

Article

Diversity and distribution of butterflies (Insecta: Lepidoptera) of district Dir lower, Khyber Pukhtoonkhwa, Pakistan

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Abstract

Butterflies are the fine-looking creatures and act as ecological indicators and pollinators. The present study is the first record of Butterfly fauna of Dir lower. Collection was carried out during March - August 2013. The specimens were collected and identified with the help of taxonomic keys and preserved specimens in National Insect Museum Islamabad. The collection of 375 specimens were preserved. Identification revealed 24 species belonging to 20 genera and 7 families. The species are *Papilio polyctor* Boisduval, *Papilio demoleus* Linnaeus, *Junonia almanac* Linnaeus, *Pararge schakra* Kollar, *Junonia hierta* Fabricius, *Junonia orythea* Linnaeus, *Argyrius hyperbius* Linnaeus, *Hypolimnys bolina* Linnaeus, *Vanessa cashmiriensis* Kollar, *Phalantha phalantha* Drury, *Melitea didyma* Esper, *Lycaena phalaeas* Linnaeus, *Lybithea lipita* Moore, *Danius chrysippus* Linnaeus, *Hipparchia parasitas* Kollar, *Lethe rohria* Fabricius, *Maniola davendra* Moore, *Pontia daplidice* Linnaeus, *Belenois aurota* Fabricius, *Pieris brassicae* Linnaeus, *Colias erate* Esper *Eurema hecabe* Linnaeus, *Colias fieldi* Linnaeus and *Cynthia cardui* Linnaeus. The highest population was shown by *Pieris brassicae* followed by *Danius chrysippus* and *Cynthia cardui*. Twelve species belong to family Nymphalidae (50%), which shows the highest abundance rate. Butterfly density was the highest at Timergara. Butterfly fauna was the highest in May followed by August and lowest in March. It is concluded that pollution free environment of Dir Lower is more suitable for the survival of butterfly fauna. Large scale study is required to fully explore the butterfly fauna of the area.

Keywords diversity; taxonomy; Nymphalidae; species; Dir Lower; Timergara.

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1 Introduction

Insects comprises more than 53% of 1.4 million species on earth (Hassan, 1994) while more than 19 thousand species of butterflies have been documented worldwide (Heppner, 1998). Butterflies constitute only 11% of all lepidopteran species (Shields, 1989). More than 5,000 species of insects including 400 species of butterflies and moths have been reported from Pakistan (Khan et al., 2000; Khan et al., 2007). The largest Indian butterfly is Common Birdwing, *Troides helena* (Linn.) with a maximum expanse of 190mm and the smallest is Grass Jewel, *Freyeria trochilusputli* (Kollar) with a minimum expanse of 15mm (Wynter-Blyth, 1957). Butterflies have been observed as the symbol of loveliness and elegance (Rafi et al., 2000). They are the best recognized insects due to their diurnal habitats and readily predictable by their bright colours, spectacular shapes and smooth flight give gratification to everyone (Iqbal, 1978). The diversity of colors and patterns on the wings of butterflies has caught the attention of evolutionary biologists for more than a century (Lennox and Aristotle, 2001). Butterflies have nearly global distribution, present on every continent except Antarctica (NRCS, 2000).

Butterflies have evolved in complex feeding relationship with plants since the development of both larvae and adults takes place on green plants (Ehrlich and Raven, 1964). Their larvae are typically host specific (Tiple et al., 2011) while adults often show a high degree of generalization. Nectar provides energy and pollen is responsible for providing proteins, lipids and vitamins (Faegri and Van-Der-Pijl, 1971). Butterflies take part in the bedrock natural process of pollination (Bhuyan et al., 1999). They are favorable as pollinator, environmental indicator and have great artistic and marketable values (Ahsan and Iqbal, 1975). Due to high economic importance, biologists worked for more than hundred years on butterflies. They are very sensitive to habitat degradation but also have a much more rapid passage of generation than higher vertebrates and hence can be quicker to react to small changes in their environment than those of other animals (Gardiner et al., 2005). Insects are mainly useful in the evaluation of forests for biological resource conservation (Kim, 1993; Samways, 1994). Among the diversity of insects, butterflies are ideal subjects for ecological study in the forests. (Molina & Palma, 1996; Parmesan, 1996; Spitzer et al., 1997) So the current study is designed to find out the diversity and distribution of butterflies to provide a base for other researchers because of abrupt climatic changes and urbanization.

2 Materials and Methods

The study was conducted in different localities of Dir lower located in Khyber-Pukhtoonkhwa, Pakistan at an elevation from 1200m to 2800m above sea level (Ullah et al., 2012). It lies in Hindukush range at latitudes between 35°-10' to 35°-16' north and longitude 71°-50' to 71°-83' east (Wahab et al., 2008). Most of the area lay in the valley of the Panjkora River which rises in the Hindu Kush Mountains and joins the Swat River near Chakdara (WFP, 2011). Seven study sites were selected that are Timergara, Balambat, Lal Qila, Adenzai, Khall, Munda and Samarbagh. Specimens were collected during March - August 2013. Butterflies were collected randomly by using sweep net and naked hands. Collected specimens were killed by pressing the thorax and placed in triangular paper bags. They were stretched and pinned with complete data. On drying these were properly preserved in wooden boxes. Naphthalene balls were placed in the boxes to keep them safe from the pests. The species were identified in National Insect Museum, NARC through keys, available literature and already identified species. Identified specimens were subjected for measurement of their total body length and wing span.

3 Results

During the present study 375 butterfly specimens were collected. Upon identification, it revealed 24 species in 20 genera and 7 families. The families are Papilionidae, Pieridae, Danidae, Nymphalidae, Satyridae, Lycaenidae and Lybetheidae.

Family Papilionidae

Genus Papilio

Papilio polyctor (Boisduval, 1836)

Common Peacock

Distribution: This species has been recorded by different researchers in different areas of Pakistan, from Muree (Hasan, 1994), Swat (Inayatullah et al., 2002) and Chitral (Leslic and Evans, 1903).

Remarks: In current study it is recorded from Timergara, Adenzai and Balambat.

Papilio demoleus (Linnaeus, 1758)

Lime butterfly

Distribution: It has been recorded from Chitral (Leslic and Evans., 1903), Lahore (Ahsan and Iqbal., 1975), Buner (Naz, 2001), Kohat (Perveen, 2012), Mansehra (Perveen and Fazal, 2013), Malakand Agency and lower Swat (Inayatullah et al., 2002).

Remarks: In current study, it has been collected from Timergara, Adenzai, Munda, Lal Qila and Samarbagh.

Family Nymphalidae

Genus Junonia Hubner

Junonia almana (Linnaeus 1758)

Peacock pancy

Distribution: It has been reported from Lahore (Ahsan and Iqbal., 1975), Rawalpindi and Islamabad (Iqbal, 1978), Kohat (Perveen, 2012), Muzaffarabad (AJK) (Khan et al., 2004), Malakand Agency and lower Swat (Inayatullah et al., 2002).

Remarks: In current study it was collected from Timergara, Munda and Lal Qila.

Junonia hierta (Fabricius, 1798)

Yellow Pancy

Distribution: It has been recorded from Lahore (Ahsan and Iqbal., 1975), Rawalpindi and Islamabad (Iqbal, 1978), Malakand Agency and lower Swat (Inayatullah et al., 2002).

Remarks: In current study it is collected from Adenzai and Balambat.

Junonia orythea (Linnaeus, 1758)

Blue Pancy

Distribution

This species has been reported from Chitral (Leslic and Evans., 1903), Lahore (Ahsan and Iqbal., 1975), Buner (Naz, 2001), Kohat (Perveen, 2012), Rawalpindi and Islamabad (Iqbal, 1978), Malakand Agency and lower Swat (Inayatullah et al., 2002).

Remarks: In current study it was collected from Timergara, Khall, Adenzai, Balambat, Munda, Lal Qila and Samarbagh.

Genus Pararge

Pararge shakra (Kollar, 1844)

Common Wall

Distribution

It has been recorded from Buner (Naz, 2001), Rawalpindi and Islamabad (Iqbal, 1978).

Remarks: In current study it was collected from Samarbagh.

Genus Argynnius Fabricius

Argynnius hyperbius (Linnaeus, 1763)

Indian Fritillary

Distribution: This species has been recorded from Chitral (Leslic and Evans., 1903), Buner (Naz, 2001), Lahore (Ahsan and Iqbal., 1975), Malakand Agency and lower Swat (Inayatullah et al., 2002), Kotli, Mirpur, Bhimber (Khan et al., 2007) and Kohat (Perveen, 2012).

Remarks: In current study it was reported from Timergara, Khall, Munda and Lal Qila.

Genus Hypolimnus

Hypolimnus bolina (Linnaeus, 1758)

The Great eggfly

Distribution: It has been reported from Lahore (Ahsan and Iqbal, 1975), Rawalpindi and Islamabad (Iqbal, 1978), Malakand Agency and lower Swat (Inayatullah et al., 2002).

Remarks: In current study it was collected from Khall.

Genus Venessa

Vanessa cashmiriensis (Kollar, 1848)

Indian Tortoise shell

Distribution: *Vanessa cashmiriensis* (syn: *Aglais cashmiriensis*) has been recorded from Skardu, Shigar, Karmang, Sadpara, Kachura and Deosai plains (Abbas et al., 2002).

Remarks: In current study it was collected from Timergara, Munda and Lal Qila.

Vanessa cardui (Linnaeus, 1758) (syn: *Cynthia cardui*)

The painted lady

Distribution: Previously it has been reported from Lahore (Ahsan and Iqbal., 1975), Rawalpindi and Islamabad (Iqbal, 1978), Buner (Naz, 2001), Malakand and lower Swat (Inayatullah et al., 2002).

Remarks: In current study, it was collected from Timergara, Khall, Adenzai, Balambat, Lal Qila and Samarbagh.

Genus Phalantha

Phalantha phalantha (Drury, 1773)

Common Leopard

Distribution: It has been documented from Kotly, Mirpur Bhimber, Muzaffarabad (AJK) (Khan et al., 2007), Kohat (Perveen, 2012), Rawalpindi and Islamabad (Iqbal, 1978).

Remarks: In current study it was reported from Timergara.

Genus Melitaea

Melitaea didyma (Esper, 1778)

Spotted or Red-band Fritillary

Distribution: It has also been recorded from Pakistan, (Roberts, 2001)

Remarks: In current study, it has been collected from Adenzai.

Genus Lethe

Lethe rohria (Fabricius, 1787)

Common Tree brown

Distribution: It has been reported from Buner (Naz, 2001), Malakand Agency and lower Swat (Inayatullah et al., 2002), Rawalpindi and Islamabad (Iqbal, 1978).

Remarks: In current study it was collected from Timergara and Khall.

Genus Hipparchia

Hipparchia parasitas* (Kollar)*White edged rock brown****Distribution**

It has been reported from Malakand Agency and lower Swat (Inayatullah et al., 2002), Buner (Naz, 2001) and Kohat (Perveen, 2012)

Remarks: In current study, it is collected from Timergara and Lal Qila.

Family Lycaenidae**Genus Lycaena*****Lycaena phalaeas* (Linnaeus, 1761)****Small Copper**

Distribution: It has been recorded from Buner (Naz, 2001), Malakand Agency and Swat (Inayatullah et al., 2002).

Remarks: In current study it was collected from Timergara, Adenzai and Munda.

Family Lybethidae**Genus Libythea*****Libythea lepita*, (Moore, 1857)****Common Beak**

Distribution: It has been recorded from Chitral (Leslic and Evans, 1903), Buner (Naz, 2001), Rawalpindi and Islamabad (Iqbal, 1978), Malakand Agency and lower Swat (Inayatullah et al., 2002).

Remarks: In current study it was collected from Timergara and Khall.

Family Danaidae**Genus Danaus*****Danaus chrysippus* (Linnaeus, 1758)****Plain Tiger or African Monarch**

Distribution: This species has been recorded from Lahore (Ahsan and Iqbal, 1975), Rawalpindi and Islamabad (Iqbal, 1978), Buner (Naz, 2001), Malakand Agency and lower Swat (Inayatullah et al., 2002), Mansehra (Parveen and Fazal, 2013), Muzaffarabad, Kotly, Mirpur and Bhimber (AJK) (Khan et al., 2007).

Remarks: In current study it was collected from Timergara, Khall, Adenzai, Balambat, Munda, Lal Qila and Samarbagh.

Family Satyridae**Genus Maniola*****Maniola davendra* (Moore, 1884)****Meadow brown**

Distribution: It is found in Chitral (Leslic and Evans, 1903) and lower Swat (Inayatullah et al., 2002).

Remarks: In current study it was collected from Khall and Adenzai.

Family Pieridae**Genus Pontia Hubner*****Pontia daplidice* (Linnaeus, 1758)****Bath White**

Distribution: It has been reported from Chitral (Leslic and Evans, 1903), Buner (Naz, 2001), Malakand Agency and lower Swat (Inayatullah et al., 2002), Rawalpindi and Islamabad (Iqbal, 1978), Skardu, Shigar, Karmang, Sadpara, Kachura, Deosai plains (Abass et al., 2002), Muzaffarabad, Kotly, Mirpur and Bhimber (AJK) (Khan et al., 2007).

Remarks: In current study it was collected from Timergara, Balambat and Munda.

Genus Belenois

Belenois aurota (Fabricius, 1793)

Pioneer White

Distribution: It has been reported from Buner (Naz, 2001), Rawalpindi and Islamabad (Iqbal, 1978), Malakand Agency and lower Swat (Inayatullah et al., 2002) and Kohat (Parveen, 2012).

Remarks: In current study it has been reported from Timergara

Genus Pieris Schrank

Pieris brassicae (Linnaeus, 1758)

Cabbage White

Distribution: It has been reported from Chitral (Leslic and Evans, 1903), Lahore (Ahsan and Iqbal, 1975), Buner (Naz, 2001), Rawalpindi and Islamabad (Iqbal, 1978), Skardu, Shigar, Karmang, Sadpara, Kachura, Deosai plains (Abbass et al., 2002), Kohat, Muzaffarabad, Kotly, Mirpur and Bhimber (Khan et al., 2007).

Remarks: In current study it was collected from Timergara, khall, Balambat, Adenzai, Lal Qila, Munda and Samarbagh.

Genus Eurema Hubner

Eurema hecabe (Linnaeus, 1758)

Common Grass Yellow

Distribution: Previously this species has been reported from Kohat (Parveen, 2012), Buner (Naz, 2001), Lahore (Ahsan and Iqbal, 1975), Rawalpindi and Islamabad (Iqbal, 1978), Malakand Agency and lower Swat (Inayatullah et al., 2002).

Remarks: In current study it was collected from Timergara and Khall.

Genus Colias Fabricius

Colias erate (Esper 1805)

The pale clouded yellow

Distribution: It has also been reported from Chitral (Leslic and Evans, 1903), Buner (Naz, 2001), Skardu, Shigar, Karmang, Sadpara, Kachura and deosai plains (Abass et al., 2002).

Remarks: In current study it was collected from Adenzai and Balambat.

Colias fieldi (Linnaeus, 1763)

African Clouded Yellow

Distribution: It has also been reported from Chitral (Leslic and Evans, 1903), Lahore (Ahsan and Iqbal, 1975), Rawalpindi and Islamabad (Iqbal, 1978) and Buner (Naz, 2001).

Remarks: In current study, it was collected from Timergara, Khall, Adenzai, Balambat and Samarbagh.

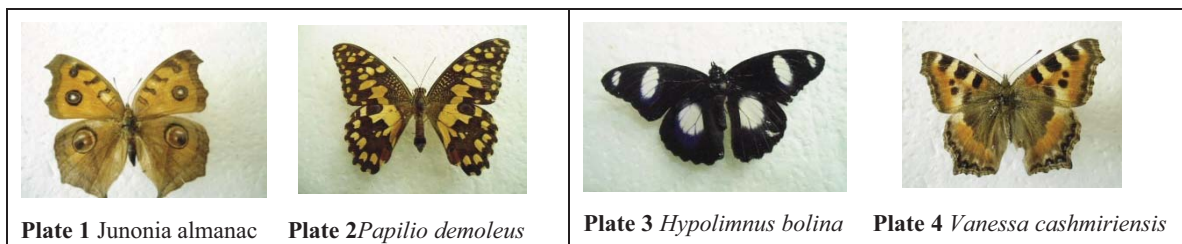


Table 1 Butterfly check list of District Dir lower

Family	Common name	Scientific name
Papilionidae	Common Peacock	<i>Papilio polyctor</i> (Boisduval, 1836)
	Lime butterfly	<i>Papilio demoleus</i> (Linnaeus, 1758)
Nymphalidae	Peacock pancy	<i>Junonia almana</i> , (Linnaeus, 1758)
	Yellow Pancy	<i>Junonia hierta</i> , (Fabricius, 1798)
	Blue Pancy	<i>Junonia orythea</i> , (Linnaeus, 1758)
	Common Wall	<i>Pararge shakra</i> , (Kollar, 1844)
	Indian Fritillary	<i>Argynnius hyperbius</i> , (Linnaeus, 1763)
	The Great eggfly	<i>Hypolimnus bolina</i> , (Linnaeus, 1758)
	Indian Tortoise shell	<i>Vanessa cashmiriensis</i> (Kollar, 1848)
	The painted lady	<i>Vanessa cardui</i> (Linnaeus, 1758)
	Common Leopard	<i>Phalantha phalantha</i> , (Drury, 1773)
	Spotted Fritillary	<i>Melitaea didyma</i> (Esper, 1778)
	Common Tree brown	<i>Lethe rohria</i> (Fabricius, 1787)
	White edged rock brown	<i>Hipparchia parasitas</i> (Kollar)
	Lycaenidae	Small Copper
Lybetheidae	Common Beak	<i>Libythea lepita</i> , (Moore, 1857)
Danaidae	Plain Tiger or African Monarch	<i>Danaus chrysippus</i> , (Linnaeus, 1758)
Satyridae	Meadow brown	<i>Maniola davendra</i> (Moore, 1884)
Pieridae	Bath White	<i>Pontia daplidice</i> , (Linnaeus, 1758)
	Pioneer White	<i>Belenois aurota</i> , (Fabricius, 1793)
	Cabbage White	<i>Pieris brassicae</i> (Linnaeus, 1758)
	Common Grass Yellow	<i>Eurema hecabe</i> , (Linnaeus, 1758)
	The pale clouded yellow	<i>Colias erate</i> (Esper 1805)
	African Clouded Yellow	<i>Colias fieldi</i> (Linnaeus, 1763)

Table 2 Morphometric measurement of collected species

S.No	Name of species	N*	Wing span (cm)	Body length (cm)
			Mean \pm std	Mean \pm std
1	<i>Papilio polyctor</i>	5	10.2 \pm 0.57	2.5 \pm 0.08
2	<i>Papilio demoleus</i>	10	9.0 \pm 0.61	2.3 \pm 0.18
3	<i>Junonia almana</i>	5	5.6 \pm 0.11	1.5 \pm 0.05
4	<i>Pararge schakra</i>	5	5.5 \pm 0.08	1.5 \pm 0.08
5	<i>Junonia hierta</i>	5	4.9 \pm 0.38	1.5 \pm 0.07
6	<i>Junonia orythea</i>	15	5.2 \pm 0.23	1.5 \pm 0.09
7	<i>Argyrius hyperbius</i>	9	8.0 \pm 0.35	2.2 \pm 0.12
8	<i>Hypolimnus bolina</i>	5	7.1 \pm 0.10	1.9 \pm 0.08
9	<i>Vanessa cashmiriensis</i>	5	6.1 \pm 1.07	1.9 \pm 0.19
10	<i>Phalantha phalantha</i>	5	6.7 \pm 0.68	1.9 \pm 0.05
11	<i>Melitaea didyma</i>	5	3.9 \pm 0.35	1 \pm 0.07
12	<i>Lycaena phlaeas</i>	7	3.2 \pm 0.11	0.9 \pm 0.07
13	<i>Lybitha lipita</i>	5	4.6 \pm 0.07	1.5 \pm 0.08
14	<i>Danius chrysippus</i>	60	8.0 \pm 0.39	2.2 \pm 0.18
15	<i>Hipparchia parasitas</i>	5	7.0 \pm 0.11	2 \pm 0.07
16	<i>Lethe rohria</i>	5	5.9 \pm 0.08	1.5 \pm 0.07

17	<i>Maniola davendra</i>	5	5.9 ± 0.08	1.7 ± 0.05
18	<i>Pontia daplidice</i>	9	4.8 ± 0.20	1.6 ± 0.11
19	<i>Belenois aurota</i>	5	5.8 ± 0.08	1.9 ± 0.08
20	<i>Pieris brassicae</i>	116	6.0 ± 0.72	2.1 ± 0.23
21	<i>Colias erate</i>	5	4.9 ± 0.10	1.9 ± 0.07
22	<i>Eurema hecabe</i>	5	3.5 ± 0.07	1.4 ± 0.08
23	<i>Colias fieldi</i>	14	4.7 ± 0.47	1.6 ± 0.24
24	<i>Cynthia cardui</i>	60	5.4 ± 0.49	1.8 ± 0.10

*N: Number of specimens collected

The Morphometry of all the collected species showed that *Papilio polyctor* have the maximum wing span of 10.2 ± 0.57 cm and body length of 2.5 ± 0.08 cm while *Lycaena phalaeas* showed the lowest wing span of 3.2 ± 0.11 cm and body length of 0.9 ± 0.07 cm.

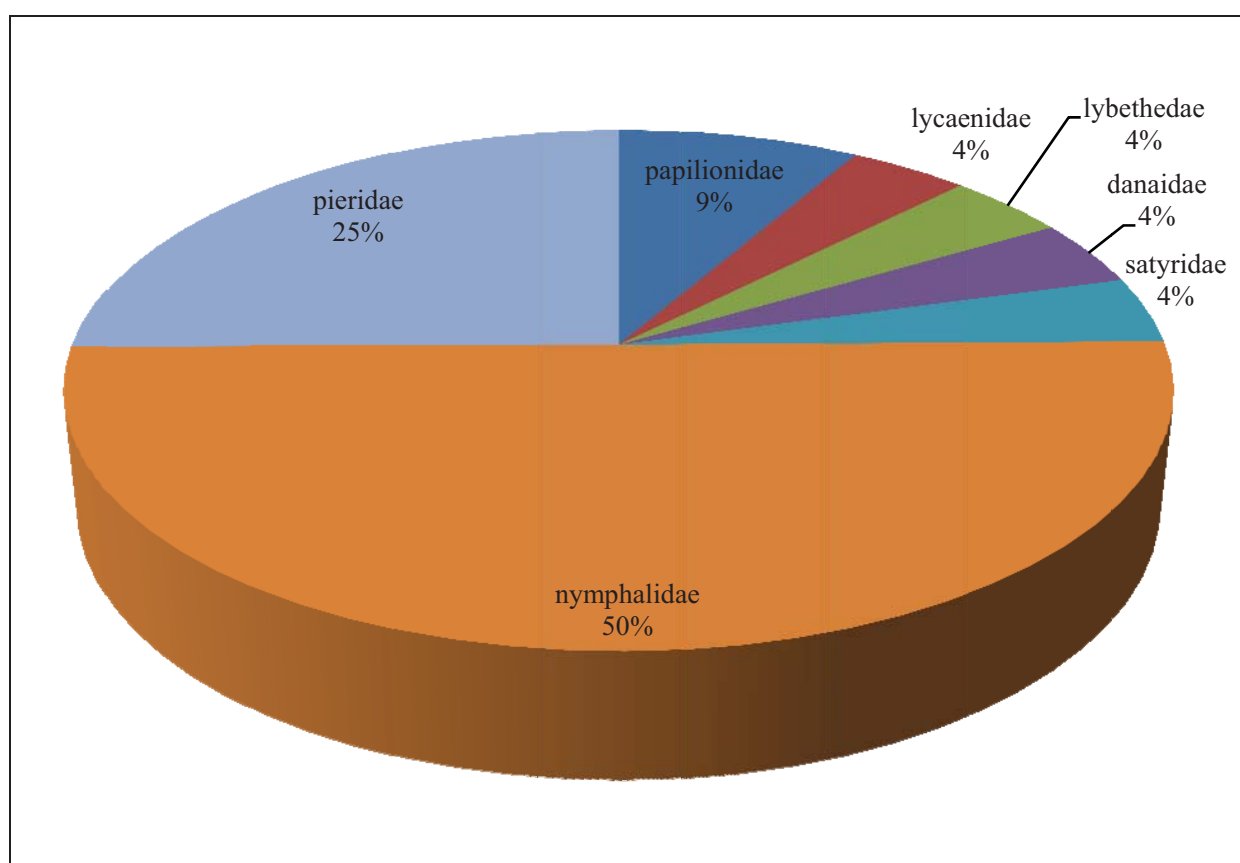


Fig. 1 Family wise distribution of butterflies.

Percentage of Butterflies families in District Dir lower, Khyber Pukhtoonkhwa, Pakistan. Family Nymphalidae was higher (50%), followed by family Pieridae (25%).

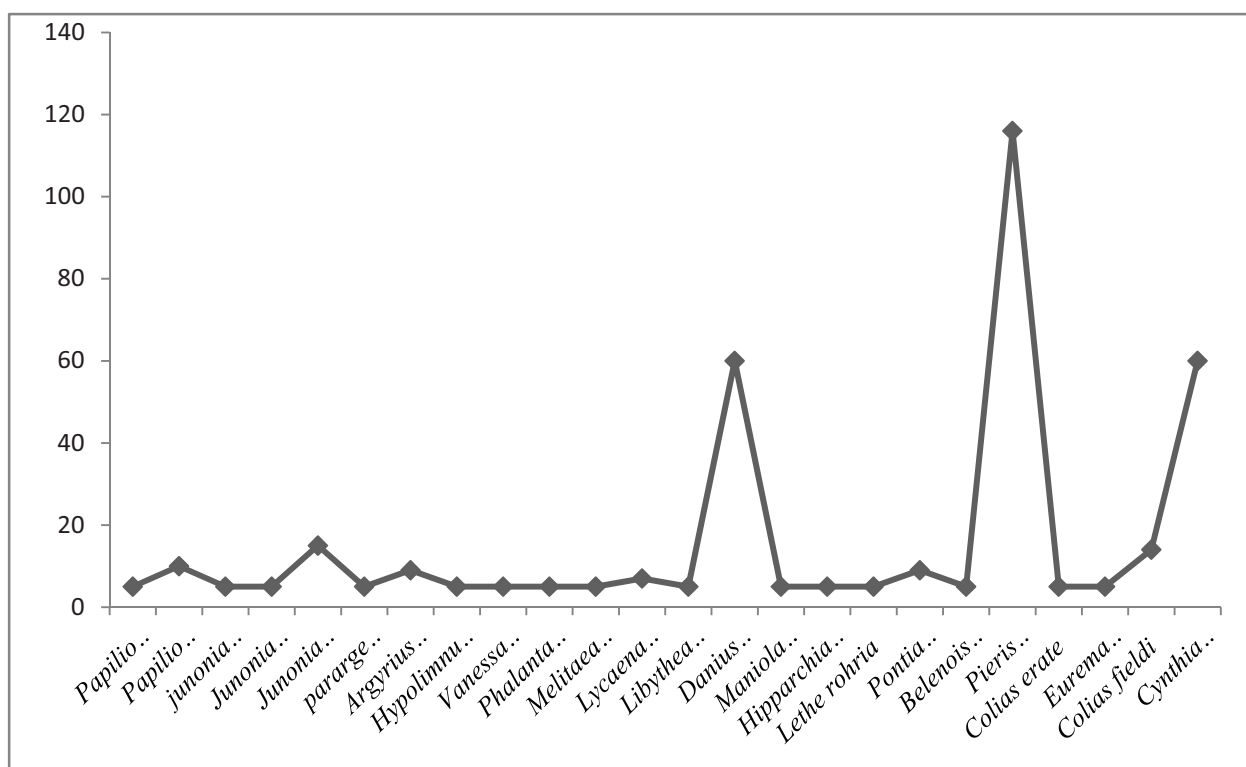


Fig. 2 Species abundance of Butterflies of Dir lower Khyber Pukhtoonkhwa, Pakistan.

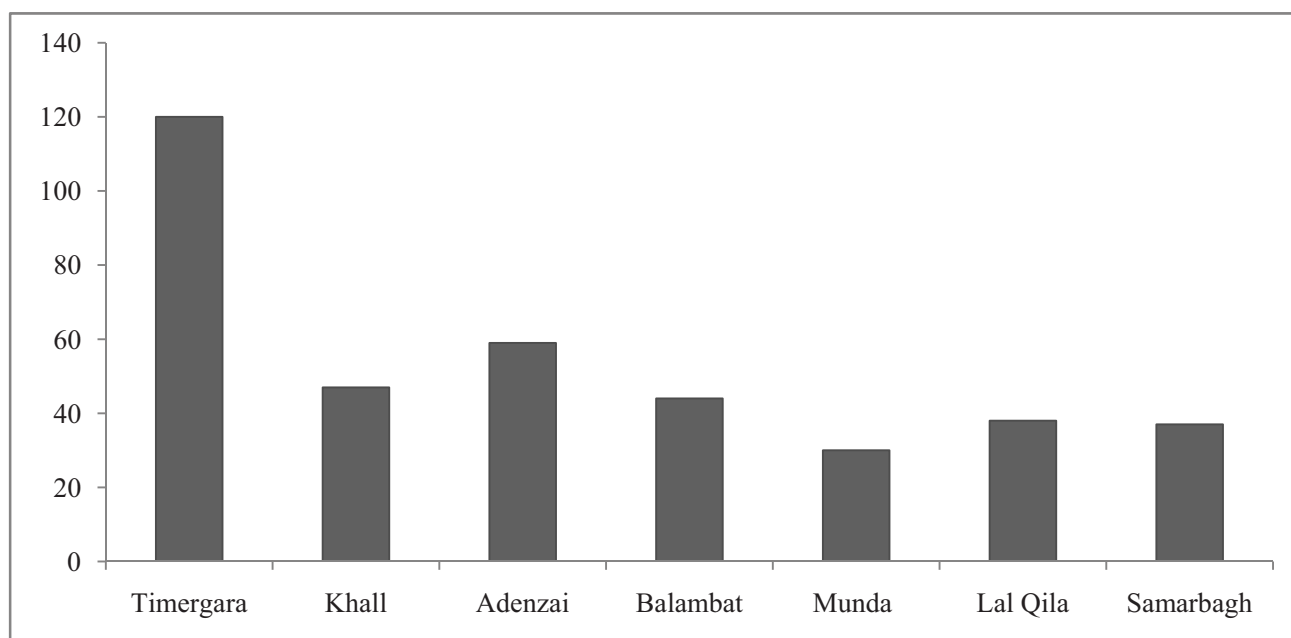


Fig. 3 Butterfly density at different localities of Dir lower Khyber Pukhtoonkhwa, Pakistan.

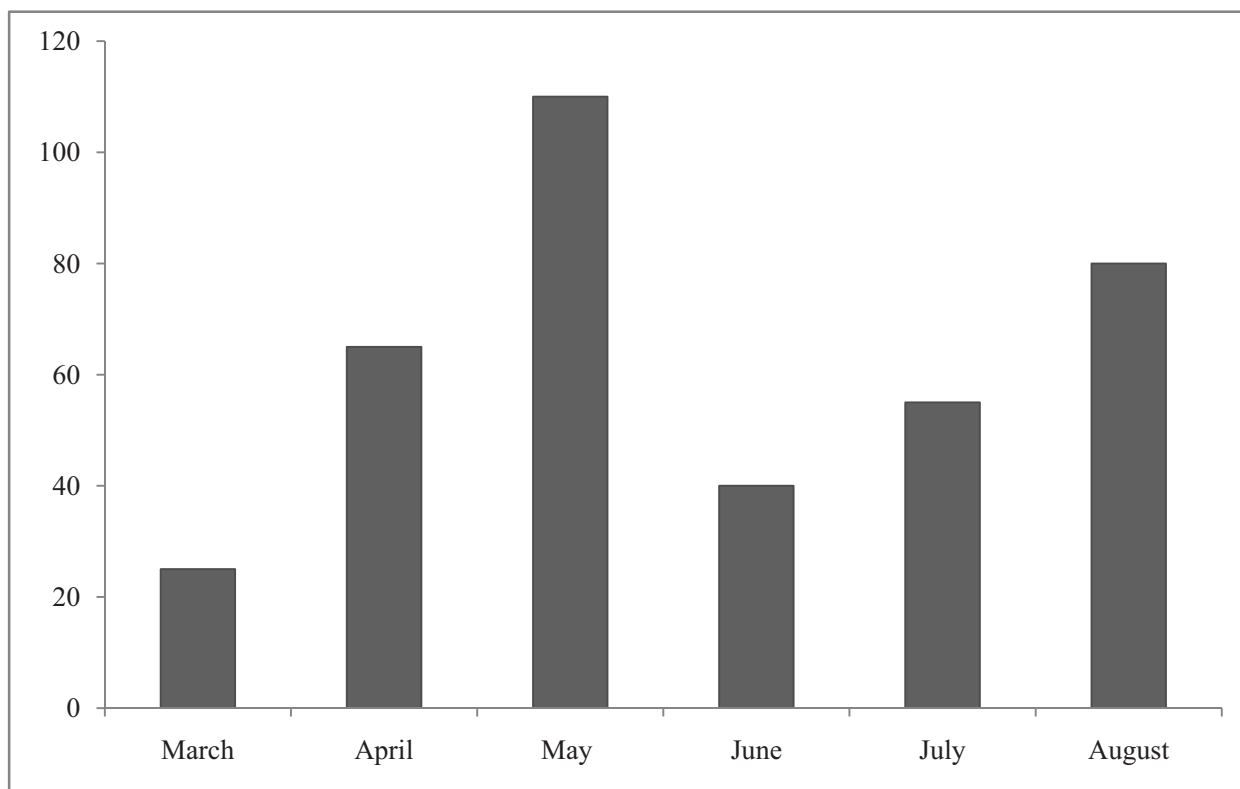


Fig. 4 Butterfly community fluctuation at Dir lower Khyber Pukhtoonkhwa, Pakistan.

4 Discussion

This is the first survey of butterfly fauna and documentary report of the mentioned area. The earlier researchers reported the butterfly fauna from different region of the country and other countries of the world. Leslic and Evans (1903) reported the butterflies of Chitral. The similar species were also recorded from Dir lower which shows great resemblance in both areas. Ahsan and Iqbal (1975) reported 66 species of butterflies from Lahore. Iqbal (1978) recorded 51 species from Rawalpindi and Islamabad showing closeness with the present study. Hasan (1994) explored the fauna of Islamabad and Murree, reporting Papilionidae, Pieridae, Lycaenidae, Libytheidae, Nymphalidae and Danaidae. Species of the same families were also recorded. Hasan (1997) reported 80 butterfly species in 9 families from Northwest Himalaya (Gilgit and Azad Kashmir). In present study family Pieridae is comprising largest number of individuals (41%) followed by family Nymphalidae (35%) while family Lybetheidae and family Satyridae have showed lowest number (1% each) of individuals, however they show great similarity in both areas.

Naz (2001) reported 37 species from District Buner, Khyber Pukhtoonkhwa. In present study some species are described while some of the species which were reported from buner like *Papilio polytes* (Linnaeus), *Ixias pyrene* (Linnaeus), *Gonepteryx nepalensis* (Doubleday), *Cataopsilia pyranthe* (Linnaeus), *Pieris canidia* (Sparman), *Tirumala limniace* (Cramer), were not reported presently. This difference may be due to the weather during collection periods or collection error but both the areas have much more similarities. Shah et al. (2001) made a survey of Kohat and collected 10 species belonging to only family Pieridae, while in another study from KP, Malakand Agency and lower Swat, Inayatullah et al. (2002) reported 29 species. Same species were also reported in present study however show little variation. Abbas et al. (2002) described butterfly

diversity from Skardu, Shigar, Karmang, Sadpara, Kachura and Deosai plains and stated 16 species. Some of the species were highly distributed at high altitude while some species were not recorded due to climatic condition in the present study. From District Muzaffarabad, Azad Kashmir, Khan et al (2004) reported 28 species. Khan et al. (2007) reported 16, 20 and 19 species from Districts Kotly, Mirpur and Bhimber respectively. Perveen (2012) identified 21 species belonging to 3 different families from Kohat. Parveen and Fazal (2013) reported 10 species from 8 genera belonging to 3 different families from Hazara University Mansehra. The present study shows high similarity and little variation. It is concluded that this region have diverse and rich fauna of butterflies. Related study is needed on large scale to fully explore the butterfly fauna of Dir lower.

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