

# Insect Fauna of Khajjiar Lake of Chamba District, Himachal Pradesh, India

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**Abstract.-** A study was conducted in various seasons of the years from July 2008 to March 2012 in Khajjiar lake area which revealed the presence of a total of 121 species of insects belonging to 108 genera spread over 28 families and 8 orders. Of these, Lepidoptera (49 species) was the most dominant insect order in the present study area, followed by Orthoptera (29 species), Coleoptera (15 species), Odonata (10), Hymenoptera (7), Hemiptera and Diptera (5 each), and Homoptera (1 species). Out of these only 3 species are placed under Wildlife Protection Act (1972) viz., *Lethe scanda* and *Lampides boeticus* placed under scheduled II and *Castalius rosimon* under scheduled IV of the Act. Out of total 121 recorded species from Khajjiar lake area, 29 species were Very Common while 68 were Common, 13 were Uncommon and 11 were Rare

**Key words:** Khajjiar lake, insect diversity, threatened species.

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## INTRODUCTION

Insects are the largest group among animals and plants in the world. It is commonly believed that 75-80 % of the total animal species on this planet are insects (Ehrlich and Wilson, 1991). Hammond (1992) estimated about 9, 50,000 described species of insects, although lower figures of around 7, 50,000 (May, 1998) are generally quoted.

The insect fauna of India is vast. In an old estimate, Lefroy and Howlett (1909) in the monumental book 'Indian Insect Life' reported 25,700 Indian species. Roonwal (1989) estimated that insects constitute two-thirds of the total fauna in India and comprise nearly 1, 00,000 species, of which about half remain yet to be studied. Varshney (1997) has reported 589 families and 51450 species of insects from India. In a recent estimate, Alfred *et al.* (1998) estimated 59353 species of insects from India belonging to 619 families.

Indian insects belong to 27 orders of which Coleoptera is most dominant with about 15,500 species. Butterflies and Moths with about 15,000 species is another important group. These are followed by Hymenoptera (10,000 spp.), Diptera (6093 spp.) and Hemiptera (6500 spp.) (Varshney, 1998).

In Himachal Pradesh, Butterflies and Moths (1250 spp.) form the most dominant group. They are followed by Coleoptera (1100 spp.), Diptera (720 spp.), Hymenoptera (470 spp.) and Hemiptera (368 spp.). These five orders together constitute 89.6 % of Himachal entomofauna. Singh (2007) has enumerated the presence of 31 species of insects belonging to five different orders viz. Orthoptera (7 species), Diptera (7 species), Lepidoptera (8 species), Coleoptera (3 species) and Hymenoptera (6 species) from Chandertal lake. Moreover, distribution pattern of insects in different altitudes of Shimla hills has been studied by Thakur *et al.* (2008) who described 70 species of insects spread over four orders namely Coleoptera, Orthoptera, Lepidoptera and Hymenoptera.

Little knowledge is there about the butterflies and grasshoppers of Chamba (Thakur *et al.*, 2002; Mehta *et al.*, 2002) and few studies on birds and mammals are also there (Singh and Banyal, 2012a, b). But there is not any study conducted on the insect fauna of the present study area of Khajjiar Lake which is one of the oldest conservation areas for wildlife. This area is under immense anthropological pressure because of the most favoured tourist destination. Keeping this in view a detailed study on insects of the Khajjiar lake area was conducted.

## MATERIALS AND METHODS

Khajjiar lake situated in Chamba district of

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Himachal Pradesh has been explored for the enumeration of insect diversity. These explorations have been conducted in various seasons of the years from July 2008 to March 2012.

Khajjiar Lake “The Mini Switzerland of Himachal Pradesh” located in the western part of Chamba district of Himachal Pradesh. It lies 32° 26′ north and 76° 32′ east about 6300 feet (1920 meters) above sea level between Chamba and Dalhousie (Fig. 1). The average depth of this lake is stated to be thirteen feet as per district gazetteer. Khajjiar Lake has a clump of reeds and grasses exaggeratedly called an island in it. Fed by slim streams this small lake rests in the centre of large glade of Khajjiar. This glade is greenish in its turf and contains in its centre a small lake having approximate area of 5000 square yards. Khajjiar Lake has thick forest of Kala Top sanctuary surrounding its soft green grass. There is a ‘golden’ domed temple at the edge of this meadow, dedicated to the deity ‘Khajjinag’, from whom the area derives its name. Khajjiar Lake is situated in Khajjiar-Kalatop wild life sanctuary. This small sanctuary lies in the catchments of the Ravi river, located in western part of Chamba District. It is one of the oldest preserved forests of state (notified on 01.07.1949). Total area of sanctuary is 2,026.89 hectares (20.69 km<sup>2</sup>). Its mean annual rainfall is 800 mm. Temperature varies from -10° C to 35°C. The climate of Khajjiar summers being mild and winters cold and bitter. It experiences south-western monsoon rains in July-September. The vegetation consists of mature mixed Blue Pine and Deodar forests, with some Green Oak and Rhododendron. Study area was broadly divided into three main types depending upon the vegetation and human intervention like dense forests, lake meadow and human settlements. Different insect species were sampled at regular intervals from all the areas.

#### *Methodology*

Due to their immense diversity, documentation of insect fauna of an area is never complete, although a good deal of information can be generated on them by planned and systematic surveys. Following methods were used for collection of arthropod fauna:

Most of insects remain a little inactive in

morning hours due to excessive cold night, hence these were picked up by using forceps from beneath grasses or below stones. For soft bodied insects, camel hair brush dipped in preserving medium was used to minimize damage to soft body covering of insect. Scissor was used to cut twigs below on which insects take shelter (Jonathan, 1990). Proper care has been taken during picking up the specimens to avoid any damage to their body parts. Free flying and free living insects were collected by sweeping method (Arora, 1990). Nylon net with long handle was used for sweeping the insects from herbage. The net used for sweeping consisted of a bag, made up of a cloth 50 cm deep, suspended on a 60 cm handle made up of stainless steel. Free flying hymenopterans, lepidopterans and some dipterans were collected by aerial nets. Net with wide mouth was moved in air with the help of long sturdy handle and as insect enters the net, the handle twisted rapidly. Soft-bodied insects like butterflies may be gently removed from the bottom of the bag, after they got trapped in the bag by a rapid twist of handle. Aspirator method was used to collect small active insects like leafhoppers, white flies, other Hemiptera and Coleoptera etc. direct from the plant surface. It is also useful to transfer small insects from sweeping nets. The air was sucked by the rubber tubing, which draw the insects to the main tube through the glass tube. The lid of the main tube was removed and the entire content transferred to the killing bottle or into the preservative. Many insects like moths, beetles etc. were collected by using artificial light on white cloth sheet. These insects were picked up by hand or forceps and killed by using killing bottle.

#### *Preserving methods*

Preservation is very important step in taxonomy. For identification purpose, insect after preservation must look like as natural as live one. Insect species of different orders have different body make up *viz.* different colour, soft or hard bodies etc. so they need specific preserving methods.

In most of cases after collection insects were put into killing bottles containing agents like chloroform, ethyl acetate or benzene. These insects were transferred to paper envelop. Each envelop

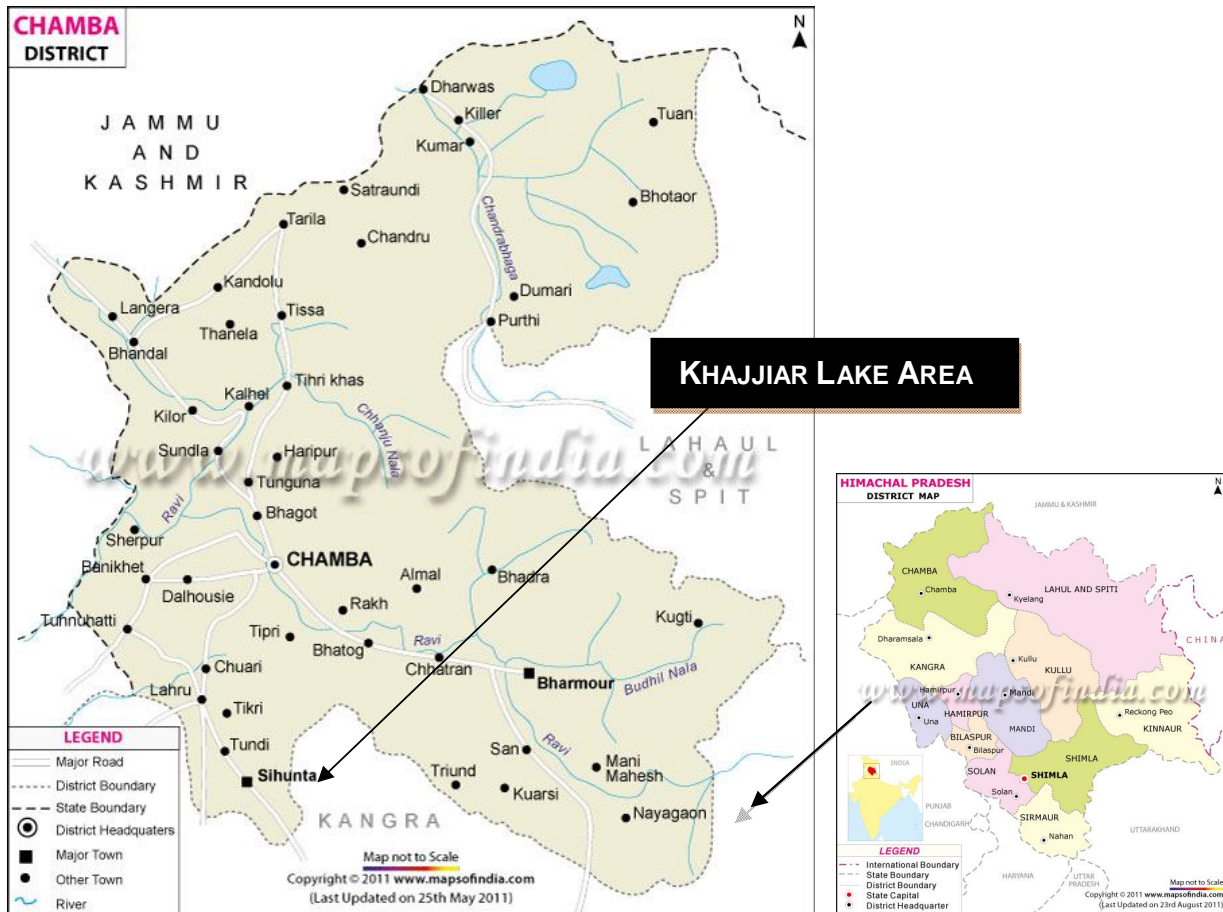


Fig. 1: Map of Chamba district showing the study area of Khajjiar lake (Source: [www.mapsofindia.com](http://www.mapsofindia.com))

was numbered carefully and detail of specimen number, date, host etc. were written in field notebook. These packets containing specimens were kept in boxes with thin layer of cotton. Thereafter insects were properly stretched and pinned by using a setting board and rust free entomological pins of different size depending upon the size of specimen (Arora, 1990). These stretched and pinned specimens were kept in wooden insect boxes in dry conditions. To protect them from fungal infection and other attacks like ants etc. naphthalene balls were placed in boxes. These balls were replaced regularly due to their volatile nature.

Abundance status was assessed on an arbitrary frequency scale as: Very common (VC)- collected from more than eight spots from three

areas; common (C)- collected from four to seven spots from three areas; uncommon (UC)- collected from two or three spots from three areas; rare ( R)- collected from one spot from three areas.

### RESULTS AND DISCUSSION

A total of 121 species of insects belonging to 108 genera spread over 28 families and 8 orders have been recorded from Khajjiar area (Table I). Of these, Lepidoptera (49 species) was the most dominant insect order in the present study area, followed by Orthoptera (29 species), Coleoptera (15 species), Odonata (10), Hymenoptera (7), Hemiptera and Diptera (5 each), and Homoptera (1 species) (Fig. 3). 113 species were identified up to species

**Table I.- Systematic list of different insect species recorded in Khajjiar area.**

Order / Family	S.N.	Scientific name	Status	
Odonata (Dragonflies and Damselflies)				
Cordulegasteridae	1	<i>Antogaster basalis</i>	Common	
Aeshnidae	2	<i>Anax immaculifrons</i>	Common	
Libellulidae	3	<i>Orthetrum s. sabina</i>	Common	
	4	<i>Orthetrum t. triangular</i>	Very Common	
	5	<i>Orthetrum pruinosum neglectum</i>	Uncommon	
	6	<i>Palpopleura s. sexmaculata</i>	Common	
	7	<i>Crocothemis servilia</i>	Common	
	8	<i>Trithemis festiva</i>	Uncommon	
Coenagrionidae	9	<i>Pseudagrionii</i> sp.	Common	
Calopterygidae	10	<i>Neurobasis c. chinensis</i>	Very Common	
Orthoptera (Grasshoppers)				
Acrididae	11	<i>Ceracris n. nigricornis</i>	Very Common	
	12	<i>Gelastorrhinus laticornis</i>	Common	
	13	<i>Dnopherula (Aulacobothrus) decisis</i>	Very Common	
	14	<i>Aiolopus thalassinus tamulus</i>	Common	
	15	<i>Locusta migratoria danica</i>	Common	
	16	<i>Pseudosphingonotus savignyi</i>	Very Common	
	17	<i>Spathosternum p. prasiniferum</i>	Very Common	
	18	<i>Oxya fuscovittata</i>	Very Common	
	19	<i>Eucoptacra saturata</i>	Rare	
	20	<i>Eyprepocnemis rosea</i>	Very Common	
	21	<i>Tylotropidius varicornis</i>	Very Common	
	22	<i>Diabolocatantops innotabilis</i>	Uncommon	
	23	<i>Xenocatantops karnyi</i>	Very Common	
	24	<i>Chondracris rosea</i>	Rare	
	25	<i>Cyrtacanthacris tatarica</i>	Rare	
	26	<i>Patanga succincta</i>	Common	
	Pyrgomorphidae	27	<i>Aularches punctatus</i>	Common
		28	<i>Poikilocerus pictus</i>	Common
	Tetrigidae	29	<i>Eucrietetix grandis</i>	Common
		30	<i>Teredorus frontails</i>	Common
		31	<i>Coptotetix consperus</i>	Common
		32	<i>Ergatetix dorsiferus</i>	Very Common
		33	<i>Ergatetix guentheri</i>	Very Common
		34	<i>Hedotetix costatus</i>	Common
	Gryllidae	35	<i>Acheta domesticus</i>	Very Common
		36	<i>Gryllus bimaculatus</i>	Very Common
		37	<i>Loxoblemmus equestris</i>	Common
38		<i>Teleogryllus occipitalis</i>	Very Common	
Conocephalidae	39	<i>Conocephalus maculatus</i>	Very Common	
Hemiptera				
Pentatomidae	40	<i>Dalpada nigricollis</i>	Common	
	41	<i>Erthesina fulla</i>	Common	
	42	<i>Prionolomia cardoni</i>	Very Common	
Largidae	43	<i>Physopelta gutta</i>	Common	
	44	<i>Physopelta schlanbuschi</i>	Common	
Homoptera				
Cicadae	45	<i>Platylomia saturata</i>	Common	

Table I Continued

Order / Family	S.N.	Scientific name	Status	
Coleoptera (Beetles)				
Carabidae	46	<i>Carabus boysi</i>	Common	
	47	<i>Calosoma</i> sp.	Common	
Dytiscidae	48	<i>Dytiscus punctalis</i>	Common	
Scarabaeidae	49	<i>Clineria</i> sp.	Uncommon	
	50	<i>Mimela pictoralis</i>	Common	
	51	<i>Onitis subopacus</i>	Common	
	52	<i>Popilla</i> sp.	Uncommon	
	53	<i>Melolontha furcicauda</i>	Common	
	54	<i>Anomala rufiventris</i>	Common	
	55	<i>Helochaes</i> sp.	Uncommon	
	56	<i>Coccinella septempunctata</i>	Very Common	
Hydrophilidae	57	<i>Myllabris pustulata</i>	Common	
Coccinellidae	58	<i>Cleorina</i> sp.	Very Common	
Meloidae	59	<i>Dorysthenes (Lophosternus) huegeli</i>	Uncommon	
Chrysomellidae	60	<i>Macrotoma</i> sp.	Rare	
Lepidoptera (Butterflies)				
Papilionidae	61	<i>Papilio protenor</i>	Common	
	62	<i>Papilio polyctor polyctor</i>	Common	
	63	<i>Parnassius hardwickei hardwickei</i>	Rare	
Pieridae	64	<i>Delias belladonna horsfieldi</i>	Uncommon	
	65	<i>Pieris canidia indica</i>	Common	
	66	<i>Catopsillia crocale</i>	Common	
	67	<i>Gonepteryx rhamni nepalensis</i>	Common	
	68	<i>Eurema hecabe fimbriata</i>	Common	
	69	<i>Colias electo fieldi</i>	Very Common	
	70	<i>Danaus genutia</i>	Common	
Danaidae	71	<i>Parantica sita sita</i>	Common	
	72	<i>Mycalesis perseus blasius</i>	Very Common	
Satyridae	73	<i>Lethe insana insana</i>	Rare	
	74	<i>Lethe scanda</i>	Rare	
	75	<i>Lethe verma verma</i>	Common	
	76	<i>Lasiommata schakra schakra</i>	Common	
	77	<i>Aulocera swaha swaha</i>	Common	
	78	<i>Aulocera saraswati saraswati</i>	Common	
	79	<i>Callerebia annade</i>	Common	
	80	<i>Ypthima nareda nareda</i>	Common	
	81	<i>Ypthima ceylonica hubneri</i>	Rare	
	82	<i>Ypthima sakra nikaia</i>	Very Common	
	83	<i>Melanitis leda ismene</i>	Very Common	
	Nymphalidae	84	<i>Athyma opalina</i>	Common
		85	<i>Athyma asura</i>	Uncommon
		86	<i>Neptis mahendra</i>	Common
87		<i>Neptis hylas astola</i>	Common	
88		<i>Pseudergolis wedah</i>	Rare	
89		<i>Precis iphita</i>	Common	
90		<i>Cynthia cardui</i>	Common	
Acraeidae	91	<i>Vanessa indica</i>	Common	
	92	<i>Kaniska canace</i>	Uncommon	
	93	<i>Aglais cashmirensis</i>	Common	
	94	<i>Childrena childreni</i>	Common	
	95	<i>Issoria lathonia</i>	Rare	
	96	<i>Acraea issoria anomala</i>	Common	

Table I Continued

Order / Family	S.N.	Scientific name	Status
Erycinidae	97	<i>Libythea myrrha</i>	Common
	98	<i>Libythea lepita</i>	Common
	99	<i>Dodona durga</i>	Common
Lycaenidae	100	<i>Pseudozizeeria maha</i>	Common
	101	<i>Lampides boeticus</i>	Common
	102	<i>Lycaena pavana</i>	Common
	103	<i>Heliophorus sena</i>	Very Common
	104	<i>Castalius rosimon</i>	Common
	105	<i>Ropala manea schistecea</i>	Common
Hesperiidae	106	<i>Coladenia dan</i>	Common
	107	<i>Sarangesa purendra</i>	Uncommon
	108	<i>Polytrema eltola</i>	Rare
	109	<i>Borbo bevani</i>	Uncommon
Diptera (Flies)			
Asilidae	110	<i>Maschimus</i> sp.	Uncommon
Calliphoridae	111	<i>Chrysomya rufifacies</i>	Very Common
	112	<i>Calliphora vomitoria</i>	Common
Muscidae	113	<i>Phaenicia Sericata</i>	Common
	114	<i>Mucsa domestica</i>	Very Common
Hymenoptera			
Apidae	115	<i>Melecta himalayana</i>	Common
	116	<i>Anthophora zonata</i>	Common
	117	<i>Bomhus trifasciatus</i>	Common
	118	<i>Apis dorsata</i>	Very Common
	119	<i>Apis cerana indica</i>	Very Common
Vespidae	120	<i>Polistes hebrsea</i>	Very Common
	121	<i>Vespa basalis</i>	Common

level but 8 species were identified only up to genus level. Out of total 121 recorded species, 29 species were Very Common while 68 were Common, 13 were Uncommon and 11 were Rare.

Himachal Pradesh is known to harbour 88 species of Odonata (dragonflies and damselflies) (Kumar, 2005) and present study revealed the presence of 10 species belonging to 8 genera spread over 5 families of odonates from Khajjiar lake area. It has been analysed that family Libellulidae supported the highest number of species (6 species, under 4 genera) and all other families have been represented by a single species each. In addition, some species like *Anotogaster basalis*, *Anax immaculifrons*, *Orthetrum sabina sabina*, *Orthetrum triangular triangular*, *Orthetrum pruinosum neglectum*, *Palpopleura sexmaculata sexmaculata*, *Trithemis festiva*, *Neurobasis chinensis* etc. recorded during present study from Khajjiar area have also been earlier recorded from Himachal Pradesh by Kumar (2005). Similarly, he has enlisted

Libellulidae as the largest family of odonates from Himachal Pradesh. Mani (1974) has elucidated that there is presence of distinct zoogeographical distributional patterns in the Himalayan fauna. The fauna of Western Himalaya is composed largely of Oriental elements, partly of Palaearctic and lesser of Mediterranean and Ethiopian elements. Present study showed the presence of *Orthetrum triangular triangular* of Indian element in Khajjiar area.

Orthoptera (Grasshoppers) is one of the largest insect orders with over 20,000 species known to the science throughout the world (Gillot, 2005). More than 1,750 species, about 10% of the total world species, have been recorded from India (Alfred and Ramakrishna, 2004). Khajjiar area supported a total of 29 species of Orthoptera belonging to 28 genera, spread over 5 families. Recently, Shishodia and Gupta (2010) have reported 165 species of grasshoppers belonging to 105 genera and 16 families from Himachal Pradesh, therefore, orthopterans of Khajjiar area represent

more than 17% of the state fauna. Analyses of data on orthopterans of Khajjiar revealed that family Acrididae supported the maximum number of species (16 species) (Table I). Similarly, Shishodia and Gupta (2010) have reported Acrididae as the largest family of Orthoptera in Himachal Pradesh. Similar studies have been conducted on orthopterans of small areas of the state by different workers like Shishodia and Tandon (2000) who compiled a list of 50 species of grasshoppers from Renuka Wetland. Shishodia *et al.* (2002) compiled the presence of 39 species belonging to 35 genera, 8 families and 4 superfamilies of grasshoppers from Pong dam wetland. Thakur and Mattu (2006) reported 10 species of Orthoptera under 9 genera and one family (Acrididae) from Pin Valley National Park. Similarly, Lal (2010) recorded 99 species of grasshoppers belonging to 73 genera, 12 families and 4 superfamilies from different localities of Himachal Pradesh. Moreover, there is a correlation of abundance of grasshopper species with the plant communities on which they depend which in turn has been linked to the climatic, physiographic, edaphic and biotic factors which control the plant distribution, therefore, presence of 17% of the total orthoptera fauna of the state in Khajjiar area situated in middle Himalayan zone has been justified.

During the course of present study 5 species of Hemiptera belonging to 4 genera and 2 families, and a single species of Homoptera (*Platylomia saturate*) belonging to family Cicadidae have been recorded from the Khajjiar area (Table I). Hemipteran fauna of Himachal Pradesh is poorly known except the family Aphididae which is rather well explored in comparison to the other families. Some 368 species belonging to 186 genera under 25 families of Hemiptera are known so far from Himachal Pradesh (Varshney, 1992). Present study elucidated Pentatomidae as the largest family of Hemiptera from Khajjiar area, but Ghosh *et al.* (2005) enumerated Aphididae as the largest family from Himachal Pradesh.

Coleoptera (Beetles) is the most diverse order of class Insecta. One out of every four described animal species is beetle. There are 350,000 species belonging to 177 families under four suborder estimated by scholars throughout the world. But still it is doubtful whether this number represent one-

tenth of those existing today. From India about 15,500 species belonging to 104 families under three sub-orders have been reported (Sengupta and Pal, 1998). Present study showed the presence of 15 species of Coleoptera. These included some species of economic importance like *Carabus boysi*, *Dytiscus punctalis*, *Mimela pectoralis*, *Onitis subopacus*, *Melolontha furcicauda*, *Anomala rufiventris*, *Coccinella septumpunctata* and *Mylabris pustulata*. Population of beetles in Khajjiar meadow increased during spring season and a multifold increase in their numbers has been recorded during this season. Present study showed Scarabaeidae as the largest family of Coleoptera in Khajjiar area, as also reported from Himachal Pradesh by Chandra (2005). Similarly, different species of Coleoptera have been reported from different areas of the state by some workers like Saraswat (2002) and Mehta (2003) who reported 7 and 9 species respectively belonging to different families including Coccinellidae from Shimla hills. Nine species of pleurostic Scarabaeidae were identified by Chandra and Uniyal (2007) from Great Himalayan National Park, Himachal Pradesh. Mukhopadhyay and Sharma (2008) reported the presence of 18 species of Coleoptera from Pin valley National Park.

A total of 49 species of butterflies belonging to 41 genera and 10 families have been recorded from Khajjiar area of Himachal Pradesh (Fig. 2, Table I). The largest representative family of butterflies and moths from India is Nymphalidae with 450 species (Varshney, 1993). Similarly, analysis of present data revealed that family Nymphalidae and Satyridae (12 species each) dominated the Lepidoptera fauna of Khajjiar area, followed by Pieridae and Lycaenidae (6 species each), Hesperidae (4 species), Papilionidae (3 species), Erycinidae and Danaidae (2 species each), and Acraeidae and Riodinidae (1 species each). In addition, 3 species placed under Wildlife Protection Act (1972) viz., *Lethe scanda* and *Lampides boeticus* placed under scheduled II and *Castalius rosimon* under scheduled IV of the Act have also been reported from the Khajjiar area. These records are in accordance with the earlier study of Arora *et al.* (2005) who also recorded some butterfly species of conservations concerns from the state of Himachal Pradesh.

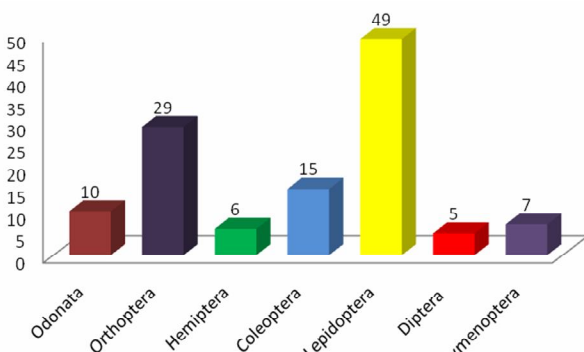


Fig. 2. Number of species of insect orders recorded in Khajjiar area.

Only 6% world dipteran (flies) diversity has been reported from India which is 6,093 species under 1,075 genera and 87 families (Datta, 1998). Present study revealed the presence of 5 species of dipterans. These included *Machimus* sp., *Chrysomya ruffifacies*, *Calliphora vomitoria*, *Phaenicia Sericata* and *Musca domestica*. Similar study by Nandi (2002) showed the presence of 41 species of Calliphorid flies, including species of genera *Calliphora*, *Chrysomyia*, *Lucilia* and *Hemipyrellia* which have diversified habitat and mostly are synanthropic, a few are forest inhabitants and attracted to garbages and dead bodies of vertebrates.

Order Hymenoptera (the bug) is probably the most beneficial in the entire insect class. It contains many insects that are of value as parasites or predators of various insect pests and pollinators. During the course of present study a total of 7 species of Hymenoptera were recorded. Almost equally, India holds about 8.3% of total world's hymenoptera with about 10,000 species (Jonathan, 1998). These included some species of economic importance viz., *Bombus trifasciatus*, *Apis dorsata*, *Apis cerana indica*, *Polistes hebraeus* and *Vespa basalisi*.

#### ACKNOWLEDGEMENTS

Vikram Singh is grateful to University Grants Commission for providing financial assistance in the form of Rajeev Gandhi National Fellowship. Authors are also thankful Director, High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan, Himachal Pradesh for help in identification.

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(Received 12 December 2012, revised 21 June 2013)