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Diversity of butterfly fauna of Doag Dara, Sheringal, Dir Upper, Pakistan

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Abstract

Butterflies are indicators of a healthy environment and a healthy ecosystem. Other than aesthetic value, butterflies are important pollinators, bio-indicators of climate change, sensitive to ecosystem fluctuations and a key source of scientific studies in diverse fields of biology. The present study was carried out to evaluate the butterfly fauna of Doag Dara, Dir Upper, KP, Pakistan. Collection of butterflies was carried out during April to October 2017. Ten species of butterflies belonging to 3 families and 8 genera were identified in the study area. Five species belonged to family Pieridae, three species to family Nymphalidae and two species to family Papilionidae. Five species of the family Pieridae were *Pieris brassicae*, *Pontia daplidice*, *Gonepteryx rhamni*, *Colias croceus*, *Colias erate*, 2 species of the family Nymphalidae were *Danaus chrysippus*, *Cynthia cardui* and *Junonia orithya* and 2 species belonging to family Papilionidae were *Papilio demoleus* and *Papilio machaon*. The morphometric measurements indicated that *Papilio demoleus* has maximum wing span of 8.85 ± 0.277 cm and body length of 2.78 ± 0.34 cm, followed by *Danaus chrysippus* 7.95 ± 0.229 cm and body length of 2.52 ± 0.082 cm compared with other identified species. Lowest wing span was found in *Junonia orithya* with a mean value of 4.96 ± 0.307 cm and mean body length of 1.9 ± 0.141 cm. This was a preliminary study on the diversity of butterfly fauna of Doag Dara, Dir Upper. This will provide a baseline for future taxonomic work on Lepidoptera in the study area.

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Introduction

Butterflies belong to order Lepidoptera which is the second largest order of class Insecta. Moths and butterflies are important pollinators of flowers and are important for humans and other animals as they help in the production of fruits, crops and seeds (Maheshwari, 2003). About 28,000 species of butterflies have been reported worldwide and about eighty percent of the species are found in tropical areas (Khan *et al.*, 2015). In Pakistan, there are about 5000 species of insects comprising of about 400 species of moths and butterflies (Khan *et al.*, 2007).

Mouth parts of adult butterflies are usually of siphoning type and are coiled under the head when not in use. These mouth parts are adapted for feeding on flower nectar and plant juices. Nectar of flowers provide energy and pollen is a source of vitamins, proteins and lipids for butterflies. Larvae of butterflies and moths are called caterpillars. They are usually eruciformes having worm like appearance, simple eyes and chewing type of mouth parts. Caterpillar has well developed silk glands formed from modified salivary glands (Borror *et al.*, 1975). Caterpillars are efficient pests as they defoliate various types of plants and cause severe damage to them (Kumar *et al.*, 2013). The wings of butterflies are held vertically when at rest.

Butterflies are considered as the sign of beauty and grace in nature (Rafi *et al.*, 2000). They are the best recognized insects due to their diurnal habits and readily predictable by their colors, spectacular shapes and smooth flights. Butterflies are most favorable as pollinators, environmental indicators and have remarkable commercial and aesthetic values (Ahsan and Iqbal, 1975). Primary herbivores on plants are butterfly larvae and other insects, which destroy the foliage herbs, shrubs and trees, to get energy and make the food chain in the web (Dayananda, 2014).

The purpose of the present study was to evaluate the butterfly fauna of Doag Dara, District Dir Upper, KP, Pakistan. This will through light on the species diversity of butterfly fauna of this area and will provide as a baseline for the future studies in the field of entomology.

Materials and methods

Study Area

The present study was carried out at Doag Dara, Dir Upper, Pakistan. The area is located between latitude (N35°18'6.24"N to 35°23'18.05"N) and longitude (72°0'15.87"E to 71°56'13.00"E) in Upper Dir KP Pakistan (Fig. 1). The total area is about 8000 hectares and its elevation is about 5100-14000 feet from sea level. Geographically, Doag Dara is linked to Sheringal on its Southern side, and on its North East to Gwaldi Kohistan, and Northern side to Karakoram mountain ranges. The Western border of Doag Dara is touched with Chitral. Climate is moderate to extreme. The average minimum and maximum temperature in the month of July has been recorded as -6.6°C to 24.6°C. Snow fall usually occurs from December to March. Average rainfall is 550-750mm.

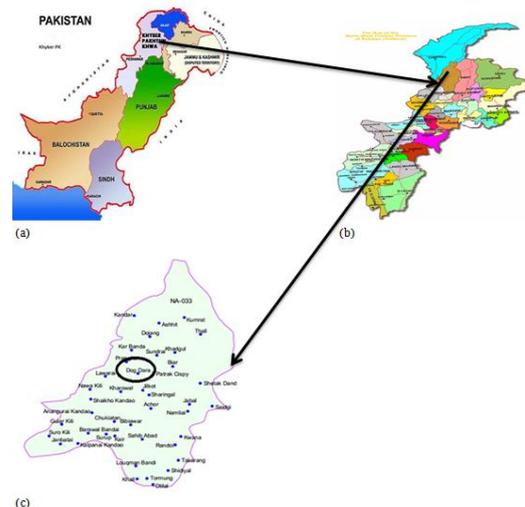


Fig. 1. Study area: (a) Map of Pakistan (b) Map of KPK (c) Map of Dir Upper Showing the Study Area, Doag Dara.

Collection of Samples

Butterflies were collected randomly by using sweep nets and aerial nets during April to September 2017 from 4 different localities of Doag Dara namely Doag Payeen, Miana Doag, Qadeer Kalay and Panaghar. The butterfly specimens were killed in the killing Jar containing cotton soaked ethyl-acetate. The collected specimens were suitably pinned and labelled in insect box containing phenolphthalein balls. Data was recorded in field book and measurements of the body length and wing span were taken through a scale.

Preservation and Morphometric Measurement

The collected specimens were placed on a thermocouple board and stretched to measure their wingspans with the help of scale in centimeters (cm). They were pinned with insect pins in their thoracic region and set on thermocouple setting board. The specimens were labeled with scientific name and location along with date. The specimens were arranged in wooden box, in different rows and phenolphthalein balls were kept in the box to keep them safe from pests.

Identification

The butterfly specimens were identified with the help of Keys (Abbas *et al.*, 2002 and Munir *et al.*, 2008), with the help of available literature (Sabir *et al.*, 2000) and internet surfing on the basis of external morphology. The identified specimens were tagged and kept on paper for photography with the help of Camera. All the identified specimens were deposited to the museum of the Department of Zoology, SBBU, Dir upper KP, Pakistan.

Results

In the present study, a total of 76 specimens of butterflies were collected at Doag Dara from April to October, 2017. Ten species were identified belonging to three families, six sub-families and eight genera. Five species belonged to family Pieridae, three species to family Nymphalidae and two species to family Papilionidae. Pieridae was represented by *Pieris brassicae*, *Pontia daplidice*, *Gonepteryx rhamni*, *Colias croceus*, and *Colias erate*. Nymphalidae family was represented by *Danaus chrysippus*, *Cynthia cardui* and *Junonia orithya*. Papilionidae family was represented by *Papilio demoleus* and *Papilio machaon* (Table 1).

Table 1. Classification of the collected species of butterflies

Class	Order	Family	Subfamily	Genus	Species
Insecta	Lepidoptera	Pieridae	Coliadinae	<i>Colias</i>	<i>erate</i>
			Pierinae	<i>Pontia</i>	<i>daplidice</i>
				<i>Pieris</i>	<i>brassicae</i>
			Coliaclinae	<i>Gonepteryx</i>	<i>rhamni</i>
				<i>Colias</i>	<i>croceus</i>
		Nymphalidae	Danainae	<i>Danaus</i>	<i>chrysippus</i>
			Nymphalinae	<i>Cynthia</i>	<i>cardui</i>
				<i>Junonia</i>	<i>orithya</i>
		Papilionidae	Papilioninae	<i>Papilio</i>	<i>demoleus</i>
				<i>Papilio</i>	<i>machaon</i>
Total	01	03	06	08	10

The morphometric measurements of specimens showed that *Papilio demoleus* has the maximum average wing span of $8.85 \pm 0.277 \text{ cm}$ and mean body length of $2.78 \pm 0.034 \text{ cm}$, followed by *Danaus chrysippus* with an average wing span of $7.95 \pm 0.229 \text{ cm}$ and mean body length of $2.52 \pm 0.082 \text{ cm}$. Lowest average wing span was found in *Junonia orithya* ($4.96 \pm 0.307 \text{ cm}$) and with mean body length of $1.9 \pm 0.141 \text{ cm}$ (Table 2).

Table 2. Morphometric measurements and common names of the identified species of butterflies.

S No.	Common Names	Scientific Names	Body No. length (cm) Mean±SD	Wing span (cm) Mean±SD
1	Lime butterfly	<i>Papilio demoleus</i>	03 2.78±0.034	8.85±0.277
2	Plain Tiger	<i>Danaus chrysippus</i>	06 2.52±0.082	7.95±0.229
3	Pale clouded yellow	<i>Colias erate</i>	05 2.12±0.147	5.22±0.286
4	The painted lady	<i>Cynthia cardui</i>	10 2.07±0.178	6.22±0.323
5	Common Swallowtail	<i>Papilio machaon</i>	04 2.42±0.108	8.25±0.111
6	Bath White	<i>Pontia daplidice</i>	07 1.94±0.08	5.38±0.292
7	Brimstone Butterfly	<i>Gonepteryx rhamni</i>	07 2.2±0.158	6.27±0.258
8	Blue Pansy	<i>Junonia orithya</i>	06 1.9±0.141	4.96±0.307
9	Dark clouded yellow	<i>Colias croceus</i>	12 1.96±0.11	5.36±0.197
10	Large white	<i>Pieris brassicae</i>	16 2.01±0.17	5.52±0.725

Pieridae was the most prevalent family comprising of 50% of the collected specimens of butterfly species followed by family Nymphalidae (30%) and then Papilionidae comprising 20 percent of the collected specimens (Fig. 2).

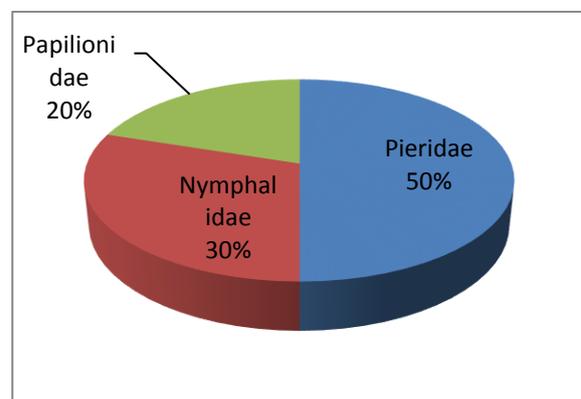


Fig. 2. Family-wise distribution of butterflies in the study area.

Classification, description and distribution of the identified species

Species No. 01. Lime butterfly, *Papilio demoleus* (Linnaeus, 1758)

Classification

Family : Papilionidae
 Subfamily : Papilioninae
 Genus : *Papilio*
 Species : *demoleus*



Description

This butterfly has a mean wingspan of 8.85 ± 0.277 cm and mean body length of 2.78 ± 0.034 cm. Dorsal side of body is black in color and on the dorsal side of the wings is a broad, irregular yellow band, which is broken in the forewings. The butterfly is tailless; a single large red spot with blue edging around it is also present near the tornus of hindwings. Ventral side of the body is whitish yellow in color, with black areas covered with yellow spots. Both sexes are similar size.

Distribution

Papilio demoleus is the most common and widely distributed species of butterflies in the world. This butterfly can be found in the Middle East, Afghanistan, the Indian Subcontinent, Japan, Malaysia, South China, Thailand, Indonesia, Papua New Guinea, and Australia (Collins and Michael, 1985). In Pakistan, it is found in Chitral (Leslic and Evans, 1903), Buner (Naz *et al.*, 2001), Malakand Agency and Lower Swat (Inayatullah *et al.*, 2002), Mansehra (Perveen and Fazal, 2013), District Rawalpindi and Islamabad (Iqbal, 1978) and District Lahore (Ahsan and Iqbal., 1975).

Species No. 2. Plain tiger, *Danaus chrysippus* (Linnaeus, 1758)

Classification

Family : Nymphalidae
 Subfamily: Danainae
 Genus : *Danaus*
 Species : *chrysippus*



Description

Average wingspan is 7.95 ± 0.229 cm and mean body length is 2.5 ± 0.082 cm. Body color is orange, upper

edge of forewing is black with white spots, the hind wing has three black spots around the center. The hind wings have also a tiny black margin surrounding a sequence of semicircular white spots. Male plain tiger is brighter in color and smaller than female. The male plain tiger is smaller than the female, but more brightly colored.

Distribution

Plain tiger or African Monarch is wide spread in Asia. In Pakistan, this species has been reported from Lahore (Ahsan and Iqbal, 1975), Malakand and Swat (Inayatullah *et al.*, 2002), Mansehra (Perveen and Fazal, 2013), Buner (Naz *et al.* 2001), Kotly, Mirpur and Bhimber AJK (khan *et al.*, 2007), Rawalpindi and Islamabad (Iqbal, 1978).

Species No. 03. Pale clouded yellow, *Colias erate* (Esper, 1805)

Classification

Family : Pieridae
 Subfamily: Coliadinae
 Genus : *Colias*
 Species : *erate*



Description

Mean wingspan is 5.22 ± 0.286 cm and mean body length is 2.12 ± 0.147 cm. Body is flop yellow with expensive black dark terminal inner margins of the wings and black spot also present above the fore wings. Pale yellow color spot present on the hind wings. Sexes are similar.

Distribution

It can be found in south Eastern Europe, Turkey, Central Asia, Japan and Taiwan. In South, its range extends to Somalia and Ethiopia. In Pakistan it has been recorded from Chitral (Leslic and Evans, 1903), Skardu, Karmang, Sadpara, Shigar and Kachura (Abbas *et al.*, 2002), Buner (Naz *et al.*, 2001) and District Kotly, Mirpur, and Bhimber AJK (Khan *et al.*, 2007).

Species No. 04. Painted lady, *Cynthia cardui* (Linnaeus, 1758)

Classification

Family : Nymphalidae
 Subfamily : Nymphalinae
 Genus : *Cynthia*
 Species : *cardui*



Description

Mean wingspan is 6.22 ± 0.323 cm and mean body length is 2.0 ± 0.178 cm. Both wings are profoundly discernable with black and gray spots, apical part of forewing has white spots and apex is rounded at tip. The hind wings convey four small sub marginal eyespots on the dorsal and ventral sides. Brown hair (cilia) are present on the base of hind wings. Both sexes are similar.

Distribution

In Pakistan, previously it has been reported from district Gujrat, Punjab (Iqbal *et al.*, 2016) Rawalpindi and Islamabad (Iqbal, 1978), Lahore (Ahsan and Iqbal, 1975), Buner (Naz *et al.*, 2001), Skardu (Abbas *et al.*, 2002) Mirpur Bhimber and Kotly Districts AJK (Khan *et al.*, 2007).

Species No.05. Common swallowtail, *Papilio machaon* (Linnaeus, 1758).

Classification

Family : Papilionidae
 Subfamily : Papilioninae
 Genus : *Papilio*
 Species : *machaon*



Description

The swallowtails has an average wingspan of about 8.25 ± 0.11 cm and mean body length of 2.42 ± 0.108 cm. Typically it has creamy wings with black trace marks. The hindwings of both male and female have a pair of protuberant tails which give resemblance to the birds of the same name. A red eye spot is present below each tail. The underside is somewhat paler in color.

Distribution

Common yellow swallowtail is present in entire Palearctic region. It is also found in United States, Alaska and Canada. In Middle East, it can be found in Oman, and the high mountains of Yemen, Israel, Lebanon and Iran. In Asia it occurs in India commonly in Northern parts including Sikkim, Assam, and Arunachal Pradesh, Pakistan and Kashmir, Nepal and Northern Myanmar.

Species No. 06. Bath white, *Pontia daplidice* (Linnaeus, 1758)

Classification

Family : Pieridae
 Subfamily : Pierinae
 Genus : *Pontia*
 Species : *daplidice*



Description

Average wingspan is 5.38 ± 0.292 cm and mean body length is 1.94 ± 0.08 cm. Dorsal side of wings is snowy in color, dusted with black marks at the apex. Ventral side of the forewing is white dusted with green spots. While underneath of the hind wing has an arrangement of greenish splotches. The male has markings on the dorsal side of the forewing. The tip of the forewing is black with white spots and lines and black spots at the end of the cell. The female also has an unclear row of terminal spots on the upper hind wings.

Distribution

In Pakistan it ranges from Baluchistan, Kashmir, Gilgit, Peshawar, Malakand, Dir, Chitral, and along with the Himalayas up to Darjeeling. The butterfly seems to be spreading its range westwards along the Himalayas. In Pakistan, previously it was recorded from Mansehra (Perveen and Fazal, 2013), Chitral (Leslic and Evan, 1903), same species was reported from Kohat (Shah *et al.*, 2001), District Buner (Naz *et al.*, 2001), Sadpara, Skardu, Kachura, Shiger, Deosai Plains (Abbas *et al.*, 2002), District Mirpur, Kotly and Bhimber AJK (Khan *et al.*, 2007) Rawalpindi and Islamabad (Iqbal, 1978).

Species No.07. Brimstone butterfly, *Gonepteryx rhamni* (Linnaeus, 1758)

Classification

Family : Pieridae
 Subfamily: Coliadinae
 Genus : *Gonepteryx*
 Species : *rhamni*



Description

Average wingspan is 6.27 ± 0.286 cm and mean body length is 2.2 ± 0.158 cm. Upper side of wings of male have lemon yellow color, while females have greenish whiter. Reddish central blotch present on both forewings and hind wings. Underside of wings is same similar to upper side. The brimstone always holds wings against each other when it is resting.

Distribution

It commonly found throughout the Palearctic region, from Western Europe (England, Scotland, Ireland and Wales) to East Asia due high migratory potential. In Pakistan, Previously it has been recorded from Rawalpindi and Islamabad (Iqbal, 1978), District Muzaffarabad AJK (Khan *et al.*, 2004) Districts Kotly, Mirpur and Bhimber AJK (Khan *et al.*, 2007), Chitral (Leslic and Evans, 1903).

Species No.08. Blue pansy, *Junonia orithya* (Linnaeus, 1758).

Classification

Family : Nymphalidae
 Subfamily: Nymphalinae
 Genus : *Junonia*
 Species : *orithya*



Description

Average wingspan is 4.96 ± 0.307 cm and average body length is 1.9 ± 0.141 cm. The body is dark bright and blue. The head is bifurcated and black with an orange patch and 2 spines. Hind wings blue shaded with velvety black towards base. Below hind wings is pastel grayish-buff. The upper forewing of male is black excluding tip which is buffy-white with tapered brown gangs and a small pane of blue in tonal area, upper hind wings rainbow blue with two red-brown

scattered black ringed ocelli. Females are similar but dull blue areas are present and have larger and clear ocelli on the hind wings.

Distribution

This species has been reported from Union council Koaz Bahram Dheri District Charsada (Haroon *et al.*, 2013), District Gujrat, Punjab (Iqbal *et al.*, 2016), Mansehra (Perveen and Fazal, 2013), Buner (Naz *et al.*, 2001), Kohat (Perveen and Ahmad, 2012), Lahore (Ahsan and Iqbal, 1975), District Lower Dir (Khan *et al.*, 2016), Kotly, Mirpur and Bhimber AJK (Khan *et al.*, 2007).

Species No.09. Dark Clouded Yellow, *Colias croceus* (Geoffroy, 1785).

Classification

Family : Pieridae
 Subfamily: Coliaclinae
 Genus : *Colias*
 Species : *croceus*



Description

Mean wingspan is 5.36 ± 0.197 cm and mean body length is 1.96 ± 0.110 cm. The upper side of the wings is golden to orange blonde with a broad black border on all four wings and forewings contain large black spots. The underside lacks the black borders and is darker with a more greenish tinge, mostly on the forewings. Females are differentiated from the males by the presence of yellow spots laterally along the black border on the upper side. Females have black border which surround a sequence of small orange-yellow acenes of irregular size.

Distribution

Colias croceus is most wide spread in Europe. The Range of Dark Clouded Yellow ranges from North Africa and South Europe and Eastwards through Turkey into the Middle East. It is not found in Central Asia. In Pakistan, previously it was reported from District Gujrat Punjab, (Iqbal *et al.*, 2016), Chitral (Afshan *et al.*, 2015), Kohat (Perveen and Ahmad, 2012), Bahawalpur (Tayyab *et al.*, 2006) and Union Council Koaz Bahram Dheri District Charasada (Haroon *et al.*, 2013).

Species No.10. Large White, *Pieris brassicae* (Linnaeus, 1758)

Classification

Family : Pieridae
Subfamily: Pierinae
Genus : *Pieris*
Species : *brassicae*



Description

Average wing span is 5.52 ± 0.725 cm and average body length is 2.01 ± 0.170 cm. The upper sides of wings are usually shining white, with a definite black tip on the forewings. Females have bolder black marks and two noticeable black spots on upper side of forewing. Males have no perceptible dark spots on upper forewings but two noticeable black spots on underneath beyond 1b and in the middle of veins 3 and 4. The undersides of both pair of wings are pale yellow dusted with grey, except for the center and base of the forewings which are white. The head, thorax and abdomen are black with grey hair-like scales.

Distribution

It has been reported from Takhti-e-Nusrati, Karak (Usman *et al.*, 2017), Lahore (Ahsan and Iqbal, 1975), Chitral (Leslic and Evans, 1903), Buner (Naz *et al.*, 2001), Skardu, Karmang, Deosai plains, Sadpara (Abbas *et al.*, 2002), Gujrat Punjab (Iqbal *et al.*, 2016), Rawalpindi and Islamabad (Iqbal, 1978) and Muzaffarabad (Khan *et al.*, 2004).

Discussion

A total of 76 butterfly specimens were collected from 5 different localities of Doag Dara. Ten different species of butterflies were identified belonging to eight (08) genera and three (03) families (Table 1). In a previous study, Perveen and Fazal (2013) has reported ten species of butterflies belonging to three families and eight genera from Hazara University, District Mansehra, KP, Pakistan. The present study correlates with the cited study with ten identified species belonging to three families with Pieridae as the most prevalent family in both of the studies.

Ahmad and Perveen (2012) has reported twenty one species of butterflies from Kohat, Pakistan belonging to family Pieridae, Nymphalidae and Papilionidae. Family Pieridae was the most abundant family representing 57% of the total collected butterflies from Kohat. These three families were also reported in the present study from Doag Dara, District Dir upper, in which family Pieridae with 50% of the collected specimens was the most prevalent family followed by Nymphalidae (30%) and Papilionidae (10%). In this way, the present study shows great similarity with the cited study from Kohat, Pakistan. Khan *et al.* (2016) reported 24 species of butterflies from District Lower Dir, KP, Pakistan in which some of the reported species were different from the present study like *Papilio polyctor*, *Pararge schakra*, *Junonia hierta*, *Lycaena phlaeas*, *Lybithea lipita*, *Hipparchia parasitas*, *Lethe rohria* and *Maniola davendra*. This difference can be due to duration of collection, climatic differences and number of collected specimens. Afshan *et al.* (2015) has reported butterfly fauna of District Chitral, Pakistan during September 2014 to 2015. They reported 15 butterfly species belonging to 4 families and eleven genera. Most of the species were different from the present study such as *Aphantopus hyperantus*, *Eurema hecabe*, *Junonia almana*, *Celastrina argiolus*, *Pieris canidia*, *Colotis amata*, *Junonia iphita*, *Cercyonis sthenele*, *Catopstha ponomia* and *Junonia hierta*. The differences may be due to number of collected specimens, duration of study, size of study area, or weather conditions during the collection period. Usman *et al.* (2017) has reported butterfly fauna of Takht-e-Nusrati, District Karak, Pakistan. The specimens were collected During April to December 2016 from five different sites of the study area. Seventeen species belonging to 03 different families and 11 genera were identified. Family Nymphalidae covered 35%, Papilionidae 12% and Pieridae 53% of the collected butterflies of District Karak. In the present study, 50% species belonged to family Pieridae, 30% to family Nymphalidae and 20% of the species belonged to family Papilionidae. In both of the studies, the species were mostly common. The similarities in both results may be due to same environmental conditions and also similar protocols

applied for the collection and identification of the butterflies. Haroon *et al.* (2013) reported butterfly diversity of Koz Bahram Dheri, Charsada, Pakistan from July to October 2012. Three species namely *Danaus chrysippus*, *Eurema hecabe* and *Papilio demoleus* were also identified in the present study. Rest of the identified species were different in both of the studies. The difference in the species may be due to different climatic conditions and also different habitats of the study areas.

This was a preliminary study of its kind in the study area and will provide a baseline for the future taxonomic work of butterfly fauna of the study area and other related areas. Different morphometric measurements and their characteristics were studied which were species specific and can be helpful in the identification and classification of butterflies. Some of the common species of the study area were *Colias croceus*, *Pieris brassicae*, *Cynthia cardui* and *Pontia daplidice*. Descriptions and distributions of the identified species described in the present work will assist entomologists in future studies on butterfly fauna. Further work is recommended for the study of all possible butterfly species covering all seasons and all possible habitats of the study area. Studies on the ecology and biology of the butterfly fauna of the study area and population dynamics is recommended that will provide a handy tool for devising conservation and management strategies in the future.

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