manipur, Nepal, Myanmar, China

Table continued

Taxon	Districts												Distribution elsewhere
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
15. <i>Lymnaea (Radix) auricularia</i> Linnaeus	+	-	-		-		-	-	-	-	-		New record for H.P., Kashmir, Afghanistan, Europe, Northern Asia
16. <i>Lymnaea (Radix) persica</i> Issel		-	-					-	-	-			Kashmir, Uttar Pradesh, N.W. Frontier, South Persia
17. <i>Lymnaea (Radix) stagnalis</i> (Linnaeus)		+	-					-		-	-	-	Kashmir, Europe, N. Africa, Syria, Iran, N. America, New Zealand
Family PLANORBIDAE													
18. <i>Gyraulus convexiuxulus</i> (Hutton)		+									-	+	Common throughout India, Pakistan
19. <i>Gyraulus labiatus</i> (Benson)	+										-	-	Fairly common in India and Myanmar
20. <i>Indoplanorbis exustus</i> (Deshayes)	+	-	+		-					-	-	+	Throughout India, Indonesia, Malaysia, Myanmar, Pakistan, Persia, Sumatra, Thailand, Vietnam
Order STYLOMMATOPHORA													
Family PUPILLIDAE													
21. <i>Bifidaria huttoniana</i> (Benson)												+	Kashmir, Maharashtra, Peninsular India, Pakistan

Taxon	Districts												Distribution elsewhere
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
22. <i>Orcula (Sphyradium) himalayanum</i> (Benson)	-	-	-	-	-	-	-	-	-	-	-	+	Kashmir, Uttar Pradesh (Restricted to Western Himalayas)
23. <i>Pupilla gutta</i> (Benson)	-	-	-	-	-	-	-	-	-	+	-	-	Restricted endemic to Himachal Pradesh
24. <i>Pyramidula humilis</i> (Benson)	-	-	-	-	-	-	-	-	-	+	-	+	Punjab, Uttar Pradesh. (Restricted to Western Himalays)
Family BRADYBAENIDAE													
25. <i>Bradybaena radiculicola</i> (Benson)	-	-	-	-	-	-	-	-	-	-	-	+	Sikkim, Uttar Pradesh. (E. & W. Himalayas)
26. <i>Plctotropis huttoni</i> (Pfeiffer)	-	-	-	-	-	-	-	-	-	-	-	+	Arunachal Pradesh, Kashmir, Nagaland, Tamil Nadu, Uttar Pradesh, West Bengal, China, Myanmar
Family VALLONIDAE													
27. <i>Vallonia ladakensis</i> Nevill	-	-	-	-	-	-	-	-	-	+	-	-	Kashmir, Punjab, Tibet.
Family ENIDAE													
28. <i>Cerastua segregatus</i> (Reeve)	-	-	-	-	-	-	-	-	-	-	-	+	Kashmir (Restricted to Western Himlayas)
29. <i>Ena (Serina) kuluensis</i> (Kobelt)	-	-	-	-	-	-	-	-	+	-	-	-	Restricted endemic to H. P.

Table continued...

Taxon	Districts												Distribution elsewhere
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Simour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
30. <i>Ena (Subzebrinus) arcuata</i> (Kuster)	-	+	-		-	-	-	-		-	-	+	Kashmir (Restricted to Western Himalayas)
31. <i>Ena (Subzebrinus) boysiana</i> (Reeve)	-	+	-	-	-	-	-	-	-	-	-	-	U.P., West Bengal, E. & W. Himalayas
32. <i>Ena (Subzebrinus) eremita</i> (Reeve)	-		-		-		-	-	-			+	Punjab, Afghanistan, Tibet.
33. <i>Ena (Subzebrinus) sindica</i> (Reeve)			-	-			-	+				-	Kashmir, Punjab, West Bengal, Afghanistan, Pakistan
34. <i>Ena (Subzebrinus) vibex</i> (Kuster)	-	-	-		-	-		-				-	Uttar Pradesh (Restricted to Western Himalayas)
Family CLAUSILIIDAE													
35. <i>Phaedusa cylindrica</i> Pfeiffer	-	-	-	-	-	-		-	-	-	-	+	Assam, Kashmir, Uttar Pradesh
Family ARIONIDAE													
36. <i>Anadenus altivagus</i> (Theobald)	-		-	-					-	-	-	+	Kashmir, Uttar Pradesh, Pakistan
37. <i>Anadenus dalhousiensis</i> Bhatia		-	-	-	-	-	+	-	-	-	-	-	Restricted endemic to Himachal Pradesh
38. <i>Anadenus schlagintweiti</i> Heynemann		-	-	-		-		-	+	-	-	+	Arunachal Pradesh, Punjab (E. & W. Himalayas)
Family SUBULINIDAE													
39. <i>Allopeas gracile</i> (Hutton)	+				-	-	-	-		-	-		Common throughout S.E. Asia

Table continued...

Taxon	Districts												Distribution elsewhere
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
40. <i>Caecilioides balamus</i> (Reeve)	-	-	-	+	-	-	-	-	-	-	-	-	Kashmir (Western Himalayas)
41. <i>Coilostele scalaris</i> Benson	-	-	-	+	-	-	-	-	-	-	-	-	Kashmir (Western Himalayas)
42. <i>Glessula paupercula</i> (Blanford)	-	+	-	-	-	-	-	-	-	-	-	-	Peninsular India
43. <i>G. tornensis</i> (Blanford)	-	+	-	-	-	-	-	-	-	-	-	-	Bilaspur
44. <i>Subulina octona</i>	-	+	-	-	-	-	-	-	-	-	-	-	Bilaspur
45. <i>Bensonia jacquemonti</i> (V. Martens)	+	-	-	-	-	-	-	-	-	-	-	-	+ Punjab (3,077m)
46. <i>Bensonia monticola</i> (Hutton)	-	+	+	-	-	-	-	+	+	-	-	-	+ Kashmir, Uttar Pradesh (Western Himalayas)
47. <i>Bensonia theobaldiana</i> Godwin-Austen	+	-	-	-	-	-	-	-	+	-	-	-	+ Restricted endemic to Himachal Pradesh
48. <i>Bensonia angelica</i> (Pfeiffer)	-	-	-	-	-	-	+	-	-	-	-	-	- Restricted endemic to Himachal Pradesh (2,461m)
49. <i>Bensonia convexa</i> (Reeve)	-	-	-	-	-	-	-	-	-	-	-	-	+ Uttar Pradesh. Restricted to Western Himalayas (2,769m)
50. <i>Kaliella bhasini</i> Rajagopalainger	-	-	-	-	-	-	-	-	-	-	-	-	+ Not known beyond type locality (Simla)
51. <i>Kaliella bullula</i> (Hutton)	-	-	-	-	-	-	-	-	+	-	-	-	+ Uttar Pradesh. Restricted to Western Himalayas
52. <i>Kaliella fastigiata</i> (Hutton)	-	-	-	-	-	-	-	-	-	-	-	-	+ Uttar Pradesh, West Bengal (2,462m)

Table continued

Taxon	Districts												Distribution elsewhere
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
53. <i>Kaliella nana</i> (Hutton)	-	-	-	-	-	-	-	-	+	-	-	+	Uttar Pradesh, West Bengal, E. & W. Himalayas
54. <i>Khasiella chloroplax</i> (Benson)	-	-	-	-	-	-	-	-	-	-	-	+	Punjab
55. <i>Khasiella hyba</i> (Benson)	-	-	-	-	-	-	+	-	-	-	-	-	Kashmir (Restricted to Western Himalayas)
56. <i>Euaustenia cassida</i> Hutton	+	-	-	-	-	-	-	-	-	-	-	-	Kashmir, Uttar Pradesh (Restricted to Western Himalayas)
57. <i>Euaustenia theobaldi</i> (Godwin-Austen)	-	-	-	-	-	+	-	-	-	-	-	-	Kashmir (Restricted to Western Himalaya)
58. <i>Macrochlamys glauca</i> (Pfeiffer)	+	-	-	-	-	+	-	-	-	-	-	+	Uttar Pradesh (Restricted to Western Himalayas)
59. <i>M. kuluensis</i> (Blanford)	-	-	-	-	-	-	-	-	+	-	-	+	Restricted endemic to Himachal Pradesh
60. <i>M. nuda</i> (Pfeiffer)	+	-	-	-	-	-	-	-	-	-	-	+	Uttar Pradesh (Restricted to Western Himalayas)
61. <i>M. planuscula</i> (Hutton)	-	-	-	-	-	-	-	-	-	-	-	+	Uttar Pradesh (Restricted to Western Himalayas)
62. <i>M. vesicula</i> (Hutton)	+	-	-	-	-	-	-	-	-	-	-	-	Punjab, Uttar Pradesh. Pakistan
63. <i>Girasia dalhousiae</i> Godwin-Austen	-	-	-	-	-	-	+	-	-	-	-	-	Restricted endemic to Himachal Pradesh. Only species of the genus in Western Himalayas.

Table continued...

Taxon	Districts												Distribution elsewhere
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	
64. <i>Syama splendens</i> (Hutton)	-	-	-	-	-	-	-	-	-	-	-	+	Common throughout India, Pakistan, Afghanistan, Myanmar
65. <i>Syama prona</i> (Nevill)	-	-	-	-	-	-	-	-	-	-	-	+	Punjab, Uttar Pradesh (Western Himalayas)
Family SUCCINEIDAE													
66. <i>Succinea crassinuclea</i> Pfeiffer	-	-	-	-	-	+	-	-	-	-	-	+	Gujarat, Punjab, West Bengal.
Family STREPTAXIDAE													
67. <i>Gulella bicolor</i> (Hutton)	+	-	-	-	-	-	-	-	-	-	-	-	Common throughout S.E. Asia, Seychelles, Mascarene, West Indies.
Family LIMACIDAE													
68. <i>Kasperia</i> sp.	+	-	-	-	-	-	-	-	-	-	-	-	The genus was recorded from Kashmir by Godwin-Austen.
Class BIVALVIA													
Order UNIONIDA													
Family UNIONIDAE													
69. <i>Parreysia (P.) favidens</i> (Benson)	-	-	-	-	-	-	-	-	-	-	-	+	Common throughout India, Bangladesh

Table continued

Taxon	Districts												Distribution elsewhere	
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una		
	1	2	3	4	5	6	7	8	9	10	11	12		13
Order VENEROIDA Family PISIDIIDAE 70. <i>Sphaerium indicum</i> Deshayes	+	-	-	-	-	-	-	-	-	-	-	-	-	India, plains and Himalays.
Family CORBICULIDAE 71. <i>Corbicula striatella</i> Deshayes	-	-	+			-		-	-	-	-		Common throughout India, Pakistan, Afghanistan, Myanmar	



## **ANNELIDA : OLIGOCHAETA**

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### **INTRODUCTION**

Earthworms have drawn the attention of philosophers and naturalists since ancient times because of their immense importance in soil improvement and fertility. They play a significant role in the disappearance of surface plant litter, and its breakdown, redistribution and incorporation in the soil. Organic matter is pulverized and subjected to digestive enzymes in their alimentary canal. Their castings (excreta) are rich in plant nutrients (Julka, 1988). It has been estimated that wormcasts contain higher amount of nitrate nitrogen and other nutrients than the parent soil (Edwards and Lofty, 1977). The burrowing activity of earthworms enhances aeration and porosity of soil, thereby improving its water holding capacity. Earthworms constitute a major component of the invertebrate biomass (>80%) in most terrestrial ecosystems of the world (Senapati and Dash, 1982). During unfavourable period, the microbial decomposition of dead worms releases considerable amount of nitrogen and other nutrients for growing vegetation.

Aquatic oligochaetes constitute an important component in the complex food web of wetlands and other water bodies. They are known to improve the quality of detritus deposited at the bottom of freshwater ecosystems. Some species of aquatic oligochaetes have been recognized as good indicators of organic pollution.

Excellent taxonomic monographs on the Indian Oligochaeta have been published by Stephenson (1923), Brinkhurst and Jamieson (1971), Gates (1972) and Julka (1988). The oligochaetes of the western Himalaya have not drawn the same attention of Oligochaetologists as those of other regions, primarily due to remoteness and difficult terrain. Ecologically, the entire western Himalaya is considered to be a highly fragile ecosystem. It is, therefore, very essential to undertake taxonomic studies on the fauna of this region. Julka (1995) published a comprehensive taxonomic account on the district-wise oligochaete diversity of the western Himalaya in Uttar Pradesh (now Uttaranchal). This article is second in the series on the oligochaete fauna of western Himalaya covering the state of Himachal Pradesh.

Studies on the oligochaete diversity of Himachal Pradesh were initiated by Stephenson (1915) with the discovery of a new species of an earthworm, *Perionyx bainii*, from Shimla and also the first record of *Pheretima heterochaeta* (= *Amyntas corticis*) from the same place. Subsequently, Stephenson (1916, 1917, 1922) reported 7 more earthworm species from this state, viz. *Helodrilus parvus* (= *Allolobophora parva*), *Helodrilus foetida* (= *Eisenia fetida*), *Drawida japonica*, *Perionyx excavatus*, *Helodrilus constrictus* (= *Dendrodrilus rubidus*), *Octolasion lacteum* (= *Octolasion trytaeum*), and *Helodrilus kempfi* (= *Octolasion cyaneum*). The first aquatic oligochaete, *Nais communis*, from Himachal Pradesh was described by Stephenson (1918) from Kasauli. Cernovitov (1937) and Gates (1951) studied the earthworms of Shimla Hills and other parts of the western Himalaya. Julka (1979) recorded a Palaearctic lumbricid, *Lumbricus castaneus*, for the first time from Himachal Pradesh and India. Soota and Halder (1980) listed some earthworm species from diverse ecosystems of this area. Anthropochorous lumbricids of high altitudes of Lahaul Valley were explored by Julka (1981). Julka and Paliwal (1993) discovered a new species, *Perionyx barotensis*, from district Mandi. Another new species of earthworm, *Plutellus sadhupulensis*, was described by Julka and Paliwal (1994) from district Solan. Paliwal (1994) undertook detailed and comprehensive studies on the taxonomy and ecology of earthworms of western Himalaya, and recorded 48 species from the entire region including 42 species from Himachal Pradesh. Julka and Paliwal (1995) recorded *Microscolex phosphoreus* and *Malabarica levis* for the first time from Himachal Pradesh and India.

The western Himalaya is characterized by markedly dissimilar environmental conditions with a wide range of soil types, rainfall, temperature, vegetation, altitude and climate. As a result, the oligochaete fauna of Himachal Pradesh is very rich, comprising both subtropical and temperate elements.

Four species, *Plutellus sadhupulensis*, *Perionyx bainii*, *Perionyx barotensis* and *Perionyx simlaensis* are considered endemic to the area (Paliwal, 1994). *Plutellus sadhupulensis* shows close affinities with endemic elements of the Gangetic Plain. *Perionyx bainii*, *Perionyx barotensis* and *Perionyx simlaensis* are allied to the species of the genus from the eastern Himalaya and northeast ranges. According to Gates (1972), species explosion of *Perionyx* seems to have occurred in the eastern Himalaya, a region with considerable and regular rainfall and high organic matter in the soil. This genus is poorly represented in the western Himalaya, possibly its westward migration from east could not reach there with full force (Julka and Paliwal, 1993). The other species of *Perionyx* occurring in Himachal Pradesh, viz. *Perionyx excavatus* and *Perionyx sansibaricus*, have acquired widespread distribution within and outside India. The original home of *Perionyx excavatus* is suspected to be in the Darjeeling hills and that of *Perionyx sansibaricus* in the peninsular India (Gates, 1972).

The remaining species in Himachal Pradesh are peregrine and have been marked with an asterisk (\*) in Table 1. Majority of these are suspected to have been introduced to these hills, possibly due to their transportation in soil around roots of exotic plants and

through other agencies. Introduction of peregrines in soil around roots of plants or otherwise has also been recognized by Gates (1976) during his studies on the oligochaetes intercepted by U.S. Bureau of Plant Quarantine. The distribution of peregrine species is, therefore, disregarded for biogeographical considerations.

Among moniligastrids, the original home of *Drawida japonica* (Michaelsen) is somewhere in Sino-Japanese region. *Drawida nepalensis* Michaelsen is endemic to Nepal. Its widespread distribution in the western Himalaya is possibly due to recent transportation, a view also supported by Julka (1993). Among lumbricids, *Allolobophora parva* is of Nearctic and the others are of Palaearctic origin (Julka, 1988). The lumbricids have been able to establish well only in the hilly regions with temperate-like climate above the elevations of 1000 m. At some places in the western Himalaya they are now dominant over native worms.

The ocnerodrilids are represented by three genera : *Ocnerodrilus*, *Malabaria* and *Thatonia*. The genus *Ocnerodrilus* comprises the well-known Neotropical *Ocnerodrilus occidentalis* with its original home in central America. *Malabaria levis*, with its type locality in China and extended distribution to Myanmar, was recorded for the first time from India and western Himalaya by Julka and Paliwal (1995). Other species of the genus are endemic in southern portion of the peninsular India. All species of *Thatonia* have endemism in northern region of the Indian peninsula (Gates 1972), from where *Thatonia exilis* and *Thatonia gracilis* may have been carried to Himachal Pradesh. The acanthodrilid *Microscolex phosphoreus* is an inhabitant of Neotropical region, but has acquired circummundane distribution due to transportation (Gates, 1972).

Available information on the distribution of Octochaetidae known from Himachal Pradesh shows that *Dichogaster bolau* is of Ethiopian origin. Endemism of species of *Lenogaster*, *Octochaetona* and *Ramiella* is in central highlands of the southern peninsula. Presently, *Lenogaster chittagongensis*, *Lenogaster pusillus*, *Lenogaster yeicus*, *Octochaetona beatrix* and *Ramiella bishambari* are found in various regions of the Indian subcontinent, and in some instances even outside the subcontinent (Julka, 1988).

The megascolecid genera, *Amyntas* and *Metaphire* are endemic in China, southeast Asia, Myanmar, and Andaman and Nicobar Islands, but are represented by the peregrine species in other parts of this country. The original home of *Amyntas alexandri* is in southeast Asia, whereas *Amyntas corticis*, *Amyntas gracilis* and *Amyntas morrisi* belong to China (Gates, 1972). All species of *Metaphire* recorded from Himachal Pradesh are native of southeast Asia.

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Table : Distric-wise distribution of Oligochaeta from Western Himalaya

Taxa	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Phylum NAIDIDAE												
Class OLIGOCHAETA												
Family NAIDIDAE												
1. <i>Nais barbata</i> Müller											+	
2. <i>Nais communis</i> Piguet											+	
Family TUBIFICIDAE												
3. <i>Limnodrilus hoffmeisteri</i> Claparède										+	+	
Family MONILIGASTRIDAE												
4. <i>Drawida japonica</i> (Michaelsen)		+	+	+		+		+	+	+	+	
5. <i>Drawida nepalensis</i> Michaelsen				+				+				
Family LUMBRICIDAE												
6. <i>Allolobophora parva</i> Eisen*	+	+	+	+	+	+	+	+	+	+	+	+
7. <i>Aporrectodea c. caliginosa</i> (Savigny)*		+			+	+	+		+		+	
8. <i>Aporrectodea c. trapezoides</i> (Dugès)*		+		+	+	+	+	+	+	+	+	
9. <i>Aporrectodea rosea rosea</i> (Savigny)*		+		+	+	+	+	+	+	+	+	
10. <i>Dendrobaena hortensis</i> (Michaelsen)*									+			
11. <i>Dendrobaena octaedra</i> (Savigny)*						+		+				
12. <i>Dendrodrilus rubidus</i> (Savigny)*		+		+	+	+	+	+	+	+		
13. <i>Eisenia fetida</i> (Savigny)*		+		+	+	+			+	+	+	
14. <i>Eiseniella t. tetraedra</i> (Savigny)*					+				+	+	+	

Table continued

Taxa	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
15. <i>Lumbricus castaneus</i> (Savigny)*		+							+			
16. <i>Lumbricus terrestris</i> Linnaeus*									+			
17. <i>Octolasion cyaneum</i> (Savigny)*		+				+			+			
18. <i>Octolasion tyrtaeum</i> (Savigny)*		+			+	+	+	+	+	+	+	
Family OCNERODRILIDAE												
19. <i>Malabaria levis</i> (Chen)										+		
20. <i>Ocnerodrilus occidentalis</i> Eisen*	+	+		+		+		+			+	+
21. <i>Thatonia exilis</i> Gates										+		
22. <i>Thatonia gracilis</i> Gates				+								
Family ACANTHODRILIDAE												
23. <i>Microscolex phosphoreus</i> (Dugès)*									+		+	
24. <i>Plutellus sadhupulensis</i> Julka & Paliwal											+	
Family OCTOCHAETIDAE												
25. <i>Dichogaster bolau</i> (Michaelsen)*			+	+						+	+	+
26. <i>Eutyphoeus incommodus</i> (Beddard)	+	+		+				+		+	+	+
27. <i>Eutyphoeus nicholsoni</i> (Beddard)										+		
28. <i>Eutyphoeus waltoni</i> Michaelsen	+	+	+	+				+		+		+
29. <i>Lenogaster chittagongensis</i> (Stephenson)	+	+	+	+				+		+	+	+
30. <i>Lenogaster pusillus</i> (Stephenson)		+		+				+	+		+	
31. <i>Lenogaster yeicus</i> (Stephenson)				+				+	+			

Taxa	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
32. <i>Octochaetona beatrix</i> (Beddard)	+	+	+	+				+		+	+	+
33. <i>Ramiella bishambari</i> (Stephenson)				+					+		+	
Family MEGASCOLECIDAE												
34. <i>Amyntas alexandri</i> (Beddard)*			+	+				+		+		+
35. <i>Amyntas corticis</i> (Kinberg)*	+	+	+	+	+	+	+	+	+	+	+	
36. <i>Amyntas gracilis</i> (Kinberg)*				+								
37. <i>Amyntas morrisi</i> (Beddard)*	+	+		+					+	+	+	
38. <i>Metaphire anomala</i> (Michaelsen)*				+				+		+		
39. <i>Metaphire birmanica</i> (Rosa)*			+	+				+		+	+	
40. <i>Metaphire houlleti</i> (Perrier)*	+		+	+				+	+	+	+	+
41. <i>Metaphire posthuma</i> (Vaillant)*		+		+				+		+		+
42. <i>Perionyx bainii</i> Stephenson		+		+	+	+		+	+	+	+	
43. <i>Perionyx barotensis</i> Julka & Paliwal								+				
44. <i>Perionyx excavatus</i> Perrier	+	+	+	+				+	+	+	+	+
45. <i>Perionyx sansibaricus</i> Michaelsen				+							+	
46. <i>Perionyx simlaensis</i> (Michaelsen)									+		+	
<b>Total</b>	<b>10</b>	<b>21</b>	<b>11</b>	<b>28</b>	<b>10</b>	<b>13</b>	<b>7</b>	<b>24</b>	<b>22</b>	<b>27</b>	<b>28</b>	<b>11</b>

\* *Peregrine species*

## **INSECTA : COLLEMBOLA**

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### **INTRODUCTION**

Collembolans popularly known as 'Spring tails' owing to the presence of Spring-like forked jumping organ underneath the fourth abdominal segment. They are small to minute in size with a range of 0.25 mm to 6 mm in length, antennae primarily with 4 segments, many species without spring tails are also common, exhibiting only sluggish movement and with beautiful deep coral red or dark blue colour.

The study of the Indian Collembola were initiated by Ritter (1910). But the significant contributions were of Imms (1912). Subsequently, Carpenter (1913, 1924), Handschin (1929), Denis (1936), Salmon (1951-69), Baijal (1955, 1968), Choudhuri (1963-1966), Yosii (1966a, b), Mitra (1966-93), Prabhoo (1971) and Hazra (1995) have contributed to the knowledge of Indian Collembola.

The Collembolan fauna of Himachal Pradesh was first known through the work of A.D. Imms (1912), who studied one specimen collected from low herbs and grass at Simla at an approximately 7000 ft altitude by Dr. N. Annandale, ex-Director, Z.S.I. on May 12<sup>th</sup>, 1908. Yosii (1966) reported few species from the State of Himachal Pradesh. Prabhoo *et al.* (1980) described a new species *Tomocerus* (s. str) *mitrai* (Tomoceridae : Collembola) from North west Himalaya.

The present study is based on a part of the collection made by S.K. Bhattacharya and Y.N. Gupta (1978). Thus there remains much of the Collembolan fauna to be explored from Himachal Pradesh and the present contribution is an initiation towards that direction.

### **STATUS OF THE TAXON**

#### **Global and Indian status**

World over this group of insects are known by 5500 species under 452 genera, 11 families and 2 suborders. They are represented by approximately 210 species under 86 genera, 8 families and 2 suborders in India.

## DISTRIBUTION

The Collembolans have very diverse distribution occurring in all parts of the world, inhabiting a wide range of ecological niche and in any climatic region. They are generally found in the decaying moist organic matter like wooden-logs, leaves etc. litter and humus layer in forest flkoor, grassland, nest of termites and ants, caves, among moss, fungus, lichens, foliage of herbs and shrubs; snow at high altitude is also known to support certain Collembolans. In general, they occur everywhere where little organic matter and moisture are available.

The spring tails have a wide range of distribution throughout India. These insects are so far reported from Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim, Tripura, Nagaland, Mizoram, Manipur, Meghalaya, Assam, West Bengal, Orissa, Kerala, Tamil Nadu and certain parts of Maharashtra.

In the Himalayan region, Sharma *et al.* (1984) recorded that the richness and abundance of total litter micro-arthropods decreased with the increase in elevation as well as the share of collembolans in total micro-arthropod population increased with the elevation. Hazra and Choudhuri (1963) found nitrate, organic matter and moisture content of the soil shows significant effects on the distribution of collembola.

## DISCUSSION

The species wise distribution list of collembola so far known from different districts of Himachal Pradesh, is given in Table-1. A total number of 10 species distributed over 9 genera and 3 families are known from this State. Out of 10 species, 2 species are endemic to Himachal Pradesh.

The zoogeographical relationship of collembola of Himachal Pradesh is given in Table-2. It is evident that most of the species of collembola occurring in Himachal Pradesh, are endemic to Indian subregion.

Three species are cosmopolitan in distribution occurring beyond the Oriental Region.

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**Table 1. : Distribution of the of Collembola in different districts of Himachal Pradesh**

Taxa	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spliti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family HYPOGASTRURIDAE												
1. <i>Hypogastrura indovaria</i> Salmon, 1970						+						
2. <i>Xenylla obscura</i> Imms, 1912						+						
3. <i>Ceratophysella gibbosa</i> Bagnali, 1941												
Family ENTOMOBRYIDAE												
4. <i>Sinella curviseta</i> Brook, 1882						+						
5. <i>Homidia cingula</i> Börner, 1906					+				+			
6. <i>Lepidocyrtus heterolepis</i> Ysii, 1959						+						
7. <i>Tomocerus mitrai</i> Prabhoo, 1980						+			+			
8. <i>Tomocerus petalospinus</i> Salmon, 1969						+			+			
Family ISOTOMIDAE												
9. <i>Isotomina thermophila</i> (Axelson, 1901)						+						
10. <i>Isotoma (Desoria) cf. mazda</i> Yosii, 1971						+						

**Table 2. :** Distribution of species occurring in different zoogeographical region

Sl. No.	Name of Species	Himachal Pradesh	Other parts of oriental region	Palearctic	Ethiopian	Australian	Neotropical	Nearctic
Family HYPOGASTRURIDAE								
1.	<i>Hypogastrura indovaria</i> Salmon, 1970	+	-	-	-	-	-	-
2.	<i>Xenylla obscura</i> Imms, 1912	+	+	-	-	-	-	-
3.	<i>Ceratophysella gibbosa</i> Bagnali, 1941	+	-	+	-	-	-	-
Family ENTOMOBRYIDAE								
4.	<i>Sinella curviseta</i> Brook, 1882	+	+	+	+	-	+	+
5.	<i>Homidia cingula</i> Börner, 1906	+	+	-	-	-	-	-
6.	<i>Lepidocyrtus heterolepis</i> Yosii, 1959	+	+	-	-	-	-	-
7.	<i>Tomocerus mitrai</i> Prabhoo, 1980	+	-	-	-	-	-	-
8.	<i>Tomocerus petalospinus</i> Salmon, 1969	+	-	-	-	-	-	-
Family ISOTOMIDAE								
9.	<i>Isotomina thermophila</i> (Axelson, 1901)	+	-	+	+	+	+	+
10.	<i>Isotoma (Desoria) cf. mazda</i> Yosii, 1971	+	-	-	-	-	-	-



## **INSECTA : THYSANURA**

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### **INTRODUCTION**

The order Thysanura comprises popularly known insects of 'Silver fish' and 'bristle tail' and are considered as a serious house hold and library pest in India. The members of the order are small, soft bodied, mostly scaled, wingless insects. They are relatively larger insects than the other members belonging to the subclass Apterygota. They are easily distinguishable from the other closely related orders by long, many segmented antennae, 2 anal cerci, and a single median telson projecting posteriorly from the terminal part of abdomen. They are blind as well as eyed. The free living forms are found in the forest floor, in the nests of ants and termites, under bark of trees, under rocks. The member of the family Machilidae representing 'bristle tail' occur mostly in the decomposing litters of the forest floor and are capable of jumping by means of the apical ventral stylets.

### **HISTORICAL RESUME**

The history of taxonomic studies on the Indian Thysanura dates back to 1903 by Escherich. The first important work of significance on the order Thysanura comes from the efforts of Escherich in 1905 in 'Das system der Lepismatiden' Thereafter Silvestri (1913, 1938, 1948) described some new Indian species from West Bengal, Orissa and Karnataka, later Wygodzinsky (1954, 1972) and recently Hazra and his co-workers (1980 to till date) doing extensive studies on Thysanura and contributed significantly to the knowledge of Indian fauna. Mendes (1990) published on zoogeographic affinities of Indian Thysanura and pointed out the poorly known diversity of the group due to not proper exploration.

### **GLOBAL AND INDIAN STATUS**

A fairly large work on Taxonomic studies has been done by many entomologists from the various parts of the world on Thysanura. The world fauna of Thysanura approximately embody over 1250 species belonging to 130 genera and 5 families.

The study of Indian Thysanuran fauna has been neglected for a long time and our knowledge of this order from India is far from perfect in contrast to world fauna. The poorly known Indian fauna of Thysanura presently represented by 31 species belonging to 21 genera and 5 families. Under Suborder Microcoryphia, the family Machilidae is represented by 7 genera, 10 species and family Meinertellidae has 1 genus and 1 species. The suborder Zygentoma consists of families viz., Lepismatidae with 8 genera and species, Nicoletiidae with 1 genus and 2 spp. And Ateluridae with 4 genera and 5 spp. This shows that approximately only 2.48% of total species of Thysanura of the world are found in India.

The Thysanuran fauna of Himachal Pradesh was first known by the work of Silvestri (1911). He recorded only a single species under the family Machilidae namely, *Allopsontus annandalei* from this state. Since then the knowledge of diversity of Thysanura from this region remains still ignored due to the lack of proper survey and there exists ample scope for further exploration of more taxa from this region in future. The present analysis of the composition of the species of Thysanura is based on a small collection consisting of 44 examples, collected by various scientists of Zoological Survey of India during 1969-1994 from Himachal Pradesh.

### ECONOMIC VALUE

The species like *Lepisma saccharina* and *Ctenolepisma longicaudata* frequently live in association with man and are found amongst house hold articles. They feed upon the starchy matter under wall paper, book, woolen and silken cloth and thus cause immense damage of household articles and books. Thus they constitute as serious house hold and library pests in India. These insects also play limited role in the process of humification.

### RANGE OF DIVERSITY

The species-wise list of Thysanura, so far known from the different districts of Himachal Pradesh, is summarized in Table-1. A total number of 9 species distributed over 5 genera and 3 families are known from this state. This represents 29.0% of the species and 23.8% of the genera of Thysanura is so far known from India. Out of these 9 species, 5 are endemic to Indian fauna. *Ctenolepisma ciliatga* and *Ct. diversisquamis* are known from outside India and they are considered as exotic species occurring in India. They are obviously dispersed by man although it is not necessarily synanthropic. Out of the total number of species, reported here only

*Ctenolepisma longicaudata* originally described from South Africa (Escherich, 1905), is cosmopolitan in distribution and is known from almost all the states of India with no zoogeographic interest. The known presence of the taxa of Himachal Pradesh from the Table-1 shows the absence of records in almost half of the districts. All the species described in this paper are recorded for the first time from the state of Himachal Pradesh.

The zoogeographical relationship of Thysanura of Himachal Pradesh is shown in Table-2. It clearly indicates that *Lepidospora ceylonica* known to occur in north west state of India and also penetrate its distribution towards other parts of oriental region. Other species viz., *Ctenolepisma ciliata*, also recorded from this state has a very wide distribution throughout all zoogeographical realms except Australian. The species like *Allopsontus annandalei*, *Atelura typhloponis*, *Machilanus lapidicola*, *Machilanus schimidi*, *Machilanus insensilis* were all endemic to India (oriental realm) and have not yet been recorded from any other region. Among the above mentioned species, genus *Allopsontus* is endemic to India. Genus *Lepidospora* is the only Nicoletiidae noticed in India. The other genus *Atelura* is typically an oriental element. *Machilanus* has a wider geographical range with good species diversity and is undoubtedly a palaeartic genus. *Ctenolepisma* is cosmopolitan.

It is apparent from the Table-3 that fauna of Himachal Pradesh is a complex admixture of Oriental, Ethiopian, Nearctic, Palaeartic and Neotropical and Australian elements. There is a preponderance of Oriental species. The Ethiopian, Neotropical and Nearctic elements are rather poorly represented and constitute about 33.3% of total fauna. The Palaeartic elements are represented and constitute about 33.3% of total fauna. The Palaeartic elements are represented by 22.2% and Australian elements are rather poorly represented by 11.1% from Himachal Pradesh.

From this study it can be concluded that the species diversity of Thysanura in Himachal Pradesh shows that this group has a mosaic of distribution pattern represented both by cosmopolitan and species endemic to oriental Region, the latter forming the bulk of the Thysanuran fauna of this region.

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**Table I :** Distribution of the species of Thysanura in different districts of Himachal Pradesh

Taxa	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family LEPISMATIDAE												
1. <i>Ctenolepisma longicaudata</i> Escherich					+	+	+		+			
2. <i>C. ciliata</i> (Dufour)					+				+		+	
3. <i>C. diversisquamis</i> Silvestri						+						
Family NICOLETIIDAE												
4. <i>Lepidospora ceylonica</i> Silvestri								+	+			
Family MACHILIDAE												
5. <i>Machilanus schimidi</i> Wygodzinsky											+	
6. <i>M. insensilis</i> Wygodzinsky									+			
7. <i>M. lapidicola</i> Wygodzinsky											+	
8. <i>Allopsontus annandalei</i> Silvestri									+			
Family ATELURIDAE												
9. <i>Atelura typhloponis</i> Silvestri								+	+			

TABLE II : Distribution of species occurring in different zoogeographical realm

Sl. No.	Name of Species	India	Other parts of oriental realm	Palearctic	Ethiopian realm	Australian realm	Neotropical realm	Nearctic realm
1.	<i>Ctenolepisma longicaudata</i> Escherich	+	-	+	+	+	+	+
2.	<i>Ctenolepisma ciliata</i> (Dufour)	+	-	+	+	-	+	+
3.	<i>Ctenolepisma diversisquamis</i> Silvestri	+	-	-	+	-	+	+
4.	<i>Lepidospor ceylonica</i> Silvestri	+	+	-	-	-	-	-
5.	<i>Machilanus schimidi</i> Wygodzinsky	+	-	-	-	-	-	-
6.	<i>Machilanus lapidicola</i> Wygodzinsky	+	-	-	-	-	-	-
7.	<i>Machilanus insensilis</i> Wygodzinsky	+	-	-	-	-	-	-
8.	<i>Allopsontus annandalei</i> Silvestri	+	-	-	-	-	-	-
9.	<i>Atelura typhloponis</i> Silvestri	+	-	-	-	-	-	-

**TABLE III : Zoogeographical analysis of Thysanura from Himachal Pradesh**

Name of family	Total number		Endemic		Species from parts of oriental region	Palearctic species	Ethiopian species	Australian species	Neotropical species	Nearctic species	Wide species
	Genera	Species	Genera	Species							
Lepismatidae	1	3	–	–	3	2	3	1	3	3	1
Nicoletiidae	1	1	1	–	1	–	–	–	–	–	–
Machilidae	2	4	1	4	4	–	–	–	–	–	–
Ateluridae	1	1	–	1	1	–	–	–	–	–	–
<b>Total</b>	<b>5</b>	<b>9</b>	<b>2</b>	<b>5</b>	<b>9</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>1</b>
<b>Total percentage</b>			<b>40%</b>	<b>55.5%</b>	<b>100%</b>	<b>22.2%</b>	<b>33.3%</b>	<b>11.1%</b>	<b>33.3%</b>	<b>33.3%</b>	<b>11.1%</b>



## **INSECTA : ODONATA**

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### **INTRODUCTION**

Range of bio-diversity in Himalayan ecosystem is very wide. The Zoological Survey of India is currently engaged in studying the total faunal component of the area. As a first major step in this direction, the scientists of the Northern Regional Station, Zoological Survey of India, Dehra Dun, have recently (1991) compiled base line data on the biodiversity of Western Himalaya, U.P. Annotated lists of as many as 2178 species including 1343 invertebrates and 835 vertebrates have been prepared (Arora & Kumar, 1991). This enumeration is only a small part of what actually may be present in the area under study, but the compiled information, being the first consolidated account of its kind, would be of great value in assessing the biotic resources and their diversity in Garhwal and Kumaon hills. Recent document on the faunal diversity of north-west Himalaya (H.P.) is the next step in the same direction.

The Odonata, comprising damsel and dragonflies, has been studied most extensively in Himalaya within the Indian sub-region. Consequent to which out of approximately 600 known species of Odonata from India, about 240 species have been recorded from the Himalayan region along, namely, Western, Central and Eastern Himalaya. These include a number of new species, endemic forms and the new records from the region, subsequent to the publication of Fauna of British India, Odonata (1-3) (Fraser, 1933, 34, 36). Kumar & Prasad (1981) and Kumar (1991) have adequately catalogued the dragonflies of the Western Himalaya, and reported as many as 162 taxa, which form about 25% of total dragonfly fauna known from India.

The Odonata fauna of Himachal Pradesh, which, form a bulk of Western Himalaya, has been studied briefly by Bhasin (1953), Singh (1954, 1963), Kumar (1978, 1982), Kumar & Juneja (1976), Kumar & Prasad (1981) and Chandra (1983).

Based upon the earlier records and the surveys carried out recently, Kumar (1982) raised the record of the known species of dragonflies from Himachal Pradesh to 75

from 33. Recently the author has been handed over the additional material of dragonflies from this area collected by ZSI, Solan. Consequent to the study of the above material, and inclusions of inadvertent omissions, the present communication contains an updated list of Odonata from Himachal Pradesh enumerating as many as 88 taxa.

### NOTES ON SYNONYMY OF SPECIES FROM HIMACHAL PRADESH

Following the publication of Fauna of British India, Odonata (Fraser, 1933-36) a number of new species were described from the Western Himalaya on the whole. A large number of these "new species" were not recorded again after their original descriptions; still a number of them have been synonymized. It will be useful to enlist such synonymies here pertaining to Himachal Pradesh fauna viz., *Lestes manaliensis* Singh, 1955 has been synonymized with *Indolestes cyaneus* (Selys, 1862) by Davies & Tobin (1984-85); *Archibasis sushmae* Baijal, 1955 has again been synonymised with *Indolestes cyaneus* (Selys, 1862) by Hamalainen (1989). He has further suggested (l.c.) that *Orthetrum guptai* Baijal, et al. (1955) may be only a young male of *O. cancellatum* (Linn., 1758); while *Nanophya katrainensis* Baijal & Singh, et al. (1955) is a synonym of *Brachythemis cantaminata* (Fabr, 1793). Mitra (1973) synonymized *Sympetrum tandicola* Singh (1955) with *Pantala flavescens* Fabricius, (1798).

In addition, several other dragonfly species described from other parts of Himalaya require critical taxonomic assesment, since as a considerable number of species from Garhwal and Kumaon have been synonymized too. Being beyond scope of the present communication the subject is dealt elsewhere by the author.

### ALTITUDINAL DISTRIBUTION OF ODONATA IN HIMACHAL PRADESH

Dragonflies are true amphibiotic insects, while the eggs and larvae are aquatic, the imagos are aerial in habits. Their aquatic stages are found in almost all types of fresh waters, be they permanent or seasonal. Spatial and seasonal distribution of imagos is determined to a large extent by the nature of aquatic biotope. A well marked parochialism in large number of species of dragonflies has been demonstrated by Kumar (1973, 1978 & 1985) in Western Himalaya. The field observations on the spatial distributional pattern of dragonflies in north-west Himalaya (H.P.) show a close resemblance with the general pattern elsewhere in Western Himalaya.

The hill stream in their upper reaches around 200 m are usually isolated by steep sided hills and their gradient is high, the water supply is permanent and its flow is swift (about 2 m/sec); the water has low and steady temperature and saturated with oxygen; the pH fluctuates little and remains at about 9.5. Though the gradient is steep, the bed

is stable because large stones and boulders are jammed and form the floor of the channel which the water has carved through the rocks. These streams have a number of rocky pools, formed due to accumulation of water in between the boulders. Submerged aquatic vegetation is rare though some may be present on the banks. The common dragonflies around these type of streams at an altitude of about 2000 m are of the genera *Drepanosticta*, *Calicnemia*, *Megalestes*, *Bayadera*, *Anisopleura*, *Anisogomphus*, *Lamelligomphus*, *Cordulegaster* and *Aeshna*.

As these streams descend into the lower ranges around 1000-1500 m their physiography changes considerably. The gradient becomes less, bed gets more open, climate becomes warmer and the water temperature vary appreciably diurnally as well as seasonally. The current velocity becomes less (30 cm to 100 cm/sec.) and may vary greatly even in a short stretch of the stream. The bed is stable comprising small boulders, stones, pebbles, gravel and sand and can be described as "Cemented" bottom (Macan, 1963). These are embedded in such a way that even the severest spate causes little alteration. Streams at this altitude are 5-8 m wide, with water depth of about 30-50 cm, except during SW monsoon when they flood heavily. Submerged aquatic and bank vegetation is adequate to support a rich dragon fly population, and the richest bio-diversity of these insects are found around these streams. Common Odonata around these biotopes are of the genera *Calicnemia*, *Caconeura*, *Disparoneura*, *Megalestes*, *Rhinocypha*, *Libellago*, *Anisopleura*, *Bayadera*, *Neurobasis*, *Mesogomphus*, *Onychogomphus*, *Nepogomphus*, *Anax*, *Macromia*, *Orthetrum*, *Crocothemis*, *Sympetrum* and *Trithemis*.

In the lower Himalayan ranges of Himachal Pradesh a number of flat valleys are present between the alt. of 500 to 1000 m. In such valleys the nature of streams, which are generally tributaries of larger rivers, change considerably and form a network through the marshy and grassy areas. They are generally perennial but a number of them yet dry up in summers. The water flow is slow (20 to 50 cm/sec.) and their bottom is generally sandy or muddy comprising a lot of debris and decaying organic matter; their pH is low (between 8.2 to 9.0) and the water temperature changes quickly with that of atmosphere. These streams hold a rich population of dragonflies throughout the year. Common dragonflies around these biotopes belong to genera *Copera*, *Pseudagrion*, *Ceriagrion*, *Rhodischnura*, *Enallagma*, *Agriocnemis*, *Ictinogomphus*, *Anax*, *Potomarcha*, *Orthetrum*, *Acisoma*, *Palpopleura*, *Diplacodes*, *Crocothemis*, *Neurothemis*, *Trithemis* and *Tramea*.

Between the alt. 500 to 1500 m a number of fresh water lakes are present in western Himalaya and hold rich populations of dragonflies. The Odonata of one such lake in Himachal Pradesh (Renuka lake, dist. Sirmour; ca. alt. 660 m) has been studied extensively by the author (Kumar, 1978, 1982; Kumar & Juneja, 1976). In all 37 species have been recorded from this lake. The common genera present are *Copera*, *Calicnemia*, *Ceriagrion*, *Pseudagrion*, *Ischnura*, *Rhinocypha*, *Bayadera*, *Neurobasis*, *Ictinogomphus*, *Orthetrum*, *Neurothemis* and *Trithemis*.

## PHENOLOGY

Seasonal distribution, larval development and life history patterns in western Himalaya Odonata has been discussed by Kumar (1971, 1972, 1977 and 1985). It gives a broad information about the seasonal distribution of emergence and reproduction, especially in relation to the incidence of the monsoons, particularly in the foot hills of north-western Himalaya, where the characteristic phenological differences among the dragonflies occupying habitats with different hydrological regimes have been detected. The ecological classification derived from these studies give rise to generalisations that apply throughout the monsoon belt. On the basis of these studies inferences can be drawn that in the species developing in streams the larval period is prolonged to 7-8 months, i.e. September-October to May-June, while the imagos are on wings for less than 3-4 months during the months of June to September-October. Emergence occurs from April to June and the oviposition takes place towards the withdrawal of SW monsoons in September-October, thus they have only a single larval generation in a year (Univoltine). The other group of univoltine species are those which inhabit ephemeral monsoon ponds, which are in existence only during the SW monsoon period, i.e., June to September, These ponds have been found to hold a rich population of various dragonfly species in foot hills and valleys of western Himalaya. Detailed studies have indicated that these species have very high larval growth rate and are able to complete one life cycle between 40-60 days, thus completing their larval development in these monsoon ponds before they are rendered unsuitable due to post monsoon dry conditions. In such species the imagos remain on wing from 7-8 months, except in a few species in which they undertake well marked migration coinciding with the SW monsoon movement [*Pantala flavescens* is one such species, (Kumar, 1985)] or making use of alternative habitats available and, therefore, have more than one larval generation in a year (multivoltine), as has been observed in case of some species, such as, *Ceriagrion coromandelianum*, *Psuedagrion rubriceps*, *Ischnura delicata*, *Orthetrum s. sabina* and *Crocothemis s. servilia* (Kumar, 1985).

The observations indicate that these species have high rate of larval development and make use of both perennial and seasonal larval biotopes available. The present knowledge and the studies in the laboratory and field demonstrate that their larval broods with slight overlapping, continue almost round the year, with 3 groups of oviposition and emergence taking place generally during the warmer months of the year (Kumar, 1985).

## ZOOGEOGRAPHY OF ODONATA OF NORTH-WEST HIMALAYA (HIMACHAL PRADESH)

Kumar & Prasad (1981) discussed the zoogeography of dragonflies of the whole of Western Himalaya, i.e., J & K, Himachal Pradesh and Garhwal & Kumaon hills. Out of

a total 78 genera present in the above areas, only one, e.g., *Himalagrion* Fraser was recorded as endemic (recorded from dist. Pithoragarh, Kumaon hills, U.P.) to the region.

In the present communication 52 genera (17 of Zygoptera and 35 of Anisoptera) have been recorded from Himachal Pradesh; of these 31 are Oriental, 08 Tropical, 02 Ethiopian, 04 Australian, 03 Palaearctic and 04 Cosmopolitan in distribution. The present check-list contains 88 species from Himachal Pradesh, 31 (35%) of which are Zygoptera, while 57 (65%) are Anisoptera. Out of these 88 forms, 74 (84%) are Oriental, 11 (13%) are Palaearctic, 02 (2% approx.) are Ethiopian and 01 (1%) is Circumtropical in distribution (cf. Table-II). The detailed zoogeographical elements present in 88 species of Odonata of Himachal Pradesh are as follows:-

**1. Oriental Element (74 species) :** This element comprises species known from Indian sub-continent (other than Palaearctic) and whose range extends south-eastwards across to Indo-Chinese-Malaysian and Indonesian region. In few cases they have been found to extend in Australian region also.

This element forms the major bulk of the Odonata fauna of Himachal Pradesh and could be further divided into following subgroups, according to the distribution range of the species.

(i) *Indian Element* (34 species) : This element comprises species recorded from the Indian sub-continent and neighbouring countries (India, Pakistan, Bangladesh, Nepal and Sri Lanka, and whose range extends eastwards across Myanmar and Thailand and sometimes to Laos and Vietnam). The origin of majority of these species seems to have occurred in the Indian area though some of them may have originated in Indo-China.

This element comprises 34 species, 46% of Oriental element, and 38% of total Odonata fauna of Himachal Pradesh. Majority of these species are widely distributed in Himachal Pradesh and U.P. hills. However, only a single species, viz., *Orthetrum triangulare triangulare* (Selys) has extended its distribution in Kashmir valley.

(ii) *Indo-Malaysian Element* (21 species) : This element includes species whose distribution includes the Indian-Indo-Chinese and Malaysian-Indonesian areas upto Philippines and Taiwan in east. The area of origin of majority of these species is however not clear.

This element comprises 21 species, and forms 28% of Oriental element and approximately 24% of total Odonata fauna of Himachal Pradesh. Most of these species are widely distributed in Himachal Pradesh and U.P. Himalaya. However, some of them have extended into Kashmir valley; while more than a dozen species are common with Nepal and Sri Lanka.

(iii) *Indo-Malaysian Element extending into Australian Region* (14 species) : This element consists of the species which extend further SE of the Oriental region into New

Guinea, Sunda Islands, Micronesia and upto the continent of Australia. Although these species occur both in Oriental and Australian region, but because of their being chiefly distributed in Oriental (Indo-Malaysian) region, have been included under oriental element.

It comprises 14 species, which is about 20% of oriental element and 16% of total Odonata fauna of Himachal Pradesh; out of 14 species only two, namely, *Ischnura delicata* (Hagen) and *Agriocnemis pygmaea* (Ramb.) are widely distributed in foot hills of Himachal Pradesh and U.P. Himalaya. However, some have extended into Kashmir valley.

(iv) **Endemic Element (05 species)** : It includes the species known only from Western Himalaya (Other than those which have Palearctic affinities). Basically it forms a sub unit of the Oriental fauna, as they generally occur on the southern slopes of Himalaya. A number of these should be present in other regions, i.e. central and eastern, as well as in the hilly tracts of Peninsula.

This element comprises five species and forms about 7% of Oriental element and 6% of total Odonata fauna of Himachal Pradesh.

**2. Palaearctic Element (11 species)** : This element includes the species usually distributed in Palaearctic region and which generally do not extend SE of Kashmir valley. However, a few exceptions have been found where some of these species have extended to the southern slopes of Himalaya into Himachal Pradesh and even Garhwal & Kumaon hills.

This element is represented by four genera in H.P. (while 09 are recorded from Kashmir valley), comprising 11 species which form about 13% of the total Odonata fauna of Himachal Pradesh, while five have been recorded from Kashmir valley, one species, viz. *Orthetrum japonicum internum* MacLac. has extended upto eastern Himalaya. *Enallagma cyathigerum* Charp. recorded from dist. Kulu in Himachal Pradesh is widely distributed through Europe and North-Africa.

**3. Ethiopian element (02 species)** : This element comprises the species which are commonly distributed in tropical Africa. Only two species (2%), namely, *Ischnura senegalensis* (Rambur) (Zygoptera) and *Orthetrum taeniolum* (Schneider) Anisoptera) occur in Himachal Pradesh. The latter species is widely distributed in countries bordering Mediterranean.

**4. Circumtropical element (01 species)** : This element comprises the species which occur in tropics of both new and old world, thus they are widely distributed along the equator countries. In western Himalaya as well as in Himachal Pradesh only *Pantala flavescens* (Fabr.) is one such species. This is widely distributed in Himachal Pradesh and U.P. Himalaya between the altitude of 300-3000 m. Though, so far, there is no record of this species from Kashmir valley, it does occur in high altitude semi-arid shadow zone of Lahaul-Spiti dist. of Himachal Pradesh.

Mani (1974), while discussing the bio-geography of India, has demonstrated the presence of distinct zoogeographical distributional patterns in the fauna of Himalaya. He has demonstrated that the fauna of Western Himalaya is composed largely of oriental element, which has spread westwards from eastern Himalaya. Partly of Palaearctic forms and to some extent mediterranean, Ethiopian element. He has further shown (l.c.) that although Indo-Chinese and Malayan genera and species are concentrated largely in eastern Himalaya, a number of them have spread, though with decreasing abundance, upto Kumaon and sometimes even as far west as Kashmir. The Palaearctic-Ethiopian genera and species are similarly dominant in north-west Himalaya, but have sparsely spread eastwards to Nepal and rarely even around Assam and Burmese mountains. Kumar & Prasad (1981) while analysing the dragonfly fauna of Western Himalaya showed similar distribution patterns; the major bulk (80%) of the dragonflies of Western Himalaya are Oriental, while only 17% are Palaearctic. The Ethiopian and the circumtropical elements are practically non-existent. The Oriental and Palaearctic elements show almost a clear demarcation in their distributional ranges in Western Himalaya, i.e., out of nine Palaearctic genera in Western Himalaya, while all are present in Kashmir valley, only four have been recorded from Himachal Pradesh.

Similarly out of 28 Palaearctic dragonflies, 23 occur in Kashmir valley, while only 11 have been recorded from Himachal Pradesh. On the other hand the Oriental species have rarely traversed into north-west Himalaya and only two species, namely, *Rhinocypha q. quadrimaculata* and *Orthetrum t. triangulare* have extended into Palaearctic limits.

**Table 1.** Checklist of the Dragonflies from Himachal Pradesh

	Order	ODONATA
	Suborder	ZYGOPTERA
	Family	PLATYCNEMIDIDAE
1.	<i>Coeliccia renifera</i>	(Selys)
2.	<i>Copera annulata</i>	(Selys)
3.	<i>C. marginipes</i>	(Ramb.)
4.	<i>C. vittata</i>	(Selys)
5.	<i>Calicnemia eximia</i>	Selys
6.	<i>C. miles</i>	Laid.
	Family	COENAGRIIDAE
7.	<i>Psudagrion rubriceps</i>	Selys
8.	<i>P. spenci</i>	Fraser
9.	<i>P. laidlawi</i>	Fraser
10.	<i>Ceriagrion cerinorubellum</i>	(Brauer)

11. *C. coromandelianum* (Fabr.)
12. *C. fallax* Ris
13. *Ischnura rufostigma* Selys
14. *I. delicate* (Hagen)
15. *I. forcipata* Morton
16. *I. Senegalensis* (Ramb.)

## Family SYNLESTIDAE

17. *Megalestes major* Selys
18. *Lestes thoracia* Laid.
19. *L. viridula* (Ramb.)

## Family CHOLOROCYPHIDAE

20. *Rhinocypha t. trifasciata* Selys
21. *R. q. quadrimaculata* Selys
22. *R. unimaculata* Selys

## Family EPALLAGIDAE

23. *Bayadera indica* Selys
24. *Anisopleura comes* Selys
25. *A. lestoides* Selys

## Family CALOPTERYGIDAE

26. *Neurobasis ch. chinensis* (Linn.)

## Suborder ANISOPTERA

## Family GOMPHIDAE

27. *Ictinogomphus rapax* (Ramb.)
28. *Burmagomphus sivalikensis* Laid.
29. *Mesogomphus lineatus* (Selys)
30. *Nepogomphus modestus* (Selys)
31. *Onychogomphus M-flavum* Selys

## Family CORDULEGASTERIDAE

32. *Chlorogomphus olympicus* Fraser
33. *Anotogaster b. basalis* (Selys)
34. *Alligaster* sp.
35. *Cordulegaster b. brevistigma* (Selys)

## Family AESHNIDAE

36. *Hemianax ephippiger* (Burm.)
37. *Cephaleschna orbifrons* (Selys)
38. *Aeshna ornithocephala* (MacLac.)
39. *Polycanthagyna erythromelas* (MacLac.)

40. *Anax immaculifrons* Ramb.
41. *A. guttatus* (Burm.)
42. *A. p. parthenope* (Selys)

## Family LIBELLULIDAE

43. *Tholymis tillarga* (Fabr.)
44. *Zyxomma petiolatum* Ramb.
45. *Brachydiplex sobrina* (Ramb.)
46. *Acisoma p. panarpoides* (Ramb.)
47. *Palpopleura s. sexmaculata* (Fabr.)
48. *Pantala flavescens* (Fabr.)
49. *Bradinopyga geminate* (Ramb.)
50. *Potamarcha obscura* (Ramb.)
51. *Brachythemis contaminate* (Fabr.)
52. *Orthetrum pruinosum neglectum* (Ramb.)
53. *O. chrysis* (Selys)
54. *O. s. sabina* (Drury)
55. *O. t. triangulare* (Selys)
56. *O. chrysostigma luzonicum* (Brauer)
57. *O. anceps* (Schneider)
58. *O. c. cancellatum* (Linn.)
59. *O. japonicum internum* MacLac.
60. *O. glaucum* (Brauer)
61. *O. b. brunneum* (Fons.)
62. *O. taeniolatum* (Schneider)
63. *Diplacodes nebulosa* (Fabr.)
64. *D. trivialis* (Ramb.)
65. *Neurothemis t. tullia* (Drury)
66. *N. fulvia* (Drury)
67. *N. i. intermedia* (Ramb.)
68. *Sympetrum commixtum* (Selys)
69. *S. hypomelus* (Selys)
70. *Trithemis pallidenervis* (Kirby)
71. *T. k. kirby* Selys
72. *T. festiva* (Ramb.)
73. *T. aurora* (Burm.)
74. *Rhyothemis triangularis* Kirby
75. *R. v. variegata* (Linn.)
76. *Tramea basilaris burmeisteri* Kirby
77. *T. virginia* (Linn.)

**KEY TO THE ODONATA OF HIMACHAL PRADESH****Key to the suborders of ODONATA**

1. Wings never petiolate, in both fore and hind wings, the discoidal cell is subdivided into a triangle plus supratriangle ..... ANISOPTERA
- Wings petiolate, subpetiolate or non-petiolate; discoidal cell in both wings simple, entire or traversed by nervures, closely similar in fore and hind wings ..... ZYGOPTERA

**Key to the superfamilies of ZYGOPTERA**

1. Only 2 (exceptionally 3) antenodals nervures present; postnodals in strict alignment with the veins below; anal vein fused at base with the posterior of wing ..... 2
- Never less than 5 antenodals present, postnodals not in line with the veins below them; anal vein separate from posterior border of wing from its base ..... AGRIOIDEA
2. The Veins IRiii and Riv+v begining much nearer to the nodus than to arculus; genital hamules of male quadrate ..... COENAGRIOIDEA
- The veins IRiii and Riv + v begining much nearer to the arculus than to the nodus; genital hamules of male elongate ..... LESTINOIDES

**Key to the families of COENAGRIOIDEA**

1. Anal vein and cup of normal length; discoidal cell elongate, anterior and posterior sides subequal, apex obtuse; veins MA and IRiii running straight for greater part of their length ..... PLATYCNEMIDIDAE
- Anal vein and Cup of normal length; discoidal cell short, anterior side considerably shorter than posterior; veins MA and IRiii markedly zigzagged for the greater part of their length ..... COENAGRIIDAE

**Key to the families of LESTINOIDEA**

1. Cuii at its origin from discoidal cell strongly arched towards the costa; moderately large species ..... SYNLESTIDAE
- Cuii at its origin only slightly arched towards the costa; rather small species ..... LESTIDAE

**Key to the families of AGRIOIDEA**

1. The Primary antenodals easily identified from the secondaries; base of discoidal cell connected to Radius by the arculus ..... 2

- The primary antenodals indistinguishable from the secondaries, base of discoidal cell connected to Radius by the arculus..... 3
- 2. Clypeus produced in the form of a prominent uptilted snout; tibiae of males often dilated or brightly coloured, no basal antenodals present..... CHLOROCYPHIDAE
- 3. The vein Rii + iii not fused with Ri shortly after its origin; discoidal cell short, entire or traversed by very few veins, 1st lateral thoracic suture incomplete..... EPALLAGIDAE
- The vein Rii + iii fused with Ri near its origin, discoidal cell longer and traversed by many veins, 1st lateral thoracic suture complete ..... CALOPTERYGIDAE

### Key to the superfamilies of the ANISOPTERA

- 1. Eyes meeting only at a point, discoidal cells of fore and hind wings equal in size and shape, or if dissimilar, than the median space traversed by one or more veins..... CORDULEGASTEROIDEA
- Eyes widely separated or more or less broadly confluent on vertex ..... 2
- 2. Discoidal cells approximately of the same size and shape in fore-and hind-wings and situated equally distant from the arc; costal and subcostal antenodal nervures not coinciding with the two robust primary antenodals present; middle lobe of labium large and fissured ..... AESHNOIDEA
- Discoidal cells differing in size and shape in fore and hind wings, that of fore wing situated far distal of the arc; middle lobe of labium very small, not fissured, broadly overlapped by the lateral lobes; costal and subcostal antenodal nervure coinciding, the robust primary antenodals absent ..... LIBELLULOIDEA

### Key to the families of AESHNOIDEA

- 1. Eyes broadly confluent above ..... AESHNIDAE
- Eyes separated; ovipositor absent ..... GOMPHIDAE

### Key to the families of LIBELLULOIDEA

- 1. Tibiae of males with an elongate lamina-shaped keel on the flexor surface; base of hind wing in the male more or less angulated or notched (same in genera (*Hemicordulia* and *procordulia*); oreillets present on the sides of abdominal segment 2; body usually coloured metallic; primary antenodals present but some what atrophied and inconspicuous, antenodals in hind wing all of the same thickness, basal space always free or cross vein ..... CORDULIIDAE

- Tibiae of males without keel, base of hindwing rounded in both sexes, oreillets absent; body rarely metallic ..... 2
- Sectors of arculus diverging from their origin, distal antenodal of fore wings always complete, antenodals widely spaced, few in number, usually on 6 or 7 in fore wing 5 in the hind, temples of head swollen. Primary antenodals present but atrophied and inconspicuous ..... MOCRODIPLACTIDAE
- Sectors of arculus fused at their origin and arising from a common stalk; distal antenodal of forewing complete or incomplete, antenodals variable in forewing, complete or incomplete antenodals variable in number, primary antenodals absent ..... LIBELLULIDAE

### Key to the genera of PLATYCNEMIDIDAE

1. Costal side of discoidal cell in forewing one fifth or shorter than the posterior.. 2
  - Costal and posterior sides of discoidal cell equal or nearly so ..... *Copera* Kirby
2. Wings petiolated to the level of ac. i.e., ab ends at the level of ac *Coelicia* Kirby ..... (one species : *C. renifera* (Selys))
  - Wings petiolated short of ac, i.e. ab ends some distance proximal to ac; only 3 cells between the discoidal cell and nervure descending from the subnode ..... *Calicnemia* Selys

### Key to the species of *Copera* Kirby

1. The two hind pairs of tibiae white and widely dilated; hind femora extending nearly to end to segment 2; 2nd abdominal segment wholly black on dorsum; inferior anal appendages strongly arched, black at apics ..... *C. annulata* (Selys)
  - The two hind pairs of tibiae yellow, reddish or brownish, only moderately dilated or not at all ..... 2
2. Superior anal appendages only 1/4 the length of inferiors; female with posterior lobe of prothorax without spines ..... *C. marginipes* (Ramb.)
  - Superior anal appendages at least half the length of inferiors; posterior lobe of prothorax of female with a pair of divergent slender forwardly directed spines ..... *C. vittata* (Selys)

### Key to the species of *Calicnemia* Selys

1. Abdomen bright vermilion-red, without markings, a small but conspicuous upper posthumeral spot on thorax; face and head as far back as posterior ocellus red, without markings ..... *C. eximia* Selys

- Abdomen black from segment 6 to the end, basal segments red; not more than 14 to 15 postnodal nervures in fore wing ..... *C. miles* Laid.

### Key to the genera of COENAGRIIDAE

1. Arc situated at the level of the distal antenodal nervure ..... 2
- Arc situated distal to the level of the distal antenodal nervure; the junction of ab and 1 A (medional link) markedly by angulated ..... *Agriocnemis* Selys
2. ab (anal bridge) arising from the hind border of wing at the point where ac meets it ..... 3
3. A prominent ridge on the frons; no postocular coloured spots on head, thorax of a uniform colour, without any dark markings ..... *Ceriagrion* Selys
- No ridge on frons, postocular coloured spots always present, head and thorax not of uniform colour, and usually with black or dark markings ..... *Pseudagrion* Selys
4. Pterostigma differing in shape and size in fore and hind wings of male; segment 10 of male with a pair of dorsal apical tubercles; post-ocular coloured spots present or absent in the adult stage ..... *Ischnura* Charp.
- Pterostigma of the same colour and shape in fore and hind wings of male; segment 10 of male usually without dorsal apical tubercles; postocular coloured spot present ..... *Enallagma* Charp.
- Post-ocular coloured spot absent; ab arising well distal to the level of ac, only 8 to 10 postnodal nervures ..... *Coenagrion* Kirby

### Key to the species of *Pseudagrion* Selys

1. Face, frons, and vertex bright reddish orange or dark ochreous; thorax golden green on dorsum, azure blue on sides, sparingly marked with black ..... *P. r. rubriceps* Selys
- Face, frons, vertex and occiput blue or green, marked with black ..... 2
2. Thorax azure blue on dorsum and sides marked with medial and humeral black stripes ..... 3
- Thorax palest blue with three fine black lines on mid-dorsal carinal ridge and a thicker black humeral stripe ..... *P. decorum* (Ramb.)
3. Superior anal appendages not expanded on the inner side, but with a long robust spine near base ..... *P. spencei* Fraser
- Superior anal appendages without expansion on the inner side and without any spines on inner side or near base ..... *P. laidlawi* Fraser

### Key to the species of *Ceriagrion* Selys

1. Abdomen bright red at base and ends, black on dorsum .....  
..... *C. cerinorubellum* (Brauer)
- Abdomen bright citron yellow, without markings ..... *C. coromandelianum* (Fabr.)
- Abdomen citron-yellow with black marking on the end segment; superior anal appendages more than half the length of segment 10 ..... *C. fallax* Ris

### Key to the species of *Ischnura* Charpentier

1. Species with ground colour of both sexes bright orange red, abdominal segment 8-10 black. .... *I. rufostigma* Selys
- Species with ground colour of males and isochrome females blue to pale grass green ..... 2
2. Abdominal segments 3 to 6 citron yellow, without black markings .....  
..... *I. delicata* (Hagen)
- Abdominal segments 3 to 6 black on dorsum ..... 3
3. Segment 10 with blue spot on dorsum; pterostigma of fore wing with costal sides shortest ..... *I. forcipata* Morton
- Segment 10 unmarked with blue, costal side of pterostigma not markedly shorter than the other sides; 2 nd abdominal segment study metallic blue on dorsum .....  
..... *I. senegalensis* (Ramb.)

### Key to the genera and species of SYNLESTIDAE

1. Body metallic green, wings stalked to slightly proximal to the level of ac; wings never coloured, thorax pale yellow beneath or pruinosed white ..... *Megalestes* Selys  
(Species : *Megalestes major* Selys)
- Discoidal cell of hind-wing shaped similarly to that of fore-wing ..... *Lestes* Leach

### Key to the species of *Lestes* Leach

1. Thorax without metallic markings, vertex of head mat black ..... *L. thoracica* Laid.
- Thorax with green metallic ante humeral stripes ..... *L. viridula* (Ramb.)

### Key to Genera of CHOLOROCYPHIDAE

1. Sectors of arc separated at origin; pterostigma present in fore-wing of both sexes; wings coloured in male ..... *Rhinocypha* Ramb.
- Sectors of arc arising from a common point, fore-wings of male without pterostigma ..... *Libellago* Selys  
(Species : *L. lineata lineata* (Burm.))

**Key to species of *Rhinocypha***

1. Dorsal mesothoracic triangle extending as far as roots of wings; hind wings of male with apical, medial and nodal opaque bands separated .....  
 ..... *R. trifasciata trifasciata* Selys
- Dorsal mesothoracic triangle as above, hind wings of male opaque with well marked vitreous spots; small species..... *R. quadrimaculata quadrimaculata* Selys
- Dorsal mesothoracic triangle either absent, uncoloured or extending not more than half way upto the root of wings; hind wings with a large subquadrate violet green vitreous spot at its centre; large species..... *R. unimaculata* Selys

**Key to genera and species of EPALLAGIDAE**

1. Costa of hind-wings of male running straight from base to node; apices of all wings in male tipped with black ..... *Bayadera* Selys  
 (One species : *B. indica* Selys)
- Costa of hind-wing of male with an obtuse projecting angle between base and node ..... *Anisopleura* Selys

**Key to species of *Anisopleura* Selys**

1. Several cubital nervures present; superior and appendages without spine .....  
 ..... *A. comes* Selys
- Usually only one cubital nervure in all wings, superior anal appendages with short spine at middle..... *A. lestoides* Selys

**Key to genus and species of COLOPTERYGIDAE**

1. Fore-wing of both sexes hyaline, hind wings opaque or hyaline; pterostigma absent in male; false or absent in female ..... *Neurobasis* Selys  
 (Species : *N. chinensis chinensis* (Linn.))

**Key to subfamilies of GOMPHIDAE**

1. Discoidal cell, hypertrigone of fore-wing traversed or reticulated .....  
 ..... ICTININAE (one genera : *Ictinogomphus*) sp. *I. rapax* (Ramb.)
- Discoidal cell, hypertrigone, and subtrigone of forewing always entire; usually only two transverse nervures between sectors of arc in fore-wing from arc to bifurcation of *Rs* ..... GOMPHINAE

**Key to genera of GOMPHINAE**

1. Hind-wing not excavated at base, with tornus rounded in the male.....  
 ..... *Anormogomphus* Selys

- Hind-wing more or less excavated at base, tornus angulate ..... 2.
- 2. Anal loop absent; first postnodal cell not extending proximal to base of subtrigone in hind-wing; anal triangle nearly always 3 celled ..... 3
- Anal loop present; first postnodal cell extending more or less proximal to base of subtrigone in hind-wing; anal triangle nearly always 4 celled ..... 4.
- 3. Superior anal appendages and branches of interior appendages of equal length and equally divericate; ..... **Burmagomphus** Will  
(One species : *B. sivalikensis* Laid.)
- Superior anal appendages variable, usually much longer than branches of inferior, or, if not, then furnished with a ventral process or spine beneath ..... 5
- 4. Superior anal appendages longer than branches of inferior appendages and furnished beneath with a black robust spine or process ..... **Anisogomphus** Selys
- Superior anal appendages longer than branches of inferior, simple and without spine beneath; segments 8 and 9 with lateral foliate dilatations ..... **Mesogomphus** Forster  
(Species : *M. lineatus* (Selys))
- 5. Anal triangle 3 celled, only two rows of cells between IA and margin of fore-wings; lobe of penis swollen and markedly vesiculate ..... **Nepogomphus** Fraser  
(Species : *N. modestus* (Selys))
- Anal triangle 4 celled; three or more rows of cells between IA and margin of fore-wing; lobe of penis not vesiculate ..... **Onychogomphus** Selys  
(Species : *O. M-flavum* Selys)

#### Key to the genera and species of CORDULEGASTERIDAE

- 1. Basal space traversed by one or more nervures; tibiae of males with a membranous keel; ovipositor of female greatly reduced ..... **Chlorogomphus** Selys  
(Species : *O. olympicus* Fraser)
- Basal space entire; tibiae of males without a keel; ovipositor of female enormously reduced ..... 2.
- 2. Base of hind-wing of male rounded; anal triangle absent oreillets absent .....  
..... **Anotogaster** Selys  
(Species : *A. basalis basalis* (Selys))
- Base of hind-wing of male angulated, anal triangle and oreillets present ..... 3.

3. Frons elevated markedly above level of occiput; face broader than long .....  
 ..... *Allogaster* Selys
- Frons not elevated above level of occiput; face only as broad as long .....  
 ..... *Cordulegaster* Leach  
 (Species : *C. brevistigma brevistigma* (Selys))

### Key to the genera and species of AESHNIDAE

1. Base of hind-wing without a notch; tornus of hind-wing rounded in both sexes; anal triangle absent..... 2
- Base of hind-wing more or less deeply notched; tornus of hind-wing angulated in the male; anal triangle always present ..... 3
2. Segment 4 to 8 of abdomen with longitudinal supplementary ridges on the side, superior anal appendages of male obtuse at apex, only 2 rows of calls between the origin of cuia and IA in the hind-wing ..... *Anax* Leach
- Segments 4 to 8 of abdomen without longitudinal supplementary ridges on the sides; superior anal appendages acuminate at apex; 3 rows of cells between the origin of cuia and IA in the hind-wing; ..... *Hemianax* Selys  
 (Species : *H. ephippiger* (Burm.))
3. Median (basal) space traversed by one or more nervures an incomplete basal antenodal nervure nearly always present; segment 10 of female rounded; dentigerous plate absent; ..... *Cephalaeschna* Selys  
 (Species : *C. orbifrons* (Selys))
- Median space entire; incomplete basal antenodal nervure absent; membrane large extending to base of wing; dentigerous plate simple ..... *Aeshna* Fabricius  
 ..... (Species : *A. ornithocephala* (MacLac.))
- Dentigerous plate of female specialized, produced posteriorly and ending in a number of robust spines ..... *Polycanthagyna* Fraser  
 (Species : *P. erythromelas* (MacLac.))

### Key to the species of *Anax* Leach

1. Thorax lurquoise-blue on sides, broadly barred with feet black .....  
 ..... *A. immaculifrons* Rambur
- Thorax pale green or bluish green or pale brown without any broad markings .. 2
2. Abdomen with orange coloured markings, male with a large patch of amber-yellow on hind wing between discoidal cell and node ..... *A. guttatus* (Burm.)

- Abdomen with blue coloured markings, wings tinted with yellow on outer three fourths ..... *A. parthenope parthenope* (Selys)

### Key to the genera and species of LIBELLULIDAE

1. Borders of anal loop running on to meet posterior border of wings, apex of loop open ..... 2
- Borders of anal loop converging and meeting before posterior border of wing; apex of loop closed ..... 3
2. Abdomen broad at base, then tapering gradually to the end; male with an opalescent white spot in centre of hind-wing ..... *Tholymis* Hagen  
(Species : *T. tillarga* (Fabricius))
- Abdomen very tumid at base, then abruptly narrowed and very slim and cylindrical to the end; wings broadly tipped with dark brown and without an opalescent white spot ..... *Zyomma* Rambur  
(Species : *Z. petiolatum* (Rambur))
3. Distal antenodal nervure in fore-wing complete ..... 4
- Distal antenodal nervure in fore-wing incomplete ..... 7
4. Lobe of prothorax large and fringed with long hairs ..... 5
- Lobe of prothorax small, inconspicuous, and usually naked, sectors of arc arising from a common and rather long stalk ..... *Cratilla* Kirby  
(Species : *C. lineata* (Burm.))
5. Frons metallic above ..... *Brachydiplax* (Brauer)  
(Species : *B. sobrina* (Ramb.))
- Frons non-metallic above ..... 6
6. Only 6 antenodal nervures in fore-wing; abdominal segments 1 to 6 dilated, 7 to 10 slim and cylindrical ..... *Acisoma* Rambur  
(Species : *A. panarpoides panarpoides* (Ramb.))
- Never less than 12 antenodal nervures in fore-wing; shape of abdomen variable but never resembling the last ..... *Orthetrum* Newman
7. Lobe of prothorax large and fringed with long hairs ..... 8
- Lobe of prothorax small, usually naked ..... 10
8. Borders of discoidal field converging strongly at wing border *Sympetrum* Newman
- Borders of discoidal field diverging widely at wing border ..... 9

9. Eyes contiguous for a short space; discoidal cell in hind-wing entire; costal border of fore-wing straight; discoidal field in fore wing beginning with a row of 2 cells ..... *Diplacodes* Kirby
- Eyes more broadly contiguous; discoidal cell in hind-wing traversed; costal border of fore wing sinuous near base; discoidal field beginning with at least 3 rows of cells ..... *Palpopleura* Rambur  
(Species : *P. sexmaculata sexmaculata* (Fabricius))
10. Sectors of arc in fore-wing arising from a common and rather long stalk; discoidal field with borders converging strongly at wing margin ..... 11
- Discoidal field with borders parallel or widely divergent at wing-margin ..... 12
11. Discoidal cell in fore-wing very narrow, its costal side only about one-fourth to one-third the length of basal; a conspicuous supplementary nervure (IRii) present between Rii and Riii ..... *Pantala* (Hagen)  
(Species : *P. flavescens* (Fabr.))
- Discoidal cell in fore-wing broader; its costal side about one half the length of basal; no supplementary nervure IRii present between Rii and Riii ..... *Trithemis* Brauer
12. Genital hamules small and inconspicuous in profile, hind-wing not markedly tapered ..... 13
- Genital hamules very long, projecting, and conspicuous in profiles; hind-wing very broad at base and rather tapered at apex; pterostigma smaller in hind-wing than in fore; apical angle of anal loop much acute than the distal ..... *Tramea* Hagen
13. Pterostigma bicolorous, black with white ends; 2 rows of cells between IRiii & Rspl ..... *Bradinopyga* Kirby  
(Species : *B. geminata* (Rambur))
- Pterostigma unicolorous; 1 or rarely 2 rows of cells between IRiii & Rspl ..... 14
14. Wings coloured amber-yellow at base or more broadly dark reddish-brown, and often with a development of close secondary reticulation, especially proximal to node; more than 1 cubital nervure in all wings ..... *Neurothemis* Brauer
- Wings usually uncoloured or with but a small basal yellow marking in hind-wing (a broader medial fascia in *Brachythemis*); no secondary reticulation in the wing; only 1 cubital nervure in all wings ..... 15
15. Red or ochreous species with basal or medial yellow markings to wings ..... 16

- Variably coloured and darker species; never or only partly red or ochreous; arc situated between the first and second antenodal nervures; 2 rows of cells between IRiii & Rspl ..... *Potamarcha* Karsch  
(Species : *P. obscura* (Rambur))
16. Wings with small basal yellow markings; eyes but shortly contiguous; face and frons red; 9 1/2 to 10 1/2 antenodal nervures in fore-wing ..... *Crocothemis* Brauer
- Wing with broad reddish yellow medial fascia; face and abdomen never red; eyes broadly contiguous; only 6 1/2 to 7 1/2 antenodal nervures in fore-wing .....  
..... *Brachythemis* Brauer  
(Species : *B. contaminata* (Fabr.))

#### Key to the species of *Orthetrum* Newman

1. Males coloured some what shade of red ..... 2
- Males coloured brown or black with yellow markings, often pruinosed ..... 3
2. Males violaceous-red, due to a thin over-lying pruinescence; frons blue black anteriorly ..... *O. pruinorum neglectum* (Ramb.)
- Males bright red; frons bright red or yellow in front; lamina of male genitalia with a tuft of stiff black bristles ..... *O. chrysis* (Selys)
3. Abdomen enormously swollen at base and then abruptly slimmed and compressed laterally to the end; black marked with greenish-yellow; not pruinosed .....  
..... *O. sabina sabina* (Dury)
- Abdomen variable but never very slim nor compressed laterally; mostly with pruinosed abdomen and thorax ..... 4
4. Base of hind-wing with a large black triangular marking .....  
..... *O. triangulare triangulare* (Selys)
- Base of hind-wing without a large triangular marking ..... 5
5. Cuii in hind-wing arising from the discoidal cell wall away from the posterior angle ..... *O. chrysostigma luzonicum* (Brauer)
- Cuii in hind-wing arising from the posterior angle of discoidal cell ..... 6
6. Only a single row of cells between IRiii and Rspl ..... *O. anceps* (Schneider)
- Two more rows of cells between IRiii and Rspl ..... 7

7. Costal border of wings and antenodal nervures bright yellow; .....  
 ..... *O. cancellatum cancellatum* (Linn.)
- Costal border of wings and antenodal nervures black ..... 8
8. Abdomen short and broad, almost white with pruinescence; thorax with 2 broad  
 greenish or bluish stripes more or less obscured by pruinescence .....  
 ..... *O. japonicum internum* MacLac
- Abdomen long and rather narrow, often blue with pruinescence; thorax with very  
 narrow whitish or creamy stripes ..... 9
9. Moderately large species with face black or frons blackish anteriorly, membrane black  
 ..... *O. glaucum* (Brauer)
- Moderately large species with face dark brown; membrane pure white .....  
 ..... *O. brunneum brunneum* (Fons)
- Smallest species of the genus, face and frons greyish green or bluish, membrane  
 dark brown bordered with black ..... *O. taeniolatum* (Schneider)

#### Key to the species of *Diplacodes* Kirby

1. Apices of wings tipped with black ..... *D. nebulosa* (Fabr.)
- Apices of wings hyaline, uncoloured except at base; anal appendages yellow .....  
 ..... *D. trivialis* (Rambur)

#### Key to the species of *Neurothemis* Brauer

1. Base of wings of male broadly black; the black basal area edged outwardly with  
 an opalescent white band ..... *N. tullia tullia* (Drury)
- Wings dark reddish-brown from base to about middle of pterostigma, apex narrowly  
 opaque brown to partly enclose a clear window in each wing ... *N. fulvia* (Drury)
- Wings pale yellow at base; costal border of wings also pale yellow to as far as  
 pterostigma ..... *N. intermedia intermedia* (Ramb.)

#### Key to the species of *Sympetrum* Newman

1. Legs entirely black or only anterior femora yellow on inner side; 6 1/2 to 7 1/2  
 antenodal nervures in fore-wing ..... *S. commixtum* (Selys)
- Legs entirely black, only anterior femora yellow on inner side; 8 1/2 to 10 1/2 ante-  
 nodal nervures in fore-wing; basal reticulation black ..... *S. hypomelas* (Selys)

### Key to the species of *Trithemis* Brauer

1. Legs very long and spidery; pterostigma bicolorous; body yellow marked with black ..... *T. pallidinervis* (Kirby)
- Legs ordinary length; pterostigma unicolorous; body colour variable ..... 2
2. Thorax and abdomen bright vermilion-red; base of hind-wing bright orange; neuration yellow ..... *T. kirbyi kirbyi* Selys
- Thorax and abdomen violaceous-black; base of hind-wing with a small dark brown spot, neuration black ..... *T. festiva* (Ramb.)
- Thorax and abdomen violaceous crimson; base of hind-wing with small reddish-brown spot; neuration crimson ..... *T. aurora* (Burmeister)

### Key to the species of *Rhyothemis* Hagen

1. Wings marked with black and amber-yellow; two rows of cells between IRiii and Rspl base of wings deep black, with steely blue reflex, up to discoidal cell in fore-wing, and nearly to nodes in the hind ..... *R. triangularis* Kirby
- Wings marked with black only, or with black and brown with metallic reflex; wings widely different in the sexes; male with whole of wings tinted yellow; fore-wings with spots at node, discoidal cell, apex and at middle of Riii, hind-wing with similar dark spots and two broad longitudinal basal bands; female with broader, shorter wing; fore-wing hyaline from node to apex, basal half with broad black markings, hind-wing with broad irregular markings to as far distal as pterostigma, apex hyaline. .... *R. variegata variegata* (Linn.)

### Key to the species of *Tramea* Hagen

1. Hamule slightly overlapping lobe; two large black spots at the hind-wing surrounded by a golden yellow areola, one in cubital space, the other lying obliquely in anal area of wing, the two narrowly confluent near base of discoidal cell in the male ..... *T. basilaris burmeisteri* Kirby
- Hamule much longer and greatly overlapping lobe; only a single black spot of variable size at base of hind-wing, spot in hind-wing dark reddish brown very large, extending distally to distal end of discoidal cell and involving nearly whole of anal loop ..... *T. virginia* (Rambur)

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## INSECTA : PLECOPTERA (Stone flies)

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### INTRODUCTION

Plecoptera or stone flies are hill stream stony bottom dwelling insects mainly of temperate climate of high altitude. From Himachal Pradesh also a good number of Plecoptera have already been reported. Among the reported species quite a few are endemic to Himachal Pradesh having been reported from here only. In relation to Indian species the endemism of Himachal Pradesh Plecoptera is about 75%. The species of this area constitute about 18% of the total species recorded from India. This shows a great deal of endemism among the stone flies of this area. In India about 113 species of Plecoptera distributed in 7 families have been reported so far. Among these about 20 sp. distributed in 6 families have been recorded so far from Himachal Pradesh. A list of the recorded species is given below :

Order PLECOPTERA

Family TAENIOPTERYGIDAE

1. *Mesyatsia karakorum* (samal)  
Loc. Chhatru, Chandra valley, Spiti valley.
2. *Rabdiopteryx lunata* Kimmins  
Loc. Kulti Nal (Chandra valley), Lahul Spiti, Chhatru, Purana Khoksar Nal.

Family NEMOURIDAE

3. *Amphinemura tricantha* Jewett  
Loc. Kote, Kulu valley, Palchan, Manali.
4. *Illiesonemoura ampula* (Jewett)  
Loc. Rahala, Marhi
5. *Illiesonemoura cordata* (Jewett)  
Loc. Gramphu, Lahul-spiti, Chandra valley, Marhi

6. *Illiesonemoura punctata* (Jewett)

Loc. Gramphu, Marhi, Kulti Nal, Chandra valley.

7. *Illiesonemoura punjabensis* (Jewett)

Loc. Chhatru, Lahul-spiti, Rahala, Kulti Nal, Chandra valley, Dhorni, Marhi, Rotang Pass, Purana Koksar Nal, Manali, Gramphu.

8. *Mesonemoura skardui* (Aubert)

Loc. Palchen, Manali

9. *Mesonemoura vaillanti* (Navas)

Loc. Manali, palchen, Solang

## Family LEUCTRIDAE

10. *Rhopalopssole magnicerca* Jewett

Loc. Kote, Kulu valley

## Family CAPNIIDAE

11. *Capnia bifida* Jewett

Loc. Kulti Nal

12. *Capnia gibbera* Jewett

Loc. Purana Koksar Nal, Chandra valley

13. *Capnia manii* Jewett

Loc. Marhi, Kulti Nal, Chandra valley

## Family PERLODIDAE

14. *Perlodes amabilis*

Loc. Marhi, Manali

## Family PERLIDAE

15. *Cryptoperla torva* Needham

Loc. Kulu

16. *Gibbosia needhami* Klapalek

Loc. Kulu

17. *Phanoperla limosa* (Hagen)

Loc. Kulu

18. *Kamimuria inone* (Needham)

Loc. Kulu

19. *Perla karletoni* Banks  
Loc. Kulu
20. *Perla nirvana* Banks  
Loc. Kulu

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## INSECTA : DERMAPTERA

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### INTRODUCTION

According to studies conducted (Srivastava and Lal, 1992) on the specimens from the area and the available literature, altogether 30 species belonging to 13 genera are reported. Most of the species are montane or submontane forms known to occur in India and adjacent countries and in other parts of Oriental Region. Of these *Euborellia annulipes* (Lucas), *Nala lividipes* (Dufour) and *Labidura riparia* (Pallas) are distributed all over the world.

The members of the genera *Haplodiplatys* Hincks and *Chelisoche*s Scudder, generally distributed in tropical and subtropical parts of the globe, are represented by six and one species, respectively.

The genera *Isolaboides* Hincks, *Allodahlia* Verhoeff, *Anechura* Scudder, and *Forficula* L. are known to occur by three, one, three and six species respectively which show the dominance of Palaearctic element, especially in the areas above 1500 m.

A key to various taxa known from Himachal Pradesh followed by a list of species alongwith their districtwise distribution is given.

#### Key to taxa known from Himachal Pradesh

(Based on males only)

1. Neck blattoid type i.e., anterior and posterior cervical sclerites anterior to prosternum separated from each other but hind margin of posterior sclerite may be separate or fused with the apical margin of prosternum; male genitalia with two functional distal lobes ..... 2 (PYGIDICRANIDAE)(DIPLATYINAE)
- Neck forficuloid type i.e., anterior and posterior cervical sclerites fused and hind margin of latter joined with anterior margin of prosternum; male genitalia with one or two functional distal lobes..... 6

2. Penultimate sternite trisinate posteriorly ..... 3  
 — Penultimate sternite not trisinate posteriorly ..... 4
3. Penultimate sternite with postero-lateral lobes triangular, emargination deep, median lobe broad and emarginate ..... *Haplodiplatys glenis* (Kapoor)  
 — Penultimate sternite with postero-lateral lobes obtuse, emargination shallow, median lobe short & faintly emarginate ..... *Haplodiplatys chinensis* (Hincks)
4. Parameres almost straight, gradually narrowing from base to apex with tip pointed. .... *Haplodiplatys srivastavai* (Kapoor)  
 — Parameres undulated, tip pointed and turned slightly inwards ..... 5
5. Penultimate sternite deeply or feebly emarginate ..... *Haplodiplatys rufescens* (Kirby)  
 — Penultimate sternite bisinate posteriorly ..... *Haplodiplatys simlaensis* (Kapoor)
6. Genitalia with two functional distal lobes, often one reduced or atrophied ..... 7  
 — Genitalia with one median functional lobe ..... 19
7. Genitalia with or without virga, if present, usually not wider at base and without sinuous inner tube; denticulated, chitinous pads present ..... 8 (ANISOLABIDIDAE)(ANISOLABIDINAE)  
 — Genitalia with a distinct virga, dilated at base with a distinct inner sinuous tube ..... 14 (LABIDURIDAE)
8. Mesosternum convex posteriorly ..... 9 (ANISOLABIDINAE)  
 — Mesosternum truncate posteriorly ..... 12 (ISOLABOINAE)
9. Parameres longer than broad, narrow, at base armed with a triangular tooth ..... (*Aborolabis* Srivastava) *Aborolabis pervicina* (Burr)  
 — Parameres rectangular, broad, at base unarmed ..... 10 (*Euborellia* Burr)
10. Sides of abdominal segments carinate; parameres without inner apical concavity 11  
 — Sides of abdominal segments ecarinate; parameres with an inner apical concavity. .... *Euborellia rajasthanensis* Srivastava
11. Legs yellow, often femora with a broad brownish or blackish band; parameres with external apical angle convex ..... *Euborellia annulipes* (Lucas)  
 — Legs with femora uniform yellow; parameres with external apical angle acute, a little projecting ..... *Euborellia compressa* (Borelli)

12. Forceps (in f macrolabia) stout and abruptly incurbed in apical half .....  
 ..... *Isolaboides burri* (Borelli)
- Forceps (in f macrolabia) thin, gradually incurved from middle to posterior half 13
13. Penultimate sternite with hind margin subtruncate ..... *Isolaboides immsi* (Burr)
- Penultimate sternite with hind margin rounded, slight emargination in middle .....  
 ..... *Isolaboides elegans* (Hebard)
14. Elytra along the costal margin with a ridge; legs relatively shorter .....  
 ..... 15 (NALINAE) (*Nala* Zacher)
- Elytra along the costal margin without a ridge (occasionally with a faint convexity),  
 legs longer ..... 16 (LABIDURINAE)
15. Forceps in basal half dilated internally ..... *Nala nepalensis* (Burr)
- Forceps long & cylindrical, not dilated in basal half ..... *Nala lividipes* (Dufour)
16. Sides of abdominal segments without spines and parameres with a short epimerite  
 apically ..... (*Labidura* Leach) *Labidura riparia* (Pallas)
- Sides of abdominal segments, in normal male specimens, with spines; parameres with  
 a long epimerite apically ..... 17 (*Forcipula* Bolivar)
17. Elytra tuberculated, with a faint convexity along the costal margin .....  
 ..... *Forcipula quadrispinosa* (Dohrn)
- Elytra smooth or punctulated, without any convexity along the costal margin .... 18
18. Body covered with dense, long and short pubescence; forceps with a sharp internal  
 spine in basal remote portion in normal forms (in minor forms tooth may be weak  
 or represented by a faint protuberance) ..... *Forcipula trispinosa* (Dohrn)
- Body covered with fine, comparatively sparse pubescence; forceps in basal remote  
 part crenulated internally ..... *Forcipula indica* Brindle
19. Second tarsal segment produced below the third as narrow lobe .....  
 ..... (CHELISOCHIDAE) *Hamaxas singhi* (Kapoor)
- Second tarsal segment dilated, forming a rounded lobe ..... 20 (FORFICULIDAE)
20. Mesosternum broader than long ..... 21
- Mesosternum about as broad as long ..... 24

21. Elytra with a sharp ridge along the costal margin.....  
 ..... (ALLODAHLINAE) *Allodahlia macropyga* (Westwood)
- Elytra without a ridge along the costal margin.....  
 ..... 22 (ANECHURINAE)(*Anechura* Scudder)
22. Elytra with a yellow spot in middle; forceps with branches undulated.....  
 ..... *Anechura zubovskii* (Semenov)
- Elytra unicolourous; forceps not undulated..... 23
23. Forceps at base with a faint internal tooth; pygidium about as long as broad,  
 emarginate posteriorly ..... *Anechura nayyari* Kapoor
- Forceps at base with a large internal tooth; pygidium transverse, emarginate posteriorly  
 & postero-lateral angles pointed ..... *Anechura stoliczkae* (Burr)
24. Basal antennal segment depressed above with lateral margin sharp and convex below;  
 forceps with branches not dilated at base, long cylindrical.....  
 ..... (EUDOHRNIINAE) *Eudohrnia metallica* (Dohrn)
- Basal antennal segment cylindrical (not as above); forceps generally dilated at base  
 or up to basal half..... 25 (FORFICULIDAE)
25. Antennae with 3rd & 4th segments almost equal; legs comparatively shorter, hind  
 tarsi with 1st segment shorter than the combined length of 2nd & 3rd segments  
 ..... *Elaunon bipartitus* (Kirby)
- Antennae with 3rd segment longer than 4th; legs longer, hind tarsi with 1st segment  
 slightly longer than combined length of 2nd & 3rd segments.....  
 ..... 26 (*Forficula* Linnaeus)
26. Pygidium distinct, longer than broad..... *Forficula beelzebub* (Burr)
- Pygidium short, broader than long, pointed or obtuse posteriorly..... 27
27. Pronotum about as long as broad or weakly transverse..... 28
- Pronotum strongly transverse..... 29
28. Size larger (13.3 to 23.0 mm including forceps); abdominal tergites punctulated..  
 ..... *Forficula davidi* (Burr)
- Size smaller (7.0-10.7 mm, including forceps); abdominal tergitefinely punctulated.  
 ..... *Forficula planicollis* (kirby)
29. Abdominal tergites finely punctulated; forceps at base with a large blunt tooth,  
 afterwards branches strongly bowed, in cross section rounded.....  
 ..... *Forficula schlangintweiti* (Burr)

- Andominal tergites punctulated; forceps dilated in basal 1/3, afterwards branches strongly bowed, in cross section quadrangular .....  
..... *Forficula asketi* Purohit, Julka and Lal

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List of Dermapteran species with district-wise distribution in Himachal Pradesh

Taxa	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family PYGIDICRANIDAE												
Subfamily DIPLATYNAE												
1. <i>Haplodiplatys glenis</i> (Kapoor, 1968)									+			
2. <i>Haplodiplatys rufescens</i> (Kirby, 1896)									+	+	+	
3. <i>Haplodiplatys simlaensis</i> (Kapoor, 1968)									+			
4. <i>Haplodiplatys chinensis</i> (Hincks, 1955)									+			
5. <i>Haplodiplatys srivastavai</i> (Kapoor, 1974)									+			
Family ANISOLABIDIDAE												
Subfamily ANISOLABIDINAE												
6. <i>Aborolabis pervicina</i> (Burr, 1913)				+		+						
7. <i>Euborellia annulipes</i> (Lucas, 1847)						+			+	+		
8. <i>Euborellia compressa</i> (Borelli, 1907)	+			+								
9. <i>Euborellia rajasthanensis</i> Srivastava, 1977	+					+			+			
Subfamily ISOLABOIDINAE												
10. <i>Isolaboides burri</i> (Borelli, 1909)		+			+		+					
11. <i>Isolaboides elegans</i> (Hebard, 1917)				+								
12. <i>Isolaboides immsi</i> (Burr, 1913)							+			+		
Family LABIDURIDAE												
Subfamily NALINAE												
13. <i>Nala lividipes</i> (Dufour, 1829)	+			+						+		

Table Contd...

Taxa	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
14. <i>Nala nepalensis</i> (Burr, 1907)	+	+		+				+	+		+	
Subfamily LABIDURINAE												
15. <i>Labidura riparia</i> (Pallas, 1773)	+		+	+		+		+	+	+		
16. <i>Forcipula indica</i> Brindle, 1966				+								
17. <i>Forcipula quadrispinosa</i> (Dohrn, 1863)				+						+		
18. <i>Forcipula trispinosa</i> (Dohrn, 1863)	+	+		+		+			+	+	+	
Family CHELISOCHIDAE												
Subfamily CHELISOCHINAE												
19. <i>Hamaxas singhi</i> (Kapoor, 1966)						+						
Family FORFICULIDAE												
Subfamily ALLODAHLINAE												
20. <i>Allodahlia macropyga</i> (Westwood, 1839)									+			
Subfamily ANECHURINAE												
21. <i>Anechura stoliczkae</i> (Burr, 1911)					+	+		+				
22. <i>Anechura zubovskii</i> (Semenov, 1901)					+		+		+			
23. <i>Anechura nyvari</i> (Kapoor, 1966)						+						
Subfamily EUDOHRNINAE												
24. <i>Eudohrnia metallica</i> (Dohrn, 1865)									+		+	

Table Contd...

Taxa	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Subfamily FORFICULINAE												
25. <i>Elaunon bipartitus</i> (Kirby, 1891)						+			+		+	
26. <i>Forficula planicollis</i> (Kirby, 1891)									+			
27. <i>Forficula schlagintweiti</i> (Burr, 1904)		+				+	+			+		
28. <i>Forficula asketi</i> (Purohit, Julka & Lal, 1985)										+		
29. <i>Forficula davidi</i> (Burr, 1905)										+		
30. <i>Forficula beelzebub</i> (Burr, 1900)									+			

## **INSECTA : HEMIPTERA**

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### **INTRODUCTION**

The Hemiptera are the most important exopterygote insects. They have piercing and sucking type of mouth parts. The representatives of the hemipteran group of insects have enormous scientific, ecological and economical values. Most of the species are injurious to various cultivated crops and vegetations. Some of them are menace to agriculture because they are vectors of many plant viral diseases. Some are often destructive, like the Leafhoppers (Cicadellidae), the Plant lice (Aphididae), the White flies (Aleyrodidae) and the Scale insects (Coccidae). The extensive damage caused by these insects is due to the very fast rate of reproduction by parthenogenesis in case of many Homoptera. Some members of water- bugs destroy fishes, tadpoles etc. and are, thus, responsible for economic loss to the fish culture. Some members belonging to Cimicidae, Triatominae and Polyctenidae are blood suckers and are reported to carry diseases. On the otherhand, some coccids are useful to mankind because these insects are either the source of stick lac of commerce in India or of dye stuff like cochineal and kermes. Some Heteropterans are predaceous and, thus, keep check on populations of other insect pests. Also, aquatic Hemiptera are effectively predaceous on Zooplanktons and thus play an important role in the aquatic ecosystem for transformation of energy. Because of their predatory habit, some aquatic bugs are studied for the biological control of mosquito larvae. Some Belostomatids are known to feed on snails, potential vectors of Schistosomiasis. Pests of the group of insects cause a considerable loss annually to our agricultural and horticultural crops and forest resource. Some homopterans play important role in transmitting plant viral diseases e.g. "mosaic", "Leaf roll", "Yellows" etc. which have directly bearing upon the agricultural economy of the country.

India being a tropical country has very rich insect fauna which comprises more than 80% of the known species of the world fauna. Of these, Indian Hemiptera consists of about 6,500 species distributed over 77 families and constitutes a little over 8% of the Hemipterans known from the world. Among 77 families, aquatic and semiaquatic hemipterans cover a little over 200 species belonging to 13 families, the remaining are terrestrial consisting of about 6,300 species belonging to 64 families. Progress on these species (familywise) has been evaluated recently (*Anonymous, 1991*). Earlier, Distant (1902-1918) published 7 volumes on Hemiptera in the "Fauna of British India" series.

Hemipteran fauna of Himachal Pradesh is poorly known except the family Aphididae which is rather well explored in comparison to the other families.

A perusal of literature reveals that a total of 368 species belonging to 186 genera under 25 families of Hemiptera are so far known from Himachal Pradesh (Distant 1902-18; Sharma and Bhalla 1964; Chowdhuri *et al.* 1969; Bindra and Sekhon 1969a, 1969b; Ghosh *et al.* 1969; Singh 1970; Chakrabarti *et al.* 1970; Bhalla 1971; Mathur 1975; Bhardwaj and Bhalla 1976; Ananthasubramanian and Ananthakrishnan 1975; Raychaudhuri *et al.* 1980; Das *et al.* 1981; Chakrabarti and Bhattacharya 1982; Ghosh 1986; Varshney 1992).

The present contribution is a first report on Hemipteran fauna so far known from Himachal Pradesh. It deals with district-wise distribution of the known species occurring in Himachal Pradesh. Attempt has also been made to throw light on the biodiversity of the species, their endemism, conservation etc. Moreover, analysis of homopteran and heteropteran species has been done in the paper. Lastly, a futuristic approach has also been made so far as hemipteran fauna of the State is concerned.

*Analysis of Taxa* : A critical analysis of the available species so far known from H.P. reveals that out of 368 species belonging to 186 genera under 25 families, Suborder Homoptera represents 290 species in 140 genera under 12 families of which the family Aphididae embraces maximum number (276) of species belonging to 110 genera. Again, in Aphididae out of Seven subfamilies *viz.* Anoeciinae, Aphidinae, Drepanosiphinae, Greenideinae, Hormaphidinae, Lachninae and Pemphiginae, the subfamily Aphidinae represents maximum number (184) of species as against minimum number (5) of species in Anoeciinae. On the otherhand, the homopteran family Fulgoridae represents only 2 species.

In suborder Heteroptera (excluding waterbugs), two families namely, Capsidae and Lygaeidae represent maximum number of 6 species each whereas the family Anthocoridae represents minimum number of 2 species only. The aquatic Hemiptera consists of 18 species.

From the above analysis of the taxa so far known from the state, it shows the homopteran species including pests are relatively more dominant than the heteropteran ones.

*Biodiversity* : The richness of fauna including Hemiptera is largely due to diverse ecosystem prevailing in India. A perusal of literature reveals that a great diversity of hemipteran insects is found in the Eastern and Northeastern Himalaya where the hemipteran fauna is a mixture of Palaearctic, Chinese, and Malayan fauna. Similar is the case with the western Himalaya which includes mainly Jammu & Kashmir, Himachal Pradesh, Kumaon and Garhwal ranges and Uttar Pradesh where four phytogeographical zones are observed *viz.*, tropical, subtropical, temperate and alpine zones. In the western Himalaya, Himachal Pradesh is a rich store house of Biodiversity with the state forming a part of megadiversity area in the Northwest. It enables the state to achieve a unique distinction of being one among the 15 megadiversity countries in the world. The favourable ecological conditions and the biogeographical position of Himachal Pradesh provides ample opportunity

for one of the highest as diverse assemblage of fauna and flora in the evergreen and semievergreen forests to subtropical forests, bamboo forests and grass-lands. Study on collection data reveals that subtropical zone is represented chiefly by rich aphid fauna (Rana and Bisht 1987) both qualitatively and quantitatively, when compared to the tropical, temperate and alpine zone. It may be true in the case of other soft-bodied homopterans. It is also observed that many hemipteran species occurring in the above areas are found in similarity with the fauna of Tibet, Afghanistan, Pakistan, and Middle East.

An analysis of region-wise distribution of some hemipteran groups like Aphididae in India reveals that species diversity and abundance is more in hilly terrains like Himachal Pradesh which meets with subtropical to warm temperate climate and represents the transition area between the realms of Oriental and Palaearctic.

Analysis of collection data reveals that maximum concentration of hemipteran species is noticed in altitude ranging between 600m. and 1500m. approx. i.e., in area enjoying subtropical to warm temperate climate of Himachal Pradesh. Analysis of data reveals that Aphididae of H.P. constitutes about 06% of the total species known from the world, 27.2% of the species from the Oriental and 42.5% of the species from the Indian fauna; 39% are endemic in origin, 33% are palaearctic, 3.3% Ethiopian, 12% Oriental, 4.2% Malayan, 7.5% Nearctic and 01% Australian in origin.

*Futuristic Approach* : Out of 77 hemipteran families represented in India, only 25 families are apparently known from Himachal Pradesh. Also, the species known under each family is rather negligible except the family Aphididae (vide Table 1). Total number of hemipteran species so far recorded from the said area is only about 368 which is meagre in comparison to 6,500 known species of Hemiptera in India.

In view of the role played by the Phytophagous Hemiptera in the agricultural and horticultural economy of the area under study, intensive surveys should be conducted for the qualitative and quantitative studies of Hemiptera in the twelve districts which have either been neglected or surveyed insufficiently.

The collection and identification of parasites and predators and their profitable utilization in biological control schedule programme instead of chemical control method may be given priority.

Since most of the hemipterans are phytophagous and host specific in many cases, attention may be given to preserve the food plants so that ecological harmony is maintained.

Our knowledge on biology of many important pest species of Hemiptera is fragmentary. So, attempt should be made to study on bionomics of such species.

Farming the beneficial insect like Lac is to be implemented on a large scale because it is directly involved in economy.

Wetland fauna of Hemiptera is poorly known in the state as shown in the table 1 (only 20 species known out of about 230 spp. on Indian record). Sincere attempt may,

therefore, be made to make systematic collections of base line data from diverse ecological niches of aquatic and semiaquatic zones of all the districts. The serious study on water bugs may reveal interesting results.

Lastly, initiative may be taken to map-out the distribution of important agricultural pests and predators of Hemiptera. Efforts may also be made to establish a data bank where computerised information on distribution of all the agricultural pests, their biology and ecology, predators etc. may be available to the farmers in each district. This may reduce the indiscriminate use of pesticides. Over and above, most important is an integrated, multidisciplinary approach towards environmental management.

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**Table 1. Showing the comparative faunal picture of major Hemipteran groups**

Order HEMIPTERA		
Suborder HOMOPTERA	<i>Total Species known</i>	
	India	Himachal Pradesh
<b>Families</b>		
ALEYRODIDAE	126	3
APHIDIDAE	650	276
CERCOPIDAE	236	5
CICADELLIDAE	680	13
COCCOIDEA (Superfamily)	624	13
FULGORIDAE	430	2
MEMBRACIDAE	210	7
PSYLLIDAE	120	4
<b>Suborder HETEROPTERA</b>		
<b>Families</b>		
ANTHOCORIDAE	45	2
CAPSIDAE	181	6
COREIDAE	200	3
LYGAEIDAE	260	6
PENTATOMIDAE	700	4
REDUVIIDAE	450	4
WATER BUGS	230	
BELOSTOMATIDAE		1
CORIXIIDAE		3
GERRIDAE		7
HYDORMETRIDAE		4
NAUCORIDAE		1
NEPIDAE		2
NOTONECTIDAE		3
<b>Total :</b>		<b>368</b>

**Table 2 : District-wise distribution of Hemiptera of Western Himalaya**

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Order HOMOPTERA												
Family I. ALEYRODIDAE												
1. <i>Aleurocanthus husaini</i> (Corbett)						+						
2. <i>Aleurocanthus bidentatus</i> (Singh)									+			
3. <i>Dialeurodes citri</i> (Ashmead)									+			
Family II. APHIDIDAE												
Subfamily ANOECIINAE												
4. <i>Aiceona pseudosugii</i> Bindra and Sekhon			+									
5. <i>A. retipennis</i> David, Nayaranan and Rajasingh									+			
6. <i>Anoecia corni</i> (Fabricius)									+			
7. <i>A. himalayaensis</i> Chakrabarti and Maity									+			
8. <i>A. nemoralis</i> (Borner)									+			
Subfamily APHIDINAE (APHIDINI)												
9. <i>Aphis affinis</i> (del Guercio)							+					
10. <i>A. citricola</i> (van der Goot)											+	
11. <i>Aphis clematidis simlaensis</i> Kumar and Burkhardt							+		+			
12. <i>A. craccivora</i> Koch											+	
13. <i>A. eugeniae</i> (van der Goot)									+			
14. <i>A. fabae solanella</i> (Theobald)											+	

Table Contd..

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
15. <i>A. gossypii</i> Glover							+		+			
16. <i>A. kurosawai</i> Takahashi												+
17. <i>A. leptorhyncha</i> (Bindar & Sekhon)									+			+
18. <i>A. nasturtii</i> (Kaltenbach)										+		
19. <i>A. nerri</i> (B.d.F.)									+			
20. <i>A. paraverbasci</i> Chakrabarti									+			
21. <i>A. polygonaceae</i> (Matsumura)									+			
22. <i>A. pollinosa</i> (Walker)									+			
23. <i>A. punicae</i> (Passerini)						+						
24. <i>A. rhamniphila</i> (David <i>et al.</i> )									+			
25. <i>A. rhoicola</i> H.R.L.									+			
26. <i>A. ruborum longisetosa</i> (A.N. Basu)									+		+	
27. <i>A. verbasci</i> (Schrank)									+			
28. <i>Hyalopterus pruni</i> (Geoffroy)									+			
29. <i>Hysteroneura setariae</i> (Thomas)									+		+	
30. <i>Melanaphis meghalayensis meghalayensis</i> (Raychaudhuri & Banerjee)									+			
31. <i>Rhopalosiphum maidis</i> (Fitch)									+		+	

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
32. <i>R. nymphaeae</i> (Linnaeus)									+			
33. <i>R. padi</i> (Linnaeus)									+			
34. <i>R. rufiabdominalis</i> (Sasaki)									+		+	
35. <i>Schizaphis rotundiventris</i> (Signoret)						+						
36. <i>Toxoptera aurantii</i> (B.d.F.)						+			+			
37. <i>T. citricidus</i> (Karikaldy)									+			
Subfamily APHIIDINAE : MACROSIPHINI												
38. <i>Acutosiphon obliquoris</i> Basu, Ghosh & Raychaudhuri									+			
39. <i>Acyrtosiphon malvae</i> (Mosley)									+			
40. <i>A. phaseoli</i> Chakrabarti, Ghosh & Raychaudhuri									+			
41. <i>A. moltshanovi</i> (Mordv.)								+				
42. <i>A. rubi</i> (Narzikulov)							+		+			
43. <i>A. soldatovi</i> ? (Mordvilko)									+			
44. <i>A. sochifolidae</i> (Raychaudhuri <i>et al.</i> )									+			
45. <i>Acyrtosiphon (Metopolophium) dirhodum</i> (Wlk.)									+			
46. <i>A. Metopolophium graminum</i> (Raychaudhuri <i>et al.</i> )									+			
47. <i>A. (M.) ranunculum</i> (Ghosh)									+			
48. <i>Acyrtosiphon (M.) simlaensis</i> (Chakrabarti & Raychaudhuri)									+			
49. <i>A. (Microlophium) rubifoliae</i> (Raychaudhuri <i>et al.</i> )									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
50. <i>Amphicercidus tuberculatus</i> (David <i>et al.</i> )								+	+			
51. <i>Amphorophora ampullata bengalensis</i> Hille Ris Lambers									+			
52. <i>A. ampullata</i> (Buckton)									+			
53. <i>Aspidoporodon harvensis</i> Verma									+			
54. <i>Aulacorthum delphinae</i> (Das <i>et al.</i> )									+			
55. <i>A. magnoliae</i> (Essig and Kuwana)									+			
56. <i>A. nipponicum</i> (Essig and Kuwana)									+			
57. <i>A. rhamni</i> (Ghosh <i>et al.</i> )									+			
58. <i>A. sclerodorsi</i> (Kumar and Burkhardt)									+			
59. <i>A. sensoriatus</i> (Davis <i>et al.</i> )									+			
60. <i>A. solani</i> (Kalt.)									+		+	
61. <i>Aulacorthum spinacaudatum</i> (Kumar and Burkhardt)									+			
62. <i>A. (Neomyzus) strobilantheri</i> (Ghosh)									+			
63. <i>A. (Perillaphis) perillae</i> (Shinji)									+			
64. <i>Brachycaudus (Mordvilkomemor) pilosus</i> (Mordv.)								+				
65. <i>B. amygdalinus</i> (Schouteden)									+			
66. <i>B. helichrysi</i> (Kalt.)								+	+		+	
67. <i>B. (Thuleaphis) rumexicolens</i> (Patch)									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
68. <i>Brevicoryne barbareae</i> (Nevsky)							+					
69. <i>B. brassicae</i> (Linnaeus)							+		+			
70. <i>Capitophorus formosartemesiae</i> (Tak.)									+			
71. <i>C. geranii</i> (Chakrabarti <i>et al.</i> )									+			
72. <i>C. hippoohaes javanicus</i> (Hille Ris Lambers)											+	
73. <i>Captiphorus hippophaes mitegoni</i> (Eastop)									+			
74. <i>Capitophorus</i> sp.							+					
75. <i>Cavariella aegopodii</i> (Scopoli)											+	
76. <i>C. araliae</i> (Tak.)									+			
77. <i>C. himachali</i> Ghosh									+			
78. <i>C. konoii</i> (Takahashi)									+			
79. <i>C. nigra</i> Basu									+			
80. <i>C. salicicola</i> (Matsummura)									+			
81. <i>C. simalensis</i> (Chowdhuri <i>et al.</i> )									+			
82. <i>C. (Cavariellia) aquatica</i> (Gillette and Bragg)							+					
83. <i>Chaetomyzus rhododendri</i> (Ghosh and Raychaudhuri)									+			
84. <i>Chaetosiphon fragaefolii</i> (Cockrell)									+			
85. <i>Chaetosiphon glaber</i> (David <i>et al.</i> )									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
86. <i>C. tetra rhoda</i> (Walker)									+			
87. <i>C. graceilicornis</i> (David <i>et al.</i> )						+					+	
88. <i>Cooradoda rufimaculata</i> (Wilson)											+	
89. <i>Cryptaphis rostrata</i> (Chakrabarti and Raychaudhuri)									+			
90. <i>C. taoi</i> (Hille Ris Lambers)									+			
91. <i>Diphorodon cannabis</i> (Passerini)						+						
92. <i>Dysaphis atimus</i> (Ghosh <i>et al.</i> )									+			
93. <i>D. emicis</i> (Mimeur)									+			
94. <i>D. foeniculus</i> (Theobald)									+			
95. <i>D. ghanii</i> (Sroyan)									+			
96. <i>D. longipilosa</i> ? (Mordv.)									+			
97. <i>D. stroyani</i> Ghosh									+			
98. <i>Eoessigia indica</i> (David <i>et al.</i> )									+			
99. <i>Eumyzus simlaensis</i> (Bhattacharya)									+			
100. <i>Hayhurstia atriplicia</i> (Linnaeus)						+						
101. <i>Himalayaphis anemones</i> Ghosh and Verma									+			
102. <i>Hyadahis coriandri</i> (Das)						+			+			
103. <i>Hyalomyzus fragaricola</i> (Ghosh)									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
104. <i>H. scarbripes</i> (David and Narayanan)									+			
105. <i>Hyalomyzus</i> sp.							+					
106. <i>Hyperomyzus carduellinus</i> (Theobald)									+		+	
107. <i>H. lactucae</i> (Linnaeus)							+		+		+	
108. <i>Impatientinum asiaticum</i> (Nevsky)									+			
109. <i>I. impatiensae</i> (Shinji)									+			
110. <i>I. impatiensae dalhousiensis</i> Verma									+			
111. <i>Indoidiopterus geranii</i> (Chowdhuri <i>et al.</i> )									+			
112. <i>Indumasonahis inulae</i> (Ghosh and Raychaudhuri)									+			
113. <i>I. tuberculatus</i> (Chakrabarti <i>et al.</i> )									+			
114. <i>Jacksonia campanulata</i> Chakrabarti									+			
115. <i>J. papillata</i> (Theobald)									+			
116. <i>Liosomaphis atra</i> Hille Ris Lambers						+			+			
117. <i>L. berberidis</i> (Kalt.)									+			
118. <i>L. himalayensis</i> Basu									+			
119. <i>Lipaphis erysimi</i> (Kalt.)									+		+	
120. <i>Longicaudus himalayensis</i> (H.R.L.)									+			
121. <i>Macromyzus indicus</i> (David and Narayanan)									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
122. <i>Macrosiphoniella hiskosanensis</i> (Moritsu)						+						
123. <i>M. kilimpongense</i> (Basu and Raychadhuri)									+		+	
124. <i>M. sanborni</i> (Gillette)									+		+	
125. <i>M. yomogifoliae</i> (Shinji)									+		+	
126. <i>Macrosiphum aulacorthoides</i> (David et al.)									+			
127. <i>M. indogeranii</i> (Chakrabarti and Raychaudhuri)									+			
128. <i>M. pachysiphon</i> (H.R.L.)										+		
129. <i>M. similacicola</i> (Takahashi)									+			
130. <i>M. rosae</i> (Linn.)									+		+	
131. <i>M. (Sitobian) bamusicola</i> (Ghosh)									+			
132. <i>M. (S.) himalayensis</i> (Ghosh)									+			
133. <i>M. (S.) indicum</i> (Basu)									+		+	
134. <i>M. (S.) miscanthi</i> (Tak.)						+	+		+		+	
135. <i>M. (S.) pseudoalupecuri</i> (Chakrabarti)									+			
136. <i>M. (S.) rosaeiformis</i> (Das)									+		+	
137. <i>M. (S.) sikkimensis</i> (Ghosh and Raychaudhuri)									+		+	
138. <i>M. (Siphonophora) euphorbiae</i> (Thomas)									+			
139. <i>Matsumuraja capitophoroides</i> (H.R.L.)									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
140. <i>Megoura</i> sp.						+						
141. <i>Megouroparsus dooarsis</i> (Ghosh <i>et al.</i> )									+			
142. <i>Melopolophium (Microlophium) rubifolide</i> (Raychaudhuri <i>et al.</i> )									+			
143. <i>Metopolophium</i> sp.							+					
144. <i>M. graminum</i> (Raychaudhuri <i>et al.</i> )									+			
145. <i>M. longicaudatum</i> (David & Hameed)							+					
146. <i>M. rubi</i> (Narzikulov)							+		+			
147. <i>M. sonchifoliae</i> (Raychaudhuri <i>et al.</i> )									+		+	
148. <i>Micromyzodium filicium</i> David									+			
149. <i>M. strobilanthei</i> Ghosh									+			
150. <i>Micromyzus nigrum</i> (van der Goot)									+			
151. <i>Myzphis avariola</i> (David <i>et al.</i> )									+			
152. <i>M. rosarum</i> (Kaltenbach)									+			
153. <i>Myzaphis turanica</i> (Nevsky)									+			
154. <i>Myzus ascalonicus</i> (Doncaster)									+			
155. <i>M. umefolidae</i> (Shinji)						+						
156. <i>M. dycei</i> (Carver)									+		+	
157. <i>M. formosanus</i> (Takahashi)									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
158. <i>M. mumecola</i> (Matsumura)									+			
159. <i>M. obtusirostris</i> (David <i>et al.</i> )									+		+	
160. <i>M. ornatus</i> (Laing)									+			
161. <i>M. persicae</i> (Sulzer)									+		+	
162. <i>Myzus</i> sp.						+						
163. <i>Nasonovia (Neokakimia) rostrata</i> (David and Hameed)						+			+			
164. <i>Neoacyrthosiphon indicum</i> (Ghosh <i>et al.</i> )									+			
165. <i>Neoacrythosiphon</i> sp.									+			
166. <i>Neomasonaphis rhododendris</i> (Chakrabarti <i>et al.</i> )									+			
167. <i>Neomyzus cricumflexus</i> (Buckton)											+	
168. <i>Nudisiphon chitinicauda</i> (Chakrabarti and Bhattacharya)									+			
169. <i>Pilorostris simlaensis</i> Raychaudhuri <i>et al.</i>									+			
170. <i>Raychaudhuriella myzophoides</i> Chakrabarti						+						
171. <i>Rhopalosiphoninus indicus</i> Ghosh									+			
172. <i>R. latysiphon</i> (Davidson)									+			
173. <i>R. longisetosus</i> Chakrabarti and Ghosh									+			
174. <i>R. sensoriatus</i> Chakrabarti									+			
175. <i>Sappaphis pyri</i> Matsumura									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
176. <i>Semiaphis</i> sp.									+			
177. <i>Senisetotarsaphis jakhuensis</i> (Raychaudhuri <i>et al.</i> )									+			
178. <i>Sinomegoura citricola</i> (v.d.G.)									+			
179. <i>S. lespedezae</i> (Essig and Kuwana)												
180. <i>S. photinae</i> (Takahashi)									+			
181. <i>Spinaphis multisetosa</i> Ghosh									+			
182. <i>Tricaudatus indicus</i> Ghosh <i>et al.</i>									+			
183. <i>T. polygoni</i> (Narzikulov)						+			+		+	
184. <i>T. polygoni tuberculatus</i> (H.R.L. and Basu).									+			
185. <i>Uroleucon fagopyri</i> (Chawdhuri <i>et al.</i> )									+			
186. <i>U. himachali</i> (Ghosh)									+			
187. <i>U. kashmiricus</i> (Verma)									+			
188. <i>U. longisetosum</i> (Chakrabarti and Verma)									+			
189. <i>U. minatii</i> (Das <i>et al.</i> )									+			
190. <i>U. similaensis</i> (Chakrabarti <i>et al.</i> )									+			
191. <i>U. sonchi</i> (Linnaeus)											+	
192. <i>Vesiculaphis pieridis</i> Basu									+			
193. <i>V. verbasci</i> Chowdhuri <i>et al.</i>									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
194. <i>Xenosiphonaphis folisacculatus</i> (Kumar and Burkhardt)												
Tribe <b>Pterocommatini</b>												
195. <i>Pterocomma popolifoliae</i> (Fitch)									+			
196. <i>P. ? pilosum</i> (Buckton)									+			
197. <i>Chaitophorus</i> sp.						+						
198. <i>Chaitophorus indicus</i> (Ghosh <i>et al.</i> )									+			
199. <i>C. kapuri</i> (H.R.L.)									+			
200. <i>C. manaliensis</i> Chakrabarti						+						
201. <i>C. niger</i> (Mordvilko)									+			
202. <i>C. nigritus</i> (H.R.L.)									+			
203. <i>C. salijaponicus niger</i> (Mordvilko)		+										
204. <i>C. pakistanicus</i> (H.R.L.)									+		+	
205. <i>Clethrobius vermai</i> Ghosh and Quednau									+			
206. <i>Chromaphis hirsutustibis</i> (Kumar and Lavigne)									+			
207. <i>Euceraphis chuansiensis</i> (Tao)						+			+			
208. <i>Globulicaudaphis pakistanica</i> (H.R.L.)									+			
209. <i>Machilaphis machili</i> (Takahashi)									+			
210. <i>Myzocallis polychaetus</i> (David)									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
211. <i>M. (Agrioaphis) aptera</i> (Richards and Kumar)									+			
212. <i>M. (Hoplocallis) pictus</i> (Farrari)									+			
213. <i>Neobetullaphis pusilla</i> (Basu)									+			
214. <i>Panaphis juglandis</i> (Goeze)									+			
215. <i>Periphyllus aesculi</i> (H.R.L.)									+			
216. <i>P. himalayensis</i> (Chakrabarti)									+			
217. <i>P. vandenboschi</i> (H.R.L.)									+			
218. <i>Shivaphis celti</i> (Das)									+		+	
219. <i>Sipha (Rungsia) maydis</i> (Passerini)						+			+			
220. <i>Takecallis himalayensis</i> (Chakrabarti)									+			
221. <i>T. affinis</i> (Ghosh)									+			
222. <i>T. aurandinariae</i> (Essig)									+			
223. <i>Takecallis</i> sp. (Ovipara)									+			
224. <i>Tinocalloides montanus</i> Basu									+			
225. <i>Tinocallis kahawaluakalani</i> (Kirkaldy)									+			
Subfamily GREENIDEINAE												
226. <i>Eutrichosiphum (Eutrichosiphum) assamense</i> (Ghosh et al.)						+						
227. <i>E. (E.) simlaensis</i> (Ghosh)									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
228. <i>E. (E.) manaliensis</i> (Agrawala and Ghosh)						+						
229. <i>E. (E.) vandergooti</i> (Raychaudhuri)									+			
230. <i>E. (E.) tapatii</i> (Mondal <i>et al.</i> )									+			
231. <i>E. (E.) tattakanum</i> (Takahashi)						+			+			
232. <i>E. (Neoparatrichosiphum) atini</i> (Raychaudhuri and Chatterjee)									+			
233. <i>E. (N.) khasyanum</i> (Ghosh and Raychaudhuri)									+			
234. <i>E. (Paratrichosiphum) alnicola</i> (Basu)									+		+	
235. <i>E. (P.) neoalnicola</i> (Raychaudhuri <i>et al.</i> )									+			
236. <i>Greenidea (Greenidea) ficicola</i> (Takahashi)		+										
Subfamily HORMAPHIDINAE												
237. <i>Astegopteryx minuta</i> (van der Goot)											+	
238. <i>Ceratovacuna lanigera</i> Zehntner											+	
239. <i>Doraphis populi</i> (Maskell)						+						
240. <i>Pseudoregma bucktoni</i> Ghosh <i>et al.</i>											+	
241. <i>Pseudothoracaphis himachali</i> Raychaudhuri <i>et al.</i>									+			
242. <i>Reticulaphis distylli rotifera</i> H.R.L. and Tak.									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Subfamily LACHNINAE												
243. <i>Cinara abieticola</i> (Chakrabarti and Ghosh)									+			
244. <i>C. atroalbipes</i> David <i>et al.</i>									+			
245. <i>C. atrotibialis</i> David <i>et al.</i>									+			
246. <i>C. chaetorostrata</i> Ghosh and Raychaudhuri									+			
247. <i>C. confinis tenuipes</i> Chakrabarti and Ghosh									+			
248. <i>C. maculipes</i> H.R.L.									+			
249. <i>Cinara</i> sp.									+			
250. <i>Cinara similis</i> (van der Goot)									+			
251. <i>C. (Lachinella) comata</i> Doncaster									+			
252. <i>Indicinara hottesis</i> Ghosh <i>et al.</i>									+			
253. <i>Lachnus acutithirsutus</i> Kr. and Burkhardt									+			
254. <i>L. longirostrum</i> David and Ghosh						+						
255. <i>L. longisetosus</i> Ghosh									+			
256. <i>L. similis</i> van der Goot												
257. <i>L. torpicalis</i> (van der Goot)									+		+	
258. <i>Maculolachnus submacula</i> (Walker)									+			
259. <i>Nippolachnus</i> sp.												
260. <i>Nippolachnus bengalensis</i> Basu and H.R.L.											+	

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Simour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
261. <i>N. eriobotryae</i> Basu and H.R.L.											+	
262. <i>N. himalayensis</i> (van der Goot)											+	
263. <i>N. piri</i> Matsumura											+	
264. <i>Protrama longitarsus sclerodensus</i> Kumar									+			
265. <i>Phyrolachmus imbricatus</i> David <i>et al.</i>									+			
266. <i>Stomaphis ? longirostris</i> (Fabricius)									+			
267. <i>Stomaphis</i> sp.									+			
268. <i>Tuberolachmus salignus</i> (Gmelin)									+			
Subfamily PEMPHIGINAE												
269. <i>Baizongia pistaciae</i> (Linnaeus)									+			
270. <i>Epipemphigus imaicus</i> (Cholod.)									+			
271. <i>Eriosoma lanigerum</i> (Hausmann)								+	+		+	
272. <i>E. phoenix</i> (Mordv.)						+			+			
273. <i>Kaburagia ailanthi</i> Chowdhuri <i>et al.</i>									+			
274. <i>Pemphigus mardwilko</i> Cholod.									+			
275. * <i>Prociphilus micheliae</i> H.R.L.												
276. <i>P. orieus</i> Mordvilko						+						
277. <i>P. taxus</i> (Ghosh <i>et al.</i> )									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
278. <i>Prociphilus</i> sp.									+			
279. <i>Prociphilus (Stagona) himalayensis</i> Chakrabarti									+			
280. <i>Smynthuodes betae</i> Westwood									+			
281. <i>Tetraneura indica</i> Ghosh									+			
282. <i>T. nigriabdominalis</i> (Sasaki) Group												
283. <i>Thecabius affinis</i> (Kalt.)						+						
Family III. CERCOPIDAE												
284. <i>Callitettix versicolor</i> (Fabricius)											+	
285. <i>Cosmoscorta dorsimaculata</i> (Walker)											+	
286. <i>Jembrana buprestioides</i> Distinct									+			
287. <i>Paphnutius ostentus</i> (Distant)									+			
288. <i>Poophilus</i> <i>vr. costalis</i> (Walker)											+	
Family IV. CICADELLIAE												
289. <i>Agallia bhuntra</i> (Singh)												
290. <i>Cicadella spectra</i> (Distant)											+	
291. <i>Evacanthus bellus</i> (Distant)									+			
292. <i>Eupteryx mutifactiata</i> (Singh)												

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Simour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
293. <i>Kolla unimaculata</i> Signoret											+	
294. <i>K. raja</i> Distant									+			
295. <i>Nehela montana</i> Distant									+			
296. <i>Thamnotettix regularia</i> Singh												
297. <i>Zygina equata</i> Singh												
298. <i>Z. manaliensis</i> Singh												
299. <i>Z. retroversa</i> Singh												
300. <i>Z. serrata</i> Singh												
301. <i>Z. simplices</i> Singh												
Family V. COCCIDAE												
302. <i>Akermes montanus</i> (Green)									+			
303. <i>Ceroplastes ceriferus</i> (Fabricius)				+								
304. <i>Deroplastods cajani</i> (Maskell)								+				
305. <i>C. chiton</i> (Green)						+						
306. <i>Coccus ramakrishnai</i> (Green)						+						
307. <i>Suturaspis indiae orientalis</i> (Lindiger)									+			
Family VI. DACTYLOPIIDAE												
308. <i>Dactylopius indicus</i> (Green)				+								

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family VII. DIASPIDAE												
309. * <i>Eulecanium</i> sp. <i>tiliae</i> (Linn.)												
310. <i>Fiorinia himalaica</i> Takagi											+	
311. * <i>Icerya purchasi</i> (Maskell)												
Family VIII. MONOPHLEBIDAE												
312. <i>Drosicha stebbingii</i> (Green)									+			
Family IX. PSEUDOCCIDAE												
313. <i>Napaecoccus veridis</i> (Newstead)									+			
314. <i>Ripersia resinophila</i> Green				+								
Family X. FULGORIDAE												
315. <i>Adolenda typica</i> (Distant)									+			
316. <i>Oliarus similae</i> (Distant)									+			
Family XI. MEMBRACIDAE												
317. <i>Indicopleustes obortus</i> (Distant)									+			
318. <i>Leptocentrus obortus</i> (Distant)									+			
319. <i>L. taiwanus</i> (Kat.)											+	

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
320. <i>Tricentrus</i> sp.											+	
321. <i>Tricentrus unicolor</i> (Ananthasubramanian)											+	
322. <i>T. platycornis</i> (Ananthasubramanian)											+	
323. <i>T. recuvicornis</i> (Ananthasubramanian)											+	
Family XII. PSYLLIDAE												
324. <i>Psylla</i> sp. nr. <i>simlae</i> Crawford									+			
325. <i>Rhinopsylla stylata</i> Crawford									+			
326. <i>Trioza analis</i> Crawford									+			
327. <i>T. hylina</i> Crawford									+			
Order HETEROPTERA												
Family XIII. ANTHOCORIDAE												
328. <i>Galchana humeralis</i> (Distant)									+			
329. <i>Macrocorisa geoffroyi</i> (Leach)									+			
Family XIV. CAPSIDAE												
330. <i>Camptorbrochis qualis</i> (Distant)									+			
331. <i>Idatius priscillianus</i> (Distant)									+			
332. <i>Megacoelum tibialis</i> (Distant)									+			
333. <i>Philostephanus vitaliter</i> (Distant)									+			

Table Contd...

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
334. <i>Phytocoris erintus</i> (Distant)									+			
335. <i>Ragmus pellucidus</i> (Distant)									+			
Family XV. COREIDAE												
336. <i>Cletus bipunctatus</i> (Westwood)											+	
337. <i>Ochrochira albiditarsis</i> (Westwood)									+			
338. <i>Riptortus pedestris</i> (Fabricius)											+	
Family XVI. LYGAEIDAE												
339. * <i>Chauliops fallx</i> Scott												
340. <i>Chauliops nigrescens</i> Distant											+	
341. <i>Consivius collinus</i> Distant									+			
342. <i>Lygaeus simla</i> Distant									+			
343. <i>Manatanus montanus</i> Distant									+			
344. <i>Nysius melanicus</i> Distant									+			
Family XVII. PENTATOMIDAE												
345. <i>Asylana punjabensis</i> (Distant)									+			
346. <i>Dalpada melania</i> (Distant)									+			
347. <i>Nezara viridula</i> (Linnaeus)											+	

Table Contd..

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Simour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
348. <i>Plecosternus ficusius</i> (Distant)									+			
Family XVIII. REDUVIIDAE												
349. <i>Acanthaspis angularis</i> (Stal)										+		
350. <i>A. maculata</i> (Distant)										+		
351. <i>Lopoephala querine</i> (Laporte)										+		
352. <i>Sphedanolistus fraterculus</i> (Berger)											+	
<b>AQUATIC HEMIPTERA</b>												
Family XIX. BELOSTOMATIDAE												
353. <i>Diplonychus molestus</i> (Dufour)									+			
Family XX. CORIXIIDAE												
354. <i>Corixa affinis</i> Distant									+			
355. <i>Corixa choprai</i> Hutchinson									+			
356. <i>C. substriata</i> Uhle									+			
Family XXI. GERRIDAE												
357. <i>Chimarrhometra orientalis</i> Distant									+			
358. <i>Gerris monticola</i> Distant									+			
359. <i>Gerris sahibergi</i> Distant									+			
360. <i>Limnogonus (Limnogonus) fossorum</i> (Fabricius)									+			





## INSECTA : COLEOPTERA : SCARABAEIDAE

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### INTRODUCTION

The family Scarabaeidae is one of the interesting and largest family of Coleoptera, which contains more than 30,000 species (Fincher, 1981) throughout the world. Unlike other groups of insects, these beetles have both positive as well as negative significance. The coprophagous beetles, play an important role in nature's sanitation by utilizing the cattle dung as food in their larval and adult stages. By burrying them inside the soil, this not only provides dung manure to the soil, but also increases its facility. The significance of dung beetles was recognised by Bornemissza (1960), who introduced the exotic species of dung beetles to improve the pastures in Australia in the absence of native fauna. Besides, it is also established that they also play an active role in controlling the development of many pest flies and enteric parasites of cattle and livestock by fast dissemination of contaminated faecal matter and thus minimising the parasitic potential of the dung. On the contrary, the phytophagous beetles popularly known as leaf chafers, cock-chafers and rose-chafers are the pests of agricultural crops, plantations and forests. The adults feed upon foliage, fruits and flowers of plants, while the larvae (white grubs) mostly feed upon the roots of various economically important plants. The problem of white grubs damaging cultivated crops, lawns, nurseries and forests is well known not only in India but also all over the world. Many such pests have already been recognised in India by Lefroy (1909), Arrow (1910, 1917), Stebbing (1914), Issac (1919), Flecher (1919), Beeson (1941), Roonwal and Bhasin (1954), Atwal (1976) and Pal (1977).

Scarabaeid fauna of Himachal Pradesh shows varied zoogeographical links with the fauna of other region. Barring a few species which are endemic to Himachal Pradesh, most of the representatives generally show their affinity with the fauna of various adjoining sub-regions like Indo-China and Indian-Peninsula and very few species also share the distribution of Palaerctic, Australian and European regions. In Himachal Pradesh, north-south zonal stratification is hardly visible. In this area, altitude acts as limiting factor for the zonation of species. Sometimes even a change of altitude of 50m limits the range of a particular species. For example, *Copris sarpedon* (Shimla, Chamba, Kangra), *Caccobius himalayanus* (Chamba, Shimla, Kullu, Kinnaur), *Caccobius denticollis* (Shimla, Kinnaur, Kangra, Kullu), *Onthophagus kuluensis* (Kullu, Shimla and Chamba), which

were collected from the high hill ranges above 1500m were not recorded from lower altitudes. Similarly, dung beetles such as *Onthophagus catta*, *Onitis cinctus*, *Onitis philemon* etc. which occupies the dominant population at their specific zones are not available in same numbers in other's zones. It is also observed that the zones of distribution of various species are limited to narrow belts in higher altitudes, while at lower altitudes or plains the species show wide range of distributions. The distribution of phytophagous beetles in this area indicates that some genera, such as *Popillia*, *Mimela*, *Cryptotrogus*, *Melolontha*, *Brahmina*, *Asactopholis*, *Articephala*, *Xylotrupes*, *Anatona* and *Clinteria* etc. are confined to hilly regions and forests only, while there are some genera viz., *Anomala*, *Adoretus*, *Serica*, *Maladera*, *Apogonia*, *Alissonotum*, *Jumnos* and *Oxycetonia*, which show tolerance to a wide range of ecological conditions and the representatives are found in higher elevations as well as in the plains.

Although enough work has been done on the group all over the world, but inspite of its great significance in agriculture and forestry, very few systematic studies have been carried out on Indian fauna. Out of 18 subfamilies now available in India (Mittal, 1984), only seven subfamilies namely Cetoniinae, Valginae, Trichinae, Dynastinae, Rutelinae, Euchirinae and Scarabaeinae (Coprinae) have been dealt comprehensively by Arrow (1910, 1917, 1931). The remaining 11 subfamilies have not received the due attention yet. Some more monographic works are also available on Scarabaeid fauna of Oriental and Palaeartic regions. Balthasar (1963, 1964) wrote monographs on Scarabaeinae and Aphodiinae of Oriental region. Endrodi (1966, 1969, 1974) published monographs on some tribes Dynastinae. Miksic (1976, 1983) published on Centoniidae of Palaeartic and Oriental regions. Frey (1971) presented a synopsis of a very important group of white grub beetle genus *Holotrichia* of India and Ceylon. Kuijten (1978, 1981, 1983) revised the genera *Paheochrous*, *Phaeochroops* and *Hybosorus* of subfamily Hybosorinae of south-east Asia. Recently Mittal (1976, 1979a, 1979b, 1980, 1981, 1989), Mittal and Pajni (1977) and Chandra (1991 a,b,c) have also added information on Scarabaeid fauna of north-west India. But, hitherto no attempt was made to give a comprehensive account of Scarabaeid fauna of Himachal Pradesh. Hence, the present attempt is made to consolidate the current account of Scarabaeid beetles of the state and after examining the whole collection of HAZFS, Zoological Survey of India, Solan, in all 167 species belonging to 50 genera and 8 subfamilies are reported. Out of them, more than 20 species are recorded for the first time from the state. It is also estimated that the known number of species may even increase if all habitats of the state are intensively explored.

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Table : District-wise distribution of Insecta : Coleoptera : Scarabaeidae from Western Himalaya												
Taxaon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Subfamily HYBOSORINAE												
1. <i>Hybosorus orientalis</i> Westw.		+								+	+	+
2. <i>Hybosorus illigeri</i> Reiche										+		
3. <i>Phaeochorus emarginatus</i> Cast		+										
Subfamily APHODIINAE												
4. <i>Aphodius parvulus</i> Harold		+								+		
5. <i>Aphodius urostigma</i> Harold										+		
6. <i>Aphodius crenatus</i> Harold										+		
7. <i>Aphodius finctarius</i> Oliv.		+			+				+			
8. <i>Aphodius marginellus</i> (F.)		+										
9. <i>Aphodius moestus</i> (F.)										+		
Subfamily SCARABAEINAE												
10. <i>Gymnopleurus opacus</i> Redtenbacher		+			+				+	+	+	
11. <i>Gymnopleurus miliaris</i> (Fabricius)		+										
12. <i>Sisyphus indicus</i> Hope									+		+	
13. <i>Heliocopriss bucephalus</i> (Fabricius)										+		
14. <i>Catharsius molossus</i> (Linnaeus)		+							+	+		
15. <i>Catharsius pithecius</i> (Fabricius)									+	+		

Table continued

Taxaon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
16. <i>Catharsius sagax</i> (Quens.)										+	+	
17. <i>Copris sacontala</i> Redtenbacher		+							+			
18. <i>Copris sabinus</i> Gill.		+										
19. <i>Copris punjabensis</i> Gill.		+										
20. <i>Copris repertus</i> Walk.		+								+		
21. <i>Copris sarpedon</i> Harold		+		+					+			
22. <i>Copris indicus</i> Gill.		+										
23. <i>Phalops divisus</i> (Wied.)										+		
24. <i>Caccobius ultor</i> (Sharp)										+		
25. <i>Caccobius vulcanus</i> (F.)										+		
26. <i>Caccobius indicus</i> (Harold)						+						
27. <i>Caccobius himalayanus</i> (Jek.)		+			+	+			+			
28. <i>Caccobius denticollis</i> Harold	+			+	+				+		+	
29. <i>Caccobius pantherimus</i> Arrow				+								
30. <i>Onthophagus marginalis</i> (Geb.)										+		
31. <i>Onthophagus spinifex</i> (Fabricius)		+										
32. <i>Onthophagus falsus</i> Gill.		+								+		+

Taxaon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
33. <i>Onthophagus ramosellus</i> Bates		+					+			+		
34. <i>Onthophagus furcillifer</i> Bates		+				+						
35. <i>Onthophagus gagates</i> Hope		+		+					+	+		
36. <i>Onthophagus kuluensis</i> Bates		+				+			+	+	+	
37. <i>Onthophagus bonasus</i> (F.)	+	+								+		
38. <i>Onthophagus expansicornis</i> Bates	+	+			+				+	+		
39. <i>Onthophagus rubricollis</i> Hope										+		
40. <i>Onthophagus productus</i> Arrow									+			
41. <i>Onthophagus duporti</i> Bouc.										+		
42. <i>Onthophagus ramosus</i> (Wied.)				+								
43. <i>Onthophagus sutleinensis</i> Splich.									+			
44. <i>Onthophagus lilliputanus</i> (Lansb.)									+			
45. <i>Onthophagus lapillus</i> Arrow									+			
46. <i>Onthophagus kumaonensis</i> Arrow									+			
47. <i>Onthophagus furcicollis</i> Arrow										+		
48. <i>Onthophagus concolor</i> Sharp				+					+			
49. <i>Onthophagus pactolus</i> (F.)										+		
50. <i>Onthophagus dama</i> (F.)				+						+	+	

Table continued

Taxaon <i>Table continued</i>	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
51. <i>Onthophagus mopus</i> (F.)		+							+	+		+
52. <i>Onthophagus tarandus</i> (F.)										+		
53. <i>Onthophagus griseosetosus</i> Arrow										+		
54. <i>Onthophagus gratus</i> Arrow		+										
55. <i>Onthophagus aenescens</i> (Wied.)												+
56. <i>Onthophagus amplexus</i> Sharp									+			
57. <i>Onthophagus centricornis</i> (F.)												+
58. <i>Onthophagus atropolitus</i> d'Orb.		+								+		
59. <i>Onthophagus quaestus</i> (Sharp)												+
60. <i>Onthophagus quadridentatus</i> (F.)										+		+
61. <i>Onthophagus fasciatus</i> (Bouc.)					+				+			
62. <i>Onthophagus tragus</i> (F.)										+		+
63. <i>Onthophagus catta</i> (F.)									+	+	+	
64. <i>Onthophagus dubernardi</i> Bouc.									+			
65. <i>Liatongus phanaeoides</i> (Westw.)		+			+				+		+	
66. <i>Liatongus gagatinus</i> (Hope)										+		
67. <i>Liatongus vertagus</i> (F.)				+						+		
68. <i>Liatongus rhinoceros</i> Arrow									+			

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Simour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
69. <i>Oniticellus spinipes</i> Roth.				+						+		
70. <i>Oniticellus pallipes</i> (F.)										+		+
71. <i>Oniticellus pallens</i> (Oliv.)										+		
72. <i>Oniticellus cinctus</i> (F.)		+		+				+	+	+		
73. <i>Drepanocerus setosus</i> (Wied.)		+		+						+		
74. <i>Onitis fulcatus</i> (Wulf.)		+						+		+		
75. <i>Onitis subopacus</i> Arrow				+						+		
76. <i>Onitis philemon</i> (F.)										+	+	
77. <i>Onitis castaneus</i> Redtenbacher				+								
78. <i>Onitis excavatus</i> Arrow										+		
Subfamily SERICINAE												
79. <i>Serica khajiaris</i> Mittal		+										
80. <i>Maladera insanabilis</i> (Brenske)								+				
Subfamily MELOLONTHINAE												
81. <i>Apogonia orbitalis</i> Ritsema						+						
82. <i>Apogonia nigrescens</i> Hope						+						
83. <i>Apogonia setosa</i> Arrow								+				
84. <i>Holotrichia stolizkae</i> Sharp						+						

Table continued

Taxaon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
85. <i>Holotrichia problematica</i> Brenske											+	
86. <i>Holotrichia anthracina</i> Brenske											+	
87. <i>Holotrichia semihirta</i> Frey		+										
88. <i>Holotrichia sikkimensis</i> Brenske		+								+		
89. <i>Holotrichia serrata</i> (F.)											+	
90. <i>Holotrichia longipennis</i> Blanch.		+			+				+	+	+	
91. <i>Holotrichia gradatifrons</i> Bates						+						
92. <i>Holotrichia nubiliventris</i> Bates						+						
93. <i>Holotrichia batillaria</i> Bates						+						
94. <i>Holotrichia occipitalis</i> Bates						+						
95. <i>Hilyotrogus holosericeus</i> Redt.		+						+		+	+	
96. <i>Cryptotrogus pajni</i> Mittal		+										
97. <i>Asactopholis dehradunus</i> Mittal											+	
98. <i>Articephala himachali</i> Mittal		+										
99. <i>Articephala lahauli</i> Chandra							+					
100. <i>Articephala planifrons</i> (Moser)									+			
101. <i>Idioncycha excisa</i> Arrow		+						+				
102. <i>Hoplosternus nepalensis</i> Hope						+						

Table continued

Taxaon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
103. <i>Brahmina crinicollis</i> Burm.		+	+		+	+			+	+		
104. <i>Brahmina coriacea</i> Hope		+				+						
105. <i>Brahmina cribricollis</i> (Redtenbacher)		+								+		
106. <i>Brahmina culuensis</i> Moser						+						
107. <i>Brahmina cupreus</i> Mittal		+										
108. <i>Brahmina simlana</i> Moser									+			
109. <i>Melolontha aeneicollis</i> Bates						+						
110. <i>Melolontha indica</i> Hope						+			+		+	
111. <i>Melolontha cuprescens</i> Blanch.		+			+	+						
112. <i>Melolontha furcicauda</i> Ancey		+			+	+		+		+	+	
Subfamily RUTELINAE												
113. <i>Popillia nasuta</i> Newm.								+				
114. <i>Popillia cupricollis</i> Hope				+		+			+	+		
115. <i>Popillia cyanea</i> Hope		+		+								
116. <i>Popillia clypealis</i> Ohaus									+			
117. <i>Popillia simlana</i> Arrow									+			
118. <i>Popillia pilosa</i> Arrow									+			

Table continued

Taxaon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
119. <i>Mimela horsfieldi</i> Hope		+		+		+			+			
120. <i>Mimela passerinii</i> Hope		+										
121. <i>Mimela pectoralis</i> Blanch.		+							+	+		
122. <i>Mimela fulgidivittata</i> Blanch.										+		
123. <i>Anomala polita</i> Blanch.		+								+		
124. <i>Anomala rufiventris</i> Redtenbacker		+		+						+	+	
125. <i>Anomala lineatopennis</i> Blanch.		+				+			+	+		
126. <i>Anomala xanthoptera</i> Blanch.		+		+		+						
127. <i>Anomala dimidiata</i> Hope		+		+		+			+			
128. <i>Anomala stoliczkae</i> (Sharp)		+										
129. <i>Anomala rugosa</i> Arrow						+						
130. <i>Anomala fulviventris</i> Arrow				+								
131. <i>Anomala chlorosoma</i> Arrow				+				+				
132. <i>Anomala xanthonota</i> Arrow		+										
133. <i>Anomala dorsalis</i> (Fab.)									+			
134. <i>Anomala cantori</i> Hope										+		
135. <i>Anomala bengalensis</i> Blanch.										+		

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
136. <i>Ischnopopillia moorei</i> Kraatz		+										
137. <i>Pachyrhinadoretus frontatus</i> (Burm.)				+								
138. <i>Tropiorhynchus orientalis</i> (Newm.)									+			
139. <i>Adoretus incurvatus</i> Ohaus		+										
140. <i>Adoretus lithobius</i> Ohaus						+						
141. <i>Adoretus caliginosus</i> Burm.				+								
142. <i>Adoretus duvauceli</i> Blanch.						+						
143. <i>Adoretus costopilosus</i> Ohaus				+								
Subfamily DYNASTINAE												
144. <i>Eophileurus perforatus</i> Arrow											+	
145. <i>Xylotrupes gideon</i> (L.)		+				+				+	+	+
146. <i>Phyllogathus dionysius</i> (F.)		+								+		
147. <i>Alissonotum bindulum</i> (Fairmaire)						+						
148. <i>Alissonotum simile</i> Arrow										+	+	
149. <i>Oryctes nasicornis</i> (L.)					+				+			
150. <i>Heteronychus annulatus</i> Redtenbacher						+						

Table continued

Taxaon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Subfamily CETONIINAE												
151. <i>Heterorrhina nigratarsis</i> (Hope)						+					+	
152. <i>Heterorrhina porphyretica</i> Westw.						+						
153. <i>Anatona stillata</i> (Newm.)				+							+	
154. <i>Anatona castanoptera</i> (Burm.)								+				
155. <i>Torynorrhina opalina</i> Hope						+						
156. <i>Protaetia impavida</i> (Janson)						+						
157. <i>Protaetia coenosa</i> (Westw.)									+			
158. <i>Protaetia neglecta</i> (Hope)												
159. <i>Chiloloba acuta</i> (Wied.)				+				+				
160. <i>Clinteria spilota</i> (Hope)		+						+	+	+	+	
161. <i>Clinteria klugi</i> (Hope)										+		
162. <i>Glycyphana horsfieldi</i> (Hope)		+								+		
163. <i>Jumnos royeli</i> (Hope)		+								+		
164. <i>Jumnos ruckeri</i> Saund.											+	
165. <i>Oxycetonia jucunda</i> (Fald.)								+		+		
166. <i>Oxycetonia versicolor</i> (F.)										+		
167. <i>Thaumastopeus pullus</i> (Billb.)				+								



## **INSECTA : LEPIDOPTERA (BUTTERFLIES)**

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### **INTRODUCTION**

The butterflies have always been a subject of interest and these are, perhaps after the ants, the best known species of insects. These are most easily recognizable of all other insects and are second in number in their universal popularity after birds. Because of their charming colour patterns and most interesting phenomena of mimicry and migration, these evoke curiosity and fondness among all the people in the planet, particularly among children, naturalists and scientists. The butterflies are cosmopolitan in distribution and occur in every suitable environment, from plains to deserts, forests and valleys of hills to mountains. Butterflies are holometabolic endopterygote, often provided with tails, a characteristic venation and clothed by overlapping scales. The mouth parts are modified into coiled proboscis; the antennae are knobbed or clubbed or hooked (Hesperiidae) at the anterior end. Butterfly larvae feed on the leaves of their host plants or diverse plants and some are predaceous on Coccidae (scale insects), Aphididae and Membracidae. Some Lycaenid-larvae live in nests of ants and often devour ant-larvae. They are good pollinators and help in cross pollination of flowers and other plants. The adults visit flowers for nectar, while some of the male species congregate on damp or moist places near streams. Some of the species are attracted in large numbers by rotting or over ripe fruit, animal dung and bird-droppings, etc. While majority of butterflies are found in sheltered and shaded areas, several others occur in open ground, among bushes and over tree tops.

The butterflies reach the adult-stage after passing through a series of stages, viz., eggs; larvae (growing stage); chrysalis (the resting stage), and finally the imago, or the sexually mature stage. Thus, the life history shows a complete metamorphosis from larval to adult stage, and the period is variable in different species.

Butterflies can be differentiated from the moths and some other nocturnal insects by their diurnal activity, sitting posture, with their wings spread out, half open or erect over

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the back. The distinction between the thorax and abdomen is more pronounced in the butterflies. Besides, the antennae are either clubbed or hooked in butterflies unlike in moths where these are simple, filiform, branched or fringed.

### Classification

The order Lepidoptera (scaly-winged) were used to be divided mainly into two suborders, viz., *Heterocera* or Moths and *Rhopalocera* or Butterflies. All the butterflies were, therefore, treated under a single superfamily Papilionoidea. However, because of the antennae being hooked and arising wide apart (*Vs* clubbed and arising close together in *Rhopalocera*); all the veins in fore-wing arising from base or cell and none forked or coincident beyond (*Vs*. one or more in forewing forked or coincident beyond); and the hind tibiae generally with a medial as well as terminal pair of spurs (*Vs*. only a terminal pair of spurs in *Rhopalocera*), the Hesperiiids or Skippers were separated out as superfamily Hesperioidea under the suborder Grypocera.

While the suborder *Rhopalocera* includes nine families, viz., Papilionidae, Pieridae, Danaidae, Satyridae, Nymphalidae, Amathusiidae, Acraeidae, Erycinidae and Lycaenidae, the Hesperioidea includes only Hesperiididae. All but Amathusiidae, which does not occur in this part, are dealt with here.

The colouration and patterns on the wings are very useful in identifying various species of butterflies and, thus, are of great utility in proper classification.

There were many workers who made the collections of butterflies from Himalayas; Carlovon Hugel (1844-1848); Hardwick's collections were described by Doubleday and Gray (1846) and Redtenbacker (1848). Besides collections were also made by Lt. Colonel A.M. Lang from N.W. Himalayas and Mr. A.G. Young from Kullu, which were included by Major G.F.L. Marshall and L. de Niceville in *The Butterflies of India, Burma and Ceylon* (vols. 1 to 3 : 1882-1890), and Rev. J.H. Hocking from Kangra district and were published by Moore, F. (1882).

Subsequently, these were included in publications by Evans (1932), and Talbot (1939, 1947). De Rhe-Philipe (1931) was probably the first to publish a comprehensive list of 246 butterflies of Shimla Hills and later Wynter-Blyth (1940-1946) listed as many as 294 species of butterflies from Shimla Hills. These were also included by the latter in a book *Butterflies of the Indian Region* (1957). Mani (1986) described 377 species of butterflies except Hesperiididae from Himalayas.

In the present work, an attempt has been made to list the butterflies of Himachal Pradesh ranging from Lower Shiwalik to Trans-Himalayan ranges between 500 m-5000 m from twelve districts representing various ecological biotopes like nurseries, forests, orchards, lakes and other humid and desert areas. The collections at HAZFS, ZSI, Solan made by various survey parties of this station during 32 years, have been identified and

studied on the basis of various characters. The present work deals with 288 species represented by families Papilionidae (25 species), Pieridae (33 spp), Danaidae (8 spp), Satyridae (46 spp), Nymphalidae (56 spp), Acraeidae (2 sp), Erycinidae (6 spp), Lycaenidae (82 spp) and Hesperidae (30 spp). The species recorded by earlier workers have also been included.

## FAMILIES

**PAPILIONIDAE** : Commonly known as the "Swallowtails", the family, however, includes both tailed as well as tail-less species and are available from foot-hills to higher altitudes. The Papilionids include some very beautiful, brilliantly coloured species, where predominant colour is either black or dark-brown in majority of species. Some species are also fond of settling on damp ground either in company of other Papilionids or the Pierids. Several species love visiting flowers or basking in sun-shine and fly leisurely over flowers, in bushes etc. But when disturbed their flight becomes very fast, erratic and the species, generally, retreat into the forested areas.

The expanse varies from as small as 40 mm, as in the Apollos, which are predominantly whitish, occurring between 5000' and 19000' to about 190 mm, as in the "Birdwings" which range from foot-hills to about 3500' in western Himalayas.

While some caterpillars feed on strong smelling plants, some pungent and evil tasting and include economically important trees like citrus, lemon, orange, bael, curry plants, others feed on cinnamon, camphor, carrot and aristolochiae species, and are of great economic importance.

The butterflies of Himachal Pradesh have been placed in two subfamilies *viz.*, Papilioninae and Parnassiinae with the following genera, of which genus *Parnassius* Latreille is being dealt here under the latter subfamily and the remaining under subfamily Papilioninae. Talbot (1939) has recorded 22 species spread over 12 districts, including two newly created districts *viz.*, district Hamirpur and district Una and the collections have been represented from these districts, of which 14 species, marked with asterics have been collected (Table-1, serial 1-25).

**PIERIDAE** : Commonly known as "Whites" or "Yellows" due to the predominant white or yellow colouration, as in *Leptosia*, *Appias*, *Pieris*, *Catopsilia*, *Eurema*, etc., other colours like orange, crimson, shade of salmon pink to blackish are also not uncommon.

The Pierids vary in expanse from as little as 25 mm, as the Little Orange Tip to about 96-100 mm amongst the Jezebels. Some are greatly affected by the seasons, which create dry-season forms in winter-months and wet-season forms in rainy months. Quite a number of Pierid species congregate in large numbers on a damp ground and often accompanied by members of the same family or of Papilionids.

The flights are usually very slow, sluggish and often close to ground, but the fast-flying species are also not uncommon.

Several species are quite common throughout peninsular India, extending to lower elevation, in Himachal Pradesh, others occur upto 15000' in Himalayas.

Several Pierids are also of economic importance, their caterpillars feeding on cruciferous plants, *Cassia*, *Indigofera*, etc.

The Himachal Pradesh butterflies have been placed in two sub-families, viz. Pierinae and Coliadinae.

Talbot (1939) recorded 33 species from Himachal Pradesh, of which as many as 20 species, marked with asterics, have been collected here. The species like *Leptosia nina* (Fabr.) and *Pareronia valeria* (Lesson), which are quite common in their range of distribution, are being recorded from Himachal Pradesh for the first time. (Table-1, serial 26-58).

**DANAIDAE** : Commonly known as "Tigers", "Crows" and "Nymphs", the latter group of butterflies are not known to occur in Himalayas, including Himachal Pradesh, J&K, etc.

The Danaids are generally of moderate to large size, tough and of very slow and sluggish flight. The butterflies also possess an unpleasant smell and acrid juices, which give them protection from their natural enemies like birds and lizards. In fact the Danaids have assumed the status of "Models" for protective mimicry and several species of different families like Papilionidae, Pieridae, Satyridae and Nymphalidae, have mimicked them and gain protection. Many of the 'Crow' species, in *Euploea*, resemble each other besides being models for species of other families.

Several species have the habit of congregating, on a single plant, sometimes in thousands. None of the Danaids exhibits seasonal variation, and all the Indian species have been placed in a single subfamily Danainae, with the following genera : *Idea* Fabricius; *Danaus* Kluk; and *Euploea* Fabricius. Of these, the genus *Idea* is not reported to occur in W. Himalayas. The other two genera, viz. *Danaus* Kluk and *Euploea* Fabricius, are represented by eight species from N.W. Himalayas, including Himachal Pradesh, and all these have been included here (Table-1, serial 59-66).

**SATYRIDAE** : Commonly known as "Browns" due to predominant light or dark brown colouration, the blackish or brilliantly coloured species are also met with. With exception of some species like Satyrs, which are generally fast fliers, majority of Satyrids are weak fliers, with slow, jerky or bouncing movements, flying rather close to ground littered with dead fallen leaves, or among jungle herbs & shrubs, over the meadows and open grassy slopes of the hills. Most of the species do not visit flowers and, generally, prefer shaded areas and often, some, are seen on cloudy day, or at dusk time, like Evening Brown, which are attracted to light. Very often the species are observed to settle on roads and stones.

The seasonal variation is well marked in several genera, where the markings tend to change to leaf like and the ocelli, otherwise well developed and distinct in wet season forms, are small or reduced to mere specks. Bushbrowns, Rings and Evening Browns are some of the species where the dry-season forms are quite different from those of wet season forms. In fact no two examples in dry season form of the Evening Brown resemble each other.

The species mainly feed on grasses. As many as 46 species have been recorded from 11 districts of Himachal Pradesh (except Una) and the present text includes 18 species and have been collected and are marked with asterics (Table-1, serial 67-112).

**NYMPHALIDAE** : The Nymphalid species are difficult to generalise for the purpose of visual identification, as the pattern varies considerably. Nevertheless, these butterflies are nearly always brightly coloured, often brilliantly. Although the predominant colour is tawny to yellowish, greenish or dark brown, all other shades are no exception. The wings also show a great variety of pattern formed by bands, spots, patches, stripes, blotches, etc., which present a characteristic pattern in the species.

The sexes may be similar or different and the seasonal variation is well exhibited only in certain species like Pansies, Oakleafs, etc. While Pansies, the Himalayan Jestors and the Black Fritillary are amongst the smaller species, being about 35-45 mm in wing expanse, the Great Duchess, the Great Eggfly, Oakleaf, etc. are amongst the larger species, reaching upto an expanse of about 120 mm.

While several species visit flowers, loving sunshine and basking, other settle on dung, or attracted to over-ripe fruit, toddy, sap, sugar solution, etc. Only a few species are reported to visit damp ground or in the vicinity of water stream.

Some members of the family display an excellent form of mimicry, particularly the Danaid Eggfly, Circe and the Courtesan, which perfectly mimic danaid genera, whereas the Sergeant Emperor mimics the Hill Sergeant of the same family. The Oakleafs are beautiful and brilliantly coloured only on upperside, but very dull and completely differently coloured & marked on underside, often imitating inanimate objects like dead and dry leaf to its perfection, displaying veins etc. These species when settled are difficult to locate as the underside coloration harmonies with the surroundings.

As many as 56 speciesz have been recorded from all the districts, of which 27 species, marked with asterics, have been recorded. (Table-1, serial 113-168).

**ACRAEIDAE** : Predominantly yellow or tawny in colour, the Acraeids are represented only by two species, of which one the Yellow Coster, is recorded from foot hills to about 8000'. (Table-1, serial 169-170).

The flight of the Coster is rather slow, closer to the ground and often settles on flowers, exposed places on leaves, or twigs. Like Danaids, the acraeids are also well

protected, and when in captivity, the species eject a sort of protective, oily evil-tasting/smelling fluid which is obnoxious to birds/predators.

**ERYCINIDAE** : Commonly known as "Beaks", "Punches" and the "Judies" the predominant colour is brown, with bands or spots on wings. Nearly all the species are fond of shaded wooded areas, hilly forests in the vicinity of streams, except the Judies, which normally inhabit denser jungle and are very sluggish during day but active only around evening when the species come out into the open.

The most obvious and characteristic feature in *Libythea*, one of the genera in this family, is the enormous prolongation of the palpi in front of the head, giving the species an appearance of a beak at the head, thus commonly known as the "Beaks"

Six species have been recorded and only three have been collected (Table-1, serial 171-176).

**LYCAENIDAE** : Commonly known as the "BLUES", because of the predominant blue colouration, all other shades or colour, however, are no exception and even metallic blue or green, or shot with purple are also observed. While some of the Lycaenids are devoid of any marks on upperside, others are suffused, striped, spotted, banded or mottled with a variety of patterns and colours.

Several species have tails at the hindwings, which may be thread-like, or long and fluffy or very often lobed, and when the wings are brought together on a position of rest, these tails are rubbed together with oscillating movements, which strikingly resemble the head of an insect or other butterfly with antennae

Although a majority of caterpillars feed on various food-plants, a few are either carnivorous or even cannibalistic.

As many as 82 species are known to occur (Table-1, serial 177-258). Only 8 species, marked with asterics, have been collected.

**HESPERIIDAE** : Commonly known as "SKIPPERS", the butterflies are smaller in size, nearly always dark brown to black, spotted or banded with white or yellow, the markings often semi-transparent, but other colours like yellow/orange and metallic green are also met-with.

Morphologically, all the legs are perfect (unlike non-functional in several butterflies); antennae are placed wide apart (unlike placed together at bases in other butterflies) and their tips which are thickly clubbed, tapering to a point, or with curved hook (unlike knobbed in other butterflies). Besides, the head is wider and the eyes large and prominent.

Being strong and robust, the skippers are generally very fast fliers (with some exceptions) and fond of basking in sunshine. Several species visit damp ground, flowers, cowdung, or even birds' droppings.

Nearly 30 species have been recorded from Himachal Pradesh (Table-1, serial 259-288). In the present work only eight species, marked with asterics, mainly from Chamba, Kangra, Kinnaur, Kullu, Shimla, Sirmour and Solan districts have been collected.

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Table : Districts-wise distribution of Insecta : Lepidoptera (Butterflies) of Western Himalaya

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family I. PAPILIONIDAE												
*1. <i>Atrophaneura dasarada ravana</i> (Moore)				+		+			+			
*2. <i>Atrophaneura philoxenus</i> (Gray)		+		+				+	+			
*3. <i>Chilasa agestor govindra</i> (Moore)				+					+			
*4. <i>Chilasa clytia clytia</i> (Linnaeus)				+					+	+		
*5. <i>Graphium sarpedon luctatius</i> (Fruhstorfer)				+				+	+	+		
*6. <i>Graphium cloanthus</i> (Westwood)				+					+	+		
*7. <i>Pachliopta aristolochiae</i> (Fabr.)				+						+		
8. <i>Papilio arcturus arius</i> Rothschild	+									+		
*9. <i>Papilio demoleus demoleus</i> Linn.	+			+				+	+	+	+	+
10. <i>Papilio machaon ladakensis</i> Moore					+		+			+		
*11. <i>Papilio machaon punjabensis</i> Eimer					+				+	+		
*12. <i>Papilio protenor protenor</i> Cramer				+				+	+	+		
*13. <i>Papilio polyctor polyctor</i> Boisduval				+		+		+	+	+	+	
*14. <i>Papiliopolytes romulus</i> Cramer			+	+				+	+	+	+	+
*15. <i>Parnassius hardwickei hardwickei</i> Gray						+	+		+			
16. <i>Parnassius jacquemontii</i> Boisduval						+						
17. <i>Parnassius cashmirensis</i> Oberthur		+										
18. <i>Parnassius stoliczkanus stoliczkanus</i> C & R Felder						+	+					
19. <i>Parnassius delphius ladakensis</i> Avinoff							+					

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
20. <i>Parnassius delphius mamaievi</i> O. Bang-Haas							+					
21. <i>Parnassius delphius rupshuana</i> Avinoff							+					
22. <i>Parnassius simo simoides</i> O. Bang-Haas					+							
23. <i>Parnassius charltonius</i> Gray							+					
*24. <i>Pathysa nomius nomius</i> (Esper)									+			
25. <i>Pazala eurous cashmirensis</i> (Rothschild)									+			
Family II. PIERIDAE												
*26. <i>Anaphaeis aurota aurota</i> (Fabr.)		+			+					+		
27. <i>Aporia nabellica</i> (Boisduval)		+		+	+				+			
28. <i>Appias lalage</i> Doubleday									+			
29. <i>Appias libythea</i> Fabr.									+			
30. <i>Baltia butleri butleri</i> (Moore)					+		+					
*31. <i>Cepora nerissa phryne</i> (Fabr.)				+					+	+	+	
*32. <i>Catopsilia crocale</i> (Cramer)	+			+		+		+	+	+	+	
*33. <i>Catopsilia pyranthe</i> (Linn.)	+		+	+		+			+	+		
*34. <i>Colias electo fieldi</i> Menetries		+		+								
35. <i>Colias. erate erate</i> (Esper)	+	+		+	+	+	+	+	+	+	+	
36. <i>Colias ladakensis</i> C&R Felder				+	+							
37. <i>Colias eogene</i> (C&R Felder)							+					
38. <i>Colotis etrida etrida</i> (Boisduval)									+			

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
39. <i>Delias sanaca sanaca</i> (Moore)				+		+			+			
*40. <i>Delias eucharis</i> (Drury.)				+				+	+	+	+	
*41. <i>Delias belladonna horsfieldi</i> (Gray)						+			+	+	+	
*42. <i>Eurema brigitta rubella</i> (Wallace)			+	+					+	+	+	
*43. <i>Eurema laeta laeta</i> (Boisduval)				+				+	+	+	+	
*44. <i>Eurema hecabe fimbriata</i> (Wallace)		+	+	+				+	+	+	+	
*45. <i>Gonepteryx rhamni nepalensis</i> Doubleday			+				+	+	+	+		
46. <i>Gonepteryx mahaguru</i> Gistel		+							+			
*47. <i>Ixias marianne</i> (Cramer)	+			+					+	+		
*48. <i>Ixias pyrene kausala</i> Moore				+	+				+	+	+	
*49. <i>Leptosia nina</i> (Fabr.)				+								
*50. <i>Metaporina leucodice soracta</i> (Moore)		+		+					+			
*51. <i>Metaporina agathon phryxe</i> (Boisduval)		+		+					+			+
*52. <i>Metaporina a. caphusa</i> (Moore)		+		+					+			+
*53. <i>Pareronia valeria anais</i> (Lesson)										+	+	
54. <i>Pieris napi ajaka</i> Moore	+				+				+			
*55. <i>Pieris canidia indica</i> Evans	+	+	+	+					+	+	+	+
*56. <i>Pieris brassicae nepalensis</i> Doubleday	+		+	+	+	+			+	+	+	+
57. <i>Pontia daplidice moorei</i> (Rober)	+						+			+		
58. <i>Synchloe callidice kalora</i> (Moore)					+		+					

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family III. DANAIDAE												
*59. <i>Danaus chrysippus</i> (Linnaeus)				+	+	+		+	+	+	+	
*60. <i>Danaus genutia</i> (Cramer)				+				+	+	+	+	
*61. <i>Euploea core core</i> (Cramer)				+				+	+	+	+	
*62. <i>Euploea mulciber mulciber</i> (Cramer)						+			+			
*63. <i>Parantica aglea melanoides</i> Moore				+		+		+	+	+	+	
*64. <i>Parantica sita sita</i> (Kollar)		+		+				+	+		+	
*65. <i>Tirumala limniace leopardus</i> (Butler)	+			+					+	+	+	
*66. <i>Tirumala hamata septentrionis</i> (Butler)				+		+			+	+	+	
Family IV. SATYRIDAE												
*67. <i>Aulocera brahminus brahminus</i> (Blanchard)						+	+	+		+		
*68. <i>Aulocera padma padma</i> (Kollar)				+		+			+			
*69. <i>Aulocera swaha swaha</i> (Kollar)				+	+	+	+		+	+	+	
*70. <i>Aulocera saraswati</i> (Kollar)		+		+		+	+					
71. <i>Callerebia kalinda kalinda</i> Moore					+				+			
72. <i>Callerebia shallada shallada</i> deN.				+		+	+		+			
73. <i>Callerebia nirmala nirmala</i> (Moore)		+		+					+			
*74. <i>Callerebia scanda scanda</i> (Kollar)				+	+				+	+	+	
75. <i>Callerebia hybrida</i> Butler				+					+			

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
76. <i>Callerebia annada caeca</i> (Watkin)				+					+			
*77. <i>Dallacha hyagriva</i> (Moore)						+			+			
78. <i>Hipparchia parisatis shiva</i> (Lecerf)				+					+		+	
79. <i>Hipparchia.huebneri huebneri</i> (C & R Felder)		+		+		+						
*80. <i>Lasiommata schakra</i> (Kollar)		+		+		+			+	+		
81. <i>Lasiommata moerula moerula</i> (C & R Felder)					+	+	+		+			
82. <i>Lethe rohria rohria</i> (Fabr.)		+		+		+		+	+	+	+	
*83. <i>Lethe confusa confusa</i> Aurivillius				+					+			
*84. <i>Lethe insana insane</i> (Kollar)		+		+					+			
*85. <i>Lethe verma verma</i> (Kollar)		+		+					+			
86. <i>Lethe pulaha pondiya</i> Talbot		+			+				+			
87. <i>Lethe yama buckleyi</i> Talbot						+			+			
88. <i>Maniola pulchella</i> (C & R Felder)							+					
89. <i>Maniola pulchra pulchra</i> (C & R Felder)					+	+	+					
90. <i>Maniola davendra davendra</i> (Moore)					+		+					
91. <i>Maniola lupinus cheena</i> Moore					+							
*92. <i>Melanitis leda ismene</i> (Cramer)				+					+		+	
93. <i>Melanitis phedima galkissa</i> Fruhstorfer				+				+	+			
94. <i>Melanitis zitenius zitenius</i> Herbst									+			
95. <i>Mycalesis francisca sanatana</i> Moore						+						

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
*96. <i>Mycalesis perseus blasius</i> (Fabr.)		+		+								
97. <i>Mycalesis lepcha lepcha</i> (Moore)												
*98. <i>Mycalesis mineus mineus</i> (Linn.)						+			+			
*99. <i>Orionomo damaris</i> Gray				+								
*100. <i>Rhaphicera moorei</i> Butler				+		+			+			
101. <i>Ypthima nareda nareda</i> (Kollar)			+			+		+	+			
102. <i>Ypthima asterope mahratta</i> Moore		+										
103. <i>Ypthima ceylonica kasmira</i> Moore			+									
104. <i>Ypthima lisandra avanta</i> Moore			+			+						
105. <i>Ypthima indecora</i> Moore			+									
106. <i>Ypthima baldus baldus</i> (Fabr.)	+		+									
*107. <i>Ypthima sakra nikaea</i> Moore	+		+					+				
108. <i>Zophoessa sidonis</i> (Hewitson)		+		+		+			+			
*109. <i>Zophoessa maitrya maitrya</i> (deN.)						+			+			
110. <i>Zophoessa nicetas</i> (Hewitson)				+		+			+			
*111. <i>Zophoessa jalaurida</i> deN.						+			+			
112. <i>Zophoessa goalpara goalpara</i> Moore						+			+			
Family V. NYMPHALIDAE												
*113. <i>Aglais cashmirensis</i> Kollar		+		+					+	+	+	

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
114. <i>Aglais urticae</i> (Linn.)					+							
115. <i>Aglais ladakensis</i> Moore					+							
*116. <i>Argyreus hyperbius</i> (Johan.)			+						+	+		
*117. <i>Ariadne merione</i> (Cramer)				+					+	+		
118. <i>Athyma selenophora</i> (Kollar)									+			
*119. <i>Athyma opalina</i> (Kollar)		+		+	+				+	+	+	
120. <i>Athyma perius</i> (Linn.)								+	+			
121. <i>Athyma asura</i> (Moore)						+			+			
122. <i>Apatura ambica</i> Kollar										+		
*123. <i>Auzakia danava</i> (Moore)										+	+	
124. <i>Bassarona patala</i> (Kollar)				+						+		
125. <i>Calinaga buddha</i> Moore							+					
126. <i>Charaxes fabius</i> (Fabr.)		+							+	+		
*127. <i>Childrena childreni</i> (Gray)		+		+		+			+		+	
*128. <i>Cyrestis thyodamas</i> Boisduval				+					+	+		+
*129. <i>Cynthia cardui</i> (Linn.)				+	+				+		+	+
*130. <i>Diagora persimilis</i> (Westwood)				+					+			+
131. <i>Diagora nicevillei</i> Moore		+										
132. <i>Dilipa morgiana</i> (Westwood)				+					+			
133. <i>Dicharragia nesimachus</i> Boisduval						+			+			

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
134. <i>Euthalia garuda</i> (Moore)						+			+			
135. <i>Euthalia lubentina</i> (Cramer)				+					+			
*136. <i>Fabriciana kamala</i> (Moore)									+			
137. <i>Hestina nama</i> (Doubleday)									+			
*138. <i>Hypolimnas bolina</i> (Linn.)		+		+				+	+	+		
*139. <i>Hypolimnas misippus</i> (Linn.)				+					+			
*140. <i>Issoria lathonia</i> (Linn.)									+	+	+	
*141. <i>Junonia hierta</i> (Fabr.)				+	+				+	+		+
*142. <i>Junonia orithya</i> (Linn.)	+		+	+	+				+	+	+	
*143. <i>Junonia lemonias persicaria</i> (Fruhstorfer)			+	+	+						+	+
*144. <i>Junonia almana</i> (Linn.)	+			+					+	+	+	
*145. <i>Junonia atlites</i> (Linn.)				+						+	+	
*146. <i>Precis iphita siccata</i> (Stichel)		+		+				+	+	+	+	
*147. <i>Kallima inachus</i> (Boisduval)				+				+	+	+		
*148. <i>Kaniska canace</i> (Linn.)									+			
149. <i>Limenitis trivena</i> Moore		+		+		+	+		+			
150. <i>Melitaea arcesia</i> Bremer							+		+			
*151. <i>Neptis mahendra</i> Moore		+		+		+			+	+	+	
*152. <i>Neptis hylas astola</i> Moore		+		+	+	+			+	+	+	
153. <i>Neptis yerburyi</i> Butler									+		+	

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
154. <i>Neptis sankara</i> Kollar									+			
155. <i>Neptis ananta</i> Moore		+				+			+		+	
156. <i>Neptis naryana</i> Moore						+			+			
157. <i>Nymphalis xanthomelas</i> (Denis & Schiffer.)				+					+			
*158. <i>Phalanta phalantha</i> (Drury)	+	+		+					+	+	+	+
159. <i>Polyura athamas</i> Drury		+		+		+		+	+	+		
160. <i>Polyura dolon</i> (Westwood)						+			+			
161. <i>Pseudergolis wedah</i> (Kollar)				+		+			+			
*162. <i>Sephisa dichroa</i> (Kollar)		+		+		+			+			
163. <i>Spottea hypselis</i> (Godart)									+			
*164. <i>Stibochiona nicea</i> (Gray)				+		+			+			
165. <i>Symbrenthia hippoclus</i> (Cramer)				+		+			+	+	+	
166. <i>Symbrenthia niphanda</i> Moore				+		+						
*167. <i>Vanessa indica</i> (Herbst)		+		+				+	+		+	
168. <i>Vanessa egea cognata</i> Moore					+	+			+			
Family VI. ACRAEIDAE												
*169. <i>Acraea issoria anomala</i> Kollar				+		+			+	+	+	
170. <i>Acraea violae</i> (Fabr.)									+			
Family VII. ERYCINIDAE												
171. <i>Abisara echerius</i> (Stoll.)		+										

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
172. <i>Dodona dipoea</i> Hewitson				+					+		+	
*173. <i>Dodona durga</i> (Kollar)		+							+			
174. <i>Dodona eugenes</i> Bates				+					+			
*175. <i>Libythea myrrha</i> Godart				+		+			+		+	
*176. <i>Libythea lepita</i> Moore		+										
Family VIII. LYCAENIDAE												
177. <i>Acytolepis puspa gisca</i> Fruhstorfer					+					+		
178. <i>Aricia agestis narira</i> (Moore)									+			
179. <i>Albulina galathea</i> (Blanch.)									+			
*180. <i>Castalius rosimon</i> (Fabr.)				+					+		+	
*181. <i>Catochrysops strabo</i> (Fabr.)				+					+			
182. <i>Celastrina huegelli</i> (Moore)		+							+		+	
183. <i>Celastrina ladonidas gigas</i> Hemming		+										
184. <i>Celastrina argiolus jynteana</i> deN.									+			
185. <i>Chilades laius</i> (Cramer)										+	+	
186. <i>Chaetoprocta odata</i> Hewitson				+					+			
187. <i>Chrysozephyrus ataxus</i> (Doub.)				+					+			
188. <i>Chrysozephyrus birupa</i> Moore				+					+		+	
189. <i>Chrysozephyrus syla</i> (Kollar)				+					+			
190. <i>Creon eleobis</i> (Godart)									+		+	

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
191. <i>Curetis acuta dentate</i> Moore				+		+		+	+		+	
192. <i>Everes hugelii</i> race <i>indica</i> Gistel									+			
193. <i>Everes hugelii dipora</i> (Moore)									+			
194. <i>Everes argiades diporides</i> Chapman									+			
195. <i>Everes lecturnus syntala</i> Cantlie									+			
*196. <i>Euchrysops cnejus</i> (Fabr.)		+		+					+		+	
*197. <i>Euchrysops pandava</i> (Horsfield)				+					+			
198. <i>Euaspa milionia</i> (Hewitson)				+					+			
199. <i>Euaspa ziha</i> (Hewitson)									+			
200. <i>Esakiozephyris icana</i> (Moore)						+			+			
201. <i>Esakiozephyris bieti</i> Oberthur						+			+			
202. <i>Freyeria trochilus</i> Freyer.									+		+	
*203. <i>Freyeria putli</i> (Kollar)				+								
204. <i>Glaucopsyche aeruginosa</i> Staud.									+			
205. <i>Heliophorus sena</i> Kollar				+		+			+			
206. <i>Heliophorus bakeri</i> Evans		+										
207. <i>Heliophorus androcles</i> Hewitson									+			
208. <i>Heliophorus oda</i> Hewitson		+		+					+			
209. <i>Horaga onyx</i> (Moore)				+		+			+			
210. <i>Horaga viola</i> Moore				+								

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
211. <i>Iraota timoleon</i> (Stoll.)		+		+					+		+	
212. <i>Jamides bochus</i> Stoll									+			
213. <i>Lampides boeticus</i> (Linn.)									+			
214. <i>Leptotes plinius</i> (Fabr.)				+								
215. <i>Lycaena pavana</i> (Kollar)		+		+					+			
216. <i>Lycaena phlaeas</i> (Linn.)				+					+			
217. <i>Lycaena kasyapa</i> (Moore)				+	+	+	+		+			
218. <i>Narathura centaurus</i> (Fabr.)								+	+			
219. <i>Narathura dodonea</i> (Moore)				+					+			
220. <i>Narathura rama</i> (Kollar)				+					+			
221. <i>Oreolyce vardhana</i> Moore				+					+			
222. <i>Panchala ganesa</i> (Moore)		+		+					+			
223. <i>Panchala alemon</i> deN. (Moore)									+			
224. <i>Philotes vicrama</i> Moore					+							
225. <i>Polyommatus eros</i> Schmett					+	+		+	+			
226. <i>Prosotis nora</i> Felder									+			
227. <i>Pratapa ictis</i> (Hewitson)								+				
*228. <i>Pseudozizeeria maha</i> (Kollar)		+		+					+	+	+	
229. <i>Rapala veruna grisea</i> Moore				+								
*230. <i>Rapala manea schistacea</i> (Moore)									+			

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
231. <i>Rapala. nissa</i> Kollar				+				+				
232. <i>Rapala. selira</i> Moore				+				+				
233. <i>Rapala. extensa</i> Evans							+					
234. <i>Rapala iarbis sorya</i> (Kollar)											+	
235. <i>Sinthusa chandrana</i> (Moore)				+								
236. <i>Sinthusa nasaka</i> (Horsfield)				+								
237. <i>Spindasis lilacinus</i> (Moore)											+	
*238. <i>Spindasis vulcanus</i> (Fabr.)				+					+		+	
239. <i>Spindasis elima</i> (Moore)				+					+		+	
240. <i>Spindasis nipalicus</i> Moore						+			+		+	
241. <i>Spindasis ictis</i> Hewitson								+				
242. <i>Strymon sassanides</i> Kollar							+		+			
243. <i>Surendra vivarana</i> Horsfield											+	
244. <i>Tajuria diaeus</i> (Hewitson)									+			
245. <i>Tajuria. cippus</i> (Fabr.)									+		+	
246. <i>Tarucus venosus</i> Moore				+		+			+			
247. <i>Tarucus callinara</i> Butler									+			
248. <i>Tarucus alteratus</i> Moore (now <i>nara</i> Kollar DSF)				+		+			+			
249. <i>Tarucus extricatus</i> (now <i>nara</i> WSF)				+							+	
250. <i>Tarucus balcanica nigra</i> Beth.-Baker									+			

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
251. <i>Thecla ziha</i> deN.									+		+	
252. <i>Udara albocoeerulea</i> Moore				+					+		+	
253. <i>Udara cardia dilecta</i> Moore									+			
254. <i>Virachola isocrates</i> (Fabr.)				+						+		
255. <i>Virachola perse</i> (Hewitson)				+							+	
256. <i>Zizeeria karsandra</i> Moore											+	
257. <i>Zizula gaika</i> Trimen				+					+		+	
258. <i>Zizula otis</i> (Fabr.)				+					+		+	
Family IX. HESPERIIDAE												
259. <i>Achalarus bifasciatus casyapa</i> Moore									+			
260. <i>Aeromachus stigmata</i> (Moore)				+					+	+	+	
261. <i>Badamia exclamationis</i> (Fabr.)				+								
262. <i>Bibasis jaina</i> Moore											+	
263. <i>Bibasis sena</i> (Moore)									+			
*264. <i>Borbo cinnara</i> (Wallare)		+							+			
265. <i>Borbo bevani</i> Moore											+	
266. <i>Celaenorrhinus leucocera</i> (Kollar)				+					+			
267. <i>Choaspes benjaminii</i> (Guerin)				+		+			+		+	
*268. <i>Coladenia dan</i> (Fabr.)		+				+					+	
269. <i>Hesperia alpina</i>					+							
270. <i>Ismene aedipodea aegina</i> Plotz				+							+	

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
271. <i>Odontoptilum angulata</i> (Felder)				+					+		+	
272. <i>Parnara guttatus</i> Bremer & Grey									+		+	
273. <i>Pelopidas assamensis</i> W.M. & deN											+	
274. <i>Pelopidas conjuncta</i> Herr. Sch.				+								
275. <i>Pelopidas sinensis</i> Mabilie				+					+			
*276. <i>Pelopidas mathias</i> Fabr.				+							+	
277. <i>Polytremis eltola</i> Hewitson				+					+			
278. <i>Sarangesa purendra</i> (Moore)				+								
*279. <i>Sarangesa dasahara</i> (Moore)		+		+					+			
*280. <i>Spialia galba</i> (Fabr.)				+							+	
*281. <i>Suastus gremius</i> (Fabr.)		+		+					+			
282. <i>Tagiades litigiosa</i> Moore									+			
*283. <i>Tagiades menaka</i> (Moore)		+		+					+			
284. <i>Taractrocera danna</i> (Moore)									+		+	
285. <i>Taractrocera. maevius</i> (Fabr.)											+	
286. <i>Telicota oharajia</i> Evans										+		
287. <i>Udaspes folus</i> (Cr.)		+		+					+		+	
288. <i>Udaspes adrastus</i> (Cr.)				+								

## **INSECTA : LEPIDOPTERA : GEOMETRIDAE (MOTHS)**

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### **INTRODUCTION**

The geometrid fauna of India has received attention of a number of workers between 1854 and 1940. The most outstanding contribution to geometrid fauna of British India is due Hampson (1895, 1896), who described 1017 species in two volumes of "Fauna of British India" Equally important contributions to the geometrid fauna of India have also been made by Warren (1895-1909), Swinhoe (1895-1916) and Prout (1906-1941). Such efforts have resulted in the recording of a total of nearly 1300 species under 6 subfamilies namely, Archiariae, Larentiinae, Geometrinae, Sterrhinae, Ennominae and Oenochrominae. Out of these, as many as 445 species under 128 genera of family Geometridae have so far been described from North-Western India.

A thorough analysis of the previous literature reveals that collection of geometrid fauna has been done only from a few selected localities in Himachal Pradesh namely, Simla, Rampur, Kangra, Dharamsala, Dalhousie, Chamba and Kulu. Therefore, the available information on sampling is far from satisfactory in evaluating the true picture of geometrid fauna-richness of a state of such variable topography and vegetation.

To evaluate and fulfill the gap between actually existing and reported geometrid fauna of Himachal Pradesh, only notable contribution in the post independence era has been made by Walia (1988, 1994, 1994a, 1994b, 1995, 2000) Walia & Pajni (1984, 1985, 1987) and Pajni & Walia (1982, 1983, 1984, 1984a, 1985). Intensive collection surveys were conducted repeatedly in climatically diverse areas not only to collect a large number of representatives of different species but also to bring to light the unexplored fauna from protected and vegetation rich areas of the state free from human interference.

As a result, 184 species were collected and identified. Out of these, 38 species belong to 27 genera of subfamily Geometrinae, 46 species to 11 genera of subfamily Sterrhinae, 86 species to 50 genera of subfamily Ennominae, 13 species to 11 genera of subfamily Larentiinae and 1 species to 1 genus of subfamily Desmobathrinae. Out of 184 species, 19 species are new, whereas 33 already described species are being reported from North-Western India for the first time. In addition to this, two species namely,

*Hemithea ochrolauta* (Warren) and *Idaea leucozona leucozona* (Hampson) are new records from India.

A list of the geometrid moths as per nomenclature by Scoble (1999) collected from different localities of Himachal Pradesh is as given below :

**Family : GEOMETRIDAE**

a) Subfamily : GEOMETRINAE

Sl. No.	Name of Species	Localities
1.	<i>Agathia lycaenaria lycaenaria</i> (Kollar)	Nauni, Chambaghat, Sairighat
2.	<i>A. hilarata hilarata</i> Guenee	Chambaghat, Sairighat, Subathu, Simla
3.	<i>Tanaorhinus reciprocata reciprocata</i> (Walker)	Solan, Chamba, Dalhousie, Kharapathar
4.	<i>Mixochlora vittata vittata</i> (Moore)	Dalhousie, Solan, Subathu, Sairighat
*5.	<i>Ornithospila avicularia avicularia</i> (Guenee)	Subathu, Sairighat, Renuka
*6.	<i>Omphacodes directa</i> (Walker)	Subathu, Solan, Nauni, Sairighat
*7.	<i>Cacochloris uvidula</i> (Swinhoe)	Subathu
8.	<i>Thetidia radiata</i> Walker	Solan
9.	<i>Geometra flavifrontaria</i> (Guenee)	Simla, Chamba, Dalhousie, Sarahan
10.	<i>Chloroglyphia variegata</i> (Butler)	Simla, Dalhousie
11.	<i>Mixocera allbilineata</i> Walia & Pajni	Solan
12.	<i>Hemistola detracta</i> (Walker)	Nauni, Chambaghat, Sairighat, Subathu, Dalhousie, Sarahan
13.	<i>H. loxiaria</i> (Guenee)	Simla
14.	<i>Thetidia pallidmarginata</i> (Walia & Pajni)	Nauni, Chambaghat, Solan, Simla, Sairighat, Subathu
15.	<i>Comostola multimaculata</i> (Pajni & Walia)	Nauni
16.	<i>Herochroma cristata cristata</i> (Warren)	Solan, Subathu, Sairighat, Dalhousie
17.	<i>Eucyclodes gavissima gavissima</i> (Walker)	Solan, Sairighat
18.	<i>Pingasa pseudoterpnaria pseudoterpnaria</i> (Guenee)	Nauni, Simla, Subathu, Sairighat
19.	<i>P. ruginaria ruginaria</i> (Guenee)	Solan

20. *Lophophelma erionoma erionoma* (Swinhoe) Solan, Dalhousie  
 21. *Comibaena cassidara* (Guenee) Nauni, Chambaghat, Simla  
 22. *Comibaena subhyalina* (Warren) Simla  
 \*23. *Rhomborista devaxata* (Walker) Nauni, Subathu, Sairighat  
 \*24. *Spaniocentra megaspilaria* (Moore) Solan, Nauni, Subathu, Sairighat  
 25. *Neromia carnifrons carnifrons* (Butler) Subathu, Sairighat, Dalhousie  
 \*26. *Episothalma robustaria* (Guenee) Nauni  
 \*\*27. *Hemithia ochrolauta* (Warren) Chambaghat  
 28. *Hemithea marina* (Butler) Nauni, Subathu, Sairighat  
 29. *H. himachalensis* Walia Nauni  
 30. *Chlorissa pretiosaria pretiosaria* (Staudinger) Simla, Solan, Kulu, Dalhousie, Chambaghat, Sairighat, Subathu, Kharapathar  
 31. *C. albifasciata* Pajni & Walia Subathu  
 32. *Hemithea aquamarina* Hampson Chambaghat, Sairighat, Subathu, Dalhousie  
 33. *Pelagodes falsaria* (Prout) Solan, Subathu, Dalhousie, Simla, Chambaghat, Nauni, Sairighat, Jangeshu  
 34. *Maxates goniaria* (Felder & Rogen.) Subathu, Sairighat  
 35. *Maxates fuscipalpa* (Pajni & Walia) Nauni, Subathu  
 \*36. *Idiochlora pudentifimbria* (Prout) Palampur, Chambaghat  
 37. *I. mundaria* (Leech) Nauni, Solan  
 38. *Protuliocnemis castalaria castalaria* (Oberthur) Nauni, Subathu, Sairighat, Renuka

## b) Subfamily : STERRHINAE

39. *Traminda mundissima mundissima* (Walker) Nauni, Subathu, Sairighat, Dalhousie  
 40. *Problepsis albidior albidior* Warren Chambaghat, Nauni, Subathu, Sairighat, Solan, Mandi, Dalhousie  
 41. *P. vulgaris* Butler Chambaghat, Nauni, Dalhousie, Solan, Mandi, Sairighat  
 \*42. *P. deliaria* (Guenee) Chambaghat, Subathu, Sairighat  
 \*43. *Chrysocraspeda faganaria* (Guenee) Subathu, Sairighat  
 \*44. *Somatina purpurascens* Moore Simla, Nauni, Subathu, Sairighat, Kiriting

45. *S. anthophilata* Guenee Subathu, Renuka, Dalhousie, Sairighat
46. *Somatina omicraria* (Fabricius) Nauni, Dalhousie
- \*47. *Antitrygodes cuneilinea* (Walker) Sairighat
48. *Rhodostrophia herbicolens* (Butler) Simla, Nauni, Sairighat, Dalhousie
49. *R. tristrigalis* Butler Simla, Solan, Subathu, Sairighat Dalhousie
50. *R. stigmatica* Butler Simla, Chambaghat, Subathu, Dalhousie
51. *Timandra correspondens* Hampson Solan, Nauni, Simla
52. *I. convectaria convectaria* Walker Simla, Nauni, Subathu
- \*53. *Chrysocraspeda olearia olearia* (Guenee) Subathu
54. *Scopula nigrifrons* sp. nov. Nauni
- \*55. *S. stigmata* (Moore) Solan, Nauni
56. *S. monosema* Prout Nauni
57. *S. emissaria emissaria* (Walker) Subathu
58. *S. kashmirensis kashmirensis* (Moore) Kulu, Nauni, Subathu, Dalhousie, Chamba
59. *S. butyroasa* (Warren) Nauni, Chambaghat, Solan, Dalhousie
- \*60. *S. pulverosa* (Prout) Solan, Simla
61. *S. pallida* (Warren) Simla, Chambaghat, Sarahan, Kharapathar
62. *S. niveus* sp. nov. Simla, Chambaghat
63. *S. atriceps* (Hampson) Chambaghat, Nauni, Simla
64. *S. attentata attentata* (Walker) Subathu
- \*65. *S. caesaria caesaria* (Walker) Subathu, Nauni
66. *S. ochripennis* sp. nov. Nauni, Chambaghat
67. *S. straminicostalis* sp. nov. Simla
68. *S. humilis* (Prout) Nauni
69. *S. fibulata* (Guenee) Chambaghat, Solan
70. *S. cleoraria cleoraria* (Walker) Simla, Solan, Chambaghat, Dalhousie
- \*71. *S. addictaria* (Walker) Subathu, Nauni
- \*72. *S. moorei moorei* (Cotes & Swinhoe) Simla, Nauni, Chambaghat

- \*73. *S. pulchellata pulchellata* (Fabricius) Nauni
- \*\*74. *Idaea leucozona leucozona* (Hampson) Nauni
75. *I. ptyonopoda* (Hampson) Chambaghat, Subathu
76. *I. protensa* (Butler) Simla, Dalhousie, Chamba
77. *I. delicatula* (Warren) Simla
78. *I. infortunata* (Prout) Chambaghat, Nauni
79. *I. grisescens* (Warren) Nauni, Chambaghat
80. *I. humeraria* (Walker) Kulu, Simla
81. *I. fuscolineata* Walia Solan
- \*82. *I. actiosaria* (Walker) Simla, Nauni
- \*83. *Lophopleps triangularis triangularis* (Hampson) Solan, Dalhousie, Subathu, Sairighat
- \*84. *Zygophyxia relictata* (Walker) Solan
- c) Subfamily : DESMOBASTHRINAE
85. *Ozola microniaria* Walker Nauni, Subathu, Sairighat
- d) Subfamily : ENNOMINAE
86. *Peratophyga hyalinata hyalinata* (Kollar) Simla, Chambaghat, Subathu, Nauni, Solan, Sairighat
87. *Lomographa distans* (Warren) Chambaghat, Solan, Subathu, Sairighat, Simla
88. *Ascotis imparata* (Walker) Chambaghat, Nauni
89. *A. selenaria selenaria* (Denis & Schiff.) Jangeshu, Sairighat, Subathu, Simla
- \*90. *Hypomesis infixaria* (Walker) Chamba, Dalhousie, Sairighat, Subathu
91. *Scardamia metallaria* Guenee Subathu, Sairighat
92. *Scardamia easwarammae* Walia Subathu, Sairighat, Solan
- \*93. *Isturgia disputaria* (Guenee) Nauni, Subathu
- \*94. *Semiothisa fumosa* (Hampson) Nauni, Subathu, Sairighat
95. *Ligdia coctata* Guenee Nauni, Chambaghat
96. *Hyperythra lutea* (Stål) Nauni, Solan
- \*97. *Heterolocha phaenicotaeniata* (Kollar) Simla, Nauni, Chambaghat Sairighat
98. *Heterostegane bilineata* (Butler) Subathu, Nauni

99. *H. subtessellata* (Walker) Nauni, Solan, Subathu, Sairighat, Renuka
100. *H. marginata* (Warren) Nauni, Chambaghat, Subathu, Sairighat
- \*101. *Heterostegane urbica urbica* (Swinhoe) Renuka, Nahar, Subathu
102. *H. sp. nov.* Subathu, Nauni, Sairighat
- \*103. *Zeheba lucidata* Walker Chambaghat, Simla, Subathu, Sairighat
104. *Pseudopanthera himaleyica* (Kollar) Simla
105. *Sirinopteryx ablunata* (Guenee) Simla
- \*106. *Synegia camptogrammaria* (Guenee) Simla
107. *Abraxas intermedia* Warren Solan, Subathu, Chail, Dalhousie, Sairighat, Chamba, Simla
108. *A. leopardina* (Kollar) Simla
- \*109. *A. martaria* Guenee Simla
110. *A. sp. nov.* Subathu, Sairighat
111. *A. sp. nov.* Nauni
112. *Ourapteryx picticaudata* (Walker) Solan, Subathu, Sairighat, Simla, Sarahan, Dalhousie
113. *O. ebuleata ebuleata* (Guenee) Solan
114. *Thinopteryx crocoptera crocoptera* (Kollar) Simla, Sairighat, Renuka
115. *Chiasmia pluviata pluviata* (Fabricius) Nauni, Subathu
116. *Chiasmia fidoniata* (Guenee) Nauni, Subathu
- \*117. *C. azataria* (Swinhoe) Subathu, Nauni
118. *C. eleonora eleonora* (Cramer) Nauni, Simla, Subathu, Kiriting
- \*119. *Chiasmia xanthonora* (Walker) Renuka, Nauni, Sairighat, Subathu
120. *Oxymacaria temeraria temeraria* (Swinhoe) Simla, Nauni
121. *Chiasmia perfusaria* (Walker) Nauni, Subathu, Simla, Sairighat
- \*122. *Abaciscus atmala atmala* (Swinhoe) Subathu
123. *Chiasmia effusata* (Guenee) Nauni, Solan, Subathu, Sairighat
124. *C. frugaliata* (Guenee) Subathu, Sairighat
125. *C. sp. nov.* Nauni
126. *C. sp. nov.* Subathu
127. *C. sp. nov.* Simla
128. *C. sp. nov.* Subathu, Renuka

129. *Corymica specularia specularia* (Moore) Subathu Sairighat, Simla, Dalhousie
130. *C. arnearia* Walker Kharapathar, Renuka, Chamba
131. *Odontopera lentiginosaria* (Moore) Sairighat, Renuka
132. *Odontopera obliquaria* (Moore) Simla
133. *Odontopera angularia* (Moore) Chamba, Sairighat
134. *Erebomorpha fulguraria fulguraria* Walker Kharapathar
135. *Biston suppressaria suppressaria* (Guenee) Chambaghat, Sairighat, Subathu
- \*136. *Zamarada baliata* (Feldes & Rog.) Subathu, Sairighat,
137. *Amraica* sp. nov. Nauni, Sairighat, Subathu
138. *Hyposidra talaca successaria* (Walker) Subathu, Jangeshu, Sairighat
139. *H. talaca talaca* (Walker) Renuka
140. *Astygisa vexillaria* (Guenee) Renuka
141. *Petelia medardaria* Herr.-Schaffer Subathu, Sairighat, Simla
142. *P.* sp. nov. Solan
143. *P.* sp. nov. Nauni
144. *Luxiaria amasa amasa* Butler Solan, Simla, Subathu, Sairighat
145. *Eutoea heteroneurata heteroneurata* (Guenee) Simla, Sairighat
146. *Anonychia grisea* (Butler) Simla, Chambaghat, Sairighat
147. *A.* sp. nov. Nauni, Subathu, Sairighat, Renuka
148. *Alcis semialba* (Moore) Simla, Sairighat
- \*149. *Alcis variegata variegata* (Moore) Sairighat
- \*150. *Psilalsis inceptaria* (Walker) Renuka Subathu, Solan, Sairighat
151. *Ectropis crepuscularia crepuscularia* (Denis & Schiff.) Renuka, Subathu, Chambaghat, Nauni, Kirting, Sairighat
152. *Dasyboarmia delineata* (Walker) Nauni, Chambaghat, Sairighat, Kharapathar
153. *Menophra subplagiata* (Walker) Subathu, Chambaghat, Sairighat, Nauni, Solan, Kirting
154. *Phthonandria atrilineata atrilineata* (Butler) Nauni, Subathu, Sairighat
155. *Chorodra pulverulenta* (Hampson) Nauni, Subathu, Sairighat
156. *Lassaba albidaria albidaria* (Walker) Sairighat
157. *Gnophos tephrosiaria* Moore Solan, Chambaghat, Sairighat, Subathu, Renuka

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|--|---|
| 158. <i>G. accipitraria</i> Guenee                     | Simla, Sairighat                                |
| 159. <i>Ctenognophos eolaria eolaria</i> (Guenee)      | Chambaghat, Sairighat, Subathu, Kirting, Chail  |
| *160. <i>Peratostega deletaria deletaria</i> (Moore)   | Solan, Chambaghat, Dalhousie, Chamba, Sairighat |
| 161. <i>Leptomiza calcearia calcearia</i> Walker       | Simla, Sairighat, Subathu                       |
| 162. <i>Ophthalmitis herbidaria</i> (Guenee)           | Chambaghat                                      |
| *163. <i>Percnia felinaria</i> Guenee                  | Manali  |
| *164. <i>Antiparncnia belluaria belluaria</i> (Guenee) | Dalhousie, Sarahan, Simla Subathu, Sairighat    |
| 165. <i>Ourapteryx convergens</i> Warren               | Simla   |
| 166. <i>Biston betularia coagnataria</i> (Guenee)      | Solan, Simla, Kharapathar, Sarahan              |
| 167. <i>Minomiza cruentaria cruentaria</i> (Moore)     | Sairighat, Dalhousie                            |
| 168. <i>Plutodes costatus</i> (Butler)                 | Simla, Sairighat                                |
| 169. <i>P. transmutata</i> Walker                      | Sairighat                                       |
| *170. <i>Opisthograptis molleri</i> Warren             | Sairighat                                       |
| 171. <i>Psyra spurcataria</i> (Walker)                 | Sairighat, Simla                                |
| e) Subfamily : LARENTIINAE                             |   |
| 172. <i>Photoscotia miniosata miniosata</i> (Walker)   | Sairighat                                       |
| 173. <i>Triphosa dubiosata</i> (Walker)                | Chambaghat, Sairighat                           |
| 174. <i>Cataclysmes conturbata conturbata</i> (Walker) | Nauni, Chambaghat                               |
| 175. <i>Cidaria</i> sp. nov.                           | Simla   |
| 176. <i>C.</i> sp. nov.                                | Sairighat                                       |
| 177. <i>Laciniodes plurilinearia</i> (Moore)           | Subathu, Sairighat                              |
| 178. <i>Heterothera consimilis</i> (Warren)            | Simla, Sairighat                                |
| 179. <i>Horisme plurilineata</i> (Moore)               | Subathu   |
| 180. <i>Docirava</i> sp. nov.                          | Dalhousie, Sairighat                            |
| 181. <i>Docirava aequilineata</i> (Walker)             | Sairighat                                       |
| 182. <i>Pomasia</i> sp. nov.                           | Sairighat, Dalhousie                            |
| 183. <i>Eupithecia rajata</i> Guenee                   | Dalhousie, Sairighat                            |
| *184. <i>Chalyboclydon marginata</i> Warren            | Sairighat                                       |

\*(New record from North-Western India)

\*\* (New record from India)

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## **INSECTA : HYMENOPTERA : ICHNEUMONIDAE**

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### **INTRODUCTION**

The Family Ichneumonidae belongs to order Hymenoptera (wasps & bees). The family includes more species than the number of entire Vertebrata and more than any other family, except Curculionidae (Coleoptera). Of all the species of insecta known from the World, 5-6% belong to Family Ichneumonidae. These insects are parasitic on the larvae and pupae of other insects, except a few which are parasitic on spiders or their eggs. By their parasitic habits, they destroy a large number of agriculture and forest pests and thus constitute one of the major forces for preventing the undue increase of noxious species.

There are an estimated 60,000 species in the world fauna, of which about 8000 are believed to occur in India, however, 1200 species have been reported from India at the present. The Western Himalaya ecosystem in the state of Himachal Pradesh is represented by about 26% of the species recorded from India. The present paper record 319 species / sub-species under 17 subfamilies of family Ichneumonidae. The Western Himalayan ecosystem in the state of Himachal Pradesh is divided into 12 districts. The districts of Solan, Shimla, Kangra, Chamba and Kulu have been explored satisfactorily, showing high records of taxa; followed by Kinnaur, Lahaul & Spiti and Mandi. The districts of Sirmour, Bilaspur, Una and Hamirpur are not extensively explored, therefore no taxa have been reported from these districts.

The analysis of the taxa recorded from Western Himalayan Ecosystem in the state of Himachal Pradesh and a detailed list of taxa showing their distribution in various districts of Himachal Pradesh is given below:

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**Table :** District-wise distribution of Species (Class Insecta, Order Hymenoptera, Family Icheumonidae)

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
	1. Subfamily PIMPLINAE												
1.	<i>Pimpla duplicauda</i> (Heinrich) = <i>Ephialtes duplicauda</i> Heinrich, 1949		+										
2.	<i>Pimpla manifestator</i> (Linnaeus) = <i>Ichneumon maifestator</i> Linnaeus, 1958 = <i>Ichneumon carbonarius</i> Christ, 1991									+			
3.	<i>Liotryphon aruni</i> Gupta & Tikar, 1976		+							+			
4.	<i>Dolichomitus crassus</i> (Morley) = <i>Ephialtes crassus</i> Morley, 1913									+			
5.	<i>Dolichomitus iridipennis</i> Morley, 1903						+			+			
6.	<i>Afrephialtes laetiventris laetiventris</i> (Cameron) = <i>Pimpla laetiventris</i> Cameron, 1899 = <i>Exeristis gracilis</i> Cushman, 1933 = <i>Calliephialtes bimarginatus</i> Cushman, 1937		+				+		+				
7.	<i>Afrephialtes latiannulatus</i> (Cameron) = <i>Ephialtes latiannulatus</i> Cameron, 1907 = <i>Pimpla sikkimensis</i> Cameron, 1908 = <i>Exeristes tibialis</i> Morley, 1913				+								
8.	<i>Iseropus (Gregopimpla) anjana</i> Gupta & Tikar, 1976									+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Simour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
9.	<i>Iseropus (Gregopimpla) himalayensis</i> (Cameron) = <i>Pimpla himalayensis</i> Cameron, 1989 = <i>Epiurus santanas</i> Morley, 1913		+										
10.	<i>Iseropus (Gregopimpla) parvatus</i> Gupta & Tikar, 1976									+			
11.	<i>Scambus (Ateleophadnus) falvicrus</i> Gupta & Tikar, 1968						+						
12.	<i>Scambus (Scambus) garhwalensis</i> Gupta & Tikar, 1968						+						
13.	<i>Scambus (Scambus) laccae</i> Gupta & Tikar, 1968						+						
14.	<i>Scambus (Scambus) lineipes</i> Morley, 1913		+							+			
15.	<i>Scambus (Scambus) simulator</i> Gupta & Tikar, 1968									+			
16.	<i>Acropimpla hapaliae</i> Rao, 1953		+		+					+			
17.	<i>Itopectis himalayensis</i> Gupta, 1968		+							+			
18.	<i>Itopectis santoshae</i> Gupta, 1968		+							+			
19.	<i>Itopectis tibetensis</i> Perkins, 1967									+			
20.	<i>Ephialtes erythromerus</i> Gupta & Tikar, 1966		+										
21.	<i>Ephialtes nigrifemoratus</i> Gupta & Tikar = <i>Ephialtes melanomerus</i> Gupta & Tikar, 1966		+							+			
22.	<i>Coccygomimus arcticus</i> (Zetterstedt) = <i>Pimpla arctica</i> Zetterstedt, 1940		+							+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
23.	<i>Coccygomimus bilineatus</i> (Cameron) = <i>Habropimpla bilineata</i> Cameron, 1900		+		+					+		+	
24.	<i>Coccygomimus cameronii</i> (Dallatore) = <i>Pimpla vidua</i> Cameron, 1899 = <i>Pimpla cameroni</i> Dalla Torre, 1901 = <i>Itopectis orientalis</i> Morley, 1913		+		+		+		+	+		+	
25.	<i>Coccygomimus carinifrons</i> (Cameron) = <i>Pimpla carinifrons</i> Cameron, 1899 = <i>Ephialtes formosana</i> Cushman, 1922		+		+				+	+		+	
26.	<i>Coccygomimus cyanator</i> (Morley) = <i>Pimpla cyanea</i> Morley, 1913 = <i>Pimpla cyanator</i> Morley, 1914		+							+			
27.	<i>Coccygomimus erebus</i> (Cameron) = <i>Pimpla erebus</i> Cameron, 1899		+		+		+		+	+		+	
28.	<i>Coccygomimus indra</i> (Cameron) = <i>Pimpla indra</i> Cameron, 1899		+							+			
29.	<i>Coccygomimus laothoe</i> (Cameron) = <i>Pimpla laothoe</i> Cameron, 1897 = <i>Pimpla nepe</i> Cameron, 1987 = <i>Pimpla poesia</i> Cameron, 1899		+							+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
30.	<i>Coccygomimus turionellae</i> (Linnaeus) = <i>Ichneumon turionellae</i> Linnaeus, 1758									+			
31.	<i>Xanthopimpla honorata honorata</i> (Cameron) = <i>Pimpla honorata</i> Cameron, 1899 = <i>Xanthopimpla cera</i> Cameron, 1908 = <i>Xanthopimpla binghami</i> Cameron, 1908 = <i>Xanthopimpla kriegariana</i> Cameron, 1908		+							+			
32.	<i>Xanthopimpla reicherti reicherti</i> Krieger, 1914				+								
33.	<i>Theronia atalantae himalayensis</i> (Gupta) = <i>Theronia atalantae atalantae</i> Gupta, 1983							+					
34.	<i>Delomerista indica</i> Gupta, 1982		+										
35.	<i>Perithous divianator himalayensis</i> Gupta, 1982					+		+					
36.	<i>Proemenia kashmirica</i> Gupta, 1980							+					
37.	<i>Deuteroxorides indicus</i> Gupta, 1980		+										
38.	<i>Megarhyssa indica</i> Kamath & Gupta, 1972							+					
	2. Subfamily TRYPHONINAE												
39.	<i>Phytodietus (Neuchorus) arisanus arisanus</i> Sonan, 1936		+					+					
40.	<i>Phytodietus (Neuchorus) longicauda</i> (Uchida) = <i>Neuchorus longicauda</i> Uchida, 1931 = <i>Phytodietus pallidus</i> Cushman, 1933		+										

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
41.	<i>Phytodietus (Neuchorus) nigrus</i> Kaur & Jonathan, 1979					+	+			+			
42.	<i>Phytodietus (Phytodietus) flavocoxatus</i> Kaur & Jonathan, 1979						+						
43.	<i>Phytodietus (Phytodietus) silvicola</i> Kaur & Jonathan, 1979		+										
44.	<i>Phytodietus (Weisia) pitambari</i> Kaur & Jonathan, 1979						+						
45.	<i>Netelia (Bessobates) virgata</i> (Fourcroy) = <i>Ichneumon virgatus</i> Fourcroy, 1785		+			+	+			+			
46.	<i>Netelia (Longiterebates) auberti</i> Kaur & Jonathan, 1976		+										
47.	<i>Netelia (Longiterebates) himalayensis</i> Kaur & Jonathan, 1976		+			+	+			+			
48.	<i>Netelia (Longiterebates) reclivousa</i> Kaur & Jonathan, 1979					+				+			
49.	<i>Netelia (Longiterebates) turgida</i> Kaur & Jonathan, 1979		+										
50.	<i>Netelia (Prosthodocis) turgida</i> Kaur & Jonathan, 1979						+						
51.	<i>Netelia (toxochiloides) latro latro</i> (Holmgren) = <i>Paniscus latro</i> Holmgren, 1868 = <i>Paniscus ferrugineus</i> Cameron, 1899 = <i>Paniscus cameroni</i> Enderlein, 1912 = <i>Paniscus samoanus</i> Kohl, 1908 = <i>Paniscus javanus</i> Szepligeti, 1908		+		+		+			+		+	
52.	<i>Netelia (Netelia) aequara</i> Kaur & Jonathan, 1979		+										
53.	<i>Netelia (Netelia) altantor</i> Aubert, 1931		+				+						

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
54.	<i>Netelia (Netelia) dolabra</i> Kaur & Jonathan, 1979		+										
55.	<i>Netelia (Netelia) facialis</i> Kaur & Jonathan, 1979											+	
56.	<i>Netelia (Netelia) fumosa</i> Kaur & Jonathan, 1979		+				+						
57.	<i>Netelia (Netelia) fuscicornis</i> (Holmgren) = <i>Paniscus fuscicornis</i> Holmgren, 1858		+							+		+	
58.	<i>Netelia (Netelia) intermedia</i> (Cameron) = <i>Paniscus intermedius</i> Cameron, 1905									+		+	
59.	<i>Netelia (Netelia) kashmirensis</i> (Cameron) = <i>Paniscus montanus</i> Cameron, 1906 = <i>Paniscus kashmirensis</i> Cameron, 1906		+				+			+			
60.	<i>Netelia (Netelia) levisulca</i> Kaur & Jonathan, 1979		+							+			
61.	<i>Netelia (Netelia) ocellaris</i> (Thomson) = <i>Paniscus ocellaris</i> Thomson, 1888				+					+		+	
62.	<i>Netelia (Netelia) opacula</i> (Thomson) = <i>Paniscus opaculus</i> Thomson, 1888						+			+			
63.	<i>Netelia (Netelia) orientalis</i> (Cameron) = <i>Paniscus orientalis</i> Cameron, 1905		+				+			+			
64.	<i>Netelia (Netelia) pectinia</i> Kaur & Jonathan, 1979		+							+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
65.	<i>Netelia (Netelia) rimosa</i> (Enderlein) = <i>Paniscus rimosus</i> Enderlein, 1912		+			+				+			
66.	<i>Netelia (Netelia) rotunda</i> Kaur & Jonathan, 1979		+			+	+			+			
67.	<i>Netelia (Netelia) siva</i> Kaur & Jonathan, 1979		+				+						
68.	<i>Netelia (Netelia) striata</i> Nikam, 1973		+										
69.	<i>Netelia (Netelia) testacea</i> (Gravenhorst) = <i>Paniscus testaceus</i> Gravenhorst, 1829									+			
70.	<i>Netelia (Netelia) thoracica</i> (Woldstedt) = <i>Ichenumon thracicus</i> Woldstedt, 1880					+		+			+		
71.	<i>Netelia (Netelia) vinulae</i> (Scopoli) = <i>Paniscus vinulae</i> Scopoli, 1763 = <i>Paniscus cephalotes</i> Holmgren, 1858				+								
72.	<i>Netelia (Paropheltes) dhruvi</i> Kaur & Jonathan, 1979		+							+			
73.	<i>Netelia (Paropheltes) guptai</i> Kaur & Jonathan, 1979		+			+				+			
74.	<i>Netelia (Paropheltes) inedita</i> (Kakujev) = <i>Paniscus ineditus</i> Kekujev, 1899									+			
75.	<i>Netelia (Paropheltes) lineolata</i> (Costa) = <i>Paniscus lineolata</i> Costa, 1883		+										

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
76.	<i>Netelia (Paropheltes) thomsoni</i> (Brauns) = <i>Paniscus thomsoni</i> Brauns, 1889 = <i>Paniscus lineatus</i> Kriechbaumer, 1890		+				+						
77.	<i>Ctenochira himachala</i> Gupta, 1985		+							+			
78.	<i>Ctenochira pallipes</i> (Cameron)					+				+			
79.	<i>Dyspetes indicus</i> Gupta, 1983		+							+			
80.	<i>Cosmoconus indicus</i> Gupta, 1985		+							+			
81.	<i>Tryphon himalayensis</i> Gupta, 1985						+						
	3. Subfamily XORIDINAE												
82.	<i>Ischnoceros himalayensis</i> Chandra, 1978						+						
83.	<i>Odontocolon indica</i> Chandra, 1978		+										
84.	<i>Xorides (Moreophora) indicus</i> Gupta & Chandra, 1972									+			
85.	<i>Xorides (Moreophora) lissopunctus</i> Gupta & Chandra, 1972					+							
86.	<i>Xorides (Xorides) anthracinus</i> Gupta & Chandra, 1974		+				+						
87.	<i>Xorides (Xorides) vitiosus</i> (Turner) = <i>Xylonomus vitiosus</i> Turner, 1919						+						
88.	<i>Glypta nursei</i> Cameron, 1902									+			
89.	<i>Lissonota albicaudata</i> Chandra & Gupta, 1977		+										
90.	<i>Lissonota bispota</i> Chandra & Gupta, 1977		+										

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
91.	<i>Lissonota curtiterebra</i> Chandra & Gupta 1977					+							
92.	<i>Lissonota danielsi</i> Chandra & Gupta, 1977		+										
93.	<i>Lissonota exculata</i> Chandra & Gupta, 1977		+										
94.	<i>Lissonota himachala</i> Chandra & Gupta, 1977					+							
95.	<i>Lissonota incrassata</i> Chandra & Gupta, 1977							+					
96.	<i>Lissonota jonathani</i> Chandra & Gupta, 1977		+										
97.	<i>Lissonota kamathi</i> Chandra & Gupta, 1977		+										
98.	<i>Lissonota kircosa</i> Chandra & Gupta, 1977		+										
99.	<i>Lissonota nigricorpa</i> Chandra & Gupta, 1977		+										
100.	<i>Lissonota paula</i> Chandra & Gupta, 1977							+					
101.	<i>Lissonota prolixa</i> Chandra & Gupta, 1977		+										
102.	<i>Lissonota saxenai</i> Chandra & Gupta, 1977		+										
103.	<i>Lissonota tergolata</i> Chandra & Gupta, 1977		+										
104.	<i>Alloplasta oblongata</i> Chandra & Gupta, 1977							+					
105.	<i>Alloplasta pilosa</i> (Cameron) = <i>Trichopimpla pilosa</i> Cameron, 1903										+		
106.	<i>Cryptopimpla buareoleta</i> Chandra & Gupta, 1977		+			+					+		
107.	<i>Cryptopimpla buccinata</i> Chandra & Gupta, 1977		+			+							
108.	<i>Cryptopimpla cristula</i> Chandra & Gupta, 1977		+										

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
109.	<i>Cryptopimpla fasciolurida</i> Chandra & Gupta, 1977		+										
110.	<i>Cryptopimpla helvicoxis</i> Chandra & Gupta, 1977		+										
111.	<i>Cryptopimpla maurocoxis</i> Chandra & Gupta, 1977		+										
112.	<i>Cryptopimpla miltothibialis</i> Chandra & Gupta, 1977		+										
113.	<i>Cryptopimpla nigripalpis</i> (Cameron) = <i>Fintona nigripalpis</i> Cameron, 1909					+				+			
114.	<i>Hadrostenthus rubriventris</i> Chandra & Gupta, 1977		+			+	+			+			
115.	<i>Amphirhachis rubriventris</i> Chandra & Gupta, 1977		+							+			
116.	<i>Stictolissonota foveata</i> Cameron, 1907		+										
117.	<i>Syzeuctus apicipennis</i> (Cameron) = <i>Lissonata apicipennis</i> Cameron, 1902									+			
118.	<i>Syzeuctus claripennis</i> (Cameron) = <i>Lissonota claripennis</i> Cameron, 1902									+			
119.	<i>Syzeuctus villosus</i> (Cameron) = <i>Meyva villosus</i> Cameron, 1987		+										
120.	<i>Syzeuctus zanthorius</i> (Cameron) = <i>Lissonota zanthorius</i> Cameron, 1902		+										
121.	<i>Leptobatopsis flavoannulata</i> Chandra & Gupta, 1977		+										
122.	<i>Leptobatopsis nigricapitis</i> Chandra & Gupta, 1977						+						
123.	<i>Banchus cerinus</i> Chandra & Gupta, 1977		+										

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
124.	<i>Banchus flavomaculatus</i> (Cameron) = <i>Cidaphurus flavomaculatus</i> Cameron, 1904									+			
125.	<i>Banchus punkettai</i> Fitton, 1985 = <i>Cidaphurus flavomaculatus</i> Cameron, 1904		+										
126.	<i>Banchus tumidus</i> Chandra & Gupta, 1977		+				+						
127.	<i>Exetastes cinctipes</i> (Retzius) = <i>Ichneumon cintipes</i> Retzius, 1783					+	+	+		+			
128.	<i>Exetastes longipes</i> (Smith) = <i>Campoplex longipes</i> Smith, 1878 = <i>Icyona rufipes</i> Cameron, 1903 = <i>Tegona rufipes</i> Morley, 1913		+							+			
129.	<i>Exetastes nigellus</i> Chandra & Gupta, 1977					+		+		+			
130.	<i>Exetastes nigritibialis</i> Chandra & Gupta, 1977									+			
131.	<i>Exetastes vacillans</i> (Cameron) = <i>Ichneumon vacillans</i> Cameron, 1897									+			
	5. Subfamily CTENOPELMATINAE = SCOLOBATINAE												
132.	<i>Rhorus orientalis</i> (Cameron) = <i>Cyphanza nigra</i> Cameron, 1909									+			
133.	<i>Euryproctus annulicornis</i> (Cameron) = <i>Fovaya annulicornis</i> Cameron, 1903									+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
134.	<i>Euryproctus spinipes</i> (Cameron) = <i>Fovaya spinipes</i> Cameron, 1907									+			
135.	<i>Labrossyta nigriceps</i> (Cameron) = <i>Lapaphras nigriceps</i> Cameron, 1902									+			
6. Subfamily PORIZONTINAE (= CAMPOPLEGINAE)													
136.	<i>Klutiana townesi</i> (Baltazar) = <i>Chriodes (Klutiana) townesi</i> Baltazar, 1961							+					
137.	<i>Campoplex collinus</i> (Morley) = <i>Sinophorus collinus</i> Morley, 1913		+							+			
138.	<i>Campoplex indicus</i> Gupta & Maheswary, 1977		+			+		+		+			
139.	<i>Compoplex kalatopensis</i> Gupta & Maheswary, 1977		+										
140.	<i>Campoplex manalinesis</i> Gupta & Maheswary, 1977							+					
141.	<i>Campoplex maximalus</i> Gupta & Maheswary, 1977		+			+		+		+			
142.	<i>Campoplex montanus</i> Gupta & Maheswary, 1977		+							+			
143.	<i>Campoplex oriens</i> Gupta & Maheswary, 1977		+		+			+		+			
144.	<i>Campoplex pseudocollinus</i> Gupta & Maheswary, 1977							+		+			
145.	<i>Campoplex septentrionalis</i> Gupta & Maheswary, 1977							+					
146.	<i>Venturia ahlensis</i> Maheswary, 1977		+										
147.	<i>Ventuia himachala</i> Maheswary, 1977		+			+		+		+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
148.	<i>Venturia inquinata</i> (Morley) = <i>Campoplex inquinata</i> Morley, 1913		+							+			
149.	<i>Venturia montana</i> Maheswary, 1977						+						
150.	<i>Venturia pseudocampoplexa</i> Maheswary, 1977						+						
151.	<i>Venturia simillima</i> Maheswary, 1977						+						
152.	<i>Casitaria arjuna</i> Maheswary & Gupta, 1977		+										
153.	<i>Casitaria atrata</i> Morley, 1913		+						+				
154.	<i>Casitaria elegantula</i> Maheswary & Gupta, 1977		+				+						
155.	<i>Casitaria formosana</i> <i>bharata</i> Maheswary & Gupta, 1977		+		+								
156.	<i>Casitaria granula</i> Maheswary & Gupta, 1977						+						
157.	<i>Casitaria indubia</i> (Morley) = <i>Trophocampa indubia</i> Morley, 1913									+			
158.	<i>Casitaria leo leo</i> Maheswary & Gupta, 1977		+							+			
159.	<i>Casianria natashae</i> Maheswary & Gupta, 1977		+				+						
160.	<i>Casitaria varuni</i> Maheswary & Gupta, 1977						+						
161.	<i>Charops bicolor</i> (Szepligti) = <i>Agrypon bicolor</i> Szepilgti, 1906 = <i>Gongropelma formosanum</i> Enderlcin, 1921						+						
162.	<i>Charops ganges</i> Cushman, 1927				+								

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
163.	<i>Scenocharops montanus</i> Gupta & Maheswary, 1971				+								
164.	<i>Cymodusa josephi josephi</i> Gupta & Gupta						+						
165.	<i>Cymodusa shiva</i> Gupta & Gupta, 1974		+			+							
166.	<i>Urvashia dentipara</i> Gupta, 1974		+				+						
167.	<i>Delopia aequorea</i> (Gupta & Gupta) = <i>Dusona aequorea</i> Gupta & Gupta, 1978									+			
168.	<i>Delopia ahalensis</i> (Gupta & Gupta) = <i>Dusona ahalensis</i> Gupta & Gupta, 1978		+										
169.	<i>Delopia aquilonaria</i> (Gupta & Gupta) = <i>Dusona aquilonaria</i> Gupta & Gupta, 1978							+		+			
170.	<i>Delopia bharata</i> (Gupta & Gupta) = <i>Dusona bharata</i> Gupta & Gupta, 1978		+					+					
171.	<i>Delopia buddha</i> (Cameron) = <i>Campoplex buddha</i> Cameron, 1897 = <i>Campoplex speciosus</i> Cameron, 1897		+			+		+		+			
172.	<i>Delopia cameroni</i> (Dalla Torre) = <i>Campoplex carinifrons</i> Cameron, 1899 = <i>Campoplex cameroni</i> Dalla Tore, 1901 = <i>Campoplex infumatus</i> Morley, 1913		+										

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
173.	<i>Delopia citeria</i> (Gupta & Gupta) = <i>Dusona citeria</i> Gupta & Gupta, 1978		+										
174.	<i>Delopia deodarea</i> (Cushman) = <i>Campoplegidea deodarae</i> Cushman, 1927									+			
175.	<i>Delopia dineshi</i> (Gupta & Gupta) = <i>Dusona dineshi</i> Gupta & Gupta, 1978		+			+				+			
176.	<i>Delpia epomiata</i> (Gupta & Gupta) = <i>Dusona epomiata</i> Gupta & Gupta, 1978		+										
177.	<i>Delopia ganeshi</i> (Gupta & Gupta) = <i>Dusona ganeshi</i> Gupta & Gupta, 1978		+							+			
178.	<i>Delopia gephyra</i> (Gupta & Gupta) = <i>Dusona gephyra</i> Gupta & Gupta, 1978		+							+			
179.	<i>Delopia himachalensis</i> (Gupta & Gupta) = <i>Dusona himachalensis</i> Gupta & Gupta, 1978		+					+					
180.	<i>Delopia himalayensis</i> (Cameron) = <i>Campoplex himalayensis</i> Cameron, 1899							+					
181.	<i>Delopia japonica</i> (Cameron) = <i>Compoplex japonica</i> Cameron, 1906							+		+			
182.	<i>Delopia kalatopensis</i> (Gupta & Gupta) = <i>Dusona kalatopensis</i> Gupta & Gupta, 1978		+										

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
183.	<i>Delopia lajæ</i> (Gupta & Gupta) = <i>Dusona lajæ</i> Gupta & Gupta, 1978		+				+						
184.	<i>Delopia lenticulata</i> (Gupta & Gupta) = <i>Dusona lenticulata</i> Gupta & Gupta, 1978		+										
185.	<i>Delopia murarii</i> (Gupta) = <i>Dusona montans</i> Gupta & Gupta, 1978		+										
186.	<i>Delopia nigritegula</i> (Gupta & Gupta) = <i>Dusona nigritegula</i> Gupta & Gupta, 1978		+										
187.	<i>Delopia nursei</i> (Cameron) = <i>Campoplex nursei</i> Cameron, 1907									+			
188.	<i>Delopia occipita</i> (Gupta & Gupta) = <i>Dusona occipita</i> Gupta & Gupta, 1978		+			+				+			
189.	<i>Delopia orientalis</i> (Gupta & Gupta) = <i>Dusona orientalis</i> Gupta & Gupta, 1978		+		+								
190.	<i>Delopia parallela</i> (Gupta & Gupta) = <i>Dusona parallela</i> Gupta & Gupta, 1978		+										
191.	<i>Delopia pectinata</i> (Gupta & Gupta) = <i>Dusona pectinata</i> Gupta & Gupta, 1978		+							+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
192.	<i>Delopia petiolator</i> (Fabricius) = <i>Ophion petiolator</i> Fabricius, 1804 = <i>Campoplex lapponicus</i> Holmgren, 1858 = <i>Campoplex greeni</i> Cameron, 1905									+		+	
193.	<i>Delopia plauta</i> (Gupta & Gupta) = <i>Dusona plauta</i> Gupta & Gupta, 1978		+										
194.	<i>Delopia prolata</i> (Gupta & Gupta) = <i>Dusona prolata</i> Gupta & Gupta, 1978		+										
195.	<i>Delopia reticulata</i> (Morely, 1913) = <i>Dusona reticulata</i> Morely, 1913									+			
196.	<i>Delopia similis</i> (Gupta & Gupta) = <i>Dusoma similis</i> Gupta & Gupta, 1978				+								
197.	<i>Delopia simillima</i> (Gupta & Gupta) = <i>Desona simillima</i> Gupta & Gupta, 1978		+							+			
198.	<i>Delopia simlayensis</i> (Cameron) = <i>Campoplex simlaensis</i> Cameron, 1905		+		+	+	+			+			
199.	<i>Delopia sumptuosa</i> (Cameron) = <i>Campoplex sumptuosa</i> (Cameron) = <i>Campoplex fuscipalpus</i> Cameron, 1899		+										
200.	<i>Delopia virgulata</i> (Gupta & Gupta) = <i>Dusona virgulata</i> Gupta & Gupta, 1978		+				+			+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
201.	<i>Delopia vitriala</i> (Gupta & Gupta) = <i>Dusona vitriala</i> Gupta & Gupta, 1978		+										
202.	<i>Delopia viveki</i> (Gupta & Gupta) = <i>Dusona viveki</i> Gupta & Gupta, 1978		+			+				+			
203.	<i>Delopia zonata</i> (Morely) = <i>Campoplex zonatus</i> Morely, 1913				+							+	
204.	<i>Kartika aspera</i> Gupta & Gupta, 1976		+					+		+			
205.	<i>Kartika dimdiata</i> Gupta & Gupta, 1976		+					+					
206.	<i>Kartika elongata</i> Gupta & Gupta, 1976		+					+					
207.	<i>Kartika longifemorata</i> Gupta & Gupta, 1976		+										
208.	<i>Kartika mediator</i> Gupta & Gupta, 1976		+										
209.	<i>Kartika nigriritibialis</i> Gupta & Gupta, 1976		+										
210.	<i>Kartika simulator</i> Gupta & Gupta, 1976		+										
211.	<i>Campoletis chlorideae</i> Uchia, 1957							+					
212.	<i>Diadegma varuna</i> Gupta, 1974		+										
213.	<i>Hyposoter himalayensis</i> (Cameron) = <i>Limnerium himalayense</i> Cameron, 1906									+			
214.	<i>Hyposoter lymantriae</i> Cushman, 1927				+			+					
215.	<i>Hyposoter similaensis</i> (Cameron) = <i>Limneria similaensis</i> Cameron, 1905									+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
216.	<i>Olesicampe flavicornis</i> (Thomson) = <i>Olesicampa flavicornis</i> Thomson, 1887									+			
217.	<i>Eriborus mandibularis</i> (Cameron) = <i>Bosmina mandibularis</i> Cameron, 1903									+			
218.	<i>Eriborus pilosellus</i> (Cameron) = <i>Neobosmina pilosella</i> Cameron, 1906									+			
	7. Subfamily CREMASTINAE												
219.	<i>Trathala noxiosa himalayana</i> (Gupta) = <i>Cremastus nosiosus</i> var. <i>himalayana</i> Gupta, 1955									+			
	8. Subfamily OPHIONINAE												
220.	<i>Ophion areolatus</i> Cameron, 1899									+			
221.	<i>Ophion bicarinatus</i> Cameron, 1905		+				+						
222.	<i>Ophion contentious</i> Gauld & Mitchell, 1981		+										
223.	<i>Ophion facetious</i> Gauld & Mitchell, 1981		+				+			+			
224.	<i>Ophion fuscomaculatus</i> Cameron, 1899		+										
225.	<i>Ophion guptai</i> Gauld & Mitchell, 1981		+										
226.	<i>Ophion hexus</i> Gauld & Mitchell, 1981		+										
227.	<i>Ophion mastrus</i> Gauld & Mitchell, 1981					+				+			
228.	<i>Ophion obscuratus</i> Fabricius, 1798		+							+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
229.	<i>Ophion ostentatious</i> Gauld & Mitchell, 1981		+										
230.	<i>Ophion virus</i> Gauld & Mitchell, 1981							+					
231.	<i>Sclerophion uchidae</i> Gauld & Mitchell, 1981		+				+						
232.	<i>Dicamptus Isshiki</i> Uchida, 1928		+										
233.	<i>Enicospilus bharatensis</i> Nikam, 1980		+				+						
234.	<i>Enicospilus formosensis</i> (Uchida) = <i>Henicospilus formosensis</i> Uchida, 1928		+										
235.	<i>Enicospilus gauldi</i> Nikam, 1980		+										
236.	<i>Enicospilus grandis</i> (Cameron) = <i>Pleuroneurophion grandis</i> Cameron, 1905 = <i>Allocamptus sinuatus</i> Morely, 1912 = <i>Allocamptus inflexus</i> Morely, 1913		+										
237.	<i>Enicospilus javanus</i> (Szepliget) = <i>enicospilus javanus</i> Szepliget, 1910 = <i>Enicospilus gephyrus</i> Chiu, 1954 = <i>Enicospilus (Bicorniata) diurnus</i> Nikam, 1975		+										
238.	<i>Enicospilus laqueatus</i> (Enderlein)		+		+		+						
239.	<i>Enicospilus lineolatus</i> (Roman) = <i>Enicospilus striatus</i> Cameron, 1899 = <i>Henicospilus lineolatus</i> Roman, 1913		+										

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
240.	<i>Enicospilus melanocarpus</i> Cameron = <i>Enicospilus reticulatus</i> Cameron, 1902 = <i>Enicospilus melanocarpus</i> Cameron, 1905 = <i>Henicospilus nigrinervis</i> Szepliget, 1906 = <i>Ophion (Henicospilus) nocturnus</i> Kohl, 1908 = <i>Henicospilus batavianus</i> Szepliget, 1910 = <i>Henicospilus turneri</i> Morley, 1912 = <i>Henicospilus atricornis</i> var. <i>zeylanicus</i> Morley, 1913 = <i>Henicospilus uncivena</i> Enderlein, 1912 = <i>Enicospilus nigrivenalis</i> Cushman, 1937		+				+						
241.	<i>Enicospilus pseudoconspersae</i> (Sonan) = <i>Henicospilus pseudoconspersae</i> Sonan, 1927 = <i>Henicospilus mushanus</i> Uchida, 1928		+										
242.	<i>Enicospilus xanthocephalus</i> Cameron, 1905 = <i>Enicospilus bullatus</i> Chiu, 1954 = <i>Enicospilus obliquus</i> Chiu, 1954								+				
243.	<i>Enicospilus yonezawanus</i> (Uchida) = <i>Henicospilus yonezawanus</i> Uchida, 1928		+				+						
	9. Subfamily MESOCHORINAE												
244.	<i>Mesochorus discitergus</i> (Say) = <i>Cryptus discitergus</i> Say, 1836 = <i>Mesochorus fascialis</i> Bridgmen, 1884				+								

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
	10. Subfamily METOPIINAE												
245.	<i>Hypsicera erythropus</i> (Cameron) = <i>Exochus erythropus</i> Cameron, 1902									+			
246.	<i>Hypsicera parca</i> (Morley) = <i>Exochus parca</i> Morley, 1913				+								
247.	<i>Exochus appendiculatus</i> Cameron, 1902									+			
248.	<i>Exochus xanthopus</i> Cameron, 1902									+			
	11. Subfamily ANOMALONINAE												
249.	<i>Anamalon foliator</i> (Fabricius) = <i>Ophion foliator</i> Fabricius, 1798				+								
	12. Subfamily GRAVENHORSTIINAE												
250.	<i>Barylypa apicate</i> (Cameron) = <i>Anamalon apicate</i> Cameron, 1905									+			
251.	<i>Therion circumflexum</i> (Linnaeus) = <i>Ichneumon circumflexus</i> Linnaeus, 1758									+			
252.	<i>Therion missouriense</i> (Cameron) = <i>Anamalon missouriense</i> Cameron, 1897									+			
253.	<i>Hteropelma amictum</i> (Fabricius) = <i>Ichneumon amicatus</i> Fabricius, 1775									+			
254.	<i>Heteropelma fulvitarse</i> Cameron, 1899									+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
255.	<i>Gravenhorstia (Erigorgus) narkandensis</i> (Gupta) = <i>Hyamenobosmina narkandensis</i> Gupta, 1955 13. Subfamily HELICTINAE								+				
256.	<i>Hyperacmus bicarinatus</i> (Cameron) = <i>Nothaima bicarinatus</i> Cameron, 1902								+				
257.	<i>Megastylus longicoxis</i> (Cameron) = <i>Letasha longicoxis</i> Cameron, 1909 14. Subfamily DIPLAZONTINAE								+				
258.	<i>Diplazon guptai</i> Diller, 1977		+						+				
259.	<i>Diplazon pectoratorius</i> (Thunberg) = <i>Ichneumon pectoratorius</i> Thunberg, 1822		+						+				
260.	<i>Diplazon varicoxa</i> (Thomson) = <i>Bassus varicoxa</i> Thomson, 1890					+							
261.	<i>Promethus rubeopleurator</i> Diller, 1984		+										
262.	<i>Sussba bicarinata</i> Cameron, 1909								+				
263.	<i>Syrphoctonus tarsatorius</i> (Panzer) = <i>Bassus tarsatorius</i> Panzer, 1809								+				
264.	<i>Woldstedtius abditus</i> (Diller) = <i>Syrphoctonus abditus</i> Diller, 1980		+										

Table contd.

Sl. No.	Taxon	Districts												
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
		1	2	3	4	5	6	7	8	9	10	11	12	
265.	<i>Woldstedtius flavolineatus</i> (Gravenhorst) = <i>Bassus flavolineatus</i> Gravenhorst, 1829 15. Subfamily PHYGADEUNTINAE		+											
266.	<i>Lysibia ceylonensis</i> (Kerrich) = <i>Haplaspis ceylonensis</i> Kerrich, 1956		+			+								
267.	<i>Xenolytus rugatus</i> Townes, 1983		+			+								
268.	<i>Xenolytus stenus</i> Townes, 1983		+			+		+						
269.	<i>Dichrogaster carinata</i> Townes, 1983		+					+						
270.	<i>Dichrogaster defecta</i> Townes, 1983		+					+						
271.	<i>Dichrogaster granulata</i> Townes, 1983		+			+					+			
272.	<i>Dichrogaster janathani</i> Townes, 1983		+					+			+			
273.	<i>Dichrogaster lateralis</i> Townes, 1983		+					+			+			
274.	<i>Dichrogaster liostylus</i> (Thomson) = <i>Hemiteles liostylus</i> Thomson, 1885							+						
275.	<i>Dichrogaster tersa</i> Townes, 1983		+					+						
276.	<i>Charitopes densus</i> Townes, 1983		+			+		+			+			
277.	<i>Charitopes granulatus</i> Townes, 1983							+						
278.	<i>Charitopes regatus</i> Townes, 1983		+					+						
279.	<i>Bathythrix hirticeps</i> (Cameron) = <i>Agenora hirticeps</i> (Cameron, 1909)													

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
	16. Subfamily HEMIGASTERINAE												
280.	<i>Mansa fulvipennis</i> (Cameron) = <i>Colganta fulvipennis</i> Cameron, 1902									+			
281.	<i>Aptesis punjabensis</i> (Gupta) = <i>Hemiteles punjabensis</i> Gupta, 1955									+			
	17. Subfamily MESOSTENINAE												
282.	<i>Apocryptus flavorbitalis himachalis</i> Gupta & Gupta, 1983		+										
283.	<i>Schreineria himalayana</i> Gupta & Jonathan, 1966		+										
284.	<i>Arhytis maculiscutis</i> (Cameron) = <i>Echthrus maculiscutis</i> Cameron, 1907				+								
285.	<i>Dihelus orientalis</i> Gupta & Gupta, 1979				+								
286.	<i>Buathra excavata</i> (Cameron) = <i>Cryptus excavatus</i> Cameron, 1905 = <i>Bathycrisis striaticollis</i> Cameron, 1905 = <i>Cryptus binghami</i> Cameron, 1907									+			
287.	<i>Buathra luculentus</i> (Cameron) = <i>Cryptus luculentus</i> Cameron, 1905									+			
288.	<i>Hadycryptus orientalis</i> (Cameron) = <i>Cryptus orientalis</i> Cameron, 1897 = <i>Hadycryptus filicornis</i> Cameron, 1903									+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
	= <i>Cryptus himalayensis</i> Cameron, 1904 = <i>Cryptus bibulus</i> Cameron, 1904 = <i>Distanetella pilosella</i> Cameron, 1909												
289.	<i>Listrognathus (Listrognathus) rufipes</i> (Cameron) = <i>Cratocryptus rufipes</i> Cameron, 1907 = <i>Listrognathus (Listrognathus) perfecta</i> Gupta & kamath, 1967				+								
290.	<i>Listrognathus (Listrognathus) spinifrons</i> (Cameron) = <i>Suvalta spinifrons</i> Cameron, 1905		+										
291.	<i>Goryphus cestus cestus</i> Jonathan & Gupta, 1973				+								
292.	<i>Goryphus difficis</i> Jonathan & Gupta, 1973				+								
293.	<i>Skeatia maculifrons</i> Jonathan & Gupta, 1973		+										
294.	<i>Isotima ruficollis</i> (Holmgren) = <i>Goryphus ruficollis</i> Holmgren, 1868				+								
295.	<i>Acroricnus peronatus</i> (Cameron) = <i>Osprynchotus peronatus</i> Cameron, 1902 = <i>Acroricnus cingulatus</i> Szepligeti, 1916				+					+			
	18. Subfamily ICHNEUMONINAE												
296.	<i>Pterocormus americanicolor</i> (Heinrich & Gupta) = <i>Ichneumon americanicolor</i> Heinrich & Gupta, 1957									+			
297.	<i>Stenichneumon maculipes</i> (Cameron) = <i>Hadrojoppa maculiceps</i> Cameron, 1904									+			

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
298.	<i>Stenichneumon maculitarsis</i> (Cameron) = <i>Myermo maculitarsis</i> Cameron, 1903						+						
299.	<i>Triptognathus subalpinus</i> Heinrich, 1949							+					
300.	<i>Fileanta radoszkowskii</i> (Berthoumieu) = <i>Amblyteles radoszkowskii</i> Berthoumieu, 1892								+				
301.	<i>Acaius flavobalteatus</i> Cameron, 1903								+				
302.	<i>Hepiopelmus guptae</i> Heinrich, 1974				+								
303.	<i>Aeoneaenaria occidentalis</i> Heinrich, 1974		+										
304.	<i>Lareiga clotho</i> (Cameron) = <i>Ichneumon clotho</i> Cameron, 1897								+				
305.	<i>Barichneumon albipilosus</i> (Cameron) = <i>Gurfyia albipilosa</i> Cameron, 1903								+				
306.	<i>Barichneumon coxalis</i> (Cameron) = <i>Spilicheneumon coxalis</i> Cameron, 1905								+				
307.	<i>Barichneumon erythrozonus</i> (Cameron) = <i>Cratichneumon erythrozonus</i> Cameron, 1905								+				
308.	<i>Ichneumon (Ichneumon) caeruleascens</i> (Morley) = <i>Aglaojoppa caeruleascens</i> Morley, 1915				+								
309.	<i>Ichneumon (Ichneumon) cyaniventrops</i> (Heinrich) = <i>Coelichneumon (Coelichneumon) cyaniventrops</i> Heinrich, 1966		+										

Table contd.

Sl. No.	Taxon	Districts											
		Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
		1	2	3	4	5	6	7	8	9	10	11	12
310.	<i>Ichneumon (Ichneumon) maculiscutis</i> (Cameron) = <i>Aglaojoppa maculiscutis</i> Cameron, 1905									+			
311.	<i>Ichneumon (Ichneumon) rufofemoratus</i> (Cameron) = <i>Cyanojoppa rufofemorata</i> Cameron, 1903 = <i>Cyanojoppa caeruleicaudis</i> Cameron, 1903 = <i>Cyanojoppa nigro-caerulea</i> Cameron, 1903 = <i>Cyanojoppa stiata</i> Cameron, 1903									+			
312.	<i>Ichneumon (Ichneumon) taihorinus</i> (Ucjoda) = <i>Spilojoppa fulvipes</i> Cameron, 1904 = <i>Coelichneumon taihorinus</i> Uchida, 1932 = <i>Ichneumon fulvimanus</i> Townes, Townes & Gupta, 1961		+										
313.	<i>Aglaojoppa rothneyi</i> Cameron, 1902		+										
314.	<i>Amblyjoppa annulitarsis annulitarsis</i> (Cameron) = <i>Hadrojoppa annulitarsis</i> Cameron, 1902									+			
315.	<i>Heresiarches rufa</i> (Cameron) = <i>Miojoppa rufa</i> Cameron, 1902									+			
316.	<i>Heresiarches spilocephalus</i> (Cameron) = <i>Stenodontus spilocephalus</i> Cameron, 1906									+			
317.	<i>Platylabus himalayanus</i> Gupta, 1955									+			
318.	<i>Platylabus viswanathai</i> Gupta, 1955									+			
319.	<i>Eurylabus dholadharensis</i> Gupta, 1955									+			

## **CHILOPODA : SCOLOPENDRIDAE**

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### **INTRODUCTION**

Perusal of the available references reveal the record of 19 species of Scolopendrid centipedes from Western Himalaya Ecosystem, Himachal Pradesh. These belong to five genera viz., *Scolopendra* Linn. (2 spp.), *Cormocephalus* Newport (1 spp.), *Asanada* Meinert (1 spp.), *Otostigmus* Porath (11 spp.) and *Rhysida* Wood (4 spp.). While a majority of the species have been recorded by Khanna and Tripathi (1985, 1986), only few viz., *Scolopendra mazbii* Gravely, described by Gravely (1912) and *Asanada brevicornis* Meinert have been recorded by Attems (1930). The author, in the present communication, has tried to give a comprehensive inventory of the species known from Himachal Pradesh, along with first references from the state and zoo-geographical status of the species. The distribution of species in different district is tabulated in Table-1.

### **BRIEF PHYSIOGRAPHY OF HIMACHAL PRADESH**

Himachal Pradesh is situated in the north-west corner of India, right in the lap of Himalayan ranges. It is surrounded by Jammu and Kashmir in the north, Uttar Pradesh in the south-east, Haryana in the south and Punjab in the west. In the east it forms India's boundary with Tibet.

The state is almost entirely mountainous with altitudes ranging from 460-6000m. above MSL. It has deep dissected topography, a complex geological structure and a rich temperate flora in sub-tropical latitudes.

Physiographically the state can be divided into two regions the southern and the northern. The southern part of Himachal Pradesh is almost as hot as the plains, while the northern region has temperate summer and winter with extreme cold and heavy snow fall. The districts of Shimla and Sirmour have alluvial soil, while the remaining ten districts have forests and hill soils. The normal rain fall of H.P. is 181.6 cms. The maximum rainfall is noticed at Dharamshala and Kangra Distts.

Himachal Pradesh is drained by a number of rivers, the most important of which are Chenab, Ravi, Beas, Sutlej and Yamuna. All these rivers are snow fed and hence perennial.

### SYSTEMATIC ACCOUNT

Phylum ARTHROPODA  
 Class CHILOPODA  
 Order SCOLOPENDROMORPHA  
 Family SCOLOPENDRIDAE  
 Subfamily SCOLOPENDRINAE  
 Tribe Scolopendrini

#### 1. *Scolopendra morsitans* Linn.

1753. *Scolopendra morsitans* Linnaeus, *syst. nat.*, 10 : 638.

*Remarks* : The species, though cosmopolitan in distribution, yet recorded here for the first time from the state from Bilaspur, Chamba, Sirmour, and Solan districts.

*Elsewhere in India* : Andhra Pradesh, Assam, Bengal, Bihar, Gujarat, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Uttar Pradesh, Orissa, Tamil Nadu and Pondicherry.

#### 2. *Scolopendra mazbii* Gravely

1912. *Scolopendra mazbii* Gravely, *Rec. Indian Mus.*, 7 (4) : 415-17.

*Type Locality* : Upper Rohtang, Kulu (H.P.)

*Remarks* : Originally described by Gravely (1912a) the species *S. mazbii* Gravely was redescribed by Jangi and Dass (1979) from Himachal Pradesh. Not available for study to the author in the present lot studied.

*Status* : Endemic.

#### 3. *Cormocephalus dentipes* Pocock

1891. *Cormocephalus dentipes* Pocock, *Ann. nat. Hist., Ser.*, 6/7 : 66 & 67.

*Type Locality* : India : Bengal.

*Remarks* : Originally known to be endemic to West Bengal, *Cormocephalus dentipes*, is now a well distributed species occurring in Meghalaya, Mizoram (Khanna, 1994), U.P.

Terai (Khanna and Tripathi 1985), Western Himalaya, U.P. (Khanna, 1987; Khanna and Kumar, 1985) and Madhya Pradesh (Ahmed, 1983). This is, however, a first record of the species from Himachal Pradesh from Sirmaur distt.

#### Tribe *Asanadini*

##### 4. *Asanada brevicornis* Meinert.

1886. *Asanada brevicornis* Meinert, *Proc. Amer. Phil. Soc.*, 23 : 189

*Type Locality* : Kulu, Himachal Pradesh.

*Remarks* : The species earlier described from H.P. was not available to the author in the present lot studied.

*Elsewhere in India* : Andaman and Nicobar (Attems, 1930), Maharashtra (Jangi and Dass, 1984) and Rajasthan and Gujarat (Khanna, unpublished record).

#### Subfamily OTOSTIGMINAE

#### Tribe *Otostigmini*

##### 5. *Otostigmus amballae* Chamberlin

1913. *Otostigmus amballae* Chamberlin, *Ent. News.*, Philad., 24 : 74

*Type Locality* : Amballa, Haryana

*Remarks* : Previously recorded by Khanna and Tripathi (1986) from Shimla, Sirmaur and Lahaul Spiti, *Otostigmus amballae* Chamberlin, is now recorded additionally from Chamba, Kulu, Kinnaur, Mandi, Bilaspur and Solan, thereby registering the extension of range of its distribution within the state.

*Elsewhere in India* : U.P. (Khanna and Kumar, 1984).

##### 6. *Otostigmus burn-murdochi* Gravely

1912. *Otostigmus burn-murdochi* Gravely, *Rec. Indian Mus.*, 7(4) : 415-417.

*Type Locality* : Kulu, H.P.

*Remarks* : Originally described and recorded by Gravely (l.c.) this species has not been recorded ever since, within the boundaries of the state or outside.

##### 7. *Otostigmus ceylonicus* Haase

1887. *Otostigmus ceylonicum* Haase, *Abh. Mus.*, Dresden, 5 : 69

*Type Locality* : Sri Lanka

*Remarks* : Khanna and Tripathi (1986) recorded this species from Kulu and Sirmaur (H.P.), which was incidentally a first record from India. Outside India the species is known from Myanmar, Palon and Reef Islands. Recently (Khanna 1994) recorded it from Khasi Hills, Garo Hills and Jaintia Hills (Meghalaya).

#### 8. *Otostigmus geophilinus* Haase

1887. *Otostigma geophilium* Haase, *Abh. Mus. Dresden*, 5 : 77.

*Type Locality* : Java

*Remarks* : Khanna and Tripathi (1986) recorded this species for the first time from India from Kulu (HP) and Kathua (J&K).

*Distribution Elsewhere* : Java, Timor.

#### 9. *Otostigmus insularis* Haase

1887. *Otostigma carinulatum* var. *insulare* Haase, *Abh Mus.*, Dresden, 5 : 69.

*Remarks* : Gravely (1912b) reported this species from Kulu (H.P.) but the present author could not find any specimen in the lot under report. Khanna, (1994), however, recently recorded it from Meghalaya and Mizoram state.

*Eslewhere in India* : West Bengal, Assam and A.&N. Isls., Mizoram and Meghalaya.

#### 10. *Otostigmus morsitans* Pocock

1890. *Otostigma morsitans* Pocock, *Ann. nat. Hist., ser.*, 6/7 5 : 246.

*Type Locality* : Chennai, Tamil Nadu.

*Remarks* : Previously known from Chennai, Tamil Nadu, Khanna and Tripathi (1986) reported it from Chamba, Dharamshala, Bilaspur and Shimla (HP.)

*Distribution elsewhere* : Srilanka and Myanmar.

#### 11. *Otostigmus nuds* Pocock

1890. *Otostigma nudum* Pocock, *Ann. nat. Hist., Ser. 6*, vol. 5 : 247.

*Type Locality* : Chennai, Tamil Nadu.

*Remarks* : Previously known from Chennai (Tamil Nadu) (Attems,1930) and Pauri (U.P.) (Khanna, 1987) the species was first recorded by Khanna and Tripathi (1986)

from Himachal Pradesh. Recently Khanna (1994) has also recorded this species from Khasi Hills, Cherrapunji and Shillong (Meghalaya).

12. *Otostigmus politus quadrispinosus* ssp. nov.

*Type Locality* : Almora, U.P.

*Remarks* : Previously reported as *Otostigmus politus* Karsch from Shimla (H.P.) by Khanna and Tripathi (1986), the specimens were later determined as a subspecies of *O. politus* by Khanna (1987), the description of which will be published elsewhere.

*Elsewhere* : In Himachal Pradesh it has been collected from Shimla, Chamba and Lahaul Spiti.

13. *Otostigmus poonamae* Khanna and Tripathi

1986. *Otostigmus poonamae* Khanna and Tripathi, *Ann. entomol.* 4 (1) : 38-39.

*Type Locality* : Chamba (H.P.)

*Remarks* : Described by Khanna and Tripathi (1.c.) from Chamba, the species was later recorded by Khanna (1987) from Uttarkashi and Chamoli distt., U.P.

14. *Otostigmus rugulosus* Porath

1876. *Otostigma rugulosum* Porath, *Bih. svenska Akad.*, 4 (7) : 21.

*Remarks* : Gravely (1910) recorded it from Kulu (H.P.) but not recorded by the present author in the recent lot of collection. Khanna (1994) has, however, recorded it from Khasi Hills (Meghalaya).

*Elsewhere in India* : Assam, Andaman and Nicobar Islands and outside India in Myanmar.

15. *Otostigmus sumatranus kraepelini* Attems

1930. *Otostigmus (Otostigmus) sumatranus kraepelini* Attems, *Das Tier.*, 45(2) : 147-148.

*Type Locality* : Chitral Island, "north-west Kashmir"

*Remarks* : Previously recorded as *O. sumatranus* Haase by Khanna and Tripathi (1986) the specimen in fact belong to the subspecies *kraepelini* Attems, collected from Chamba and Shimla Distts. (HP).

16. *Rhysida afra cuprea* Kraepelin

1903. *Rhysida cuprea* Kraepelin, *Mitt. Mus.*, Hamburg, 20 : 154.

*Type Locality* : Bhutan.

*Distribution* : Sirmaur, H.P. (Khanna and Tripathi, 1985)

*Elsewhere* : West Bengal, Assam, Arunachal Pradesh, Meghalaya, Bhutan and Bangladesh (Khanna 1994).

### 17. *Rhysida ceylonica* Gravely

1912. *Rhysida ceylonica* Gravely, *Rec. Indian Mus.* 7 : 415.

*Type Locality* : Paradeniya, Srilanka.

*Distribution* : Sirmaur, H.P. (Khanna and Tripathi, 1985).

### 18. *Rhysida longicarinulata* Khanna and Tripathi

1985. *Rhysida longicarinulata* Khanna and Tripathi, *Ann. Entomol.*, 3 (1) : 19-21.

*Type Locality* : Sirmaur, H.P.

*Remarks* : Described earlier by Khanna and Tripathi (l.c.) from Bilaspur and Sirmaur (H.P.) the species was later recorded by Khanna (1987) from Dehra Dun (Uttaranchal) also.

### 19. *Rhysida monalii* Khanna and Kumar

1984. *Rhysida monalii* Khanna and Kumar, *Uttar Pradesh J. zool.*, 4 (1) : 93-95.

*Type Locality* : Almora, U.P. now Uttaranchal.

*Distribution* : Lakhanpur, Sirmaur, Bilaspur, Mahaansu, H.P. (Khanna and Tripathi, 1985); Uttar Pradesh (Khanna and Kumar, 1984).

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Table : Distric-wise distribution of Chilopoda : Scolopendridae from Western Himalaya

List of Species	Districts												Zoogeographical Status
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	
	1	2	3	4	5	6	7	8	9	10	11	12	13
1. <i>Scolopendra morsitans</i> Linn.	+	+								+	+		Cosmopolitan
2. <i>Scolopendra mazbii</i> Gravely						+							Endemic
3. <i>Cormocephalus dentipes</i> Poc										+			Indian
4. <i>Asanada brevicornis</i> Meinert										+			Indian
5. <i>Otostigmus amballae</i> Chamb	+	+			+	+	+	+	+	+	+		Indian
6. <i>O. burn-murdoch</i> Gravely						+							Indian
7. <i>O. ceylonicus</i> Haase						+				+			Sri Lanka
8. <i>O. geophilinus</i> Haase						+							Indo-Malayan
9. <i>O. insularis</i> Haase						+							Sri Lanka
10. <i>O. morsitans</i> Pocock	+	+		+					+				Indian
11. <i>O. nudus</i> Pocock									+				Indian
12. <i>O. politus quadrispinosus</i> ssp. nov.		+					+		+				Endemic
13. <i>O. poonamae</i> Khanna		+							+				Indian
14. <i>O. rugulosus</i> Pocock						+							Indian
15. <i>O. sumatranus kraepelini</i> Att.		+							+				Palaeaclic
16. <i>Rhysida afra cuprea</i> Krpln.										+			Oriental

Table continued

List of Species	Districts													Zoogeographical Status
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una		
	1	2	3	4	5	6	7	8	9	10	11	12	13	
17. <i>Rhysida ceylonica</i> (Gravely)										+			Oriental	
18. <i>Rhysida longicarinulata</i> Khanna and Tripathi	+									+			Endemic	
19. <i>Rhysida monalii</i> Khanna & Kumar	+	+							+	+	+		Indian	
<b>Total no. of species from each district</b>	<b>5</b>	<b>7</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>7</b>	<b>2</b>	<b>1</b>	<b>6</b>	<b>9</b>	<b>3</b>	<b>-</b>		



## TICKS (ACARI : IXODIDA)

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### INTRODUCTION

The Ixodida or ticks are blood sucking ectoparasites of vertebrates. They are relatively large acarines ranging in length from 1.7 to 12.7 mm in the unfed state. The movable capitulum consists of the basis capituli, paired 4-segmented palps, paired chelicerae and a ventral median hypostome armed with rows of backwardly-directed teeth which securely attach the tick to its host. Haller's organ which is used in searching host, is located on the tarsus of the first pair of legs.

Taxonomic studies of these parasitic acarines were done by many acarologists in the world specially due to their medical and veterinary importance. A recent estimate shows that 821 species are included in the Ixodida. The families Ixodidae, Argasidae and Nuttalliellidae (found in the afrotropical region only) have 650,170 and one species respectively.

The Indian ticks were taken up for research as early as in 1758 by Linnaeus. The most comprehensive study of Indian ticks was done by Sharif (1928). Later Hoogstraal and his co-workers (1962-1971) made extensive studies on Ixodida and till date, approximately 107 species and 12 genera have been known from India. This shows that approximately 13% of total species of ticks of the world are found in India.

The tick fauna of Himachal Pradesh was first known through the work of Sharif (1928). He recorded 4 species of ixodid ticks from Shimla Hills. Sen (1938) while studying the tick collection of the then Imperial Veterinary Research Institute at Mukteswar reported an argasid species *Argas persicus* from this state. After a gap of about three decades, a species as new to the science was added to the list of ticks of Himachal Pradesh by Dhanda and Kulkarni (1969). Later Dhanda and Kulkarni (1969), Dhanda *et al.* (1970), Dhanda *et al.* (1971) and Hoogstraal *et al.* (1972) reported few species from the state. The most exhaustive study on ticks of Himachal Pradesh was done by Miranpuri *et al.* (1975) and recorded 20 species under 7 genera. The last contribution towards the tick fauna of the state so far known was made by De (1977).

### IMPORTANCE OF TICKS

Ticks are of great medical and veterinary importance. They are capable of transmitting a greater variety of infectious agents to man and domesticated animals than any other group of blood-feeding arthropods. The disease organisms transmitted by ticks include viruses, spirochaetes, rickettsiae, anaplasmas, bacteria, piroplasmas and filariae.

The tick-borne viral diseases are Russian spring-summer encephalitis in man occurring in the forest zone of Russia; Colorado tick fever in man from the USA and Kyasanur forest-disease in India. Ticks are vectors of spirochaetes of the genus *Borrelia*, a group of bacteria pathogenic to man and other vertebrates, causing African tick-borne relapsing fever which is widespread in East, Central and South Africa. Another disease termed Lyme disease or Lyme borreliosis in the northern temperate regions is also caused by ticks. A number of human diseases including rocky Mountain spotted fever in USA, Canada and Mexico, Siberian tick typhus and Q-fever-Anaplasmosis, a blood parasitic febrile disease, are transmitted by ticks. This disease occurs in red blood cells of ruminants and is widespread in cattle, goat and sheep in Russia and Africa. *Francisella tularensis*, the bacilli having close affinity with the plague causing bacterium, causing tularaemia in man, rabbit and sheep are transmitted by ticks in North America and North Asia.

The protozoan disease, babesiosis or Red water in cattle and biliary fever in horse caused by ticks, affects cattle, horse and dog in USA, Africa, Australia and Europe. The other protozoan parasites *Theileria* spp. are casual agents of East Coast fever or Rhodesian red water fever and Mediterranean Coast fever transmitted by ticks to cattle and buffalo in southern Africa. It is also reported that few species of ticks are known to transmit nematode filariae to pythons and gerbils.

### RANGE OF DIVERSITY

The species-wise list of ticks so far known from different districts of Himachal Pradesh is shown in Table 1. A total number of 30 species distributed over 9 genera and 2 families are known from this state. This represents 28% of the species and 75% of the genera of ticks so far known from India. Out of the 30 species, 13 species were described as new to science from India of which one species *I. himalayensis* was described from Himachal Pradesh. This species is still known from this state only. Out of these 13 species, 7 are still known to be endemic to Indian fauna. The other species in the list are known from outside India and are considered as exotic species occurring in this state.

Out of the total number of species, 10 are cosmopolitan in distribution and known to occur in almost all the states of India. 12 species are known only from the state of their first record and Himachal Pradesh.

The Zoogeographical relationship of ticks of Himachal Pradesh is shown in Table 2. It clearly indicates that the species viz, *B. microplus* and *R. sanguineus* recorded from the state have a very wide distribution throughout the world and are known from all the Zoogeographical realms. The species like *H. anatolicum anatolicum*, *H. detritum*, *H. dromedari* and *A. persicus* which are common in occurrence in Himachal Pradesh have not yet been recorded outside the Palaearctic, Oriental and Ethiopian realms. Further, *H. kumari*, *H. marginatum issaci*, *I. acutitarsus*, *R. turanicus* and *D. raskemensis* are known only from Palaearctic and Oriental realms, while *A. helvolum* and *H. bispinosa* are restricted to Oriental and Pacific realms. The other species in the list are known so far only from Oriental region.

The range of diversity in the tick fauna of Himachal Pradesh shows a nature of distribution that is intermediate between the two extremes i.e. restricted and very wide pattern of distribution. It also indicates that the tick fauna of this state is largely influenced by the faunal elements of Oriental and Palaearctic realms.

**Table 2.** Distribution of Ticks of Himachal Pradesh in different Zoogeographical Realms

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I. Nearctic	- <i>B. microplus</i> , <i>R. sanguineus</i>
II. Palaearctic	- <i>B. microplus</i> , <i>D. raskemensis</i> , <i>H. a. anatolicum</i> , <i>H. dromedari</i> , <i>H. Kumari</i> , <i>H. m. issaci</i> , <i>H. detritum</i> , <i>H. acutitarsus</i> , <i>R. sanguineus</i> , <i>R. turanicus</i> , <i>A. persicus</i>
III. Neotropical	- <i>B. microplus</i> , <i>R. sanguineus</i>
IV. Ethiopian	- <i>B. microplus</i> , <i>H. a. anatolicum</i> , <i>H. dromedari</i> , <i>H. detritum</i> , <i>H. acutitarsus</i> , <i>R. sanguineus</i> , <i>A. persicus</i>
V. Oriental	- All species of Himachal Pradesh
VI. Pacific	- <i>A. helvolum</i> , <i>B. microplus</i> , <i>H. bispinosa</i> , <i>R. sanguineus</i>

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Table : Distribution of tick in different districts of Himachal Pradesh

Species	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family IXODIDAE												
1. <i>Amblyomma helvolum</i> Koch				+								
2. <i>Boophilus microplus</i> (Canestrini)		+		+		+						
3. <i>Dermacentor raskemensis</i> Serdyukoa & Pomeientzev		+			+		+					
**4. <i>Haemaphysalis anomala</i> Warburton	+			+		+						
*5. <i>H. bispinosa</i> Neumann				+		+			+			
6. <i>H. cornigera</i> Neumann				+								
**7. <i>H. cornupunctata</i> Hoogstral & Verma		+			+	+						
**8. <i>H. garhwalensis</i> Dhanda & Bhat		+										
*9. <i>H. intermedia</i> Wraburton & Nuttall		+		+		+						
10. <i>H. montgomeryi</i> Nuttall		+							+			
**11. <i>H. ramachandrai</i> Dhanda, Hoogstrel & Bhat						+						
**12. <i>H. sundrai</i> Sharif											+	
13. <i>Hyalomma anatolicum</i> <i>anatolicum</i> Koch		+		+		+		+	+			
*14. <i>H. brevipunctata</i> Sharif												
15. <i>H. dromedarii</i> Koch									+			
16. <i>H. datritum</i> Schulze				+		+			+			

Table continued

Species	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
*17. <i>H. hussani</i> Sharif		+		+								
*18. <i>H. kumari</i> Sharif				+		+		+	+	+		
*19. <i>H. marginatum isaaci</i> Sharif	+			+		+		+	+	+		
20. <i>Ixodes acutitarsus</i> (Karsch)						+						
21. <i>I. granulatus</i> Supino				+								
**22. <i>I. kashmiricus</i> Pomerantzev				+								
**23. <i>I. himalayensis</i> Dhanda & Kulkarni					+	+						
24. <i>I. ovatus</i> Neumann				+		+						
25. <i>Rhipicephalus haemaphysaloides</i> Supino		+	+		+		+			+		
26. <i>R. sanguineus</i> (Latreille)		+		+								
27. <i>R. turanicus</i> Pomerantzev		+				+						
Family ARGASIDAE												
28. <i>Aragas persicus</i> (Oken)									+			
29. <i>Ornithodoros lahorensis</i> Neumann								+				
30. <i>O. tholozani</i> (Laboulbene & Megnin)				+								

\*/\*\* Described as new species from India.

\*\* Endemic to the Indian Fauna

## **SOIL DWELLING MITES (ACARI)**

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### **INTRODUCTION**

Taxonomic studies of the soil dwelling mites, done by many acarologists in different parts of the world, has enriched our knowledge regarding the remarkable diversity of these mites. A recent estimate shows that approximately 4000 species under an approximate number of 500 genera of mesostigmatid mites and 6000 species under 1000 genera of oribatid mites have been described from the world.

The soil mesostigmata of Indian soil was first studied by Oudemans (1903). Later several workers took up this study and till date 150 species under 55 genera are known from India.

The first account of oribatid mites of India was provided by Pearce (1906). Bhaduri and Raychaudhuri (1967, 1968, 1981) made pioneering ventures towards extensive faunistic explorations on oribatids in India, inspiring many other workers to study these mites. As a result of these studies approximately 407 species, subspecies and varieties of Oribatei under 174 genera and 72 families have been known from India. This shows that approximately 4.88% of total species and 17.8% of total genera of these mites known in the world inhabit Indian soils.

The soil mite fauna of Himachal Pradesh, an Indian state which includes both Indian plains and mountainous terrains of the Himalayan Mountain System, has remained virtually unexplored. The information so far known is restricted to oribatid mites except only two species of mesostigmata known from this state. The present authors have taken up an extensive study of oribatid mites in this state. In the first phase of this study 5 mountainous districts of this state have been sampled, and the first result, reporting 36 genera and 40 species, has been published (Sengupta and Sanyal, 1990). Except this work the only other work on the oribatid taxa of Himachal Pradesh is that of Niedbala (1982).

### **IMPORTANCE OF SOIL INHABITING MITES**

The soil dwelling mesostigmatid and oribatid mites have drawn the attention of acarologists for various reasons. Their best understood role in the ecosystem is their contribution towards the break down of organic matter, both of plant and animal origin, by their direct feeding on dead and decomposing material and/or by their ability to increase the surface area of such material through their feeding. In this way these organic materials become more suitable for further breakdown by microflora and enzymes. Due to this role in the nature the soil mites specially oribatids are considered as an indispensable component of soil biota, as they play a vital role in increasing soil fertility.

The soil inhabiting mesostigmatids often sometimes considered as pest of stored food products.

The oribatids have been found to be important on some other counts also. The oribatids have long been known as important vectors of disease producing helminthes of cattle and other domesticated animals. The oribatid mites have also been reported as injurious to plants sometimes attaining a pest status attacking fruits and agricultural crops.

The oribatid mites also act as the causative agents in producing allergy in man as they form component fauna of house dust mites.

Oribatids also form a very good material for the study of fossils and subfossils and number of workers have studied this aspect.

Both the mesostigmatid and oribatid mites are also being used as agents of biological control.

Finally, these tiny mites, with their size ranging from 0.2 to little over 1.4 mm are considered as a homogenous material for the study of Zoogeography. Being minute, and unable to fly, these mites cannot migrate actively, and wind-borne dispersal is almost ruled out. So, except the possibility of an occasional, passive transport, the soil mites are unable to move out of the regions of their origin and hence form an excellent material for the study of zoogeographic aspects.

### **RANGE OF DIVERSITY**

Since the mesostigmatid mite of Himachal Pradesh is known by only two species, the results of the findings being presented in this paper are based on the first phase of a detailed investigation on the oribatid fauna of Himachal Pradesh. In this phase only

5 districts of this state have so far been sampled. For this reason no meaningful information can be provided on the range of diversity of Oribatei of this state at this stage of the study. However, the following analysis would help to focus on the preliminary aspect of their diversity.

Table-1 gives a family-wise list of the genera and species so far collected from the soils of Himachal Pradesh. The total number of genera and species of soil mesostigmatid and cryptostigmatid mites known from this state stands at 40 and 46 respectively. This represents 17.46% of the genera and 8.25% of the species of the mites as mentioned above so far known from the Indian soils. Out of the 46 species so far known from the state, 6 are new to science (the description of the new species will be published separately) and one species, *Hoplophthiracarus latior*, was described as new species from Shimla by Niedbala (1982). The 7 species thus recorded as new seem to be endemic to the soils of this state. Further, 25 of the species recorded in the present work have earlier been known outside India. These 25 represent the exotic species occurring in this state. A total number of 14 undetermined species are also listed in table 1. Their status with regard to being endemic or exotic can not be ascertained till these are studied at the species level.

For the same reason as stated above any specific comment on the Zoogeographical relationship of the oribatid mites of Himachal Pradesh would be premature at the present state of our knowledge. The data available at present only indicates that some genera of oribatids of Himachal Pradesh have a very wide distribution throughout the world, whereas a few have a very restricted pattern of distribution as they are known so far from only one Zoogeographical realm.

Table-2 shows that 16 genera of oribatids collected from Himachal Pradesh have a cosmopolitan distribution, while 7 genera of Himachal oribatid fauna occur in almost all of the Zoogeographical realms and 4 genera occur in at least 4 realms. These figures indicate that 40 % of the total number of genera known from this state are cosmopolitan and 27.5% have a very wide distribution occurring in 4-5 Zoogeographical realms. On the other hand 9 genera (12.5%) of oribatids of Himachal Pradesh are restricted to the Holarctic region only, and 1 genus (2.5%) is known so far only from the Oriental region.

Among the genera of oribatids known from Himachal Pradesh, some shows a nature of distribution that is intermediate between the above two extremes *i.e.* very wide and restricted pattern of distribution and their distribution has not been considered for a discussion at present.

The information provided on the Zoogeographical distribution of oribatid fauna is based on the genera of these mites only, following Balogh (1972) and Balogh and Balogh (1992).

**Table - 2.** Genera of Oribatids of Himachal Pradesh showing nature of Zoogeographical relationship

<b>Zoogeographical relationship of genera</b>	<b>Names of Genera</b>
1. Cosmopolitan	<i>Hoplophthiracarus, Phthiracarus, Rhysotritia, Eniochthonius, Nothrus, Platynothrus, Camisia, Trimalaconothrus, Liacarus, Dolicheremaeus, Oppiella, Scheloribates, Zygoribatula, Peloribates, Rostrozetes, Eupelops</i>
2. Occurring in 5 Zoogeographical regions	<i>Epilohmannia, Phyllhermannia, Cultroribula, Arcoppia, Suctobelbella, Lamellobates, Oribatella</i>
3. Occuring in 4 regions	<i>Hermanniella, Pedrocortesella, Eremaezetes, Ceratoppia</i>
4. Restricted to only Holarctic region	<i>Hammerella, Lepidozetes, Neolepidozetes, Unduloribates</i>
5. Restricted to only Oriental region	<i>Phalacrozetes</i>

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**Table :** Distribution of mite genera and species in different districts of Himachal Pradesh (only 5 out of 12 districts so far sampled)

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Order MESOSTIGMATA												
Family EVIPHIDAE												
1. <i>Eviphis indicus</i>						+						
2. <i>E. parindicus</i>									+			
Order ORIBATIDA												
Family PHTHIRACARIDAE												
3. <i>Hoplophthiracarus latior</i>		+				+			+			
4. <i>H. pakistanensis</i>		+									+	
5. <i>Hoplothiracarus</i> sp.		+										
6. <i>Phthiracarus</i> sp.		+				+			+		+	
7. <i>Steganacarus striculus</i>		+				+			+		+	
Family EUPHTHIRACARIDAE												
8. <i>Rhysotritia ardua</i>		+				+			+		+	
Family HYPOCHTHONIIDAE												
9. <i>Hypochothonius rufulus</i>		+		+		+			+		+	
Family ENIOCHTHONIIDAE												
10. <i>Eniochthonius minutissimus</i>		+				+			+			



Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family PLATEREMEIDAE												
20. <i>Pedrocortesella</i> n. sp.		+										
Family EREMAEOZETIDAE												
21. <i>Eremaeozetes lineatus</i>		+				+						
Family LIACARIDAE												
22. <i>Liacarus</i> n. sp.		+				+			+			
Family XENILLIDAE												
23. <i>Xenillus</i> sp.		+				+			+			
Family ASTEGISTIDAE												
24. <i>Cultroribula</i> sp.		+				+			+		+	
Family METRIOPPIDAE												
25. <i>Ceratoppia bipilis</i>		+		+					+			
Family TECTOCEPHEIDAE												
26. <i>Tectocephus velatus</i>		+		+		+			+		+	
Family OTOCEPHEIDAE												
27. <i>Dolicheremaeus</i> sp.		+										

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family OPPIIDAE												
28. <i>Arcoppia</i> n. sp.		+							+		+	
29. <i>Hammerella</i> n. sp.		+										
30. <i>Brachioppia</i> sp.		+										
31. <i>Opiella nova</i>		+		+		+			+		+	
Family SUCTOBELBIDAE												
32. <i>Suctobelbella</i> n. sp.									+		+	
Family SCHELORIBATIDAE												
33. <i>Scheloribates</i> spp.		+		+		+			+		+	
Family ORIBATULIDAE												
34. <i>Zygoribatula tenuiseta</i>		+										
35. <i>Z. tortilis</i>		+										
Family HAPLOZETIDAE												
36. <i>Peloribates pakistanensis</i>		+				+			+			
37. <i>Phalacrozetes</i> sp.												+
38. <i>Rostrozetes foveolatus</i>				+							+	

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family PELOPIDAE												
39. <i>Eupelops</i> sp.		+				+			+			
Family ORIBATELLIDAE												
40. <i>Lamellobates palustris</i>				+							+	
41. <i>Oribatella meridionalis</i>		+							+		+	
42. <i>O. microfoveolata</i>					+							
43. <i>Unduloribates hebes</i>		+				+						
Family TEGORIBATIDAE												
44. <i>Lepidozetes</i> sp.												
45. <i>Neolepidozetes</i> sp.		+										
Family PARAKALUMMIDAE												
46. <i>Neoribates</i> sp.		+									+	

## PARASITIC MITE (ACARI)

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### INTRODUCTION

Considering veterinary and medical importance of parasitic group of mites (including astigmatids, mesostigmatids and prostigmatids) associated with invertebrates and vertebrates including man, the acarologists all over the world took up the studies as early as in the beginning of 19th century.

This group of mites has received wide attention in India since the beginning of the acarological works in the country by Oudemans (1914). Later, more than fifty acarologists made valuable contributions on Indian parasitic mites associated with vertebrate hosts and as many as 327 species under 40 families and 107 genera are so far known (Gupta, 1991). The major families of parasitic mites known to occur in India are Astigmata : Analgidae, Dermoglyphidae, Falcuiferidae, Epidermoptidae, Cytoditidae, Psoroptidae, and Sarcoptidae, etc; Prostigmata : Trombiculidae, Pterygosomidae, Cheyletidae, Demodicidae, Myobiidae, Pymotidae, Tarsonemidae, Cheyletiidae, Siringophilidae, Harpirhynchidae and Mesosigmata : Dermanyssidae, Macronyssidae, Laelapidae, Raillietidae, Spinturnicidae, Rhinonyssidae, Myonyssidae, Haemogamasidae, Macrochelidae, Scutacaridae, Tarsonemidae, etc. A fragmentary knowledge about mite fauna associated with invertebrates is known in India.

This most important group of mites was practically unexplored in Himachal Pradesh till the year 1980. The parasitic mites were first known from the state through the work of Mehta (1937). He reported four species viz. *Z. indica*, *S. oudemansi*, *T. acuscutellaris* and *L. deliensis* and an undescribed species of *Leptotrombidium* from rats in the Shimla Hill. In the same year Smith and Mehta recorded *O. bacoti* from the same locality. Later Singh and Adlakha (1958) reported *A. woodi* and Lindquist (1969) described one new species *I. gaebleri himalayensis* from Muree Hills. The more recent and exhaustive study on parasitic mites of this state was done by Bhat *et al.* (1980). While studying the parasitic mesostigmatid and prostigmatid mites of Himachal Pradesh, they recorded 41 species under 20 genera and 9 families from different vertebrate hosts.

### IMPORTANCE OF PARASITIC MITES

The parasitic species of mites are known in all acarine groups except the beetle mites, the Oribatida. The majority are external parasites, including those most important to man and his domesticated animals. A few species are internal parasites of animals.

The ectoparasitic mites attack human skin and cause allergic dermatitis like scabies, scrub itch, grain itch, grocer's itch or copra itch, etc. Mites act as vectors of rickettsial disease called "Scrub typhus" causing fever and maculopapular rash on chest and abdomen. Another serious disease, Rickettsial pox, characterised by an initial skin lesion followed by fever, chills, headache and papulovesicular rash is also caused by mite. Mite is also considered to be one of the causative agents for respiratory allergy like asthma in man.

Most of the animals in nature are attacked by different species of mites. Some of them are parasitic on the host animals for shelter and food and the rest are associated with the host only for food. These mites either suck blood from the host body or feed on the tissue material, resulting in loss of health and ultimately death of the animal. The most important of these mites are poultry mites causing diseases of poultry birds. Bee keepers also face problems in keeping the bees healthy, due to attack of mites. The livestock and domestic animals are often attacked by several species of mites. The most common diseases are scabies and mange causing irritation, thickening of skin, loss of hair and exudation of fluid.

### RANGE OF DIVERSITY

Since the results presented in the paper are mainly based on the work of Bhat *et al.* (1980) who reported parasitic mites from 10 out of 12 districts in the state and that too do not throughout the year and from different ecological habitats, the comments on the range of diversity would not be much meaningful. However, the following analysis would help to get some idea on some aspects of their diversity.

Table 1 gives a systematic list of family, genera and species of parasitic mites so far known from different hosts in Himachal Pradesh. A total number of 48 species distributed over 25 genera and 12 families belonging to the orders Mesostigmata and Prostigmata are so far known from this state. This represents 30% of families, 23% of genera and 15% of species of parasitic mites so far recorded from India. Out of the 48 species known from the state, only 4 species *viz.*, *S. pindarensis*, *A. kanheri*, *I. gableri himalayensis* and *S. indica* were described as new to science from India of which first and third ones are still unknown from other Indian states.

All the other species are the exotic species occurring in this state. *H. gyrinodes* seems to be the only species which is still unknown from the Indian states. It is also

noted that most of the species are occurring in Jammu and Kashmir and Uttar Pradesh and a few are known from Madhya Pradesh, Tamil Nadu, Sikkim and West Bengal. This restricted pattern of distribution in India is due to the fact that the states except the above have not yet been thoroughly explored for studying the parasitic mites.

Table 2 shows the distribution of parasitic mites known from Himachal Pradesh in different zoogeographical realms. It indicates that only 4 species have a very wide distribution throughout the world, whereas 6 species are known to occur only in Oriental region. It is also observed that the parasitic mite fauna of Himachal Pradesh is dominated by Oriental and Palaearctic species and partly by Nearctic and Pacific regions.

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Distribution of parasitic mites in different districts of Himachal Pradesh												
Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Order MESOSTIGMATA												
Family LAELAPIDAE												
Genus <i>Androlaelaps</i> Berlese, 1903												
1. <i>A. aduncus</i> Allred, 1969				+								
2. <i>A. casalis</i> (Berlese, 1887)			+								+	+
3. <i>A. marshalli</i> Berlese, 1911				+								
4. <i>Androlaelaps</i> sp.	+	+	+	+		+					+	+
Genus <i>Hypoaspis</i> Canestrini, 1884												
5. <i>H. pavlovskii</i> (Bergetova, 1955)				+	+	+	+					
6. <i>H. miles</i> (Berlese, 1892)			+								+	+
Genus <i>Laelaps</i> Koch, 1836												
7. <i>L. aqilis</i> Koch, 1836		+	+		+	+	+				+	+
8. <i>L. algericus</i> Hirst, 1925		+	+	+	+	+	+				+	+
9. <i>L. jugalis</i> Allred, 1969				+				+				
10. <i>L. nuttalli</i> Hirst, 1916.	+		+	+				+			+	+
11. <i>L. traubi</i> Domrow, 1962				+		+				+		
12. <i>L. tukestanicus</i> Lange, 1955		+	+		+	+			+		+	+
13. <i>Laelaps</i> sp. 1				+					+	+		

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
14. <i>Laelaps</i> sp. 2			+					+			+	+
15. <i>Laelaps</i> sp. 3								+				
Genus <i>Echinolaelaps</i> Ewing, 1929												
16. <i>E. echidninus</i> Berlese, 1887	+		+			+		+			+	+
Family MACRONYSSIDAE Oudemans, 1936												
Genus <i>Ornithonyssus</i> Sambon, 1928												
17. <i>O. bacoti</i> (Hirst, 1913)	+	+	+	+		+		+	+	+	+	+
18. <i>O. bursa</i> (Berlese, 1888)		+		+		+		+				
19. <i>O. sylviarum</i> (Canestrini & Fanzago, 1877)								+				
20. <i>Ornithonyssus</i> sp.			+		+	+					+	+
Genus <i>Sauronyssus</i> Sambon, 1928												
21. <i>Sauronyssus</i> sp.												
Genus <i>Hirstionyssus</i> Fonseca, 1948												
22. <i>H. musculi</i> (Johnston, 1849)		+	+		+	+	+				+	+
Genus <i>Steatonyssus</i> Kolenati, 1858												
23. <i>Steatonyssus</i> sp.									+			
Genus <i>Pellomyssus</i> Calrk and Yunker, 1956												
24. <i>P. passerii</i> Yunker, 1956								+				

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family DERMANYSSIDAE Kolenati, 1859												
Genus <i>Liponyssoides</i> Hirst, 1913												
25. <i>L. sanguineus</i> (Hirst, 1914)		+	+	+			+	+	+	+	+	+
Genus <i>Dermanyssus</i> Duges, 1834												
26. <i>D. gallinae</i> (De Geer, 1778)		+										
27. <i>Dermanyssus</i> sp.						+						
Family MYONYSSIDAE Stardtman & Wharton, 1958												
Genus <i>Myonyssus</i> Tiraboschi, 1904												
28. <i>Myonyssus</i> sp.												
Family HAEMOGAMASIDAE Oudemans, 1926												
Genus <i>Eulaelaps</i> Berlese, 1903												
29. <i>E. indiscretus</i> Alfred, 1969		+	+				+				+	+
30. <i>E. stabularis</i> (Koch, 1836)		+	+	+	+	+	+				+	+
Genus <i>Haemogamasus</i> Bregetova, 1956												
31. <i>H. nidiformes</i> Bregetora, 1956			+		+	+	+				+	+
32. <i>H. gyrinodes</i> Alfred, 1969					+	+						

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Simour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Family RHINONYSSIDAE Trouessart, 1895 Genus <i>Tinaminyssus</i> Strandmann and Wharton, 1958 33. <i>Tinaminyssus</i> sp.								+				
Family SPINTURNYSSIDAE Oudemans, 1901 Genus <i>Spinturnix</i> Heyden, 1826 34. <i>S. pindarensis</i> Bhat, 1973 35. <i>S. plecotinus</i> (C. L. Koch, 1839)			+			+					+	+
Genus <i>Ancystropus</i> Kolenati, 1856 36. <i>A. kanheri</i> Hiregaudar & Bal, 1956 37. <i>A. taprobanicus</i> (Turk, 1950) 38. <i>A. zeleborii</i> Kolenati, 1856	+			+		+	+	+				
Genus <i>Meristaspis</i> Kolenati, 1857 39. <i>M. lateralis</i> (Kolenati, 1856)				+		+		+				
Family MACROCHELIDAE Vitzthum, 1930 Genus <i>Northroholaspis</i> Berlese, 1903 40. <i>Northroholaspis</i> sp.	+				+	+						

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Order PROSTIGMATA												
Family PTERYGOSOMIDAE												
Genus <i>Pterygosoma</i> Peters, 1849												
41. <i>Pterygosoma</i> sp.						+						
Family SCUTACARIDAE												
42. <i>Acarapsis woodi</i> (Rennie, 1921)						+						
Family TARSONEMIDAE												
43. <i>Iponemus gaebleri himalayensis</i> Lindquist, 1969												
Family TROMBICULIDAE												
44. <i>Schongastia indica</i> Hirst, 1915									+			
45. <i>S. oudemansis</i> (Walch, 1923)									+			
46. <i>Tragardhula acuscutellaris</i> (Walch, 1922)									+			
47. <i>Leptotrombidium deliensis</i> (Walch, 1923)												
48. <i>Leptotrombidium</i> sp.									+			

## PISCES

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### INTRODUCTION

The hill state of Himachal Pradesh is an important part of Western Himalayas, represented by 12 districts with an altitude ranging from 450-7000m, varying from lesser Himalaya to greater Himalayas and trans Himalayas. These hills are bestowed with rich network of drainages of rivers like Yamuna, Ravi, Chenab, Sutlej, and Beas. Due to the diverse ecological niches like torrential streams and lentic water bodies with varying temperature from normal to sub zero. The fishes of this region had adapted and evolved in commensurate with the challenging environment. The icy-streams harbor country's richest cold water fish- fauna including world famous Mahseer, array of catfishes and trout. There are some important natural and man made lakes and wetland like Renuka, Revolsar, Chandertal, Pong and Gobind Sagar where the fish fauna is under protection either religiously or by the laws of conservation of wetlands. The fishes are readily available as rich source of protein in the natural ecosystems. The indigenous fishes have been a source of food and livelihood for the masses whereas the introductions of exotic fishes like trout in the cold water of high altitudes dates back to the yester century as the game fishes for the anglers and naturalist. The diversity of fishes increases up to 1500m and further decreases with the increasing altitudes. Increased anthropogenic pressure in the name of developmental activities like power generation, deforestation, mining, road construction had in turn lead towards the destruction of fish habitats. The introduction of carps in the man made reservoirs had also seriously affected the native species. Different parts of the state has been explored for fish faunal resources by various workers among them the important contributors are McClelland, 1839,1842; Stenidachner, 1867; Day, 1875-1878; Prasad, 1919; Fowler, 1924; Hora, 1927,1937; Khan, 1935; Menon, 1951, 1954, 1962, 1974, 1987, 1999; Bhatanagar, 1973; Seghal, 1974; Tilak, and Husain, 1977a, 1977b; Tilak, and Juneja, 1978; Sharma and Tandon, 1990; Sharma, 1991; Uniyal, 1995; Johal, 1998, 2002; Johal, *et al.* 2002, 2003; Mehta, 2000; and Dhanze and Dhanze, 2004. The main objective of this paper is to review the fish distribution in districts of the state, so that a clear-cut idea could be drawn, for further research and policy planning.

## MATERIAL AND METHODS

Authors had made the detailed survey of various water resources of Himachal Pradesh for the period of 8 years (1994-2002) these surveys were made under different projects. The inventory of fish fauna has been prepared on the bases of material (specimen) identified by authors, available in Zoological Survey of India, Solan (H.P.). Identification was based on the Tilak, and Husain (1977), Talwar and Jhingran (1991), Menon (1999) and Jayaram (1999), classification given by Nelson (1984) is followed with slight modification.

## RESULT AND DISCUSSION

A total of 104 species of pisces belonging to 48 genera 14 families and 8 orders have been reported, out of which two species are the new records for the state i.e. *Glossogobius giuris*, reported from Sirmour and Una district, while *Macrogonothus panculus*, reported from Solan districts (Table 1.). The familywise distribution of fishes revealed that 55 species belongs to family Cyprinidae, 16 species from Cobitidae, 11 species from Sisoridae, 5 species from Channidae, 4 species from Bagridae, 2 species each from Notopraidae, Salmonidae and Mastacembalidae and 1 species each from Amblycipidae, Siluridae, Clariidae, Schibeidae, Belonidae, Centropomidae, Gobiidae, Heterpneustidae and Nanidae (Fig.1).

The district wise distribution of fishes exhibited that 57 species reported from Sirmour, 55 species are present in Kangra and 50 species inhabit in Bilaspur and Solan districts. The reason for high fish diversity in these districts is that they represent the lesser Himalayas ranges of Shiwalik hills with low altitude, high temperature and rich drainage of the Yamuna, Giri and Tons, where warm water as well as cold water fishes were found. While 22 species reported from Mandi, 20 species from Chamba, 16 species from Shimla, 15 species from Hamipur, 14 species from Una and 9 species from Kullu, while the trans Himalayan districts like Kinnuar and Lahual & Spiti showed the presence of 5 species and 2 species respectively (Fig.2). The reason for less diversity of fishes in these districts is the high altitude and low water temperature, which is unsuitable for fish propagation. Recently Johal (2002) studied the fishes of Himachal Pradesh and Garhwal Himalayas, and state that the diversity of fish increases with the decrease in altitude and decreases, as with the increase in altitude, this is the agreement with the present finding.

## CONCLUSION

In total 104 species have been reported, and a consolidated information on distribution up to district level have been given. It is concluded that Himachal sate supports rich and diversified fish fauna and having good numbers of commercial important fishes which

can be cultured' to improve the economic status of the people. For this proper planning and implementation of laws are required. A sharp decline in fish abundance and habitat was noticed which may be due to anthropogenic activity, this should be stopped immediately. A number of hill streams are either drying or water carrying capacity is decreasing, these streams act as a breeding ground for many fishes mainly migratory in nature, i.e. *Tor* spp. and *Labeo* spp, the restoration to be done, otherwise further population of fishes can be effected adversely. A through assessment should be done to know the latest status of fishes of the state, so that special action plan can be launched to protect the fishes in critical endangered and endangered category. It is necessary to generate the mass awarness by involve the people (villagers, college and school students, NGO'S and concern Government agencies) for the fish protection and restoration of water bodies.

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Fig. 1. Fish diversity (family-wise) in H.P.

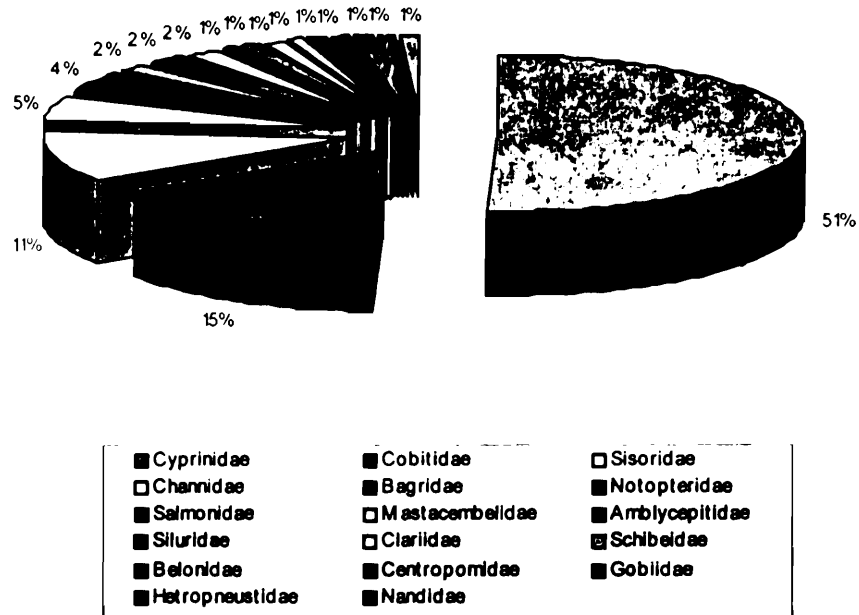
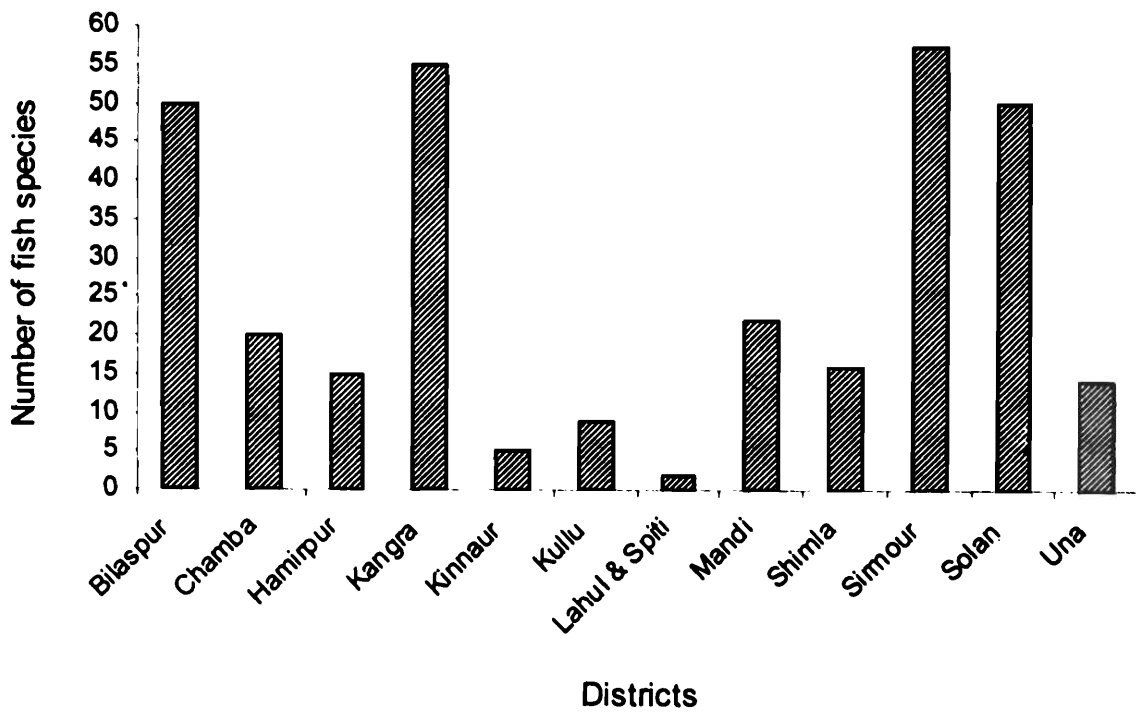


Fig. 2. Distribution of fish in H.P.



**Distric-wise distribution of Pisces from Western Himalaya**

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Phylum CHODRATA												
Class ACTINOPTERYGII												
Order OSTEOGLOSSIFORMES												
Family NOTOPTERIDAE												
1. <i>Notopterus notopterus</i> (Pallas)	+							+		+		
2. <i>Chitala chitala</i> (Hamilton- Buchanan)								+		+		
Order CYPNINIFORMES												
Family CYPRINIDAE												
3. <i>Barilius barila</i> (Hamilton-Buchanan)	+			+				+		+		
4. <i>Barilius barna</i> (Hamilton-Buchanan)				+						+		
5. <i>Barilius bendelisis</i> (Hamilton-Buchanan)	+	+	+	+				+	+	+	+	+
6. <i>Barilius modestus</i> Day	+									+		
7. <i>Barilius shacra</i> (Hamilton-Buchanan)										+		
8. <i>Barilius vagra vagra</i> (Hamilton-Buchanan)	+	+		+					+	+		
9. <i>Raiamas bola</i> (Hamilton-Buchanan)				+						+	+	+
10. <i>Brachydanio rerio</i> (Hamilton-Buchanan)				+						+	+	
11. <i>Danio devario</i> (Hamilton-Buchanan)				+						+	+	
12. <i>Esomus danricus</i> (Hamilton-Buchanan)	+			+						+	+	

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
13. <i>Rasbora daniconius</i> (Hamilton-Buchanan)	+	+	+	+						+	+	+
14. <i>Carassius auratus</i> (Linnaeus)	+		+	+		+			+		+	
15. <i>Crassius carassius</i> (Linnaeus)	+		+	+							+	
16. <i>Catla catla</i> (Hamilton-Buchanan)	+			+						+		
17. <i>Cirrhinus reba</i> (Hamilton-Buchanan)	+			+								
18. <i>Cirrhinus mrigala</i> (Hamilton-Buchanan)	+			+						+	+	
19. <i>Crossocheilus latus latus</i> (Hamilton-Buchanan)	+	+	+	+				+		+	+	+
20. <i>Crossocheilus latius diplocheilus</i> (Heckle)	+	+	+	+				+		+	+	
21. <i>Cyprinus carpio communis</i> Linnaeus	+										+	
22. <i>Cyprinus carpio specularis</i> Lacepedes	+	+		+								
23. <i>Cyprinus carpio nudus</i> Bloch	+											
24. <i>Garra gotyla gotyla</i> (Gray)	+	+	+	+		+		+	+	+	+	+
25. <i>Garra lamta</i> (Hamilton-Buchanan)								+		+	+	
26. <i>Ctenopharyngodon idellus</i> (Valenciennes)	+											+
27. <i>Labeo bata</i> (Hamilton-Buchanan)	+									+	+	
28. <i>Labeo boga</i> (Hamilton-Buchanan)										+		
29. <i>Labeo calbasu</i> (Hamilton-Buchanan)	+											
30. <i>Labeo dero</i> (Hamilton-Buchanan)	+	+		+				+		+	+	
31. <i>Labeo dycocheilus dycocheilus</i> (McClelland)	+							+				

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
32. <i>Labeo pangusia</i> (Hamilton-Buchanan)				+				+		+	+	+
33. <i>Labeo rohita</i> (Hamilton-Buchanan)	+		+	+				+		+	+	+
34. <i>Labeo gonius</i> (Hamilton-Buchanan)										+		
35. <i>Neolissochilus hexagonolopis</i> (McClelland)									+			
36. <i>Osteobrama cotio cotio</i> (Hamilton-Buchanan)	+									+		
37. <i>Puntius chola</i> (Hamilton-Buchanan)	+			+						+	+	+
38. <i>Puntius phutunio</i> (Hamilton-Buchanan)				+							+	
39. <i>Puntius conchonioides</i> (Hamilton-Buchanan)	+	+	+	+				+		+	+	
40. <i>Puntius sarana sarana</i> (Hamilton-Buchanan)	+			+				+		+	+	
41. <i>Puntius sophore</i> (Hamilton-Buchanan)	+			+				+				
42. <i>Puntius ticto</i> (Hamilton-Buchanan)	+			+		+		+		+	+	+
43. <i>Puntius waageni</i> (Day)				+		+						
44. <i>Puntius stigma</i> (Hamilton-Buchanan)			+								+	
45. <i>Puntius tetrapagus</i> (McClelland)			+	+								
46. <i>Puntius punjabensis</i> (Day)										+		
47. <i>Salmostoma bacaila</i> (Hamilton-Buchanan)										+		
48. <i>Tor tor</i> (Hamilton-Buchanan)				+					+	+		
49. <i>Tor putitora</i> (Hamilton-Buchanan)			+	+				+		+	+	+
50. <i>Tor chelynooides</i> (McClelland)										+		
51. <i>Tor mosal</i> (Hamilton-Buchanan)				+						+	+	

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
52. <i>Chagunius chagunio</i> (Hamilton-Buchanan)										+		
53. <i>Schizothorax richardsonii</i> (Gray)	+	+	+	+					+	+	+	
54. <i>Diptus maculatus</i> Steindachner							+					
55. <i>Hypophthalmichthys molitrix</i> (Valenciennes)	+										+	
Family COBITIDAE												
56. <i>Botia birdi</i> Chaudhari	+			+							+	
57. <i>Botia dayi</i> Hora	+	+									+	+
58. <i>Botia dario</i> (Hamilton-Buchanan)											+	
59. <i>Botia lochachata</i> Chaudhari				+							+	
60. <i>Botia geto</i> (Hamilton-Buchanan)					+	+						
61. <i>Lepidocephalus guntea</i> (Hamilton-Buchanan)		+		+								
62. <i>Noemacheilus botia</i> (Hamilton-Buchanan)				+				+		+	+	
63. <i>Noemacheilus carletoni</i> Fowler						+						
64. <i>Noemacheilus corica</i> (Hamilton-Buchanan)	+	+						+				
65. <i>Noemacheilus horai</i> Menon	+			+					+		+	
66. <i>Noemacheilus himachalensis</i> Menon				+								
67. <i>Noemacheilus montanus</i> (McClelland)		+		+				+	+	+		
68. <i>Noemacheilus punjabensis</i> (Hora)	+								+	+	+	
69. <i>Noemacheilus rupecola</i> (McClelland)	+					+			+	+	+	

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
70. <i>Noemacheilus nilgiriensis</i> (Menon)				+								
71. <i>Triplophysa stoliczkae</i> (Steindachner)					+		+		+			
Order SILURIFORMES												
Family AMBLYCIPITIDAE												
72. <i>Amblyceps mongois</i> (Hamilton-Buchanan)				+				+				
Family BAGRIDAE												
73. <i>Mystus bleekeri</i> (Day)	+			+								
74. <i>Mystus vittatus</i> (Bloch)										+		
75. <i>Aorichthys aor</i> (Hamilton-Buchanan)	+			+								
76. <i>Aorichthys seenghala</i> (Sykes)	+		+	+							+	
Family SILURIDAE												
77. <i>Wallago attu</i> (Bloch & Schneider)	+			+								
Family CLARIIDAE												
78. <i>Clarias batrachus</i> (Linnaeus)										+		
Family SCHIBEIDAE												
79. <i>Clupisoma garua</i> (Hamilton-Buchanan)				+								

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
<b>Family SISORIDAE</b>												
80. <i>Bagarius bagarius</i> (Hamilton-Buchanan)	+											
81. <i>Glyptothorax brevipinnus brevipinnus</i> Hora										+		
82. <i>Glyptothorax conirostrae conirostrae</i> (Steindachner)	+	+		+				+		+	+	
83. <i>Glyptothorax garhwali</i> Tilak				+						+		
84. <i>Glyptothorax gracile</i> (Gunter)												
85. <i>Glyptothorax kashmirensis</i> Hora		+										
86. <i>Glyptothorax pectinopterus</i> (McClelland)	+	+		+						+	+	
87. <i>Glyptothorax stoliczkae</i> (Steindachner)		+		+						+	+	
88. <i>Glyptothorax dakpathari</i> Tilak & Husain	+											
89. <i>Gyptosternon reticulatum</i> McClelland		+							+	+		
90. <i>Pseudecheneis sulcatus</i> (McClelland)									+	+		
<b>Order SALMONIFORMES</b>												
<b>Family SALMONIDAE</b>												
91. <i>Salmo gardnerii gardnerii</i> Richardson					+	+			+			
92. <i>Salmo trutta fario</i> Linnaeus					+	+			+			
<b>Order BELONIFORMES</b>												
<b>Family BELONIDAE</b>												
93. <i>Xenentodon cancila</i> (Hamilton-Buchanan)	+			+						+		

Table continued												
Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Order CHANNIFORMES												
Family CHANNIDAE												
94. <i>Channa gachua</i> (Hamilton-Buchanan)												
95. <i>Channa marulius</i> (Hamilton-Buchanan)	+			+						+	+	
96. <i>Channa orientalis</i> Bloch & Schneider	+			+						+	+	
97. <i>Channa punctatus</i> (Bloch)		+									+	
98. <i>Channa striatus</i> (Bloch)				+							+	
Family CENTROPOMIDAE												
99. <i>Pseudambasis baculis</i> (Hamilton-Buchanan)	+									+	+	
Family GOBIIDAE												
100. <i>Glossogobius giuris</i> (Hamilton-Buchanan)*				+						+		
Family HETEROPNEUSTIDAE												
101. <i>Heteropneustes fossilis</i> (Bloch)				+								
Order PERCIFORMES												
Family NANDIDAE												
102. <i>Badis badis</i> (Hamilton-Buchanan)										+	+	

Table continued

Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahaul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
Order SYNBRANCHIFORMES Family MASTACEMBELIDAE												
103. <i>Macrognaathus pancalus</i> Hamilton-Buchanan*											+	
104. <i>Mastacembelus armatus</i> (Laceped)		+			+						+	+
<b>TOTAL</b>	<b>50</b>	<b>20</b>	<b>15</b>	<b>55</b>	<b>5</b>	<b>9</b>	<b>2</b>	<b>22</b>	<b>16</b>	<b>57</b>	<b>50</b>	<b>14</b>

\* New records

## AMPHIBIA

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### INTRODUCTION

Amphibians are an important group of Vertebrates holding an intermediate position between fishes and reptiles. They are least numerous amongst the vertebrates and comprise nearly 6.6% of the total life on this earth (Lagler *et al.*, 1962). Three groups of amphibians are recognised viz. Urodeles, Caecelians and Anurans. There are about 3140 species of living amphibians in this world (Duellman, 1982) and the frogs & toads comprise nearly 85% of the total existing amphibian fauna. In India, 214 species of amphibians are known, while in Himachal Pradesh, 17 species representing families viz. *Bufo* *idae*, *Rana* *idae*, *Microhylidae* and *Rhacophoridae* are studied from different parts of the state with varied mountainous ranges, altitudes and diverse ecological niches.

The Himachal state comprises Shivaliks, Lesser, Middle, Great and Trans Himalayan ranges politically separated into 12 districts viz. Bilaspur, Chamba, Hamirpur, Kangra, Kinnaur, Kullu, Lahaul & Spiti, Mandi, Shimla, Sirmour, Solan and Una, with altitudinal ranges of 200-8000 m. These varying altitudes with diverse ecological niches like lakes, torrential streams, humid forests and cold deserts, coupled with various physico-chemical factors like humidity, temperature, rainfall and sunshine hours directly or indirectly influence the fauna. The amphibian fauna and various biological activities of the amphibians like breeding and feeding are correlated with localised climatic conditions. Normally, the breeding activity triggers off with the onset of spring i.e., March-April and continues till the end of August. The rainfall accelerates the process of breeding and feeding activity. The distribution of amphibians within the altitudinal ranges of 200-8000 m shows an increase in the number of species upto 1500 m while the number of species immediately declines above 1600 m.

The amphibians are an important part of the natural ecosystems. These are preyed upon by fishes, birds, reptiles and cannibalism is also studied in some forms like *Uperodon systoma* and *Bufo stomaticus*. The occurrence of frogs and toads in orchards, nurseries, rice fields and hill streams is directly related with the abundance of insect and invertebrate

fauna. These consume large number of abnoxious insects. Thus their role in biological control of insects is predominant. In countries like France and Italy, farmers purchase the toads for control of insect pests.

Following species have been studied from different parts of Himachal Pradesh representing 12 districts :

#### Family BUFONIDAE

1. *Bufo melanostictus* Schneider
2. *Bufo himalayanus*
3. *Bufo viridis* Laurenti
4. *Bufo stomaticus* Lutken
5. *Bufo andersonii* Boulenger.

#### Family MICROHYLIDAE

6. *Microhyla ornata* Dummeril & Bibron
7. *Uperodon systoma* Schneider

#### Family RHACOPHORIDAE

8. *Polypedatus maculatus* (Tree Frog)

#### Family RANIDAE

9. *Rana cyanophlyctis* Schneider (Frogs)
10. *Rana limnocharis* Boie & Wiegman
11. *Rana tigerina* Daudin
12. *Rana (Tomopterna) breviceps* Schneider
13. *Rana (Paa) minica* Dubois
14. *Rana (Paa) liebigii* Annandale
15. *Rana (Paa) vicinia* Stoliczka
16. *Amolops afgahanus* Gunther
17. *Amolops himalayanus*

#### KEY TO THE IDENTIFICATION OF AMPHIBIANS OF HIMACHAL PRADESH

1. Tongue bifid; teeth present in upper jaw ..... 8
- Tongue not bifid; teeth absent in upper jaw ..... 2

2. Tongue large and pyriform; paratoid glands present; clavicles present ..... 3  
 — Tongue small and oval; paratoid glands absent; clavicles absent ..... 7
3. Head with cranial ridges; border of various bones elevated and superficially demarcated ..... 4  
 — Head without cranial ridges; borders of various bones not elevated ..... 5
4. Tympanum small, less than half in ocular diameter ..... *Bufo himalayanus*  
 — Tympanum large, more than half in ocular diameter ..... *Bufo melanostictus*
5. Snout somewhat pointed; tympanum more than half in the ocular diameter; toes almost three-fourth webbed ..... 6  
 — Snout round; tympanum less than half in the ocular diameter; toes half-webbed ..  
 ..... *Bufo viridis*
6. Head 1.35 to 1.4 times broader than long; tarsal fold present ..... *Bufo andersonii*  
 — Head 1.1 to 1.25 times broader than long; tarsal-fold absent ..... *Bufo stomaticus*
7. Green with regular white patches; inner metacarpal tubercle with groove, inner metacarpal tubercle double in length than outer; hind limbs 1.4-1.5 times longer than body length ..... *Uperodon systoma*.  
 — Pink or white with specific black streak; inner metacarpal tubercle without groove, inner and outer ones of equal length; hind limbs more than 1.5 times longer than body length ..... *Microhyla ornata*
8. Extremity of penultimate phalanx well defined, an intercalary ossification between distal and penultimate phalanx ..... *Polypedates maculatus*  
 — Extremity of penultimate phalanx not well marked, no intercalary ossification between distal and penultimate phalanx ..... 9
9. Omosternum forked ..... 10  
 — Omosternum not forked ..... 13
10. Head broader than long, nasals raised on platform; inner metatarsal tubercle longer than first toe ..... *Rana (Tomopterna) breviceps*  
 — Head as long as broad or slightly longer than broad, nasals not raised on platform, inner metatarsal tubercle smaller than first toe ..... 11

11. Tympanum nearly half in the ocular diameter or less than half; hind limbs 1.25 times longer than body length; outer metatarsal tubercle present; toes half webbed'.....  
..... *Rana limnocharis*
- Tympanum more than half in the ocular diameter; hind limbs 1.6 times longer than body length; outer metatarsal tubercle absent; toes almost fully webbed ..... 12
12. Snout long, 0.45 in head length, first finger long than second, subarticular tubercles of fingers well developed longer than second; inner metatarsal tubercle strong and bladeliike. Snout short, 0.35 in head length; first finger equals to second or smaller, subarticular tubercles of fingers weakly developed, inner metatarsal tubercle not strong and blade-like..... *Rana cyanophlyctis*
13. Head broader than long; finger tips swollen and without discs; subarticular tubercles prominent; inner metatarsal tubercle well developed..... 14
- Head as long as broad; finger tips not swollen and with discs; subarticular tubercles not prominent; inner metatarsal tubercle very weakly developed ..... 15
14. First finger longer than second, fingers with discs devoid of grooves, discs of fingers not broader than half in the ocular diameter ..... *Rana (Paa) minica*
- First finger smaller than second, or equal in length, tips of fingers and toes with discs broader than half in the ocular diameter; seperated by grooves..... 15
15. Fingers moderately long, discs of fingers less than width of tympanun.....  
..... *Amolops himalayanus*
- Fingers very long, with large discs, broader than diameter of tympanun .....  
..... *Amolops afghanus*
16. Head 1.5 times broader than long; dorsolateral folds present .....  
..... *Rana (Paa) liebighii*
- Head less than 1.5 times broader than long, dorsolateral fold absent .....  
..... *Rana (Paa) vicina*

### KEY TO IDENTIFICATION OF TADPOLES

1. Tail rounded ..... (2)
- Tail pointed ..... (3)
2. Colour dark brown; nostrils nearer the eye than snout; mouth slightly aterminal; tail more than 3 times snout-vent length ..... *Bufo melanostriectus*

- Colour grey; nostril equidistant from eye and snout; mouth terminal; tail less than 3 times snout-vent length ..... *Bufo stomaticus*
3. Tadpoles transparent with specific streak; nostrils at the tip of eyes, laterally placed, wide apart ..... *Microhyla ornata*
- Tadpoles opaque and grey; nostrils nearer the eye than snout; eyes dorsal; inter or bital space narrow ..... (4)
4. Dentitional rows in upper jaw six, three in lower jaw ..... *Rana (Paa) minicà*
- Dentitional rows in upper jaw one, two in lower jaw ..... *Rana cyanophlyctis*

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Distric-wise distribution of Amphibian from Western Himalaya												
Taxon	Districts											
	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una
	1	2	3	4	5	6	7	8	9	10	11	12
<b>Family RANIDAE</b>												
1. <i>Rana cyanophlyctis</i> Schneider	+	+	+	+	-	+	-	+	-	+	+	+
2. <i>Rana limnocharis</i> Boie & Wiegman	+	+	+	+	-	+	-	+	+	+	+	+
3. <i>Rana tigerina</i> Daudin	+	-	+	+	-	-	-	+	-	+	+	+
4. <i>Rana (Tompterna) breviceps</i> Schneider	+	-	+	+	-	+	-	+	-	+	+	+
5. <i>Rana (Paa) minica</i> Dubois	+	+	+	+	-	+	-	+	+	+	+	-
6. <i>Rana (Paa) liebigii</i> Annandale	-	+	-	+	-	+	-	+	+	+	+	-
7. <i>Rana (Paa) vicinia</i> Stoliczka	-	-	-	-	-	+	-	+	+	+	-	-
8. <i>Amolops afgahanus</i> Gunther	-	+	-	+	-	+	-	+	+	+	-	-
9. <i>Amolops himalayanus</i> Boulenger	-	-	-	+	-	+	-	-	+	+	-	-
<b>Family RHACOPHORIDAE</b>												
10. <i>Polypedates maculates</i> Gunther	-	-	-	-	-	-	-	-	+	-	-	-
<b>Family BUFONIDAE</b>												
11. <i>Bufo stomaticus</i> Lutken	+	+	+	-	-	+	-	+	+	+	+	+
12. <i>Bufo andersonil</i> Boulenger	-	-	-	-	-	-	-	-	-	+	-	-
13. <i>Bufo melanostictus</i> Schneider	+	+	+	+	-	+	-	+	-	+	+	+
14. <i>Bufo himalayanus</i> Gunther	-	+	-	+	+	+	-	+	+	+	+	-
15. <i>Bufo viridis</i> Laurenti	-	-	-	-	+	-	-	-	-	-	-	-
<b>Family MICROHYLIDAE</b>												
16. <i>Microhyla ornata</i> Dummeril & Bibron	+	+	+	+	-	-	-	-	-	+	+	+
17. <i>Uperodon systoma</i> Schneider	-	-	-	+	-	-	-	-	-	+	-	+

## AVES

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### INTRODUCTION

The Himalaya are the most magnificent complex folded mountain chain in the northern boundary of the Indian sub-continent acting as bridge and barrier. The fauna occurring in this mountain chain has been influenced by Palaearctic, Oriental, Tibetan, Central Asian and south Indian elements. The Oriental element in the avifauna is richly represented in the eastern Himalaya and gradually diminishes westwards until in Kashmir. The Kali Gandaki river in Central Nepal has been shown as the dividing line between the avifauna of western and eastern Himalaya. In floristics too, western Himalayan flora differs from eastern Himalayan in a greater representation of conifers. European elements are conspicuous in the former, while Malayan, Chinese and Burmese elements are in the later.

Birds endemic to the Himalaya, not found in peninsular India, are Broadbills, Honeyguides, Finfoots and Parrotbills; but these birds do not occur in Himachal Pradesh as such. A monotypic genera of Pheasant family, endemic to Himalaya (and also to H.P.) is namely *Catreus*. Ripley (1961) has considered this to be Palaearctic relicts. In addition, he showed that some seven Palaearctic endemic species are confined to Himalaya, without adjacent relatives, and give strong evidence of being relict forms. Among them few notable species are Himalayan Pied Woodpecker *Dendrocopos himalayensis*, Blackheaded Jay *Garrulus lanceolatus*, and Redheaded and Orange Bullfinches *Pyrrhula erythrocephala* and *P. aurantiaca*.

The birds of Himachal Pradesh and particularly of hill stations like Shimla, Dalhousie, Kulu, Kangra and Dharmasala were well studied about 50 to 65 years ago as summarised by Ali & Ripley (1983 b). Whistler (1926 a & b) studied the birds of Kangra and Kulu districts respectively. Ali (1949) has listed about 225 birds from Western Himalaya. Ali (1981) has described in general about the Indian Ornithology in Himalaya. Gaston *et al.* (1981), Khajuria and Sharma (1983) have studied distribution of Pheasants and habits of altitudinal birds in Western Himalayas respectively. Pandey (1989 a & b), Narang (1989) and Suyal (1992) have made some contributions to birds of Kangra, Kinnaur and Shimla districts respectively. Singh *et al.* (1990) have enlisted about 358 birds from 2 National Parks and 29 wildlife sanctuaries of Himachal Pradesh. Mahabal and Mukherjee (1991);

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Mahabal (1992 a & b, 1996, 2000 a & b); Mahabal and Sharma (1992 and 1993); and Sharma and Mahabal (1997) have focussed significant light on the distribution pattern, abundance and status of the bird life in different districts and wildlife sanctuaries of Himachal Pradesh. Thakur *et al.* (2002) have listed 66 species of birds from Kalatop-Khajjiar Wildlife Sanctuary in district Chamba, Himachal Pradesh. Eventhen there is lack of sufficient data on seasonal migration and abundance particularly those of Kinnaur and Lahul-Spiti districts in Trans-Himalayan region.

The present studies deals with a upto date review of districtwise occurrence of birds of Himachal Pradesh and their distribution pattern in realtion to different regions and forest biotopes of Western Himalayan ecosystem.

Himachal Pradesh 30°22' to 33°12' N latitude and 75°45' to 79°04' E longitude, with an area of about 56,019 Sq Km is located in the north-western hill tracts of Himalaya. The entire state consists of hills and mountains ranging from 300 m to over 6000 m. The general increase in elevation from W→E and from S→N divides the state into following four biogeographic regions : 1) Siwalik or Outer Himalaya, ii) Lower or Lesser Himalaya, iii) Higher or Greater Himalaya and iv) Trans-Himalaya (Map). The state has been drained by number of river systems such as Chenab, Ravi, Beas, Sutlej and Yamuna. Average annual rainfall ranges from 1000 mm to 2500 mm; precipitation at higher elevation is mostly due to snow. Temperature varies from (+) 30° C to (-) 30° C depending upon the location. The land under forest is 21.8% of the total area of the state. At present there are 29 Wildlife Sanctuaries and 2 National parks in this state. The total area under both these categories of protected areas is 3,94,788.65 ha, covering 7.10% of the state area (Negi, 1990; Singh *et al.*, 1990). The state has been divided into 12 districts.

Topography, variations in altitude and the prevailing climatic conditions thereon influence the corresponding changes on the biotic diversity both in the extent and composition. Consequently, it affects the life of birds inhabiting in different 'life zones' of these mountains. This provoke seasonal migration of birds which cause variation in their distribution pattern in different biogeographic regions of Himalaya. To investigate this, the avifaunal surveys were conducted in different districts and sanctuaries of Himachal Pradesh in various seasons of the year: Mandi (March 1990 and October, 1994), Chamba (July 1990), Kangra (January-February 1991 and September 1994), Una and Hamirpur (September-October 1991), Hamirpur and Bilaspur (February 1992), Renuka Lake in Sirmour (April 1992), Talra Wildlife Sanctuary (September-October 1992) and Chirgaon Tehsil of Shimla District (July-August 1993). Besides this, a number of short surveys and personal tours were undertaken in Solan, Shimla and Kullu districts during March 1990 to October 1994. During these surveys more than 10,000 Kms were travelled in different altitudinal zones covering diverse eco-habitats such as natural and manmade lakes, river banks, streames, torrents, marshy places, scrub forests, thick forested areas, snow bound high mountains, high altitude meadows, grass and shrub-clad hillsides, conifer cald slopes, valleys, cultivations, wastelands, roadsides and urban areas for birds observations. Further, the data on the birds of Lahul and Spiti, Kinnaur and Kullu districts has been mainly compiled from Ali and Ripley (1983 b) and to certain extent from Narang (1989), Pandey (1989 b) and Singh *et al.* (1990).

All observations were made by using a pair of binoculars (8 x 50 with zoom focussing). The identification of birds in the field and its species account (residential status, altitudinal range, food habits) in tabular form (Table 1) is based on Ali (1949) and Ali & Ripley (1983 a&b). Further, in the systematic list of birds in the tabular form (Table 1) the common names, scientific names have been followed as per standardised common and scientific names of birds by Manakadan and Pittie (2001). However, the family and genus sequence has been followed as per Ali and Ripley (1983 b).

### DIVERSITY AND STATUS

The great altitudinal variations in Himachal Pradesh has offered varied topography and vegetation exhibiting a wide variety of eco-habitats each supporting its own distinctive type of fauna and particularly bird diversity and its abundance.

In avifaunal systematics about 1342 bird species belonging to 21 orders, 88 families and 432 genera have been recorded in India by Ali and Ripley (1983 b) of which 17 orders, 65 families and 232 genera comprising 447 species of birds are being represented herewith in the state of Himachal Pradesh. An orderwise diversity of these birds have been indicated in Table 2. This clearly show the state of Himachal Pradesh possess a substantial bird diversity as compared to that with Indian subcontinent. The districtwise occurrence, altitudinal distribution and status and food habits of the birds of Himachal Pradesh have been given in Table 1. The relative percentage of residential status of these birds was then derived and has been plotted in Fig. 1.

The Table 1 indicate that the families like Accipitridae, Phasinidae, Columbidae, Strigidae, Picidae, Corvidae, Muscicapidae and Fringillidae were found to be better represented in Himachal Pradesh. However, the distribution of different bird species in families such as Ciconiidae, Laridae, Bucerotidae etc. was noticed to be uneven and poor when compared with that of bird species recorded from Indian sub-continent. Table also indicates that the maximum number of bird species have been recorded in district Kangra (313) followed by Shimla (232) and Bilaspur (191) districts. The lowest number of birds species have been recorded in Lahul & Spiti (74) and Kinnaur (40) districts.

Further, from the Table 1 and Fig 1, it can be pointed out that out of the total bird species recorded, 35.5% were residents found in Himachal Pradesh (also occurring in other places in India). Of these resident birds, many of them show local and temporary movements. Some of the resident birds like Pariah Kite, Spotted Dove, Green Barbet, Yellowfronted Pied Woodpecker, Indian Mynas, Punjab Redvented Bulbul and Spotted Munia occurred almost throughout the state. They found fairly in good number in Siwalik and in Lower Himalayas as compared to Higher and Trans-Himalayan region. Number of winter visiting birds from Central Asia, Europe, Siberia on annual migration spend their winter quarters in India as well as in many part of Himachal Pradesh. Brown Chiffchaff, *Phylloscopus collybita* was the most common species found throughout the

state in substantial number. Of the total birds, 15.4% were constituted winter visitors to the state. European Bee-eaters, Siberian Lesser Whitethroat and Brambling were recorded to be either winter visitor and or passage migrants (Spring/Autumn) to the state.

A number of birds from plains of central India and foothill areas migrate towards Himalayan ranges particularly in their breeding season during March to September. These are summer visitors. Such 11.6% birds (Fig.1) were noticed to be visiting the state in every summer for breeding. Swallows of the genus *Hirundo* and Hoopoes were observed in substantial numbers throughout the state. Seasonal altitudinal movements is an interesting feature of birds migration in Himalayas. Western Turtle Dove, Longbilled Horned Lark, Scarlet Minivet, Kashmir Sooty Flycatcher and Plumbeous Redstart were few common bird species, among the 10.7% of seasonal altitudinal migrants breeding at higher elevations of Himachal Pradesh. In winter, they move down and take shelter in valleys, in the foothills and neighbouring plains of northern India. However, species like Wood Cock *scolopax rusticola*, may even fly non-stop to the hills of Western Ghat Complex in south India.

A unique phenomenon can be noticed in the Western Himalayan ecosystem. Several high altitude resident birds, endemic to Western Himalaya migrate towards lower elevations during winter because of heavy snowfall at higher ranges. They return back to their feeding and breeding quarters as soon as the season become favourable in summer. These vertical movements during winter-summer can clearly be noticed only within four biogeographic regions of the state. Himalayan Griffon Vulture, Red-billed Blue Magpie, Himalayan Bulbul, Simla Streaked Laughing Thrush, Blackcapped Sibia, Himalayan Whistling Thrush, were some of the prominent resident birds of Himalayas. Out of the total birds recorded 26.8% were noticed to be resident birds of Himalayas (Fig. 1).

**Food Habits :** The account of various food habits of birds of Himachal Pradesh given in Table 1 is based on Ali and Ripley (1983 b). The relative preference of these various food habits was then derived and in order of percentage histogram has been plotted (Fig. 2). The figure indicates that 45.9% birds of Himachal Pradesh are insectivorous followed by graminivorous 15%. The percentage of omnivorous and carnivorous is almost similar. However, percentage of nectar eaters and scavenger bird species is less in this state.

## ALTITUDINAL DISTRIBUTION

The distribution of birds and their residential status observed in four different biogeographic regions of the state w.r.t. altitude and forest biotopes thereon has been given below and has also been plotted in Fig. 3 (with representative districts pertaining to these four regions).

### 1. Siwalik or Outer Himalayas

Siwalik is a series of low hills developed along the southern periphery of the state. The elevation ranges from 300 m to 1500 m. Una, Hamirpur, Bilaspur, and parts of Kangra, Solan, Sirmour districts comes under this Siwalik Himalaya. Deot-Sidh, Sola

Sing, Naina Devi and Siwalik ranges; Pong Dam and Gobind Sagar lakes; Renuka, and Simbalwar sanctuaries are some of the prominent wildlife habitats of this zone. Temperature variation is from (+) 5°C to (+) 30°C with annual average rainfall of 1100 mm. Winters are mild.

In this sub-montane and sub-tropical biotope occurs the following forest types with avifauna : Siwalik Sal forest is composition of *Shorea robusta* with dry deciduous trees like *Acacia* sp. (Khair), *Albizia* sp., *Ziziphus* sp., *Dalbergia* and *Sissoo*; and moist deciduous treelike *Bauhinia* sp., *Bombax* sp., *Terminalia* sp. and *Ficus* sp. mixed with Bamboo breaks and shrubs. This type of forest can be noticed at lower elevations (below 900 m). Maximum number of resident birds occurred in these forested areas of which some important species were Jungle Fowl, Large Indian Parakeet, Tree Pie, Wood Shrike and Yellow-eyed Babbler. Shallow waters of Pong Dam and Gobind Sagar lakes with swampy riverine forest belt along the banks has not only provided habitat for resident water birds but an adequate wintering ground for many migratory water birds. Various species of Gulls commonly found in the coastal areas were also noticed in fairly good numbers at Pong Dam lake.

Siwalik Chir-Pine forest is mostly dominated by *Pinus roxburghii* mixed with moist deciduous trees occurring at higher levels between 900 and 1500 m. A number of birds endemic to Himalayan ecosystem i.e. resident birds of Himalayas and many seasonal altitudinal migrants were noticed to be wintering in these ranges from December to March, for *ex* Griffon Vulture, Red-billed Blue Magpie, Laughing and Whistling Thrushes, Scimitar Babblers, Kaleej and Chir Pheasants, Creepers, River Chats etc.

In general it was noticed that in this Siwalik Himalaya percentage of resident birds (with local movements) was much higher as compared to other visitors or migrant birds (Fig. 3.).

## 2. Lower or Lesser Himalaya

This region extends from a elevation of about 1000 m to 3500 m. Extension of Dhaulandhar range gives way to an series of mountain ranges such as Nagtibba range, Shimla hills and Churdhar range. A typical temperate climate prevails in this tract. Annual rainfall is between 2500 and 2800 mm. Upper reaches receives heavy snowfall. Temperature varies from (-) 5°C to (+) 25°C. In this biogeographic zone includes Shimla, Mandi and Upper parts of Kangra, Solan and Sirmour districts of the state with a number of Wildlife Sanctuaries.

Himalayan (sub-tropical) Chir-Pine forest occurs on the lower elevation of this zone from 1000 m to 1800 m particularly in upper ranges of Solan and Sirmour districts. It is more or less pure association of *Pinus roxburghii* with Chir *Carissa* grass. The avifauna was more or less similar to that of Siwalik Chir-Pine forest.

Himalayan temperate forest constitutes different types of forests such as Oak forest (*Quercus leucotricophora*, *Q. himalayana* : 1700 m-3500 m); Moist Deodar forest (*Cedrus deodara* : 1700m-2500 m); Kail forest (*Pinus wallichiana* : 1700m-2500m); Western

mixed coniferous forest (Oak, Deodar, kail, Maple, Fir and Spruce : 2500 m-3300 m); Fir and Spruce (*Abies pindrow*, *Picea smithiana* with Blue Pine *Pinus excelsior*) and Mixed broad-leaved forest (*Rhododendron* sp., *Betula* sp., Chestnut, and Walnut : 3300 m and above). These forest types were mostly observed in Shimla and higher ranges of Mandi districts. Various species of resident endemic pheasants occurred at different altitudinal zones of these temperate forests types. Of which Simla Hill Partridges and Kaleej, Koklas and Chir Pheasants were estimated to be in good numbers whereas Monals were found in sizeable population. The number of resident birds of Himalayas of genus *Garrulus* Jays; *Nucifraga*, Nutcrackers; *Garrulax* Laughing Thrushes; *Turdus* Black birds; and Tits of the genus *Parus*, *Sylviparus*, and *Aegithalos* were well represented particularly in the mixed coniferous forest of Talra Wildlife Sanctuary in Shimla district (Mahabal, 2000 a). Some members of Bush Robins, Redstart, Chats and Leaf Warblers were seem to be regular seasonal altitudinal migrants to the Oak and Deodar forested areas of this tract. Similarly, Wedgetailed Green Pigeons, Cuckoos, several members of Flycatchers, Pipits and Wagtails were some important summer visitors of these temperate forests.

In general, it was noticed that the percentage of number of resident and winter visitor birds was relatively decreased as compared to birds occurring in Siwalik Himalaya. However, summer visitors, seasonal altitudinal migrants and resident birds endemic to Himalayas showed a simultaneous increase in number of species (Fig. 3) alongwith their population.

### 3. Higher or Greater Himalayas

This range is core of the complex mountain chain, runs in an arc shape along the northern parts of the state. It consists of snow clad peaks, glaciers and deep river valleys of Beas and Ravi river systems. Most of the Chamba, Kullu and parts of Kinnaur districts are included in this region. Southern slopes of this range are steeper, well wooded while their northern counterparts are largely devoid of vegetation except grass. In this region altitude ranges from 1500 m to 4800 m and temperature varies from (-) 10°C to (+) 25°C.

Himalayan temperate forests occurs at lower elevations particularly in broad open valleys of Kullu and Chamba. It comprises of Oak, Moist Deodar, Western mixed coniferous, Mixed broad-leaved forests, and Fir and Spruce, as already mentioned in upper ranges of lower Himalayas. The avifauna was also found to be more or less similar to the upper ranges of lower Himalayas.

At higher altitudinal zones of this range prevails a typical arctic climate with heavy snowfall which occurs all through long winter. This zone constitute different types of forest : Dry Temperate forest (above 2000 m) consists of *Alder* (*Alnus nitida*) and mixed coniferous; Sub-alpine forest (above 2900 m) consists of high level fir *Abies spectabilis*, Birch-fir (*Betula utilis*) and *Rhododendron* (*Rhododendron anthopogan*, *R. lepidotum*); and Moist-alpine scrub forest (above 3500 m) found near snowline for ex. Manimahesh in Chamba and Rohtang Pass in Kullu district. Resident birds endemic to the Himalayas especially Himalayan Snow Cocks, Snow and Chukar Partridges, Snow

and Hill Pigeons, Eurasian Goldfinches and Rosefinches of genus *Carpodacus* occurred in these high mountain ranges.

In general, it was noticed that in this biogeographic region of higher Himalaya the number of resident and winter visitors have been markedly decreased, however, there was an substantial increase in the summer visitors and endemic birds resident to Himalaya (Fig. 3).

#### 4. Trans-Himalaya

The region lies north of the Great Himalayan mountain wall. The average elevation is over 3000 m. The vast tableland of Lahul-Spiti and most of the Kinnaur district lies in this tract. As the SW monsoon unables to cross this Great Himalayan Wall, these rain deficient areas resembles an altitudinal cold desert. The upper reaches of this tract are permanently covered by thick snow. Temperature varies from (-) 30°C to (+) 22°C. The rocky slopes are devoid of vegetation. The tree growth is restricted to the moist stripes of land. In this zone, as the growing period available for plants is very short, the birds can be found only during short period of summer between June and September.

Himalayan temperate forest contains climax vegetation in Kinnaur district mainly a composition of Dry broad-leaved coniferous forest; Dry Chilgoza-Neoza Pine forest of *Pinus gerardiana*; Dry Deodar; and Dry Juniper forest; whereas in Sub-alpine areas mainly high level Birch and or Fir forest can be noticed. Some of the important resident birds of Himalayas (endemic birds) found in these forest biotopes were Himalayan Bearded Vulture (a pure mountain-living species), Snowcock, Alpine Chough and Missel Thrush.

In the Lahul and Spiti district an alpine zone consists of a Moist-alpine of Birch and or Rhododendron scrub forest; Alpine scrubs and Pastures just below the snowline; and Dry-alpine scrub and or meadows close to snowline particularly in drier tracts. Here vegetation is semi-xerophytic in nature. Turkeshtan Hill Pigeon, Yellow-billed and Red-billed Cough, Rufous-breasted Accentor, Tibetan Snow Finch, Tibetan Twite were reported to be major resident birds of Himalayas. Solitary Snipe, Longeared Owl, Pied wheatear were some of the summer visitors to this belt. Lesser Sand Plover, Tibetan Sandgrouse, Tengmalm's Owl and Tibet Short-toed Lark were seasonal altitudinal migrants exclusively recorded in this belt only. In general there was a notable increase in resident birds endemic to Himalayas followed by summer visitors and seasonal altitudinal migrants in this Trans-Himalayan region (Fig. 3).

### ETHOLOGICAL OBSERVATIONS

It is a well know phenomenon that birds are not evenly distributed at a given locality. At some places, there is a good concentration of birds whereas at other places they found in lesser numbers (by species and populationwise). Various species of birds assembles together for feeding, for nesting, resting during daytime and for roosting during night. These associations depend upon the various abiotic and biotic factors. During the various avifaunal surveys, it was noticed that at number of places there was

a comparatively rich birdlife such as at Gagret, Chail, Renuka Lake, Mashobra, Bhambla, Sujampur Tira, Dehra Gopipur, Sahoo and Hadsar in different districts of the state. Feeding assemblages of Himalayan Bulbuls and Punjab Red-vented Bulbuls were noticed throughout the state. Besides this, large mixed feeding parties of Laughing Thrushes, Leaf Warblers, Tree Creepers and various species of Blackbirds and Tits; and pure feeding flocks of Himalayan Black Bulbuls, Nutcrackers, Verditer Flycatchers, etc. were observed commonly in Talra Wildlife Sanctuary in Shimla district (Mahabal, 2000 a).

Nesting of Indian Bayas *Ploceus phillipinus* was seen at several places in district Una during September, 1991. During the Chamba district survey in July 1990, few pairs of Guldenstadts Redstart *Phoenicurus erythrogaster* and pair of Wall Creeper *Tichodroma muraria* were found to be nesting in sub-alpine rocky scrub mountains on the way to Manimahesh at an altitude between 3300 and 3500 m (Mahabal, 1992 b). Further, during this Chamba district survey birds like Tickell's Flowerpecker, Purple and Crimson Sunbirds; and birds like Brown Flycatcher, White-eye and the White-capped Bunting were noticed to be extended their distributional and altitudinal breeding range from their known range in Western Himalayas respectively (Mahabal, 1992 a).

Communal roosts of Red-vented Bulbuls, Indian Mynas, House and Jungle Crows were noticed most commonly in various towns and villages of districts pertaining to Siwalik and Lower Himalayas. The Large Indian and Rose-ringed Parakeets roosted in very large numbers at Gagret and Una town in district Una. A large congregation of Pariah Kites was also noticed in Mandi town. Roosting of Himalayan Bulbuls was commonly observed at number of places, throughout the Lower and Higher Himalayas.

### CONSERVATION STATUS

It is now well-established fact that because of illegal poaching, hunting, illegal trade and mainly due to habitat destruction, many animal species have been threatened or have become endangered. Birds of Himachal Pradesh is also not an exception to this cause. Table 3 indicates such birds having different conservation status. Particularly, birds from families Accipitridae, Pandionidae and Falconidae are included under Schedule I, Part III of Wild Life (Protection) Act, 1972 (amended upto 2002) and many of them have also the conservation status of near threatened, lower risk, vulnerable, or even critical in case of Himalayan Long-billed Vulture and Indian White-backed Vulture (IUCN, 2002). Similarly, various resident endemic pheasants of Himalaya are included in Schedule I, Part III of WL(P) Act, 1972 and also having conservation status as vulnerable (IUCN, 2002).

### DISCUSSION

1. In general, it was noticed that because of varied range of climate, altitude and associated forest biotopes and suitable undisturbed feeding and nesting habitats the distributional pattern of avifauna of Himachal Pradesh – a Western Himalayan ecosystem, is diverse and remarkable.

2. Resident birds (with local movements) and winter visitors were predominantly observed in the Siwalik Himalaya; but with corresponding increase in the altitude it showed subsequent decrease in the remaining three biogeographic regions of Himalayas. However, percentage of summer visitors, seasonal altitudinal migrants and resident birds endemic to Himalayas was found to be in increasing order from Siwalik to Trans-Himalayan region.

3. The avifauna of Una and Bilaspur districts of Siwalik ranges resembled with that of neighbouring plains of Punjab and Haryana (Ali & Ripley 1983 b, Mahabal and Sharma 1993).

4. Because of varied topographic position of Kangra district, maximum number of birds species (313) have been recorded herewith followed by Shimla district (232). The lowest number of bird species (40) have been noticed in district Kinnaur.

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**Table 1.** District-wise distribution, status and altitudinal range of birds of Himachal Pradesh

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
Class AVES																		
Order PODICIPEDIFORMES																		
Family PODICIPEDIDAE																		
1. <i>Podiceps cristatus</i> (Linnaeus) Great Crested Grebe	3	+	-	+	-	-	-	-	-	+	-	-	-	WV	AqA	-400		
2. <i>Podiceps griseigena</i> (Boddaert) Red-necked Grebe	4	+	-	-	+	-	-	-	-	-	-	-	-	WV	AqA	460-1800		
3. <i>Podiceps ruficollis</i> (Pallas) Little Grebe	5	+	-	+	+	-	-	-	+	+	-	+	-	R/LM	AqA	460-1800		
Order PELICANIFORMES																		
Family PELECANIDAE																		
4. <i>Pelecanus philippensis</i> Gmelin Spot-billed Pelican	21	+	-	-	+					-				R/LM	AqA (Fish)	-460		
Family PHALACROCORACIDAE																		
5. <i>Phalacrocorax niger</i> (Vieillot) Little Cormorant	28	+	-	-	+	-	-	-	-	+	-	-	-	R/LM	AqA	-460		
Family ANHINGIDAE																		
6. <i>Anhinga melanogaster</i> Pennant Darter	29			-	+	-				-				R/LM	AqA (Fish)	-460		

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
		1	2	3	4	5	6	7	8	9	10	11	12	13			
Order CICONIIFORMES Family ARDEIDAE																	
7. <i>Ardea cinerea</i> Linnaeus Eastern Grey Heron	36	+	-	-	+	-	-	-	-	-	+	-	-	R/LM	AqA	460-900	
8. <i>Ardea purpurea</i> Linnaeus Eastern Purple Heron	37	+	-	-	+	-	-	-	-	-	-	-	-	R/LM	AqA	-500	
9. <i>Ardeola grayii</i> (Sykes) Indian Pond Heron	42	+	-	+	+	-	-	-	-	-	+	+	+	R/LM	AqA & I	460-1500	
10. <i>Bubulcus ibis</i> (Linnaeus) Cattle Egret	44	+	-	+	+	-	-	-	-	-	-	+	+	R/LM	AqA	460-1500	
11. <i>Casmerodius albus</i> (Linnaeus) Eastern Large Egret	46	+	-	-	+	-	-	-	-	-	+	+	+	R/LM	AqA & I	460-1500	
12. <i>Mesophoyx intermedia</i> (Wagler) Median Egret	47, 48	+	-	-	+	-	-	-	-	-	+	-	+	R/LM	AqA & I	460-1500	
13. <i>Egretta garzetta</i> (Linnaeus) Little Egret	49	+	-	+	+	-	-	-	+	-	+	-	+	R/LM	AqA & I	460-1400	
14. <i>Nycticorax nycticorax</i> (Linnaeus) Black-crowned Night Heron	52	+	-	-	+	-	-	-	-	-	-	-	+	R/LM	AqA & I	460-1400	
Family CICONIIDAE																	
15. <i>Mycteria leucocephala</i> (Pennant) Painted Stork	60	-	-	-	+	-	-	-	-	-	-	-	-	R/LM	AqA & I	300-600	

Table contd.

Taxon	Districts												Status	Food Habit	Altitudinal Range (Mts.)	
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan				Una
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
16. <i>Ciconia nigra</i> (Linnaeus) Black Stork  Order ANSERIFORMES Family ANATIDAE	65	-	-	-	+	-	-	-	-	-	-	-	-	WV	AqA & I	460-900
17. <i>Anser indicus</i> (Latham) Bar-headed Goose	82	-	-	-	+	-	-	-	-	-	-	-	-	WV	VgM	460
18. <i>Tadorna ferruginea</i> (Pallas) Brahminy Shelduck	90	+	-	-	+	-	-	-	-	-	-	-	-	WV	OM	460
19. <i>Anas acuta</i> Linnaeus Northern Pintail	93	+	-	-	+	-	-	-	-	-	-	-	-	WV	VgM	460
20. <i>Anas crecca</i> Linnaeus Common Teal	94	+	-	-	+	-	-	-	-	-	-	-	-	WV	VgM	460
21. <i>Anas poecilorhyncha</i> J.R. Forster Spotbill Duck	97	+	-	-	+	-	-	-	-	-	-	-	-	R/LM	VgM	-1200
22. <i>Anas platyrhynchos</i> Linnaeus Mallard	100	+	-	-	+	-	-	-	-	-	-	-	-	WV	VgM	460
23. <i>Anas strepera</i> Linnaeus Gadwall	101	+	-	-	+	-	-	-	-	-	-	-	-	WV	VgM	460
24. <i>Anas penelope</i> Linnaeus Eurasian Wigeon	103	-	-	-	+	-	-	-	-	-	-	-	-	WV	VgM	460

Table contd.

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
25. <i>Anas querquedula</i> Linnaeus Garganey	104	+	-	-	+	-	-	-	-	-	-	-	-	-	WV	VgM	-460	
26. <i>Anas clypeata</i> Linnaeus Northern Shoveller	105	+	-	-	+	-	-	-	-	-	-	-	-	-	WV	AqA & I	-460	
27. <i>Aythya ferina</i> (Linnaeus) Common Pochard	108	+	-	-	+	-	-	-	-	-	-	-	-	-	WV	OM	-460	
28. <i>Aythya nyroca</i> (Guldenstadt) Ferruginous Pochard	109	-	-	-	+	-	-	-	-	-	-	-	-	-	WV	OM	-460	
29. <i>Aythya fuligula</i> (Linnaeus) Tufted Pochard	111	-	-	-	+	-	-	-	-	-	-	-	-	-	WV	OM	-460	
30. <i>Aythya marila</i> (Linnaeus) Greater Scaup	112	-	-	-	-	-	+	-	-	-	-	-	-	-	WV	OM	-500	
Order FALCONIFORMES Family ACCIPITRIDAE																		
31. <i>Elanus caeruleus</i> (Desfontaines) Black-shouldered Kite	124	+	+	+	+	-	+	-	+	+	+	+	+	+	R/LM	CR	-1600	
32. <i>Milvus migrans</i> (Boddaert) Black Kite	133	+	+	+	+	+	+	+	+	+	+	+	+	+	R/LM	OM	-2800	
33. <i>Milvus (migrans) lineatus</i> (Gray) Black-eared Kite	134	-	+	-	-	-	+	+	-	-	-	-	-	-	WV	OM	-4500	
34. <i>Haliastur indus</i> (Boddaert) Brahminy Kite	135	+	-	-	+	-	-	-	-	-	+	-	+	-	R/LM	CR	460-1800	

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
35. <i>Accipiter gentilis</i> (Linnaeus) Northern Goshawk	136	-	-	-	+	-	-	-	-	-	-	-	-	WV	CR	460-7240
36. <i>Accipiter badius</i> (Gmelin) Indian Shikra	138	+	+	+	+	-	-	-	+	-	+	+	+	R	CR	460-1400
37. <i>Accipiter nisus</i> (Linnaeus) Eurasian Sparrow-Hawk	148	-	-	-	-	-	+	-	+	+	-	-	-	R/SM	CR	1400-3500
38. <i>Accipiter virgatus</i> (Temminck) West Himalayan Besra Sparrow-Hawk	149	-	+	-	-	-	+	-	-	+	-	-	-	R/SM	CR	460-3000
39. <i>Buteo rufinus</i> (Cretzschmar) Long-legged Buzzard	153	-	+	-	-	-	+	-	-	+	-	-	-	SM	CR	1500-3700
40. <i>Buteo hemilasius</i> Temminck & Schlege Upland Buzzard	154	-	-	-	-	-	+	-	+	+	-	-	-	WV	CR	-2500
41. <i>Butaster teesa</i> (Franklin) White-eyed Buzzard	157	+	-	+	+	-	-	-	-	-	+	+	+	R/SM	CR	460-1200
42. <i>Spizaetus nipalensis</i> (Hodgson) Mountain Hawk-Eagle	158	-	-	-	+	-	-	-	-	+	-	-	-	R	CR	600-2400
43. <i>Hieraaetus pennatus</i> (Gmelin) Booted Eagle	164	-	-	-	-	-	+	-	+	+	-	-	-	WV	CR	460-3000
44. <i>Aquila chrysaetos</i> (Linnaeus) Himalayan Golden Eagle	166	-	+	-	-	-	+	-	-	-	-	-	-	R (Him)	CR	1850-3000
45. <i>Aquila heliaca</i> Savigny Eastern Imperial Eagle	167	+	-	-	+	-	-	-	-	-	-	-	-	WV	CR	-600

Table contd.

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
46. <i>Aquila rapax</i> (Temminck) Twany Eagle	168	-	-	-	+	-	-	-	-	-	-	+	-	R/LM	CR	-460		
47. <i>Aquila nipalensis</i> Hodgson Eastern Steppe Eagle	169	-	+	-	-	-	-	+	-	+	-	-	-	WV	CR	-3000		
48. <i>Ictinaetus malayensis</i> (Temminck) Black Eagle	172	-	-	+	-	-	-	-	-	+	-	-	-	R/SM	CR	460-2700		
49. <i>Haliaeetus leucoryphus</i> (Pallas) Pallas's Fish Eagle	174	+	-	+	+	-	-	-	-	-	-	-	-	R/SM	CR	460-1800		
50. <i>Ichthyophaga humilis</i> (S. Muller & Schlegel) Lesser Grey-headed Fish-Eagle	177	+	-	-	-	-	+	-	-	-	-	-	-	SM	CR (Fish)	460-2400		
51. <i>Sarcogyps calvus</i> (Scopoli) Red-headed Vulture	178	-	-	-	+	-	-	-	+	-	-	-	-	R/LM	SC	460-2000		
52. <i>Aegypius monachus</i> (Linnaeus) Cinereous Vulture	179	-	-	-	-	-	-	+	-	-	-	-	-	R (Him)	SC	1800-3600		
53. <i>Gyps fulvus</i> (Hablizl) Eurasian Griffon	180	+	-	+	+	-	-	-	-	+	-	-	-	R/LM	SC	460-2000		
54. <i>Gyps himalayensis</i> Hume Himalayan Griffon	181	+	+	+	+	-	+	+	+	+	+	+	+	R (Him)	SC	600-4000		
55. <i>Gyps indicus</i> (Scopoli) Himalayan Long-billed Vulture	184	-	-	-	+	-	-	-	+	-	-	-	-	R	SC	460-1500		
56. <i>Gyps bengalensis</i> (Gmelin) Indian White-backed Vulture	185	+	+	+	+	-	+	-	+	+	+	+	+	R	SC	460-2500		

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
57. <i>Neophron percnopterus</i> (Linnaeus) Egyptian Vulture	186	+	+	-	+	-	-		+	+	+	-	+	R/SM	SC	460-2500
58. <i>Gypaetus barbatus</i> (Linnaeus) Himalayan Bearded Vulture	188	-	+	-	-	+	-	+	-	-	-			R (Him)	SC	1200-400
59. <i>Circus cyaneus</i> (Linnaeus) Hen-Harrier	189	-	-	-	+		+	-	+	+	-	-		WV	CR	460-2500
60. <i>Circus macrourus</i> (S.G. Gmelin) Pallid Harrier	190	+	-	-	+		-				-		-	WV	CR	460-3000
61. <i>Circus aeruginosus</i> (Linnaeus) Western Marsh-Harrier	193	+	-		+	-	-	-			-		-	WV	CR	—
62. <i>Circaetus gallicus</i> (Gmelin) Short-toed Snake-Eagle	195	+		+	+	-			-	-	+	-	-	R	CR	460-2300
63. <i>Spilornis cheela</i> (Latham) Crested Serpent-Eagle Family PANDIONIDAE	196	+		+	+				+	-	+	+	-	R/LM	CR	460-2000
64. <i>Pandion haliaetus</i> (Linnaeus) Osprey Family FALCONIDAE	203	+	-		+	-	-	-	-		-	-	-	WV	CR (Fish)	2000-3300
65. <i>Falco jugger</i> J.E. Gray Laggr (Falcon)	208		-		+			-		-	-	-	-	R/LM	CR	-1000
66. <i>Falco peregrinus</i> Tunstall Peregrine Falcon	211		+			-	+		+				-	R/SM	CR	-2500

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
67. <i>Falco subbuteo</i> Linnaeus Eurasian Hobby	213	-	-	-	+	-	-	-	-	+	-	+	-	R/SM	I	1200-4000
68. <i>Falco chicquera</i> Daudin Red-headed Merlin	219	+	-	-	-	-	-	-	-	-	-	-	+	R	CR	-460
69. <i>Falco tinnunculus</i> Linnaeus Common (European) Kestrel	222	+	+	+	-	-	-	+	+	+	+	+	+	R/SM	I	700-5500
Order GALLIFORMES Family PHASIANIDAE																
70. <i>Lerwa lerwa</i> (Hodgson) Snow Partridge	227	-	+	-	-	-	+	+	+	-	-	-	-	R (Him)	VgM	3000-5500
71. <i>Tetraogallus himalayensis</i> G.R. Gray Himalayan Snow Cock	232	-	+	-	+	-	+	+	-	-	-	-	-	R (Him)	VgM	4000-5500
72. <i>Alectoris chukar</i> (J.E. Gray) Chukor	236	-	+	-	-	+	-	+	-	+	-	+	-	R (Him)	VgM	1200-5000
73. <i>Francolinus francolinus</i> (Linnaeus) Black Francolin	238	+	-	+	-	-	-	-	-	+	-	+	-	R	VgM & I	1200-2500
74. <i>Francolinus pondicerianus</i> (Gmelin) Grey Francolin	245	+	-	+	+	-	-	-	-	-	+	+	+	R	GR	-500
75. <i>Coturnix coturnix</i> (Linnaeus) Common Quail	250	+	-	+	-	-	-	-	-	-	+	+	+	R/WV	GR	-600

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
		1	2	3	4	5	6	7	8	9	10	11	12	13			
76. <i>Coturnix coromandelica</i> (Gmelin) Black-breasted or Rain Quail	252	+	-	+	-	-	-	-	-	-	-	+	-	R/LM	GR	-2000	
77. <i>Coturnix chinensis</i> (Linnaeus) Blue-breasted Quail	253		-	-	-			-	+	+	-	-		R/LM	GR	-2000	
78. <i>Perdicula asiatica</i> (Latham) Punjab Jungle Bush-Quail	256	+		+	+	-			-	-	+	+	+	R	GR	-1200	
79. <i>Arborophila torqueola</i> (Valenciennes) Simla Hill-Partridge	266		+		+	-	+		+	+	-		-	R (Him)	OM	1550-3000	
80. <i>Tragopan melanocephalus</i> (J.E. Gray) Western Tragopan	285		+	-	+	+	+	-	+	+		-		R (Him)	VgM	1350-3000	
81. <i>Lophophorus impejanus</i> (Latham) Himalayan or Impeyan Monal	290		+		+	+	+		+	+	-		-	R (Him)	VgM & I	2600-5000	
82. <i>Lophura leucomelanos</i> (Latham) Kaleej Pheasant	293		+	-	+	-	+	-	+	+	-	-		R (Him)	GR	460-3600	
83. <i>Gallus gallus</i> (Linnaeus) Red Junglefowl	299	+	-	+	+	-	-		-	-	+	-	+	R	GR	-2000	
84. <i>Pucrasia macrolopha</i> (Lesson) Koklass Pheasant	304	-	+	-	+	+	+	-	+	+	-	+	-	R (Him)	VgM & I	1500-4000	
85. <i>Catreus wallichii</i> (Hardwicke) Cheer Pheasant	307		+	-	+	-	+		+	+	-	+		R (Him)	VgM	1400-3500	
86. <i>Pavo cristatus</i> Linnaeus Indian Peafowl	311	+	-	-			+	-	+				+	R	OM	-1800	

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
Order GRUIFORMES																		
Family TURNICIDAE																		
87. <i>Turnix sylvatica</i> (Desfontaines) Small Buttonquail	313	+	-	-	+	-	-	-	-	-	-	+	-	R/SM	GR		-2400	
Family GRUIDAE																		
88. <i>Grus grus</i> (Linnaeus) Common Crane	320	-	-	-	+	-	-	-	-	-	-	-	-	WV	VgM & I		-500	
89. <i>Grus antigone</i> (Linnaeus) Sarus Crane	323	+	-	-	+	-	-	-	-	-	-	-	-	R/LM	OM		-500	
Family RALLIDAE																		
90. <i>Amaurornis akool</i> (Sykes) Brown Crake	342	+	-	+	+	-	-	-	-	-	-	-	+	R/LM	OM		-600	
91. <i>Amaurornis phoenicurus</i> (Pennant) White-breasted Waterhen	343, 344	+	-	+	+	-	-	-	-	-	+	-	+	R	OM		-650	
92. <i>Gallinula chloropus</i> (Linnaeus) Moorhen	347	+	-	+	+	-	-	-	-	-	-	-	-	R/WV	VgM		460-2400	
93. <i>Porphyrio porphyrio</i> (Linnaeus) Purple Moorhen	349	+	-	-	+	-	-	-	-	-	-	-	-	R/LM	OM		-460	
94. <i>Fulica atra</i> Linnaeus Common Coot	350	+	-	-	+	-	-	-	-	-	-	-	-	R/WV	OM		460-2500	

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Order CHARADRIIFORMES																	
Family JACANIDAE																	
95. <i>Hydrophasianus chirurgus</i> (Scopoli) Phaesant-tailed Jacana	358	+	-	-	+	-	+	-	-	-	-	-	R/LM	VgM	460-3700		
Family CHARADRIIDAE																	
96. <i>Venellus vanellus</i> (Linnaeus) Northern Lapwing	364	-	-	-	+	-	-	-	-	-	-	-	WV	I	-500		
97. <i>Vanellus indicus</i> (Boddaert) Red-wattled Lapwing	366	+	+	+	+	-	+	+	+	+	+	+	R/SM	I	-1800		
98. <i>Vanellus duvaucelii</i> (Lesson) River Lapwing	369	-	-	-	+	-	-	-	-	-	-	+	R/SM	OM	-500		
99. <i>Charadrius dubius</i> Scopoli Little Ringed Plover	379, 380	-	-	-	+	-	-	-	-	+	-	+	WV	I	-500		
100. <i>Charadrius mongolus</i> Pallas Lesser Sand Plover	384	-	-	-	-	-	+	-	-	-	-	-	SM	AqA	3900-5500		
Family SCOLOPACIDAE																	
101. <i>Tringa nebularia</i> (Gunner) Common Greenshank	396	+	-	-	+	-	-	-	-	+	-	+	WV	AqA	-500		

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
102. <i>Tringa ochropus</i> Linnaeus Green Sandpiper	397	+	-	-	+	-	-	-	-	-	+	-	+	WV	AqA	-200		
103. <i>Tringa glareola</i> Linnaeus Wood Sandpiper	398	+	-	-	+	-	-	-	-	-	-	-	+	WV	AqA	-2000		
104. <i>Actitis hypoleucos</i> Linnaeus Common Sandpiper	401	+	-	+	+	-	-	-	-	-	+	-	+	WV	AqA	-3200		
105. <i>Gallinago solitaria</i> Hodgson Solitary Snipe	404	-	+	-	-	-	-	+	-	-	-	-	-	SV	OM	2800-4800		
106. <i>Gallinago nemoricola</i> Hodgson Wood Snipe	405	-	+	-	-	-	-	-	-	-	-	-	-	SV	AqA	1900-3700		
107. <i>Scolopax rusticola</i> Linnaeus Eurasian Woodcock	411	-	+	-	-	-	-	-	-	+	-	-	-	SM	OM	2000-3800		
108. <i>Calidris temminckii</i> (Leisler) Temminck's Stint	417	+	-	-	+	-	-	-	-	-	-	-	-	WV	AqA	-460		
Family ROSTRATULIDAE																		
109. <i>Rostratula benghalensis</i> (Linnaeus) Greater Painted-Snipe	429	+	-	-	+	-	-	-	-	-	-	-	-	R	AqA & VgM	-1800		
Family RECURVIROSTRIDAE																		
110. <i>Ibidorhyncha struthersii</i> Vigors Ibisbill	433	-	-	-	+	-	-	-	-	-	-	-	-	R	I & AqA	700-4400		

Table contd.

Taxon	Districts												Status	Food Habit	Altitudinal Range (Mts.)	
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan				Una
		1	2	3	4	5	6	7	8	9	10	11				12
Family BURHINIDAE																
111. <i>Burhinus oedicnemus</i> (Linnaeus) Stone-Curlew	436	+	-	-	+	-	-	-	-	-	-	-	-	R/LM	OM	460-1000
112. <i>Esacus recurvirostris</i> (Cuvier) Great Stone-Plover	438	+	-	-	+	-	-	-	-	-	-	-	-	R/SM	AqA	-460
Family GLAREOLIDAE																
113. <i>Glareola lactea</i> Temminck Small Pratincole	444	+	-	+	+	-	-	-	-	-	-	-	-	R/LM	I	460-1800
Family LARIDAE																
114. <i>Larus cachinnans</i> Pontoppidan Yellow-legged Gull	450	-	-	-	+	-	-	-	-	-	-	-	-	WV	AqA (Fish)	-460
115. <i>Larus ichthyaetus</i> Pallas Pallas's Gull	453	+	-	-	+	-	-	-	-	-	-	-	-	WV	AqA (Fish)	-460
116. <i>Larus brunnicephalus</i> Jerdon Brown-headed Gull	454	+	-	-	+	-	-	-	-	-	-	-	-	WV	AqA (Fish)	-460
117. <i>Larus ridibundus</i> Linnaeus Black-headed Gull	455	+	-	-	+	-	-	-	-	-	-	-	-	WV	AqA (Fish)	-460
118. <i>Sterna aurantia</i> J.E. Gray Indian River Tern	463	+	-	+	+	-	-	-	-	-	+	-	-	R	AqA	-550

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
119. <i>Sterna acuticauda</i> J.E. Gray Black-bellied Tern Order COLUMBIFORMES Family PTEROCLIDIDAE	470	+	-	-	+	-	-	-	-	-	+	-	-	R/LM	AqA (Fish)	-550
120. <i>Syrrhaptes tibetanus</i> Gould Tibetan Sandgrouse Family COLUMBIDAE	485	-	-	-	-	-	-	+	-	-	-	-	-	R/SM	VgM	4200-5400
121. <i>Treron sphenura</i> (Vigors) Wedge-tailed Green-Pigeon	494	-	+	-	-	-	+	-	-	+	-	-	-	R/SV	FR	460-2500
122. <i>Treron phoenicoptera</i> (Latham) Yellow-legged Green-Pigeon	503	+	-	+	+	-	-	-	-	+	+	+	+	R/LM	FR	460-1200
123. <i>Columba leuconota</i> Vigors West Himalayan Snow Pigeon	513	-	+	-	-	+	-	+	-	+	-	-	-	R (Him)	VgM	3000-5000
124. <i>Columba rupestris</i> Pallas Turkestan Hill Pigeon	515	-	-	-	-	-	-	+	-	-	-	-	-	R (Him)	VgM	3000-5000
125. <i>Columba livia</i> Gmelin Blue Rock Pigeon	516, 517	+	+	+	+	-	-	+	+	+	+	+	+	R/SM	GR	460-3300
126. <i>Columba palumbus</i> Linnaeus Common Wood-Pigeon	519	-	-	-	-	-	-	-	-	-	-	+	-	R/SM	GR	1500-3000

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
127. <i>Columba hodgsonii</i> Vigors Speckled Wood-Pigeon	520	-	-	-	-	-	+	-	-	-	-	-	-	R/SM	FR	-2500
128. <i>Macropygia unchall</i> (Wagler) Barred Cuckoo-Dove	526	-	-	-	-	-	-	-	-	+	-	-	-	R	GR	-2700
129. <i>Streptopelia orientalis</i> (Latham) Oriental Turtle-Dove	531	-	+	-	-	-	+	-	+	+	-	+	-	R/SM	GR	-4000
130. <i>Streptopelia decaocto</i> (Frivaldsky) Eurasian Collared-Dove	534	+	+	+	+	-	-	-	+	+	+	+	+	R/SM	GR	-2400
131. <i>Streptopelia tranquebarica</i> (Hermann) Red Collared-Dove	535	+	-	+	+	-	-	-	-	-	+	-	+	R/LM	GR	-800
132. <i>Streptopelia chinensis</i> (Scopoli) Spotted Dove	537	+	-	+	+	-	-	+	+	+	+	+	+	R/LM	GR	-2400
133. <i>Streptopelia senegalensis</i> (Linnaeus) Little Brown or Senegal Dove	541	+	-	+	-	-	-	-	-	-	+	+	+	R	GR	-1000
134. <i>Chalcophaps indica</i> (Linnaeus) Emerald or Bronzewinged Dove	542	-	-	-	-	-	-	-	-	-	-	+	-	R/LM	GR	-1800
Order PSITTACIFORMES																
Family PSITTACIDAE																
135. <i>Psittacula euptria</i> (Linnaeus) Alexandrine Parakeet	545	+		+	-	-		-	-	-	+	+	+	R/LM	FR	460-1600

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
136. <i>Psittacula krameri</i> (Scopoli) Northern Rose-ringed Parakeet	549	+	-	+	+	-	-	-	-	-	+	+	+	R/LM	FR	-1600
137. <i>Psittacula cyanocephala</i> (Linnaeus) Plum-headed Parakeet	557	+	-	+	+	-	+	-	-	-	+	+	+	R/LM	FR	-1500
138. <i>Psittacula himalayana</i> (Lesson) Himalayan Slaty-headed Parakeet	562	-	+	-	+	+	+	-	+	+	+	+	-	R (Him)	FR	600-2500
Order CUCULIFORMES Family CUCULIDAE																
139. <i>Clamator jacobinus</i> (Boddaert) Pied Crested Cuckoo	570	-	+	+	+	-	+	+	-	+	+	+	-	SV	I	460-3800
140. <i>Hierococcyx sparverioides</i> (Vigors) Large Hawk-Cuckoo	572	-	-	-	+	-	-	-	-	+	-	+	-	SV	I	900-2700
141. <i>Hierococcyx varius</i> (Vahl.) Common Hawk-Cuckoo	573	+	-	+	+	-	-	-	+	+	+	+	+	R/LM	I	-1000
142. <i>Cuculus micropterus</i> Gould Indian Cuckoo	576	+	-	+	+	-	-	-	-	-	+	+	+	R/SM	I	-1000
143. <i>Cuculus canorus</i> Linnaeus Common Cuckoo	578	+	-	+	+	-	-	-	-	-	-	+	-	R/SM	I	600-1400
144. <i>Cuculus saturatus</i> Blyth Himalayan Cuckoo	580	-	-	-	-	-	+	-	+	+	-	-	-	SV	I	1500-3300

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
145. <i>Cuculus poliocephalus</i> Latham Lesser Cuckoo	581	-	-	-	+	-	-	-	-	+	-	+	-	SV	I	1500-3300
146. <i>Cacomantis merulinus</i> (Scopoli) Rufous-bellied Plaintive Cuckoo	585	-	-	-	+	-	+	-	-	+	-	+	-	R/LM	I	-2700
147. <i>Surniculus lugubris</i> (Horsfield) Drongo-Cuckoo	588	-	-	+	+	-	-	-	-	-	-	-	-	R/LM	I	2700
148. <i>Eudynamis scolopacea</i> (Linnaeus) Asian Koel	590	+	+	+	+	-	-	-	-	+	+	+	+	R/LM	FR	-1800
149. <i>Phaenicophaeus leschenaultii</i> (Lesson) Sirkeer Malkoha	596	+	-	+	+	-	-	-	+	-	+	+	+	R	I	-2100
150. <i>Centropus sinensis</i> (Stephens) Greater Coucal	600	+	-	+	+	-	-	-	-	-	+	+	+	R/LM	CR	-2100
Order STRIGIFORMES																
Family STRIGIDAE																
151. <i>Otus spilocephalus</i> (Blyth) Western Spotted Scops-Owl	611	-	-	+	+	-	-	-	-	+	-	-	-	R	I	600-2600
152. <i>Otus scops</i> (Linnaeus) Eurasian Scops-Owl	615	-	-	+	+	-	-	-	-	-	-	-	-	R	I & CR	-1500
153. <i>Otus bakkamoena</i> Pennant Punjab Collared Scops-Owl	619	+	-	+	-	-	-	-	-	+	-	-	+	R	I	900-2700

Table contd.

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
154. <i>Bubo bubo</i> (Linnaeus) Himalayan or Eurasian Eagle-Owl	626, 627	-	+	-	+	+	+	+	+	+	+	+	-	R (Him)	CR	2000-4200		
155. <i>Ketupa flavipes</i> (Hodgson) Twany Fish Owl	633	+	-	-	+	-	-	-	-	-	-	-	-	R	CR	-1800		
156. <i>Glaucidium brodiei</i> (Burton) Collared Owlet	635	-	-	-	+	-	-	-	-	+	-	-	-	R (Him)	CR	-3200		
157. <i>Glaucidium radiatum</i> (Tickell) Jungle Owlet	636	-	+	+	+	-	-	-	-	-	-	+	-	R (Him)	I, CR	460-2000		
158. <i>Glaucidium cuculoides</i> (Vigors) Asian Barred Owlet	639	+	-	-	-	-	-	-	+	+	-	-	-	R/SM	I, CR	-2700		
159. <i>Athene brama</i> (Temminck) Northern Spotted Owlet	650	+	-	+	+	-	-	-	-	-	+	+	+	R	I, CR	-1400		
160. <i>Strix leptogrammica</i> Temminck Himalayan Brown Wood-Owl	658	-	-	-	-	-	+	-	+	+	-	-	-	R/SM	CR	750-2400		
161. <i>Strix aluco</i> Linnaeus Himalayan or Twany Wood-Owl	662	-	-	-	-	-	+	-	+	+	-	-	-	R (Him)	CR	1200-4250		
162. <i>Asio otus</i> (Linnaeus) Long-eared Owl	663	-	+	-	-	-	-	+	-	-	-	-	-	SV	CR	460-3800		
163. <i>Aegolius funereus</i> (Linnaeus) Tengmalm's Owl	665	-	-	-	-	-	-	+	-	-	-	-	-	R/SM	CR	-4000		

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Order CAPRIMULGIFORMES																	
Family CAPRIMULGIDAE																	
164. <i>Caprimulgus indicus</i> Latham Himalayan Jungle Nightjar	670	+	-	+	+	-	-	-	-	+	+	+	+	R (Him)	I	460-3300	
165. <i>Caprimulgus macrurus</i> Horsfield Larg-tailed Nightjar	675	+	-	+	+	-	-	-	-	-	+	+	-	R/SM	I	-1800	
166. <i>Caprimulgus affinis</i> Horsfield Franklin's Nightjar	682	-	-		+	-			-	+				R (Him)	I	1800-2400	
Order APODIFORMES																	
Family APODIDAE																	
167. <i>Collocalia brevirostris</i> (Horsfield) Himalayan Swiftlet	683	-	+	-	+	-	+		-	-		-	-	R (Him)	I	-3600	
168. <i>Tachymarptis melba</i> (Linnaeus) Alpine Swift	694	+	+	+	-	-	-		-	+	+	+	+	R/LM	I	460-3600	
169. <i>Apus pacificus</i> (Latham) Himalayan White-rumped Swift	700	+	-	+	+	-	-		-	+	-	-	+	R (Him)	I	600-3600	
170. <i>Apus affinis</i> (J.E. Gray) House Swift	703	+		+	+	-	-			+	+	+	+	R	I	-2000	

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Simour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
<b>Order CORACIIFORMES</b>																		
<b>Family ALCEDINIDAE</b>																		
171. <i>Megaceryle lugubris</i> (Temminck) West Himalayan Pied Kingfisher	717	+	+	+	+	-	-	-	-	-	-	+	+	R (Him)	AqA (Fish)	460-2000		
172. <i>Ceryle rudis</i> (Linnaeus) Lesser Pied Kingfisher	719	+	-	-	+	-	-	-	-	-	+	-	+	R	AqA (Fish)	-1800		
173. <i>Alcedo atthis</i> (Linnaeus) Small Blue Kingfisher	722	+	-	+	+	-	+	+	+	-	+	+	+	R/LM	AqA	400-3800		
174. <i>Halcyon smyrnensis</i> (Linnaeus) White-breasted Kingfisher	736	+	+	+	+	-	-	-	+	-	+	+	+	R/LM	AqA	-1000		
<b>Family MEROPIDAE</b>																		
175. <i>Merops apiaster</i> Linnaeus European Bee-eater	746	-	+	-	-	-	+	-	+	+	-	-	-	WV/SM	I	900-2100		
176. <i>Merops orientalis</i> Latham Small Bee-eater	750	+	+	+	+	-	-	-	+	-	+	+	+	R/SM	I	-1500		
177. <i>Nyctyornis athertoni</i> (Jerdine & Selby) Blue-bearded Bee-eater	753	-	-	-	-	-	-	-	-	+	-	-	-	R/SM	I	460-1700		
<b>Family CORACIIDAE</b>																		
178. <i>Coracias benghalensis</i> (Linnaeus) Northern Roller	755	+	-	+	+	-	-	-	-	-	+	+	+	R/SM	I	400-1500		

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Family UPUPIDAE																
179. <i>Upupa epops</i> Linnaeus Common Hoopoe	763	+	-	+	+	+	-	-	+	+	+	+	+	SV	I	400-4600
Family BUCEROTIDAE																
180. <i>Ocyrceros birostris</i> (Scopoli) Indian Grey Hornbill	767	+	-	+	+		-				+	+	+	R/LM	FR	400-1000
Order PICIFORMES																
Family CAPITONIDAE																
181. <i>Megalaima virens</i> (Boddaert) Himalayan Great Barbet	777	-	+	-	+		+		+	+		+	-	R (Him)	FR, I	1000-3000
182. <i>Megalaima zeylanica</i> (Gmelin) Brown-headed Barbet	780	+	+	+	+		+		+	-	+	+	+	R	FR	400-800
183. <i>Megalaima asiatica</i> (Latham) Blue-throated Barbet	788	+	+	+	+	-		-	+	+	+	+	+	R	FR	400-2000
184. <i>Megalaima haemacephala</i> (P.L.S. Muller) Coppersmith Barbet	792	+	-	+	+	-	-		+	-	+	+	+	R	FR	400-2000
Family PICIDAE																
185. <i>Jynx torquilla</i> Linnaeus Eurasian Wryneck	797a	-	-		+		+	-	+	-				SM	I	1500-3300

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
186. <i>Picumus innominatus</i> Burton Northern Speckled Piculet	798	-	-	-	+	-	-	-	+	-	-	-	-	R	I	460-2000
187. <i>Picus squamatus</i> Vigors Himalayan Scaly-bellied Green Woodpecker	807	+	+	+	+	+	+	+	+	+	+	+	-	R (Him)	I	1000-3300
188. <i>Picus canus</i> Gmelin Black-naped Green Woodpecker	809	-	+	-	+	-	+	-	+	+	-	+	-	R (Him)	I	460-2400
189. <i>Picus chlorolophus</i> Vieillot West Himalayan Small Yellow-naped Woodpecker	814	-	-	-	+	-	-	-	+	-	+	-	-	R (Him)	I	460-2100
190. <i>Dinopium benghalense</i> (Linnaeus) Northern Golden-backed Woodpecker	819	-	-	+	+	-	-	-	-	-	-	+	+	R	I	460-1800
191. <i>Mulleripicus pulverulentus</i> (Temminck) Himalayan Great Slaty Woodpecker	828	-	-	-	-	-	-	-	+	+	-	-	-	R/SM	I	-2000
192. <i>Dendrocopos hyperythrus</i> (Vigors) Western Rufous-bellied Woodpecker	832	-	-	-	+	-	-	-	+	+	-	-	-	SM	I	-1600
193. <i>Dendrocopos himalayensis</i> (Jerdine & Selby) Himalayan Pied Woodpecker	836	-	+	-	+	+	+	-	-	+	-	+	-	R (Him)	I	1700-3300
194. <i>Dendrocopos auriceps</i> (Vigors) West Himalayan Brown-fronted Pied Woodpecker	842	-	+	-	+	-	+	-	+	+	-	+	-	R (Him)	I	-3300

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
195. <i>Dendrocopos macei</i> (Vieillot) Fulvous-breasted Pied Woodpecker	845	-	-	-	+	-	-	-	-	+	+	+	-	R	I	460-2000
196. <i>Dendrocopos mahrattensis</i> (Latham) Yellow-fronted Pied Woodpecker	847	+	+	+	+	-	+	-	+	+	+	+	+	R/SM	I	400-1300
197. <i>Dendrocopos canicapillus</i> (Blyth) West Himalayan Pied Woodpecker or Grey-capped Pygmy Woodpecker	848		+		+	-	+	-	+	+	+	+		R (Him)	I	460-1700
Order PASSERIFORMES Family PITTIDAE																
198. <i>Pitta brachyura</i> (Linnaeus) Indian Pitta	867		-	-	+			-			+	-		R/SM	I	460-1700
Family ALAUDIDAE																
199. <i>Mirafra cantillans</i> Blyth Singing Bush Lark	872	-	-	-	+	-				-			+	R	GR	-460
200. <i>Eremopterix grisea</i> (Scopoli) Ashy-crowned Sparrow-Lark	878	-	-	-	+	-	-	-	-		+	-	+	R/LM	GR	460-1000
201. <i>Calandrella brachydactyla</i> (Leisler) Greater Short-toed Lark	886	-	-	-	+	-	-	-	-	-	+	-	+	WV	GR	-800
202. <i>Calandrella acutirostris</i> Hume Hume's Short-toed Lark	887	-	-	-				+						SM	GR, I	-3400

Table contd.

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
203. <i>Eremophila alpestris</i> (Linnaeus) Horned Lark	896	-	-	-	-	-	+	+	-	-	-	-	-	R/SM	GR, I	3500-4000		
204. <i>Galerida cristata</i> (Linnaeus) Common Crested Lark	899	+	-	-	+	-	-	-	-	-	+	-	+	R/LM	GR, I	-460		
205. <i>Alauda arvensis</i> Linnaeus Eurasian Skylark	903	-	-	-	+	-	-	-	-	-	+	-	+	WV	GR, I	1500-3000		
206. <i>Alauda gulgula</i> Franklin Kashmir or Eastern Skylark	905	+	-	+	+	-	-	+	+	+	-	-	+	R/SM	GR	600-4300		
Family HIRUNDINIDAE																		
207. <i>Riparia riparia</i> (Linnaeus) Sand Martin	911	-	+	-	-	-	-	-	-	-	-	-	-	SM	I	-4500		
208. <i>Hirundo rupestris</i> Scopoli Eurasian Crag-Martin	913	-	+	-	-	+	+	-	+	-	-	-	-	SM	I	1600-5000		
209. <i>Hirundo rustica</i> Linnaeus Western Swallow	916	-	+	+	+	-	+	-	-	+	+	+	+	SV	I	460-3000		
210. <i>Hirundo smithii</i> Leach Wire-tailed Swallow	921	+	-	+	+	-	-	-	+	+	+	+	+	SV	I	460-1500		
211. <i>Hirundo flavicola</i> Blyth Streak-throated Swallow	922	-	-	-	+	-	-	-	-	-	-	-	-	SV	I	-700		

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
212. <i>Hirundo daurica</i> Linnaeus Himalayan Striated or Red-rumped Swallow	924, 925	-	+	+	-	+	-	+	+	+	+	+		SV	I	1000-3300
213. <i>Delichon urbica</i> (Linnaeus) Northern House-Martin	930	+	-	-	-	-	-	-	-	+	+	+		R/LM	I	1500-5000
Family LANIIDAE																
214. <i>Lanius vittatus</i> Valenciennes Bay-backed Shrike	940	-	-	+	+	-	-	-	+	-	-	+		R/SM	CR	460-2000
215. <i>Lanius tephronotus</i> (Vigors) Ladhakh Grey-backed Shrike	944	-	+	-	-	-	+	+	-	-	-	-		R/SM	I	2700-3000
216. <i>Lanius schach</i> Linnaeus Rufous-backed Shrike	946	+	+	+	+	+	-	-	-	+	+	+		SV	CR	460-3000
Family ORIOLIDAE																
217. <i>Oriolus oriolus</i> (Linnaeus) Eurasian Golden Oriole	953	+	+	+	+	+	-	-	-	+	+	+		SV/R	FR	460-2000
218. <i>Oriolus xanthornus</i> (Linnaeus) North Indian Black-headed Oriole	958	-	-	-	+	-	-	-	-	+	-	+		R/LM	FR	-1200
219. <i>Oriolus traillii</i> (Vigors) Maroon Oriole	961	-	-	-	+	-	-	-	-	-	-	-		R/LM	FR	460-2400

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Simour	Solan	Una				
		1	2	3	4	5	6	7	8	9	10	11	12	13			
<b>Family DICRURIDAE</b>																	
220. <i>Dicrurus macrocercus</i> (Vieillot) North Indian Black Drongo	962	+	+	+	+	-	-	-	+	+	+	+	+	R/LM	I	400-2100	
221. <i>Dicrurus leucophaeus</i> Vieillot Ashy Drongo	965	-	-	-	+	-	-	-	-	-	-	+	-	SM	I	460-3300	
222. <i>Dicrurus caerulescens</i> (Linnaeus) White-bellied Drongo	967	-	-	-	+	-	-	-	-	+	-	-	-	R/SM	I	-1800	
223. <i>Dicrurus hottentottus</i> (Linnaeus) Spangled Drongo	973	-	-	-	-	-	-	-	-	-	+	+	-	R/SM	I	-1500	
<b>Family ARTAMIDAE</b>																	
224. <i>Artamus fuscus</i> Vieillot Ashy Woodswallow	982	-	-	-	+	-	-	-	-	+	-	-	-	R/SM	I	-1700	
<b>Family STURNIDAE</b>																	
225. <i>Saroglossa spiloptera</i> (Vigors) Spot-Winged Starling	984	-	-	-	-	-	-	-	+	+	-	-	-	SM	OM	-2000	
226. <i>Sturnus malabaricus</i> (Gmelin) Grey-headed Starling	987	-	-	-	-	-	-	-	-	+	-	+	-	R/SM	OM	-500	
227. <i>Sturnus pagodarum</i> (Gmelin) Brahminy Starling	994	+	+	+	+	+	-	-	-	+	+	+	+	R/SM	FR	-2400	

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
228. <i>Sturnus vulgaris</i> Linnaeus Common Starling	999	-	-	-	+	-	-	-	-	-	-	-	-	WV	OM	-550	
229. <i>Sturnus contra</i> Linnaeus Asian Pied Starling	1002	-	-	-	+	-	-	-	-	+	-	-	R/LM	OM	-700		
230. <i>Acridotheres tristis</i> (Linnaeus) Indian Myna	1006	+	+	+	+	-	+	+	+	+	+	+	R	OM	-3000		
231. <i>Acridotheres ginginianus</i> (Latham) Bank Myna	1008	+	-	+	+	-	-	-	-	+	-	+	R/LM	OM	-800		
232. <i>Acridotheres fuscus</i> (Wagler) Northern Jungle Myna	1009	+	+	+	+	-	-	+	-	+	+	+	R/LM	OM	-2100		
Family CORVIDAE																	
233. <i>Garrulus glandarius</i> (Linnaeus) West Himalayan or Eurasian Jay	1020	-	-	-	-	+	-	+	+	-	-	-	R (Him)	OM	1500-2500		
234. <i>Garrulus lanceolatus</i> Vigors Black-headed Jay	1022	-	-	-	-	+	-	+	+	-	+		R (Him)	OM	1500-2500		
235. <i>Urocissa flavirostris</i> (Blyth) Western Yellow-billed Blue Magpie	1025	-	+	-	+	+	+	+	+	-	-		R (Him)	OM	1600-2700		
236. <i>Urocissa erythrorhyncha</i> (Boddaert) Himalayan Red-billed Blue Magpie	1027	+		+	+		-		+	+	+	+	R (Him)	OM	1000-2100		
237. <i>Pica pica</i> (Linnaeus) Black-billed Magpie	1029		+			+		+	+			-	R (Him)	OM	1500-4600		

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
238. <i>Dendrocitta vagabunda</i> (Latham) Northwestern Treepie	1030a	+	+	+	+	-	-	-	+	+	+	+	+	R/SM	OM	400-2100
239. <i>Dendrocitta formosae</i> Swinhoe West Himalayan Grey Treepie	1037	-	+	-	+	-	-	-	+	+	+	+	-	R (Him)	OM	600-1800
240. <i>Nucifraga caryocatactes</i> (Linnaeus) Himalayan Spotted Nutcracker	1043	-	+	-	+	+	+	+	-	+	-	-	-	R (Him)	GR	2000-3300
241. <i>Pyrrhonorax graculus</i> (Linnaeus) Himalayan Yellow-billed Cough	1045	-	-	-	-	+	-	+	-	-	-	-	-	R (Him)	I	2700-5500
242. <i>Pyrrhonorax pyrrhonorax</i> (Linnaeus) Himalayan Red-billed Cough	1046	-	-	-	-	-	-	+	-	-	-	-	-	R (Him)	I	2400-3500
243. <i>Corvus splendens</i> Vieillot House Crow	1049	+	+	+	+	-	-	-	+	-	+	+	+	R/SM	OM	-2100
244. <i>Corvus macrorhynchos</i> Wagler Himalayan Jungle Crow	1054	+	+	+	+	+	+	-	+	+	+	+	+	R (Him)	OM	-4500
245. <i>Corvus corax</i> Linnaeus Tibet or Common Raven	1060	-	-	-	-	-	-	+	-	-	-	-	-	R (Him)	OM	4000-5000
Family CAMPEPHAGIDAE																
246. <i>Tephrodornis pondicerianus</i> (Gmelin) Common Woodshrike	1069	+	+	+	+	+	-	+	-	+	+	+	+	R/SM	I	-900
247. <i>Coracina macei</i> (Lesson) Himalayan Large Cuckoo-Shrike	1073	-	-	-	+	-	-	-	-	+	-	-	-	R/SM	I	-1800

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
248. <i>Coracina melaschistos</i> (Hodgson) Black-winged Cuckoo-Shrike	1077	+	+	+	+	-	+		+	+	+	+	+	R/SM	FR, I	-2000	
249. <i>Coracina melanoptera</i> (Ruppell) Himalayan Blackheaded Cuckoo-Shrike	1078	+	-	+	+	-	-	-	-	-	-	-	+	R/LM	I	-1000	
250. <i>Pericrocotus flammeus</i> (Forster) North Indian Scarlet Minivet	1080	-	+	-	+	-	-	-	+	+	+	+	-	R/SM	I	900-1800	
251. <i>Pericrocotus ethologus</i> (Bangs & Phillips) West Himalayan Long-tailed Minivet	1085	+	+	+	+	-	+	-	+	+	+	+	-	SV	I	1500-2400	
252. <i>Pericrocotus roseus</i> (Vieillot) Rosy Minivet	1089	+	-		+	-	-	-		+	+			R/SM	I	600-1800	
253. <i>Pericrocotus cinnamomeus</i> (Linnaeus) Sind Small Minivet	1090	+	+	+	+	-	-	-		+	+	+	+	R/RM	I	-1000	
Family IRENIDAE																	
254. <i>Aegithina tiphia</i> (Linnaeus) Northwestern Iora	1097	+	-	+	+	-	-	-			+	+	+	R/LM	I	460-600	
255. <i>Chloropsis aurifrons</i> (Temminck) Northern Golden-fronted Chloropsis	1103	-	-	-	+	-	-	-	-	+		-	-	R/LM	FR, I	-1800	
256. <i>Chloropsis hardwickii</i> Jardine & Selby Orange-bellied Chloropsis or Leafbird	1106	-	-	-	-	-	-	-		+		-	-	R/SM	I	600-2250	

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Family PYCNONOTIDAE</b>																
257. <i>Pycnonotus melanicterus</i> (Gmelin) Black-crested Bulbul	1115	-	-	-	-	-	-	-	-	+	-	-	-	R/SM	FR, I	460-1800
258. <i>Pycnonotus leucogenys</i> (Gray) Himalayan Bulbul	1125	+	+	+	+	+	+	-	+	+	+	+	+	R (Him)	FR	300-2500
259. <i>Pycnonotus cafer</i> (Linnaeus) Punjab Red-vented Bulbul	1126	+	+	+	+	+	+	-	+	+	+	+	+	R/SM	FR	300-1400
260. <i>Hypsipetes leucocephalus</i> (P.L.S. Muller) Himalayan Black Bulbul	1148	-	+	-	+	-	+	-	+	+	+	+	-	R (Him)	FR	800-2500
<b>Family MUSCICAPIDAE</b>																
<b>Subfamily TIMALIINAE</b>																
261. <i>Pellorneum ruficeps</i> Swainson Western Spotted Babbler	1152	-	-	-	+	-	-	-	-	+	+	+	-	R/LM	I	400-1200
262. <i>Pomatorhinus schisticeps</i> Hodgson West Himalayan or Hodgson's Scimitar-Babbler	1168	-	-	-	+	-	-	-	+	+	+	+	-	R (Him)	I, FR	300-1800
263. <i>Pomatorhinus erythrogegens</i> Vigors West Himalayan Rusty-cheeked Scimitar-Babbler	1181, 1182	+	-	+	+	-	-	-	+	+	+	+	+	R (Him)	I, FR	450-2250

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
264. <i>Pnoepyga albiventer</i> (Hodgson) Western Scaly-breasted Wren-Babbler	1197	-	-	-	+	-	-	-	-	+	-	-	-	R (Him)	I	2400-3600
265. <i>Stachyris pyrrhops</i> Blyth Black-chinned (Red-billed) Babbler	1211	-	-	-	+	-	-	-	-	+	-	-	-	R (Him)	I	750-2400
266. <i>Dumetia hyperythra</i> (Franklin) Rufous-bellied Babbler	1222		-	-	+	-	-	-	+	+	-	-	-	R (Him)	I	300-1900
267. <i>Chrysomma sinense</i> (Gmelin) Western Yellow-eyed Babbler	1230	+	+	+	+	-	+	+	+	+	+	+	+	R/SM	I	300-1200
268. <i>Turdoides caudatus</i> (Dumont) Common Babbler	1254	+	-	+	+	-	-	-	-		+	+	+	R	I	-2100
269. <i>Turdoides earlei</i> (Blyth) Western Straited Babbler	1255		-	-	+	-	-	-	-	-	+	-		R	I	-600
270. <i>Turdoides striatus</i> (Dumont) Sind Jungle Babbler	1261	+	-	+	+	-		-	+	+	+	+	+	R	I	300-1800
271. <i>Garrulax albogularis</i> (Gould) Western White-throated Laughingthrush	1273	-	-	-	-	-	-	-	+	+	-	-	-	R (Him)	I	1200-2900
272. <i>Garrulax striatus</i> (Vigors) Western Straited Laughingthrush	1279		-	-	-	-	+	-	+	+		+	-	R (Him)	I	1200-2700
273. <i>Garrulax leucolophus</i> (Hardwicke) Himalayan White-crested Laughingthrush	1283	-	+		+	-	-		+	+		+		R (Him)	I	300-2100

Table contd.

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
274. <i>Garrulax variegatus</i> (Vigors) Western Variegated Laughingthrush	1289	-	+	-	+	-	-	+	-	+	-	+	-	R (Him)	I, FR	1200-3300		
275. <i>Garrulax rufogularis</i> (Gould) Western Rufous-chinned Laughingthrush	1292, 1293	-	-	-	+	-	-	-	-	+	-	-	-	R (Him)	I	600-1800		
276. <i>Garrulax lineatus</i> (Vigors) Simla Streaked Laughingthrush	1314	+	+	+	+	-	+	+	+	+	+	+	+	R (Him)	I	1000-3000		
277. <i>Garrulax erythrocephalus</i> (Vigors) Red-headed Laughingthrush	1324	-	+	-	-	-	-	-	-	+	-	-	-	R (Him)	OM	700-3300		
278. <i>Leiothrix lutea</i> (Scopoli) Western Red-billed Leiothrix	1335	-	+	-	+	-	-	-	-	+	+	+	-	R (Him)	I	1000-2400		
279. <i>Pteruthius flaviscapis</i> (Temminck) Red-winged Shrike-Babbler	1341	+	-	+	+	-	-	-	-	+	-	-	-	R (Him)	I	1200-2500		
280. <i>Minla strigula</i> (Hodgson) Western Bar-throated Minla	1358	-	-	-	+	-	+	-	+	+	-	-	-	R (Him)	I	1300-3600		
281. <i>Yuhina flavicollis</i> Hodgson Western Yellow-naped Yuhina	1367	-	+	-	+	-	-	-	-	+	-	-	-	R (Him)	I	1200-3000		
282. <i>Alcippe vinipectus</i> (Hodgson) Western White-browed Tit-Babbler	1380	-	+	-	+	-	-	-	-	+	-	-	-	R (Him)	I	1500-3000		
283. <i>Heterophasia capistrata</i> (Vigors) Western Rufous Sibia	1396	+	+	+	+	-	+	-	+	+	-	+	-	R (Him)	I	1200-2700		

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Subfamily MUSCICAPINAE																
284. <i>Muscicapa sibirica</i> Gmelin Kashmir Sooty Flycatcher	1405	+	+	+	+	-	-	+	-	-	+	+	+	WR&SM	I	1200-3900
285. <i>Muscicapa daurica</i> Pallas Asian Brown Flycatcher	1407	-	+	-	+	-	+		+	+	-	+	-	SV	I	900-2000
286. <i>Muscicapa ruficauda</i> Swainson Rufous-tailed Flycatcher	1409	-	+	-	-	-	+	+	+	+	-		-	SV	I	2100-3600
287. <i>Ficedula parva</i> (Bechstein) Western Red-throated Flycatcher	1411	-	+	-	+	-		-	-					WV	I	300-1200
288. <i>Ficedula subrubra</i> (Hartert & Steinbacher) Kashmir Flycatcher	1413	-	-	-	+		-	-	-		-	-	-	R/SM	I	750-2400
289. <i>Ficedula strophciata</i> (Hodgson) Orange-gorgeted Flycatcher	1414		-	-	+	-	+				-			R/SM	I	1200-3600
290. <i>Ficedula superciliaris</i> (Jerdon) Ultramarine Flycatcher	1421	-	+	-	+	+	+	-	+	+	-	+	-	SV	I	1800-3000
291. <i>Ficedula tricolor</i> (Hodgson) Western Slaty-Blue Flycatcher	1423	-	+	-	+	-	-	-	-	+	-	-		R/SM	I	1800-3300
292. <i>Niltava sundara</i> (Hodgson) Western Rufous-bellied Niltava	1431	-	-	-	+	-		-	-	+	-		-	R (Him)	I	350-2700
293. <i>Cyornis rubeculoides</i> (Vigors) Blue-throated Flycatcher	1440		+	-										SV	I	300-1800

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
294. <i>Eumyias thalassina</i> (Swainson) Verditer Flycatcher	1445	+	+	+	+	-	-	-	-	+	+	+	+	WR/SV	I	350-3000
295. <i>Culicicapa ceylonensis</i> (Swainson) Northern Grey-headed Flycatcher	1448	+	-	+	+	-	-	-	+	+	+	+	+	WR/SV	I	300-2700
Subfamily RHIPIDURINAE																
296. <i>Rhipidura hypoxantha</i> Blyth Yellow-bellied Fantail-Flycatcher	1450	+	-	+	+	-	+	-	-	-	+	+	+	WR/SM	I	300-3600
297. <i>Rhipidura aureola</i> Lesson Northern White-browed Fantail-Flycatcher	1451	+	-	+	+	-	-	-	-	-	+	+	+	R/LM	I	300-1000
298. <i>Rhipidura albicollis</i> (Vieillot) Western White-throated Fantail-Flycatcher	1454	+	-	+	+	-	-	+	+	-	+	+	+	WR&SM	I	300-3000
Subfamily MONARCHINAE																
299. <i>Terpsiphone paradisi</i> (Linnaeus) West Himalayan Paradise-Flycatcher	1460	+	+	+	+	-	+	-	-	+	+	+	+	WR/SV	I	300-3100
Subfamily SYLVIINAE																
300. <i>Tesia castaneocoronata</i> (Burton) Chesnut-headed Tesia	1473	-	-	-	+	-	+	-	+	+	-	-	-	R (Him)	I	300-3300
301. <i>Cettia fortipes</i> (Horsfield) Brown-flanked Bush-Warbler	1477	+	+	+	+	-	-	-	-	+	+	+	+	WR&SM	I	300-3000

Table contd.

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
302. <i>Cettia brunnifrons</i> (Hodgson) Grey-sided Bush-Warbler	1485	-	-	-	-	-	-	-	+	-	-	-	SM	I	300-3300			
303. <i>Bradypterus thorocicus</i> (Blyth) Western Spotted Bush-Warbler	1489	-	-	-	-	-	-	-	+	-	-	-	SM	I	300-3500			
304. <i>Prinia hodgsonii</i> Blyth Franklin's Prinia	1502	+	-	+	+	-	-	-	+	+	+	+	R/SM /WR	I	300-1600			
305. <i>Prinia inornata</i> Sykes Northwestern Plain Prinia	1510	-	-	-	+	-	-	-	-	-	-	-	R/SM	I	300-800			
306. <i>Prinia socialis</i> Sykes Northern Ashy Prinia	1515	-	-	-	+	-	-	-	-	-	+	-	R/LM	I	300-1200			
307. <i>Prinia sylvatica</i> Jerdon Jungle Prinia	1519	-	-	-	+	-	-	-	-	-	-	-	R/LM	I	300-1000			
308. <i>Prinia crinigera</i> Hodgson Himalayan Brown Prinia	1527	-	+	-	+	-	-	+	+	-	+	-	R (Him)	I	600-3100			
309. <i>Orthotomus sutorius</i> (Pennant) Tailor Bird	1535	+	+	+	+	-	+	+	+	+	+	+	R & SM	I	300-1800			
310. <i>Locustella naevia</i> (Boddaert) Pale Grasshopper-Warbler	1545	-	-	+	+	-	-	-	+	-	-	-	WV/PM	I	300-2100			
311. <i>Acrocephalus dumetorum</i> Blyth Blyth's Reed-Warbler	1556	+	-	-	-	-	-	-	-	-	-	-	WV	I	300-1300			
312. <i>Acrocephalus agricola</i> (Jerdon) Paddyfield Warbler	1557	+	-	-	-	-	-	-	-	-	-	-	WV	I	300-600			

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
		1	2	3	4	5	6	7	8	9	10	11	12	13			
313. <i>Acrocephalus stentoreus</i> (Hemprich & Ehrenberg) Indian Great Reed-Warbler	1550	-	-	-	+	-	-	-	-	+	-	-	-	WV	I	300-1500	
314. <i>Sylvia curruca</i> (Linnaeus) Lesser Whitethroat	1567	-	-	-	+	-	-	+	-	-	-	-	-	WV or PM	I	300-4000	
315. <i>Phylloscopus collybita</i> (Vieillot) Brown Chiflchaff	1575	+	+	+	+	-	+	-	+	+	+	+	+	WV	I	900-2100	
316. <i>Phylloscopus neglectus</i> Hume Plain Leaf-Warbler	1577	+	-	+	+	-	-	-	-	-	+	-	-	WV	I	300-900	
317. <i>Phylloscopus affinis</i> (Tickell) Tickell's Leaf-Warbler	1579	-	+	-	+	-	-	+	-	-	-	-	-	SV	I	1000-4500	
318. <i>Phylloscopus griseolus</i> Blyth Olivaceous Leaf-Warbler	1581	-	-	-	-	-	-	+	-	-	-	-	-	SV	I	2400-4500	
319. <i>Phylloscopus pulcher</i> Blyth Western Orange-barrred Leaf-Warbler	1587	-	-	-	+	-	-	-	-	+	-	-	-	R/SM	I	800-3900	
320. <i>Phylloscopus inornatus</i> (Blyth) Yellow-browed Leaf-Warbler	1592	+	+	-	+	-	-	-	-	+	-	+	+	WR or SV	I	2100-3600	
321. <i>Phylloscopus subviridis</i> (Brooks) Brooks's Leaf-Warbler	1593	-	-	-	-	-	-	-	-	+	-	-	-	WV	I	300-1800	
322. <i>Phylloscopus chloronotus</i> (G.R. Gray & J.E. Gray) Western Pallas's Leaf-Warbler	1594	+	+	+	+	-	-	-	-	+	-	+	+	R/SM or WR	I	300-3000	

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
323. <i>Phylloscopus maculipennis</i> (Blyth) Western Grey-faced Leaf-Warbler	1597	-	-	-	+	-	-	-	-	-	-	-	-	R/SM	I	300-600
324. <i>Phylloscopus trochiloides</i> (Sundevall) Western Greenish Leaf-Warbler	1602	-	+	-	-	-	+	-	+	+	-	-	-	SV	I	2700-3700
325. <i>Phylloscopus reguloides</i> (Blyth) Blyth's Leaf-Warbler	1608	-	+	-	-	-	-	-	-	+	-	-	-	SV	I	2400-3300
326. <i>Seicercus burkii</i> (Burton) Gold-spectacled Flycatcher-Warbler	1615		+	+	+	-		-		+	-	-	-	SV	I	800-3000
327. <i>Seicercus xanthoschistos</i> (G.R. Gray & J.E. Gray) Western Greyheaded Flycatcher-Warbler	1616	+	+	+	+	-	+		+	+	+	+	+	R (Him)	I	900-2700
328. <i>Regulus regulus</i> (Linnaeus) Himalayan Goldcrest	1629	-	-	-	-	-				+	-	-	-	R (Him)	I	1500-3600
Subfamily TURDINAE																
329. <i>Luscinia svecica</i> (Linnaeus) Northern Bluethroat	1644	-	-	-	+	-	-	-	-	-	-	-	-	WV	I	350-700
330. <i>Luscinia pectoralis</i> (Gould) Himalayan Rubythroat	1647	-	+	-	-	-	-	+	-	+	-	-	-	SV	I	2700-4500
331. <i>Luscinia brunnea</i> (Hodgson) Indian Blue Robin	1650, 1651	-	-	-	-	-	-	-	-	+	-	-	-	SV	I	1600-3300
332. <i>Tarsiger cyanurus</i> (Pallas) Kashmir Orange-flanked Bush-Robin	1654			-	-	+	-		-	+				R/SM	I	1200-3600

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
		1	2	3	4	5	6	7	8	9	10	11	12	13			
333. <i>Tarsiger chrysaeus</i> (Hodgson) Western Golden Bush-Robin	1657	-	-	-	-	-	-	-	-	+	-	-	-	R/SM	I	1200-3600	
334. <i>Copsychus saularis</i> (Linnaeus) Oriental Magpie Robin	1661	+	+	+	+	-	-	-	+	+	+	+	+	R or SV	I	300-2000	
335. <i>Phoenicurus erythronotus</i> (Eversmann) Eversmann's Redstart	1669	-	-	-	-	-	+	-	+	+	-	-	-	WV	I	300-2100	
336. <i>Phoenicurus caeruleocephalus</i> (Vigors) Blue-capped Redstart	1670	+	-	-	-	-	-	-	-	+	-	+	+	R/SM or WR	I	1000-3900	
337. <i>Phoenicurus ochruros</i> (Gmelin) Kashmir Black Redstart	1671	+	+	+	+	+	-	+	-	+	+	+	+	SV or WR	I	1000-4800	
338. <i>Phoenicurus frontalis</i> (Vigors) Blue-fronted Redstart	1675	-	+	-	+	-	-	+	-	-	-	-	-	R/SM	I	1000-4500	
339. <i>Phoenicurus erythrogaster</i> (Guldenstadt) Guldenstadt's Redstart	1678	-	+	-	+	-	+	-	+	+	-	-	-	R/SM	I	900-5200	
340. <i>Rhyacornis fuliginosus</i> (Vigors) Plumbeous Redstart	1679	+	+	+	+	+	+	-	+	+	+	+	+	R/SM	I	900-3900	
341. <i>Grandala coelicolor</i> Hodgson Hodgson's Grandala	1683	-	-	-	-	+	-	-	-	-	-	-	-	R (Him)	I	2200-5400	
342. <i>Enicurus scouleri</i> Vigors Little Forktail	1684	-	-	-	-	-	-	-	+	+	-	-	-	R (Him)	I	300-3300	

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Simour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
343. <i>Enicurus maculatus</i> Vigors Western Spotted Forktail	1688	-	+	-	-	-	+	-	+	+	-	+	-	R (Him)	AqA	600-3600
344. <i>Cercomela fusca</i> (Blyth) Indian Chat	1692	-	-	-	+	-	-	-	-	-	-	-	-	R/SM	I	300-1300
345. <i>Saxicola torquata</i> (Linnaeus) Common Stonechat	1696, 1697	+	+	+	+	-	-	-	-	+	+	+	+	WR or SV	I	300-3000
346. <i>Saxicola caprata</i> (Linnaeus) Northern Pied Bushchat	1700	+	+	+	+	-	-	-	+	+	+	+	+	R/SM or WR	I	300-2800
347. <i>Saxicola ferrea</i> Gray Grey Bushchat	1705	+	+	+	+	-	-	-	+	+	+	+	+	R/SM or WR	I	300-3300
348. <i>Oenanthe deserti</i> (Temminck) Tibetan Desert Wheatear	1709		-	-	-	-	-	+	-	-	-	+	-	SV	I	2000-5100
349. <i>Oenanthe picata</i> (Blyth) Variable Wheatear	1712	+	-	+	+	-	-	-	-	-	-	-	+	WV	I	400-1200
350. <i>Oenanthe pleschanka</i> (Lepechin) Pied Wheatear	1715	-	-	-	-	-	-	+	-	-	-	-	-	SV	I	1500-3100
351. <i>Chaimarrornis leucocephalus</i> (Vigors) White-capped Redstart or River Chat	1716	+	+	+	+	+	-	+	+	+	+	+	+	R/SM or WR	I	1000-3900
352. <i>Saxicoloides fulicata</i> (Linnaeus) Brown-backed Indian Robin	1717	+	+	+	+	-	+	-	+	+	+	+	+	R/SM	I	300-3000
353. <i>Monticola cinclorhynchus</i> (Vigors) Blue-headed Rock-Thrush	1723	-				+				+				SV	I, OM	1200-2200

Table contd.

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
354. <i>Monticola rufiventris</i> (Jardine & Selby) Chestnut-bellied Rock-Thrush	1724	-	-	-	-	-	+	-	-	+	-	-	-	R (Him)	I	1200-3300		
355. <i>Monticola solitarius</i> (Linnaeus) Indian Blue Rock-Thrush	1726	-	-	-	+	-	+	-	-	-	-	-	-	SV	I	1200-3000		
356. <i>Myiophonus caeruleus</i> (Scopoli) Himalayan Blue Whistling-Thrush	1729	+	+	+	+	+	+	-	+	+	+	+	+	R (Him)	AqA	300-3600		
357. <i>Zoothera wardii</i> (Blyth) Pied Thrush	1731	-	-	-	-	-	+	-	+	+	-	-	-	SV	I	1500-2400		
358. <i>Zoothera mollissima</i> (Blyth) Western Plain-backed Thrush	1738	-	-	-	-	-	+	-	-	+	-	-	-	R/SM	OM	2700-3600		
359. <i>Zoothera monticola</i> Vigors Greater Long-billed Thrush	1745	-	-	-	-	-	+	-	-	+	-	-	-	R/SM	I	1500-2200		
360. <i>Turdus unicolor</i> Tickell Tickell's Thrush	1748	-	-	-	+	-	+	-	+	+	-	-	-	SV	I	1200-2100		
361. <i>Turdus albocinctus</i> Royle White-collared Blackbird	1749	-	+	-	+	-	+	-	+	+	-	-	-	R (Him)	I, VgM	2100-3300		
362. <i>Turdus boulboul</i> (Latham) Grey-winged Blackbird	1750	+	-	+	+	-	-	-	-	+	+	+	+	R (Him)	I	1800-2700		
363. <i>Turdus merula</i> Linnaeus Eurasian (Tibetan) Blackbird	1752	-	+	-	+	-	-	-	-	+	-	-	-	R/SM or WR	I	2100-4600		
364. <i>Turdus ruficollis</i> Pallas Dark-throated Thrush	1763	-	-	-	+	-	-	-	-	-	-	-	-	WV	I	300-3000		

Table contd.

Taxon	Districts																
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
365. <i>Turdus viscivorus</i> Linnaeus Mistle Thrush Family TROGLODYTIDAE	1768	-	-	-	-	+	-	+	-	+	-	-		R (Him)	I	1600-3900	
366. <i>Troglodytes troglodytes</i> (Linnaeus) Kashmir Wren Family CINCLIDAE	1770	-	+	-	-		-		-	+	-	-	-	R (Him)	I	2700-3900	
367. <i>Cinclus cinclus</i> (Linnaeus) White-throated Dipper	1773	-	-	-	-	-	-	+		-	-	-	-	R (Him)	AqA	3000-4800	
368. <i>Cinclus pallasii</i> Temminck West Himalayan Brown Dipper Family PRUNELLIDAE	1775	+	-	+	+	-		+		+				R (Him)	AqA	450-3700	
369. <i>Prunella himalayana</i> (Blyth) Altai Accentor	1780	-	+	-			-		-	-			-	WV	I	1000-4000	
370. <i>Prunella strophciata</i> (Blyth) Western Rufous-breasted Accentor	1782	-	-	-	+	-		+	-	+	-	-	-	R (Him)	I	600-3600	
371. <i>Prunella atrogularis</i> (Brandt) Turkestan Black-throated Accentor	1786	-	-	-						+			-	WV	I	600-2500	

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
		1	2	3	4	5	6	7	8	9	10	11	12	13			
Family PARIDAE																	
372. <i>Parus major</i> Linnaeus Kashmir Great Tit	1792	+	+	+	+	-	+	+	+	+	+	+	+	R (Him)	I	100-1200	
373. <i>Parus monticolus</i> Vigors Green-backed Tit	1799	-	+	-	+	+	+	-	+	+	-	+	-	R (Him)	I	1800-2800	
374. <i>Parus melanolophus</i> Vigors Spot-winged Crested Tit	1802	-	-	-	+	-	+	-	-	+	-	+	-	R (Him)	I	2000-3300	
375. <i>Parus rufonuchalis</i> Blyth Simla Crested Tit	1804	-	-	-	-	-	-	-	-	+	-	-	-	R (Him)	I	1500-3600	
376. <i>Parus dichrous</i> Hodgson Western Brown Crested Tit	1807	-	-	-	-	-	-	-	-	+	-	-	-	R (Him)	I	2400-3300	
377. <i>Parus xanthogenys</i> Vigors Northern Black-lored Yellow Tit	1809	-	-	-	-	-	-	-	-	+	-	+	-	R (Him)	I	1200-2100	
378. <i>Sylviparus modestus</i> Burton Simla Yellow-browed Tit	1813	-	-	-	-	-	-	-	-	+	-	-	-	R (Him)	I	1200-2400	
Family REMIZIDAE																	
379. <i>Cephalopyrus flammiceps</i> (Burton) Western Fire-capped Tit	1815	-	-	-	-	-	+	-	-	-	-	-	-	SV	I	2000-3300	

Table contd.

Taxon	Districts													Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Family AEGITHALIDAE																
380. <i>Aegithalos concinnus</i> Gould Western Red-headed Tit	1818	-	+	-	-	+	+	-	+	+	-	+	-	R (Him)	I	1400-2400
381. <i>Aegithalos niveogularis</i> (Gould) White-throated Tit	1822	-	-	-	+	-	+	-	-	+	-	-	-	R (Him)	I	1800-3300
Family SITTIDAE																
382. <i>Sitta leucopsis</i> Gould Western White-cheeked Nuthatch	1832		+		+		+		-	-	-	-		R (Him)	I	1800-3000
383. <i>Sitta himalayensis</i> Jardine & Selby Himalayan White-tailed Nuthatch	1834		+				+		+	+	-	-	-	R (Him)	I	1500-3000
384. <i>Tichodroma muraria</i> (Linnaeus) Wall Creeper	1839		+	-	+		-		-	-	-	+	-	R (Him)	I	1500-3000
Family CERTHIIDAE																
385. <i>Certhia familiaris</i> Linnaeus Eurasian Tree Creeper	1842, 1843		-	-	-		+		-	+	-			R (Him)	I	2700-4000
386. <i>Certhia himalayana</i> Vigors Himalayan Bar-tailed Tree Creeper	1847	+	+	+	+	-	+		+	+	+	+	+	R (Him)	I	1500-3000

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Family MOTACILLIDAE</b>																
387. <i>Anthus hodgsoni</i> Richmond Oriental Tree Pipit	1852	+	-	+	+	-	+		-	+			+	SV	I	2700-3300
388. <i>Anthus trivialis</i> (Linnaeus) Eurasian Tree Pipit	1855	-		-	+			+	+	+				SV	I	2700-3700
389. <i>Anthus rufulus</i> Vieillot Northwestern Paddyfield Pipit	1858	+	-	+	+		-		-	+	+	+	+	R/LM	I	400-2000
390. <i>Anthus campestris</i> (Linnaeus) Twany Pipit	1861	+	-	+	+	-	-	-	-	+	-	-	+	WV	I	400-1500
391. <i>Anthus similis</i> Jerdon Brown Rock Pipit	1867	+	-	+	+	-	-	-	-	-	-	-	-	SV	I	600-1800
392. <i>Anthus sylvanus</i> (Hodgson) Upland Pipit	1873	-	-	-	+	-	-	-	-	+	-	+	-	R (Him)	I	900-3000
393. <i>Motacilla flava</i> Linnaeus Yellow Wagtail	1875	+	-	-	+	-	-	-	-	+	-	-	-	WV/PM	I	400-600
394. <i>Motacilla citreola</i> Pallas Northern Citrine Wagtail	1881 &1883	+	-	+	+	-	-	-	-	-	+	+	+	WV	I	500-1500
395. <i>Motacilla cinerea</i> Tunstall Grey Wagtail	1884	+	+	+	+	+	+	-	-	+	+	+	+	SV/WR	I	800-3900
396. <i>Motacilla alba</i> Linnaeus Pied or White Wagtail	1885	+	-	+	+	-	-	-	-	-	+	+	+	WV	I	400-1800

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
397. <i>Motacilla alba</i> Linnaeus Hodgson's Pied Wagtail	1887	-	+	-	-	-	+	+	-	+	-	-	-	SV	I	1500-3900
398. <i>Motacilla maderaspatensis</i> Gmelin Large Pied Wagtail	1891	+	+	+	+	-	+		+	+	+	+	+	R/SM	I	300-1800
Family DICAIEIDAE																
399. <i>Dicaeum agile</i> (Tickell) Thick-billed Flowerpecker	1892, 1894	+	-	+	-	-	-	-	-	-	-	+	+	R	FR	400-1800
400. <i>Dicaeum erythrorhynchos</i> (Latham) Tickell's Flowerpecker	1899	-	+	+	-	-	+	-	-	-	-			R	FR	400-1800
401. <i>Dicaeum ignipectus</i> (Blyth) Fire-breasted Flowerpecker	1905	-	+	+	+		-	-	-	+	-	-	-	R (Him)	I	600-2900
Family NECTARINIIDAE																
402. <i>Nectarinia asiatica</i> (Latham) Purple Sunbird	1917	+	+	+	+	-	+	-	-	+	+	+	+	R/LM	N	500-1800
403. <i>Aethopyga gouldiae</i> (Gould) Mrs. Gould's Sunbird	1919	-	-	-	-	-		-		+	-	-		R (Him)	N	1400-2400
404. <i>Aethopyga siparaja</i> (Raffles) Crimson Sunbird	1927	-	+	-	+		+	-	+	+	+	+		R (Him)	N	500-2200
Family ZOSTEROPIDAE																
405. <i>Zosterops palpebrosa</i> (Temminck) Oriental White-Eye	1933	+	+	+	+		+	-	+	+	+	+	+	R/SM	OM	400-2200

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Family PASSERIDAE																
Subfamily PASSERINAE																
406. <i>Passer domesticus</i> (Linnaeus) House Sparrow	1938	+	+	+	+	+	+	+	+	+	+	+	+	R/SM	GR	400-2100
407. <i>Passer rutilans</i> Temminck Himalayan Cinnamon Tree Sparrow	1946	-	+	-	+	-	+	-	+	+	-	+	-	R (Him)	GR	1200-2800
408. <i>Petronia xanthocollis</i> (Burton) Yellow-throated Sparrow	1949	-	-	-	+	-	-	-	-	-	-	+	-	SV	GR	400-2000
409. <i>Montifringilla adamsi</i> Adams Tibet Snowfinch	1952	-	-	-	+	-	-	+	-	-	-	-	-	R (Him)	I	1600-4600
Subfamily PLOCEINAE																
410. <i>Pioceus philippinus</i> (Linnaeus) Baya Weaver	1957	+	-	+	+	-	-	-	-	-	+	+	+	R/SM	GR	400-1200
Family ESTRILDIDAE																
411. <i>Amandava amandava</i> (Linnaeus) Red Munia or Adavat	1964	-	+	-	+	-	+	-	-	+	-	-	-	R	GR	400-2500
412. <i>Lonchura malabarica</i> (Linnaeus) White-throated Munia	1966	+	-	+	+	-	-	-	-	-	-	-	+	R	GR	400-1800
413. <i>Lonchura punctulata</i> (Linnaeus) Spotted Munia	1974	+	+	+	+	-	+	-	-	+	+	+	+	R	GR	600-2400

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Family FRINGILLIDAE																
414. <i>Fringilla montifringilla</i> Linnaeus Brambling	1980	-	-	-	-	-	-	-	-	+	-	-	-	WV/PM	GR	1000-2500
415. <i>Mycerobas icterioides</i> (Vigors) Black-and-Yellow Grosbeak	1982	-	+	-	-	-	-	-	-	+	-	-	-	R (Him)	FR	1800-3000
416. <i>Mycerobas affinis</i> (Blyth) Collared Grosbeak	1983	-	+	-	-	-	+	-	-	-	-	-	-	R (Him)	GR, I	1800-4200
417. <i>Mycerobas carnipes</i> (Hodgson) Himalayan White-winged Grosbeak	1985	-	-	-	-	-	-	+	-	-	-	-	-	R (Him)	GR	2700-3600
418. <i>Mycerobas melanozanthos</i> Hodgson Spotted-winged Grosbeak	1986	-	+	-	-	-	-	+	-	-	-	-	-	R (Him)	GR	3000-3600
419. <i>Carduelis carduelis</i> (Linnaeus) Eurasian Goldfinch	1989	-	+	-	-	+	-	-	-	+	-	-	-	R (Him)	GR	2400-3900
420. <i>Carduelis spinoides</i> Vigors Himalayan Yellow-breasted Greenfinch	1990	-	+	-	+	+	+	-	+	+	-	-	-	SV	GR	1800-2700
421. <i>Carduelis flavirostris</i> (Linnaeus) Tibetan Twite	1996	-	-	-	-	-	-	+	-	-	-	-	-	R (Him)	GR	3600-4800
422. <i>Callacanthus burtoni</i> (Gould) Spectacled Finch	1997	-	-	-	-	-	-	+	-	-	-	-	-	R (Him)	GR	2400-3600

Taxon	Districts															Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14			
423. <i>Serinus pusillus</i> (Pallas) Fire-fronted Serian	1998	-	+	-	-	+	-	+	-	+	-	-	-	R (Him)	GR	2400-4300		
424. <i>Leucosticte nemoricola</i> (Hodgson) Western or Hodgson's Mountain-Finch	1999	-	-	-	+	-	-	+	-	-	-	-	-	R (Him)	GR, I	2200-4800		
425. <i>Leucosticte brandti</i> Bonaparte Himalayan Black-headed Mountain-Finch	2003, 2004	-	-	-	-	-	-	+	-	-	-	-	-	R (Him)	GR/ VgM	3900-4500		
426. <i>Carpodacus erythrinus</i> (Pallas) Turkestan Rosefinch	2010	-	-	-	-	-	-	+	-	-	-	-	-	R (Him)	GR	2700-3900		
427. <i>Carpodacus erythrinus</i> (Pallas) Common Rosefinch	2013	-	-	+	+	-	-	-	-	+	-	-	+	WV	GR	450-1500		
428. <i>Carpodacus nipalensis</i> (Hodgson) Dark-breasted Rosefinch	2014	-	-	-	+	-	-	+	-	+	-	-	-	R/SM	GR	1200-3600		
429. <i>Carpodacus rodochrous</i> (Vigors) Pink-browed Rosefinch	2017	-	+	-	-	-	+	+	-	+	-	+	-	R (Him)	GR/ VgM	2800-3600		
430. <i>Carpodacus rhodochlamys</i> (Brandt) Red-mantled Rosefinch	2018	-	-	-	-	-	-	+	-	+	-	-	-	R (Him)	GR	3000-3800		
431. <i>Carpodacus thura</i> Bonaparte & Schlegel Kashmir White-browed Rosefinch	2020	-	+	-	-	-	-	+	-	+	-	-	-	R (Him)	GR/ VgM	3000-3600		
432. <i>Carpodacus rubicilla</i> (Guldenstadt) Common Great Rosefinch	2027	-	-	-	-	+	-	+	-	-	-	-	-	R (Him)	FR, I	3000-4800		

Table contd.

Taxon	Districts															
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una	Status	Food Habit	Altitudinal Range (Mts.)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
433. <i>Carpodacus puniceus</i> (Blyth) Western Red-fronted Rosefinch	2030	-	+	-	-	-	+	+	-	+	-	-	-	R (Him)	GR	3200-5700
434. <i>Loxia curvirostra</i> Linnaeus Red Crossbill	2032	-	-	-	-	-	+	+	-	-	-	-	-	R (Him)	GR	2700-4000
435. <i>Pyrrhoptes epauletta</i> (Hodgson) Gold-naped Black Finch	2035	-	-	-	+	-	-	-	-	+	-	-	-	R (Him)	GR	2800-3900
436. <i>Pyrrhula nipalensis</i> Hodgson Nepal Brown Bullfinch	2036	-	-	-	+	-	+	-	-	+	-	-	-	R (Him)	GR	2100-3000
437. <i>Pyrrhula erythrocephala</i> Vigors Red-headed Bullfinch	2039	-	+	-	-	-	-	-	-	+	-	+	-	R (Him)	GR	2400-3300
438. <i>Pyrrhula aurantiaca</i> Gould Orange Bullfinch	2040	-	+	-	+	-	-	-	-	+	-	-	-	R (Him)	GR	2700-3300
Family EMBERIZIDAE Subfamily EMBERIZINAE																
439. <i>Emberiza leucocephalos</i> Gmelin Pine Bunting	2042	-	-	-	+	-	-	-	-	+	-	-	-	WV	GR	900-2700
440. <i>Emberiza melanocephala</i> Scopoli Black-headed Bunting	2043	-	-	-	+	-	-	+	-	-	-	-	-	WV/PM	GR	900-2500
441. <i>Emberiza bruniceps</i> Brandt Red-headed Bunting	2044	-	-	-	+	-	-	+	-	-	-	-	-	WV/PM	GR	900-2500

Table contd.

Taxon	Districts														Status	Food Habit	Altitudinal Range (Mts.)
	Hand Book No.	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmour	Solan	Una				
		1	2	3	4	5	6	7	8	9	10	11	12	13			
442. <i>Emberiza stewarti</i> (Blyth) White-capped Bunting	2048	+	+	+	+	+	+	-	+	+	+	+	+	SV or WR	GR	400-2500	
443. <i>Emberiza cia</i> Linnaeus Transcaspian Rock Bunting	2051	-	-	-	-	-	-	+	-	-	-	-	-	SV	GR	2700-4200	
444. <i>Emberiza cia</i> Linnaeus Himalayan Rock Bunting	2052	-	+	-	+	+	+	-	-	+	-	+	+	R (Him)	GR	600-3600	
445. <i>Emberiza fucata</i> Pallas Grey-headed Bunting	2055	+	+	-	-	-	+	-	-	+	-	-	+	R (Him)	GR	400-2700	
446. <i>Emberiza schoeniclus</i> (Linnaeus) Reed Bunting	2058	+	-	-	-	-	-	-	-	-	-	-	-	WV	GR	300-600	
447. <i>Melophus lathami</i> (Gray) Crested Bunting	2060	+	+	+	+	-	+	-	+	+	+	+	+	R/SM	GR	400-2200	
		191	158	148	313	40	125	74	134	232	148	173	144				

Abbreviation :

*Residential Status*

(R) : Resident, (LM) : Local Movements, (SM) : Seasonal (altitudinal) Movements (for breeding), (SV) : Summer Visitor (for breeding), (WV) : Winter Visitor, (WR) : Wintering (particularly in Siwalik & Lower Himalayas), (PM) : Passage Migrant, R (Him) : Resident bird endemic to Himalaya (showing vertical movements during winter-summer), (+) : Observed / Recorded, (-) : Not observed / not recorded.

*Food Habits*

(I) : Insectivorous, (GR) : Graminivorous, (CR) : Carnivorous, (AqA) : Aquatic Animal, (OM) : Omnivorous, (VgM) : Vegetable Matter, (FR) : Frugivorous, (SC) : Scavenger, (N) : Nectar eater.

Hand Book No. is as per Ali &amp; Ripley (1983 b)

**Table 2 : Avian Diversity of Himachal Pradesh**

<b>Sl. No.</b>	<b>Order</b>	<b>Family</b>	<b>Sub Family</b>	<b>Genera</b>	<b>Species</b>
1.	PODICIPEDIFORMES	1	-	1	3
2.	PELECANIFORMES	3	-	3	3
3.	CICONIIFORMES	2	-	9	10
4.	ANSERIFORMES	1	-	4	14
5.	FALCONIFORMES	1	-	22	39
6.	GALLIFORMES	1	-	14	17
7.	GRUIFORMES	3	-	6	8
8.	CHARADRIIFORMES	8	-	15	25
9.	COLUMBIFORMES	2	-	6	15
10.	PSITTACIFORMES	1	-	1	4
11.	CUCULIFORMES	1	-	8	12
12.	STRIGIFORMES	1	-	8	13
13.	CAPRIMULGIFORMES	1	-	1	3
14.	APODIFORMES	1	-	3	4
15.	CORACIIFORMES	5	-	9	10
16.	PICIFORMES	2	-	7	17
17.	PASSERIFORMES	29	9	115	250
	<b>TOTAL : 17</b>	<b>65</b>	<b>9</b>	<b>232</b>	<b>447</b>
	<b>* (21)</b>	<b>(88)</b>	<b>(11)</b>	<b>(423)</b>	<b>(1342)</b>

\* (Avian diversity in Indian Subcontinent is given in paranthesis)

Table 3 : Conservation status of Birds of Himachal Pradesh

Sl. No.	Species Name	Common Name	WL(P)A 1972	CITES (2002)	IUCN (2002)
1.	Family PELICANIDAE <i>Pelecanus philippensis</i> Gmelin	Spot-billed Pelican	-	-	GT/VU
2.	Family ANHINGIDAE <i>Anhinga melanogaster</i> Pennant	Darter	-	-	NT/LR
3.	Family CICONIIDAE <i>Mycteria leucocephala</i> (Pennant)	Painted Stork	-	-	NT/LR
4.	<i>Ciconia nigra</i> (Linnaeus)	Black Stork	-	App. II	-
5.	Family ANATIDAE <i>Aythya nyroca</i> (Guldenstadt)	Ferruginous Porchard	-	-	NT
6.	Family ACCIPITRIDAE All Hawk Species		Sch. I, Part. III		
7.	<i>Aquila heliaca</i> Savigny	Eastern Imperial Eagle	-	App. I	GT/VU
8.	<i>Haliaeetus leucoryphus</i> (Pallas)	Pallas's Fish-Eagle	-	-	GT/VU
9.	<i>Ichthyophaga humalis</i> (S. Muller & Schlegel)	Lesser Gray-headed Fish-Eagle	-	-	NT/LR
10.	<i>Sarcogyps calvus</i> (Scopoli)	Red-headed Vulture	-	-	NT/LR
11.	<i>Aegypius monachus</i> (Linnaeus)	Cinereous Vulture	-	-	NT/LR
12.	<i>Gyps indicus</i> (Scopoli)	Himalayan Long-billed Vulture	Sch. I, Part. III	-	CR
13.	<i>Gyps bengalensis</i> (Gmelin)	Indian White-backed Vulture	Sch. I, Part. III	-	CR
14.	<i>Circus macrourus</i> (S.G. Gmelin)	Pallid Harrier	-	-	LR

Sl. No.	Species Name	Common Name	WL(P)A 1972	CITES (2002)	IUCN (2002)
	Family PANDIONIDAE				
15.	<i>Pandion haliaetus</i> (Linnaeus)	Osprey	Sch. I, Part. III	-	-
	Family FALCONIDAE				
16.	<i>Falco jaggarr</i> J.E. Gray	Larger (Falcon)	-	App. I	-
17.	<i>Falco peregrinus</i> (Tunstall)	Feregrine Falcon	Sch. I, Part. II	App. 1	-
18.	<i>Falco chicquera</i> Daudin	Red-headed Merlin	Sch. I, Part. III	-	-
	Family PHASIANIDAE				
19.	<i>Tragopan melanocephalus</i> (J.E. Gray)	Western Tragopan	Sch. I, Part. III	-	VU
20.	<i>Lophophorus impejanus</i> (Latham)	Himalayan Impeyan Monal	Sch. I, Part. III	-	-
21.	<i>Lophura leucomelanos</i> (Latham)	Kaleej Pheasant Monal	Sch. I, Part. III	-	-
22.	<i>Catreus wallichii</i> (Hardwicke)	Cheer Pheasant	Sch. I, Part. III	-	VU/LR
23.	<i>Pavo cristatus</i> Linnaeus	Indian Peafowl	Sch. I, Part. III	-	-
	Family GRUIDAE				
24.	<i>Grus antigone</i> (Linnaeus)	Saras Crane		-	GT/VU
	Family SCOLOPACIDAE				
25.	<i>Gallinago nemoricola</i> Hodgson	Wood Snipe		-	GT/VU
	Family LARIDAE				
26.	<i>Sterna acuticauda</i> J.E. Gray	Black-bellied Tern			GT/NT

*Abbreviations :*

WL(P)A 1972 : Wildlife (Protection) Act, 1972, Govt. of India (amended upto 2002)

CITES (2002) : Convention on International Trade in Endangered Species of Wild Fauna and Flora

IUCN (2002) : IUCN Red List of Threatened Species; GT - Globally Threatened, LR Lower Risk, NT Near Threatened, VU - Vulnerable and CR Critically Endangered.

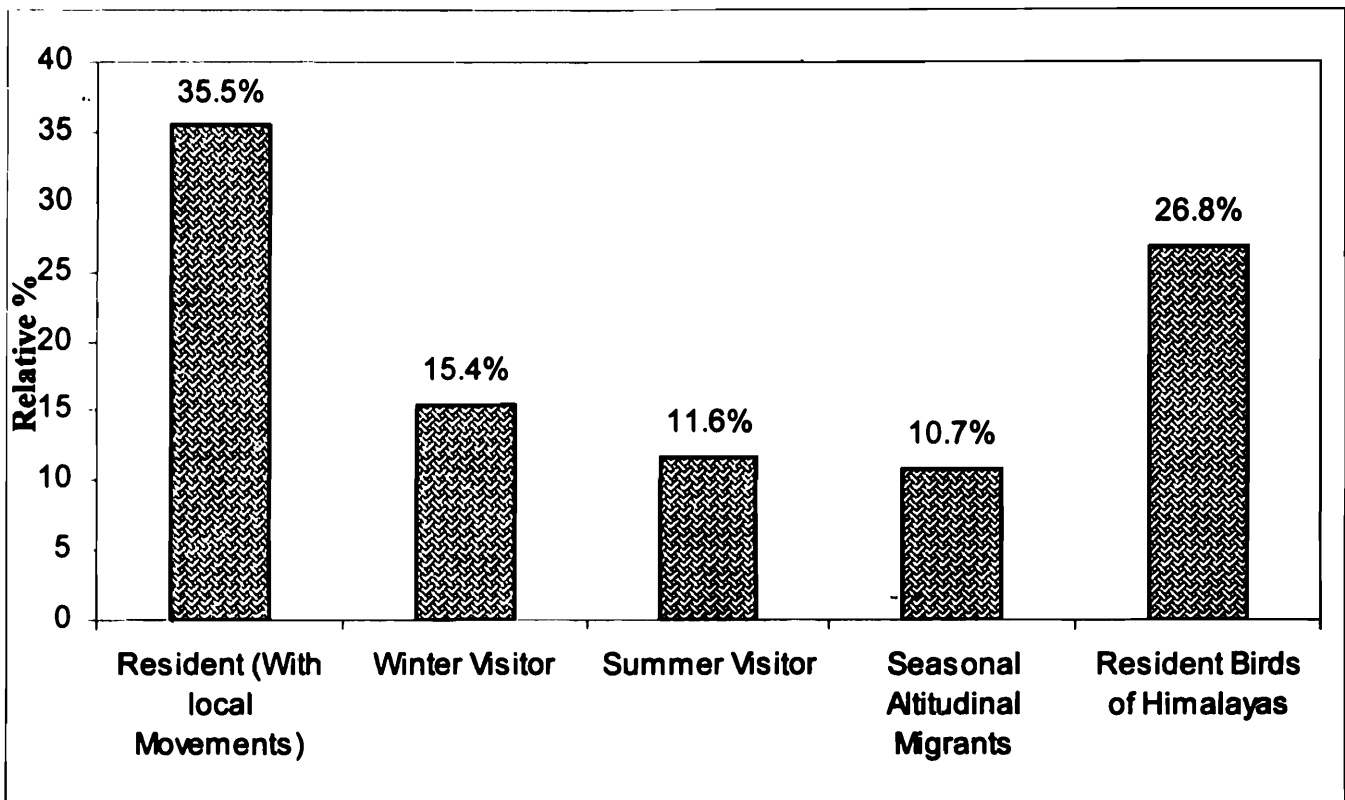


Fig. 1. Residential status of Birds of Himachal Pradesh

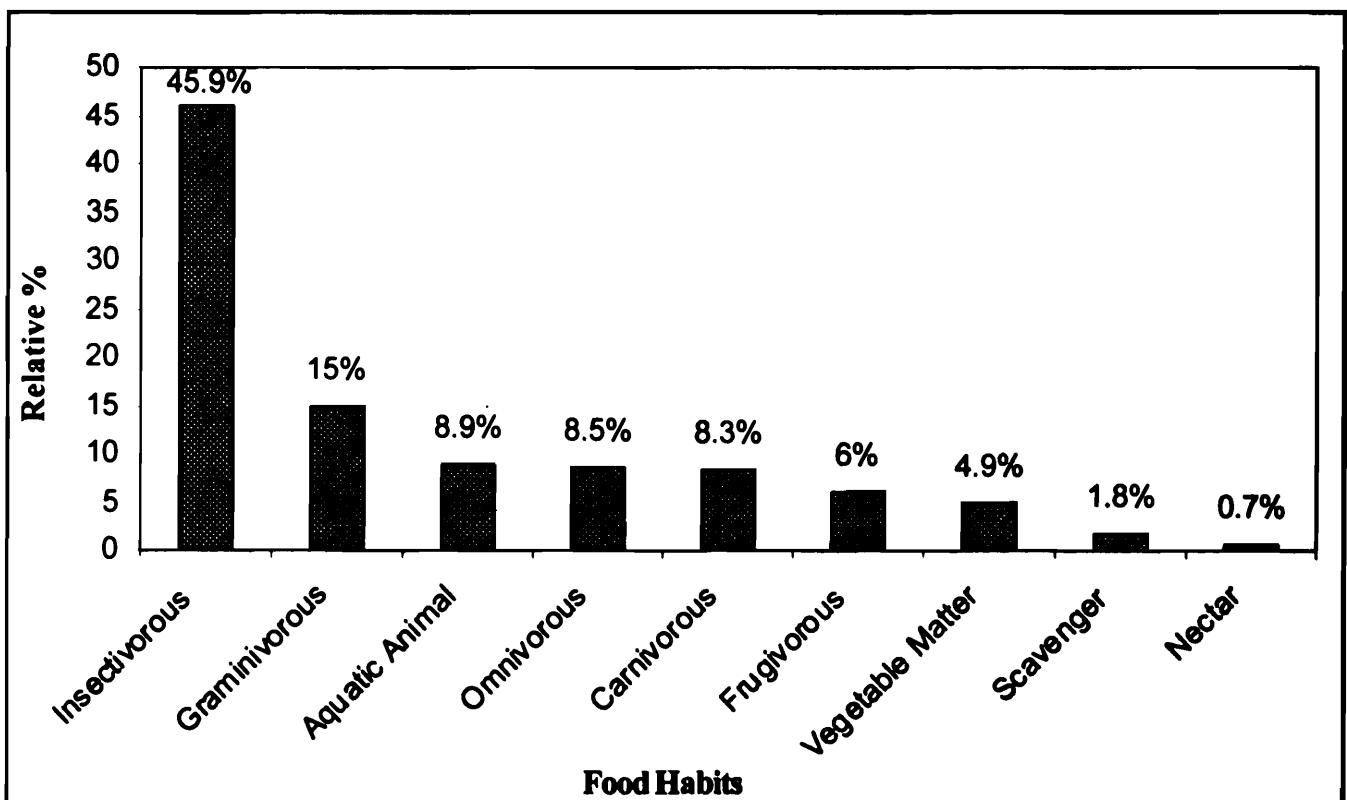


Fig. 2. Food Habits of Birds of Himachal Pradesh

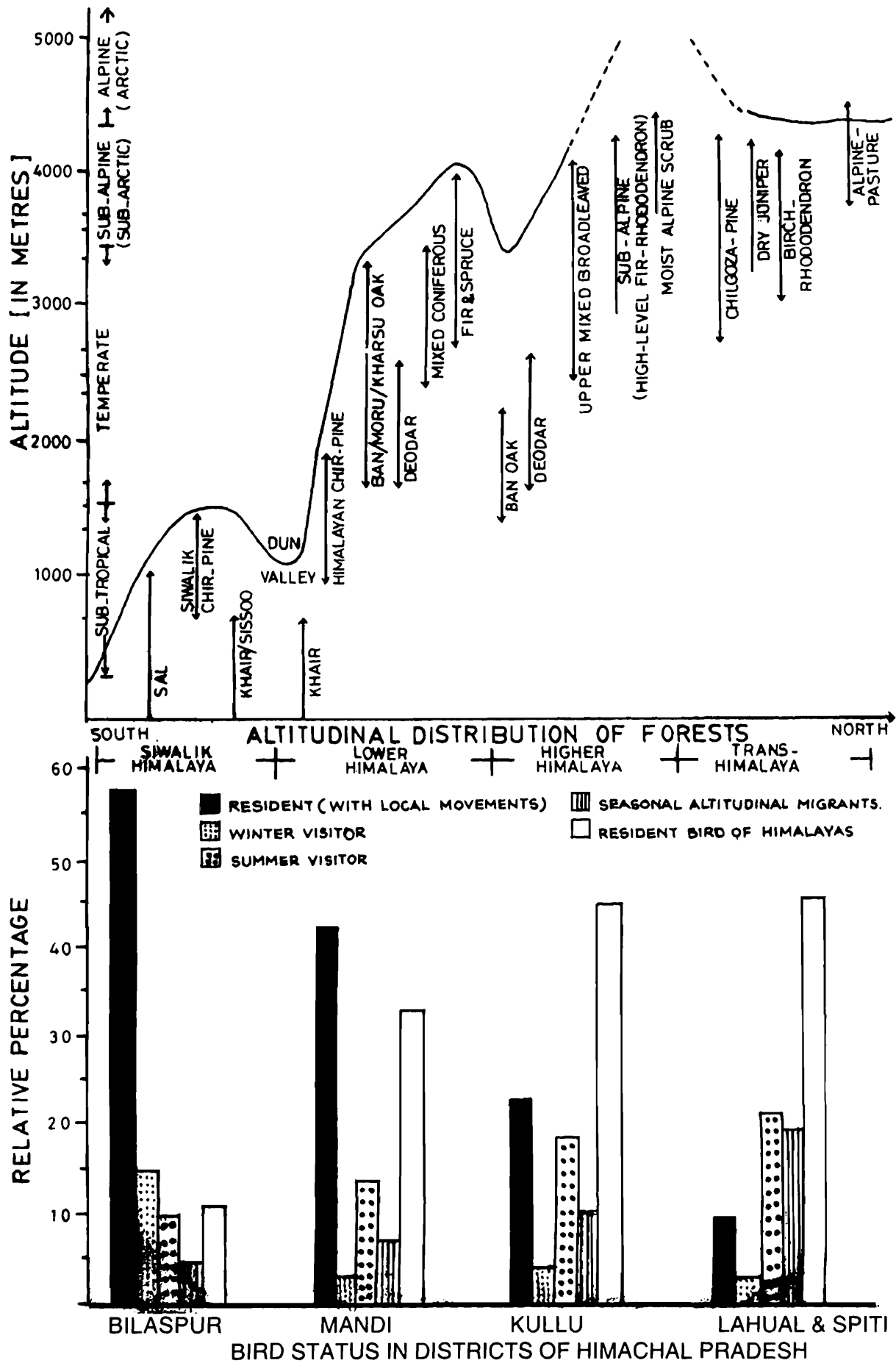


Fig. 3. Residential status of birds in representative districts w.r.t. altitude and forest Biotope in four biogeographic regions of Himachal Pradesh.



## MAMMALS

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### INTRODUCTION

Himachal Pradesh located in the heart of the Himalayas embodies the full range of Himalayan ecosystems from the arid desert of the Trans-Himalayas across the main Himalayan range to the semi-arid foothills. From the biogeographical point of view, the administrative district of Lahul-Spiti is considered as Zone-1, the Trans-Himalayas; the Himalayas, Zone-2, is divided into two provinces by the river Sutlej, viz. Northwest 2A and West 2B; the hot dry foot-hills are included in the Semi-arid Zone, 4A (Rodgers and Panwar 1988). About 67.52% of the total geographical area of the state has one or other kind of forest cover (Forest survey of India, 1995). These, combined with variations in altitudes, rainfall and temperature have made Himachal Pradesh a land rich in wildlife specially of mammalian species. Our knowledge about the diversity of mammalian species of Himachal Pradesh and their distribution, ecology, population, threat factors, etc. gained mainly through the contributions of Blanford (1881-91), Hinton and Lindsay (1926), Lindsay (1926, 1929), Pocock (1939, 41), Ellerman and Morrison-Scott (1951), Winter-Blyth (1950, 1951), Ellerman (1961), Mahajan and Mukherjee (1974), Prater (1980), Gaston *et al.* (1981), Rodgers and Panwar (1988), Singh *et al.* (1990), Negi (1992), Cavallini (1992), Pandey (1992), Julka *et al.* (1999) and many others. However, available information is very much scattered and far from complete. For the appropriate management of renewable economic and spiritual resource like mammals, knowledge about their characteristics, significance, species composition, ecological and altitudinal distribution, status, threat factors, etc., is the basic requirement. In the present paper, based on the observations and collection made during the survey of Shimla, Kullu and Mandi district and the extent literature, an attempt has been made to compile the available information on the mammalian fauna of Himachal Pradesh.

### MAMMALIAN SPECIES CHARACTERISTICS AND DIVERSITY

The name Mammalia itself describes the unique feature of the group i.e. the possession of 'Mammæ' or 'teats' for suckling the youngs. In the world of nature, they are the

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only animals having mammary glands for nourishing their youngs with milk. Further, their body is covered with hairs at least at some stage of life.

As compared to other groups of animals, class Mammalia contains relatively fewer number of species, Living mammalian species of the world have been estimated as 4307 of which only 390 occur in India (Agrawal 1998). However, within this small number, it embraces species as varied as Blue Whale with head and body length about 24 m and as small as Pygmy Shrew measuring only 4 cm. It includes colourful squirrels, flying bats, fossorial shrews, majestic tiger, huge elephant, shielded rhinos, dancing deer, scaly anteaters, pouched kangaroos and egg laying platypus and finally the human beings. Mammals are adapted to live in all the ecosystems of this planet, from deep sea to snow-clad mountains, dense forests to open deserts and in close association with the human beings in modern cities and agricultural land.

### **SIGNIFICANCE OF MAMMALS**

The mammalian species have played the most important role in human culture from the first appearance of man. At the dawn of civilization, they were the source of man's protein, folklore, clothing, religious belief and tool. With the development of agriculture, some species were domesticated to serve the man directly, others continued to be hunted for meat, horns, skins, tusk, wool, etc. Their role in socio-cultural, scientific, educational, ethical and historical values of natural environment is also very significant. By virtue of existence in different levels of food chain, they contribute in maintaining the population level of various plant and animal species, whose unchecked increase would adversely affect the natural balance. Activities of mammalian species may alter the plant production, species composition of plant species, seed dispersal, microtopography, drainage characteristics and physico-chemical nature of soil in many of the ecosystem area. Many of the mammalian species have the potentiality of becoming sustainable resource of considerable dimensions by way of captive breeding, farming and conservation of natural ecosystems.

On the other hand, due to destruction and modification of habitat and scarcity of natural food, some of the mammals like rodents, fruit bats, monkeys, langurs, deer, blackbuck, wild boar, bear, leopard, elephant, etc. started to partake fruits of human labour, viz., the agricultural and horticultural products, livestock and articles of merchandise. This has resulted in undesirable damage and man-animal conflicts. Moreover, causative agents of many of the deadly diseases like plague, typhus, rat-bite fever, rabies, etc. are being harboured by the mammalian species which can be transferred to human beings.

Significance of mammalian species in human civilization and maintenance of ecosystems is well understood. Still the man-mammal relationship seems to be changing at its most rapid rate. With the spread of modern technology, the human ecological niche is expanding and man is becoming much more efficient at clearing forests, draining swamps and

polluting the natural habitats. Combined with these, hunting, poaching and commercial exploitation have taken a huge toll of the country's wildlife specially of mammals. Today, most of the mammalian species of the country including those occurring in Himachal Pradesh have greatly reduced in respect of their populations and range, some are seriously threatened and at least two have been wiped out from Indian limit during the last century.

## **DIVERSITY AND MAMMAL SPECIES COMPOSITION OF HIMACHAL PRADESH**

From the identification of survey material, field observations and extant literature as already mentioned, it has been found that at least 107 species belonging to 77 genera, 25 families and 9 orders occur in Himachal Pradesh. A detailed systematic list of the mammalian species along with their status as per Indian Wildlife (Protection) Act, 1972, CITES and National Red Data Book (Director, ZSI., 1994) is given in Table I. Species richness is simply amplified by the fact that Himachal Pradesh has only 1.7% of the total geographical area of the country and within this area it preserves at least 25% of mammalian species of India. This species richness may be attributed to the several factors as stated below :

- i) Hilly terrain provides more available surface area as compared to the geographical area.
- ii) Species suitable for plains or low hills to snowy areas have found refuge in the state owing to huge variations in altitudes.
- iii) The State is one of the most forested State of the Indian Union and includes nine major forest types (Champion and Seth 1968). Of these, seven are specific of the hill areas and two are confined to the low out lash gravels at the foot of the front ranges (Bhabar and Terai), each supporting characteristic mammalian fauna.
- iv) The State is in the transition zone of Palaearctic and Oriental region, thus enriched by the faunal elements of both the region.

However, as the State is a part of the Great Himalayan range, species level endemism could not be found in respect of mammalian species.

So far the number of species, genera and families are concerned, the Order Carnivora is most well represented in the state, followed by Rodentia and Chiroptera, where as, Order Pholidota and Perissodactyla are represented by single species. When global or Indian situation is taken into account, it will be found that species diversity among the rodents and chiroptera is much more than that of the carnivora. Most of the rodent and chiropteran species are nocturnal, small-sized, living in burrows, crevices, tree-holes, caves and other very much secluded areas. Thus, many of the species of these two groups remain unrecorded unless there is thorough survey by way of systematic trapping

and netting. In that sense, greater part of Himachal Pradesh is yet to be surveyed and it is expected that detailed survey will record relatively more species of rodents and chiroptera.

Each biome or the ecological zone of the State has its own distinctive faunal assemblage. The arid cold desert of the Trans Himalayan range covering North Spiti is at the range edge for the Tibetan fauna of ass, gazelle, chiru, antelope along with snow leopard, bharal, Blyth's vole, Gilgit vole, Himalayan marmot, Royle's pika, etc. The temperate and alpine biomes of the main Himalayan range contain fragmented populations of snow leopard, brown and black bear, bharal, ibex, red flying squirrel, Kashmir flying squirrel, pika, and Siberian weasel. The hot dry foot provide refuge to black bear, jungle cat, tiger, leopard, serow, goral, barking deer, monkey, langur and different species of bats and rats.

### ECOLOGICAL DISTRIBUTION OF SOME MAMMALIAN SPECIES OF HIMACHAL PRADESH

The following account has been compiled from Prater (1980), Gaston *et al.* (1981) Singh *et al.* (1990), Negi (1992) and field observations made during May-June, 1992.

#### PRIMATES

**Rhesus Macaque, *Macaca mulatta*:** Found all over the lower foothills and may ascend upto 3100m. During winter avoids area of heavy snowfall. Lives mainly in and around human settlements and areas of forest with luxuriant understorey.

**Common Langur, *Semnopithecus entellus*:** Mostly found between 1900 and 2800 m in coniferous or broad leaved forests and also along the cultivated tracts. Troops of langurs have been noted at 3200m in both April and October. During mid-January, they have been observed at 2850m where they were moving in 0.5m of snow. Records of langurs at different altitudes during different parts of the year suggest that some troops remain above the snow line even in winter although others move down from areas experiencing heavy snowfall.

#### CARNIVORA

**Tiger, *Panthera tigris*:** Very rare, reported from low hill forests in Simbalbara Sanctuary, District Sirmour.

**Leopard or Panther, *Panthera pardus*:** Found all over the state from foothills to tracts near the snow line. Available records do not indicate much seasonal movement as field tracks were observed in snows even in late January. It is found both in forests as well as open rocky areas.

- Leopard Cat, *Prionailurus bengalensis*:** Confined to the forested parts of lower foot-hills and also around human settlements.
- Jungle Cat, *Felis Chaus*:** A semiurban species living in and around human settlements from lower foothills to near snow line. No seasonal movement has been reported.
- Small Indian Civet, *Viverricula indica*:** Confined to the foothills, usually preferring tall grasslands.
- Common Palm Civet, *Paradoxurus hermaphroditus*** Restricted to the forest patches of lower reaches and spends the day amongst the branches or in a hole in the tree trunk.
- Common Mongoose, *Herpestes edwardsi*:** Lives in open areas, scrublands and in and around cultivated areas of foothills.
- Striped Hyaena, *Hyaena hyaena*:** Confined to open areas and scrub lands of lower Himalayas.
- Lynx, *Lynx lynx*:** Found only in the desert tract of Trans-Himalayan range. Seeks shelter amongst alpine scrub grasses and rocks near the snow line. It is an altitudinal migrant and ascends further up during summer months.
- Jackal, *Canis aureus*:** Found in various habitats of the State upto an elevation of about 3500 m. However, the altitudinal range in which the jackal is usually found varies from 1200m to 2100m. Lives in dense forest, open areas, grasslands, scrublands and crop fields.
- Red Fox, *Vulpes vulpes*:** Inhabits cold desert region of Lahul, Spiti and Kinnaur particularly in the subalpine scrub forests, pastures, rocky areas, cultivated lands and in the vicinity of water courses.
- Indian Fox, *Vulpes bengalensis*:** Lives in open areas, scrublands, cultivated tracts of the foothills avoiding thick forest.
- Asiatic Black Bear, *Ursus tibetanus*:** Ranges in various kinds of forested tracts viz. khair-sisso, moist mixed deciduous, oak, coniferous, temperate, etc. It is an altitudinal migrant, moves to elevation of over 3500m. near snow line. During summer returns to the shelter of valleys to about 1500m.
- Brown Bear, *Ursus arctos*:** Inhabits open, rocky areas above the tree line but descends to low elevations in winter and retires to shelter of caves.
- Common Otter, *Lutra lutra*:** Lives amongst rocks and boulders and in the hollows of trees near lakes, streams or rivers. Altitudinal migration is very much evident, ascending over 3600m along the streams in search of food during summer and returning to lower elevations in winter.

**Stone Marten, *Martes foina*:** Usually found in rocky tracts, grasslands and forests of temperate, subalpine and alpine region. Usually not found below the elevations of about 1500m.

**Himalayan Yellow-throated Marten, *Martes flavigula*:** Inhabits tropical, subtropical, temperate and subalpine forest belts, usually between an elevation of 1200m. and 2700m.

**Himalayan Weasel, *Mustela sibirica*:** Lives in open areas, scrublands and forested areas of temperate, subalpine and alpine tracts between 1500m and 4800m.

#### PERISSODACTYLA

**Tibetan Wild Ass or Kiang, *Equus kiang*:** Reported as a visitor in the cold desert tracts of Spiti.

#### ARTIODACTYLA

**Yak, *Bos grunniens*:** Reported as visitor in the Lahul-Spiti region, searching for food in alpine meadows.

**Nayan, *Ovis ammon*:** Lives in wilderness of desolate plains and low, undulating hills in the Trans-Himalayan tracts of Lahul-Spiti. Herds of Nayan ascend to the higher slopes in search of grass during summer months.

**Bharal or Blue Sheep, *Pseudois nayaur*:** Lives between the timber line and snow line, preferring to keep to the alpine and subalpine pastures. In Himachal Pradesh mainly confined to Lahul and Spiti.

**Siberian Ibex, *Capra sibirica*:** Found in the upper tracts usually above an elevation of 3800m, upto 4400 m. Inhabits rocky areas and alpine tracts and moves to higher elevations with the retreating snow in summer.

**Himalayan Tahr, *Hemitragus jemlahicus*:** Found in the stunted subalpine forests between 2000m to 3770m. particularly at ground having slope of 70 degrees or more with some overstorey and a good growth of herbs, shrubs and grasses. Further, tahr exhibits upward movement when snow melts between March and May.

**Serow, *Nemorhedus sumatraensis*:** Mainly concentrated on craggy, but only moderately steep ground (50 degrees) in dry deciduous and birch-rhododendron forest, subalpine scrub and adjacent small patches at elevation between 1800m and 3400m.

**Hangul or Kashmir Stag, *Cervus elaphus hanglu*:** Reported from Gamgul Siya Behi Sanctuary of Chamba. Winter is spent at lower elevations usually below 2000m in valleys and gorges and moving up in search lush green grass upto 3600m.

**Sambar**, *Cervus unicolor*: Found in the forests, open areas and cultivated fields of foothills.

**Barking Deer**, *Muntiacus muntjac*: Lives at low elevations between 500m and 2450m. Remains in the dense forest, but may come out to graze in the grasslands lying near the periphery of forest or in clearings.

**Musk deer**, *Moschus chrysogaster*: Found above the temperate zone in the subalpine and alpine forests. It is an altitudinal migrant, moves to areas near the snow line in summer and returns to the shelter of valleys in the temperate zone but usually not below 2350m in winter.

**Indian wild Boar**, *Sus scrofa*: Found upto elevation of about 1500m. in the grasslands, scrublands and at times in dense forests. During cropping season, regularly raids the crop fields.

#### CHIROPTERA

Most of the species of bat. *viz.*, Flying Fox, *Pteropus giganteus*, Fulvous Fruit Bat, *Rousettus leschenaulti*, Hardwicke's Bat, *Rhinopoma hardwickii*, Indian False Vampire *Megaderma lyra*, Common Yellow Bat, *Scotophilus heathi*, etc. are found in forests, orchards as well as in the human settlement areas of foothills upto 2100 m. While whiskered Bat, *Myotis mystacinus*, Lesser Noctule, *Nyctalus listeri*, Mountain Noctule, *N. montanus* Serotine, *Eptesicus serotinus* etc. are denizens of further higher altitudes in alpine and subalpine zones. Further, most of the bat species in higher elevation hibernate in hollows of trees and in caves or come down to lower elevations during cold.

#### RODENTIA

Smaller Kashmir Flying Squirrel, *Hylopetis timbriatus* is found in the forested tracts at elevations between 1800m. and the tree line, while Red Flying Squirrel, *Petaurista petaurista* are mainly found in the foothill forest and available records suggest an upward movement upto 3500m. during spring. Long-tailed Marmot, *Marmota caudata* reported from Lahul-Spiti is typical of alpine areas between an elevation of 2400m. and 4300m. The Indian Porcupine, *Hystrix indica* is mainly concentrated in the forested tracts particularly in the periphery of cultivated land at altitudes varying from 1300 m. in September to 2750m in March-April. Murid rodents like Wood Mouse, *Apodemus sylvaticus*, Turkestan Rat, *Rattus turkestanicus*, Chestnut Rat, *Niviventer fulvescens*, Royle's Vole *Alticola royei*, etc. occur in both heavily wooded valleys and also in sparsely vegetated meadows within 1700-2850m. Other rats, mice and gerbil, *viz.*, House Rat, *Rattus rattus*, Lesser Bandicoot Rat, *Bandicota bengalensis*, House Mouse, *Mus musculus*, Little Indian field Mouse, *M. Booduga*, Metad, *Millardia meltada*, Indian Gerbil, *Tatera indica* are found in bushes,

scrubs, under the rocks, cultivated fields, godowns, but usually not in the forested tracts. They have reached at all the elevations, wherever there are human settlements.

#### INSECTIVORA

**Himalayan Water Shrew, *Chimarrogale himalayica*:** Confined to the vicinity of hill streams in alpine and sub-alpine zone.

**House shrew, *Suncus murinus*:** Associated with the human settlement from foothills to near tree line.

#### LAGOMORPHA

Species of the genus *Ochotona* are the denizens of the higher altitudes and live permanently in snow covered areas. While Black-naped Hare, *Lepus nigricollis* is mainly found in the grasslands, cultivated fields and forests of foothills.

#### CONSERVATION

Table I reveals that at least 21 number of mammalian species of Himachal Pradesh are included in the schedule I of the Indian Wildlife (Protection) Act, 1972, and entered under one or other category of threatened species in the Red Data Book (Director, Z.S.I., 1994). Though detailed population status of many of these species in Himachal Pradesh was not made, but circumstantial evidence suggests that population levels of most of them have declined during the last 100 years. Gaston *et al.* (1981) have identified four principal causes for decline in wildlife populations in Himachal Pradesh: livestock grazing, forest cutting, road construction and hunting. These problems are not new and no unique solutions can be offered. However all these factors have been discussed and following suggestions have been provided by them for mitigating the impact.

**Livestock grazing :** Domestic animals affect wildlife by competing with them for food, by altering the habitat and introducing exotic diseases. Once grazing reaches a level where it begins to significantly alter the structure and composition of the vegetation, it becomes a threat not only to wild herbivores but to every component of the ecosystem. In some of the areas, due to over grazing, no cover remained for wildlife and top soil has eroded to such an extent that regeneration becomes a very slow process. Grazing pressure can be controlled by the construction and careful maintenance of fences around small critical areas, by stringent enforcement of grazing permit regulation and reducing the livestock population with the introduction of high yielding varieties. Further, systematic vaccination of domestic livestock will reduce the chances of transmission of diseases to the wild herbivores.

**Forest cutting** : Commercial timber harvesting is not widespread, but fire and house construction requires wood alongwith fodder collection are common practices in the State. Increased human population growth and huge number of tourists have accelerated the rate of forest cutting for these purposes. Further, as forest provides cover for most of the wildlife species, efforts should be made to minimise the existing pressure on forest. Arrangement of alternative fuel and building material can significantly reduce the pressure on forest. National Forest policy (1988) lays specific emphasis, *inter alia*, on securing the participation of local communities in the management and development of forests, while meeting the subsistence needs, particularly of fuel wood and fodder, of these communities to achieve environmental development as well as forest conservation. To achieve this goal, several total or partly centrally sponsored schemes such as integrated afforestation and ecodevelopment Project Scheme to promote afforestation and development of degraded forests, area oriented fuelwood and fodder Project Scheme to augment production of fuelwood and fodder, have been evolved. State government should avail all these opportunities to minimise the probable disaster due to forest cutting.

**Road constructions** : A key factor in the economic development of the Indian Himalayas is the construction of an evergrowing network of roads. Apart from direct loss of forest cover due to road construction, indirect impact on forest, wildlife and environment is enormous. Building a road on a steep slope causes tremendous soil erosion and disturbs the ecosystem in a swath many times wider than the road itself. Roads also make new areas accessible for commercial timber cutting. Movement of vehicles through the forest not only disturbs the normal activities of wildlife as a whole specially of mammals, but also increases road-kills. In evaluating the relative costs and benefits of a proposed new road, apart from the financial cost in respect of construction and maintenance, environmental costs should also be considered. Second part of the assessment is particularly critical in case of roads which will cross through or extend to the areas important for wildlife. Thus, prior to the construction of a road, environmental impact assessment is to be done by the subject specialists.

**Hunting** : With the implementation of Indian Wildlife (Protection) Act, 1972, there is not much incidence of hunting for the sport purpose. However, illegal hunting for the purpose of meat, coat, fur, musk, is still taking a huge toll of wildlife in the State. Different species of artiodactyles and carnivores particularly snow leopard, foxes, musk deer are the worst victims of illegal hunting for commercial exploitation. Despite, many of these species being included in the appendix I of CITES, still their products in illegal international trade are often reported. Intensive patrolling of selected areas where these species still exist is the only immediate solution, although if international efforts to stop the trade are successful, hunting pressure may decline in the future. Farming of musk deer has already been tried in the State. Success in this respect will automatically reduce the pressure on wild population.

**Tourism** : A large number of tourists visit different parts of the State and economic development of the local people depends on these tourists. Wildlife, particularly the mammalian species are generally shy, and they desert the areas frequented by the tourists. Furthermore as already stated, firewood requirement of tourists might also cause damage to local forests and increase the risk of forest fire. To minimise this problem, well-defined trails and camp sites should be identified for tourist movement by setting aside areas to be left totally undisturbed. Tourists need to be educated on how to behave in order to minimise disturbance and to maximise their chances of seeing wildlife.

As per National Policy, various necessary conservation measures are being adopted in Himachal Pradesh. These include setting up of protected areas, regeneration and forestry programmes, implementation of Indian Wildlife (Protection) Act, 1972, awareness programme, research and monitoring. In fact, as compared to the total geographical areas, number of protected areas in the State is reasonably high having 2 nos. of National Parks and 32 Nos. of Wildlife Sanctuaries (Rodgers *et al.* 2000) covering an area of 7166 sq. km i.e. 12.87 % of the total area of the State. However, most of these protected areas are too small, covering only a few square kilometers and surrounded by completely clean areas. Throughout the Himalayas an inter digitation of different forest types seems to be characteristic of the remaining undisturbed areas. This mixture of different trees increases the capacity of particular areas to support wildlife. Thus, small protected areas may preserve a particular stand of forest but not be able to support the viable populations of different species of mammals. Conservation can be scientifically done by encompassing a number of protected areas having stands of several forest types into one with the establishment of corridors between them.

Without the improvement of living conditions (human ecology) in the poverty-stricken Himalayas, no conservation programme can be successful. For the awareness of the people sermons like 'do not cut trees' (and starve for fuel), 'do not kill wildlife' (and starve for protein food), 'do not trade in hides, skins, fur, musk pods and other animal products' (and starve for money) are being issued by the management authorities. But the expanding population in the hills must get these necessities of life to survive, only 'do not' will not help. The arrangement of alternative resources through ecodevelopment by afforestation, regeneration of degraded areas, employment generation, education, domestication and farming of some of the wild species, along with marketing facilities of permissible wildlife produce is a must to achieve the goal of sustainable development and conservation of the biological heritage of the region.

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Table 1. Mammals of Himachal Pradesh				
Common Name	Scientific Name	Status		
		CITES	IWPA (1972)	National Red Data Book (1994)
Order : INSECTIVORA				
Family : SORICIDAE				
1. Himalayan Shrew	<i>Soriculus nigrescens</i>	-	-	-
2. Grey Shrew	<i>Crocidura attenuata</i>	-	-	-
3. House Shrew	<i>Suncus murinus</i>	-	-	-
4. Himalayan water Shrew	<i>Chimarrogale himalaica</i>	-	-	-
Family : ERINACEIDAE				
5. Long-eared Hedgehog	<i>Hemiechinus auritus</i>	-	IV	-
6. Pale Hedgehog	<i>Hemiechinus micropus</i>	-	-	-
Order : CHIROPTERA				
Family : PTEROPODIDAE				
7. Short-nosed Fruit Bat	<i>Cynopterus sphinx</i>	-	V	-
8. Flying Fox	<i>Pteropus giganteus</i>	II	V	-
9. Fulvous Fruit Bat	<i>Rousettus leschenaulti</i>	-	V	-
Family : VESPERTILIONIDAE				
10. Tickell's Bat	<i>Hesperopterus tickelli</i>	-	V	-
11. Painted Bat	<i>Kerivoula picta</i>	-	-	-
12. Lesser Mouse-eared	<i>Myotis blythi</i>	-	-	-
13. Hodgson's Bat	<i>Myotis farnosus</i>	-	-	-
14. Whiskered Bat	<i>Myotis mystacinus</i>	-	-	-
15. Lesser Noctule	<i>Nyctalus montanus</i>	-	-	-

Table continued

Common Name	Scientific Name	Status		
		CITES	IWPA (1972)	National Red Data Book (1994)
16. Mountain Noctule	<i>Nyctalus montanus</i>	-	-	-
17. Indian Pygmy Pipistrelle	<i>Pipistrellus mimus</i>	-	-	-
18. Kelaart's Pipistrelle	<i>Pipistrellus ceylonicus</i>	-	-	-
19. Darmer's Bat	<i>Pipistrellus darmeri</i>	-	-	-
20. —	<i>Scotophilus kuhli</i>	-	-	-
21. Common yellow bat	<i>Scotophilus heathi</i>	-	-	-
22. Serotinae	<i>Eptesicus serotinus</i>	-	-	-
Family : MEGADERMATIDAE				
23. Indian False Vampire	<i>Megaderma lyra</i>	-	-	-
24. —	<i>Hipposideros fulvus</i>	-	-	-
Family : RHINOLOPHIDAE				
25. Greater Horse-Shoe Bat	<i>Rhinolophus ferrumequinum</i>	-	-	-
26. Blyth's Horse-Shoe Bat	<i>Rhinolophus lepidus</i>	-	-	-
27. Great Eastern Horse-Shoe Bat	<i>Rhinolophus luctus</i>	-	-	-
28. Rufous Horse-Shoe Bat	<i>Rhinolophus rouxi</i>	-	-	-
Family : RHINOPOMATIDAE				
29. Hardwicke's Bat	<i>Rhinopoma hardwickei</i>	-	-	-
Order : PRIMATES				
Family : CERCOPIITHECIDAE				
30. Rhesus macaque	<i>Macaca mulatta</i>	II	II	-
31. Common langur	<i>Semnopithecus entellus</i>	I	II	-

Table continued

Common Name	Scientific Name	Status		
		CITES	IWPA (1972)	National Red Data Book (1994)
Order : CARNIVORA				
Family : CANIDAE				
32. Jackal	<i>Canis aureus</i>	III	II	-
33. Indian Wolf	<i>Canis lupus</i>	I	I	Vulnerable
34. Bengal Fox	<i>Vulpes bengalensis</i>	III	II	-
35. Red Fox	<i>Vulpes vulpes</i>	III	II	-
36. Indian Wild Dog	<i>Cuon alpinus</i>	-	II	-
Family : HERPISTIDAE				
37. Grey Mongoose	<i>Herpestes edwardsii</i>	III	IV	-
38. Small Indian Mongoose	<i>Herpestes javanicus</i>	III	IV	-
Family : VIVERRIDAE				
39. Himalayan Palm Civet	<i>Paguma larvata</i>	III	II	-
40. Small Indian Civet	<i>Viverricula indica</i>	III	II	-
41. Common Palm Civet	<i>Paradoxurus hermaphroditus</i>		II	-
Family : MUSTELIDAE				
42. Common Otter	<i>Lutra lutra</i>	I	II	-
43. Smooth Indian Otter	<i>Lutrogale perspicillata</i>	II	II	-
44. Clawless Otter	<i>Amblonyx cinereus</i>	II	I	-
45. Beech Marten	<i>Martes foina</i>	III	II	-
46. Yellow-throated Marten	<i>Martes flavigula</i>	III	II	-
47. Himalayan Weasel	<i>Mustela sibirica</i>	III	II	-

Common Name	Scientific Name	Status		
		CITES	IWPA (1972)	National Red Data Book (1994)
48. Pale Weasel	<i>Mustela altaica</i>	III	II	-
49. Yellow-bellied Weasel	<i>Mustela kathiah</i>	III	II	-
50. Honey Badger or Ratel	<i>Mellivora capensis</i>	-	I	-
Family : URSIDAE				
51. Brown Bear	<i>Ursus arctos</i>	I	I	Endangered
52. Asiatic Black Bear	<i>Ursus thibetarus</i>	I	II	-
Family : HYAENIDAE				
53. Striped Hyaena	<i>Hyaena hyaena</i>	-	III	-
Family : FELIDAE				
54. Leopard Cat	<i>Prionailurus bengalensis</i>	I	I	Vulnerable
55. Jungle Cat	<i>Felis chaus</i>	II	II	Vulnerable
56. Leopard	<i>Panthera pardus</i>	I	I	Vulnerable
57. Tiger	<i>Panthera tigris</i>	I	I	Endangered
58. Snow Leopard	<i>Uncia uncia</i>	I	I	Vulnerable
59. Lynx	<i>Lynx lynx</i>	II	I	-
Order : PHOLIDATA				
Family : MANIDAE				
60. Indian Pangolin	<i>Manis crassicaudata</i>	II	-	-

Table continued

Common Name	Scientific Name	Status		
		CITES	IWPA (1972)	National Red Data Book (1994)
Order : PERISSODACTYLA Family : EQUIDAC				
61. Kiang or Tibetan Wild Ass	<i>Equus kiang</i>	II	-	-
Order : ARTIODACTYLA Family : CERVIDAE				
62. Kashmir Stag	<i>Cervus elaphus hanglu</i>	I	I	Endangered
63. Sambar	<i>Cervus unicolor</i>	-	III	-
64. Cheetal or Spotted Deer	<i>Axis axis</i>	-	III	-
65. Barking Deer	<i>Muntiacus muntjac</i>	-	III	-
Family : MOSCHIDAE				
66. Musk Deer	<i>Moschus chrysogaster</i>	I	I	Endangered
Family : BOVIDAE				
67. Siberian Ibex	<i>Capra sibirica</i>	-	I	Endangered
68. Himalayan Tahr	<i>Hemitragus jemlahicus</i>	-	I	Endangered
69. Tibetan Gazelle	<i>Procapra picticaudata</i>	-	I	IK
70. Indian Gazelle or Chinkara	<i>Gazella benetti</i>	-	I	Vulnerable
71. Serow	<i>Nemorhedus sumatraensis</i>	I	I	Vulnerable
72. Goral	<i>Nemorhedus goral</i>	I	III	-
73. Bharal	<i>Pseudois nayaur</i>	-	I	Vulnerable
74. Argali or Nayan	<i>Ovis ammon</i>	I	I	Ik
75. Nilgai	<i>Boselaphus tragocamelus</i>		III	-
76. Yak	<i>Bos grunniens</i>	I	I	Critical

Table continued

Common Name	Scientific Name	Status		
		CITES	IWPA (1972)	National Red Data Book (1994)
Order : RODENTIA				
Family : SCIURIDAE				
77. Long-tailed Marmot	<i>Marmota caudata</i>	III	II	-
78. Flying Squirrel	<i>Petaurista petaurista</i>	-	II	-
79. Kashmir Flying Squirrel	<i>Eupataurus cinereus</i>	-	II	-
80. Smaller Kashmir Flying Squirrel	<i>Hylopetes fimbriatus</i>	-	II	-
81. Northern Palm Squirrel	<i>Funambulus pennanti</i>	-	IV	-
Family : HYSTRICIDAE				
82. Indian Porcupine	<i>Hystrix indica</i>	-	IV	-
83. Hodgson's Porcupine	<i>Hystrix brachyura</i>	-	II	-
Family : MURIDAE				
84. Royle's High Mountain Vole	<i>Alticola roylei</i>	-	-	-
85. Blyth's Vole	<i>Microtus lucurus</i>	-	-	-
86. Wood Mouse	<i>Apodemus sylvaticus</i>	-	V	-
87. Large Bandicoot Rat	<i>Bandicota indica</i>	-	V	-
88. Lesser Bandicoot Rat	<i>Bandicota bengalensis</i>	-	V	-
89. Short-tailed Bandicoot Rat	<i>Nesokia indica</i>	-	-	-
90. House Rat	<i>Rattus rattus</i>	-	V	-
91. Turkestan Rat	<i>Rattus turkestanicus</i>	-	V	-
92. Chestnut Rat	<i>Niviventer fulvescens</i>	-	V	-
93. White-bellied Rat	<i>Niviventer niviventer</i>	-	V	-
94. Kutch Rat	<i>Cremnomys cutchicus</i>	-	V	-

Table continued

Common Name	Scientific Name	Status		
		CITES	IWPA (1972)	National Red Data Book (1994)
95. Metad	<i>Millardia meltada</i>	-	V	-
96. Indian Bush Rat	<i>Golunda ellioti</i>	-	V	-
97. Indian Long-tailed Mouse	<i>Vandeleuria oleracea</i>	-	V	-
98. House Mouse	<i>Mus musculus</i>	-	V	-
99. Fawn-coloured Mouse	<i>Mus cervicolor</i>	-	V	-
100. Little Indian Field Mouse	<i>Mus boodgua</i>	-	V	-
101. Spiny Field Mouse	<i>Mus platythrix</i>	-	V	-
102. Indian Gerbil	<i>Tatera indica</i>	-	-	-
Order : LOGOMORPHA				
Family : LEPORIDAE				
103. Black-naped Hare	<i>Lepus nigricollis</i>	-	IV	-
104. Wooly Hare	<i>Lepus Oiostolus</i>	-		-
Family : OCHOTONIDAE				
105. Ladak Pika	<i>Ochotona ladacensis</i>	-	IV	-
106. Large-eared Pika	<i>Ochotona macrotis</i>	-	IV	-
107. Royle's Pika	<i>Ochotona roylei</i>	-	IV	-

