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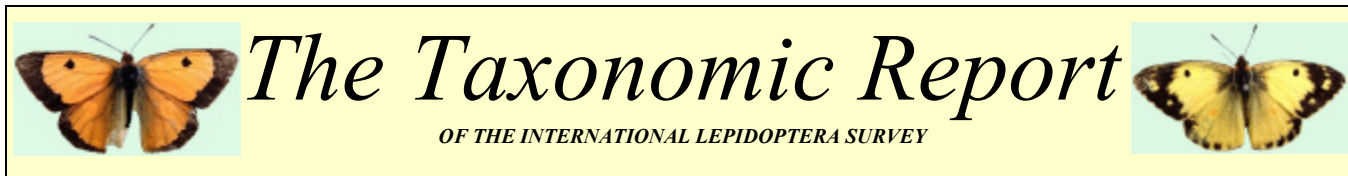
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TAXONOMY AND DISTRIBUTION OF BUTTERFLIES (PAPILIONOIDEA) OF THE SKARDU REGION, PAKISTAN

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ABSTRACT. A study was conducted in six different localities around Skardu to document the butterfly fauna of that region. The study revealed that 16 species in 5 families and 14 genera occur in the area. The families include: Papilionidae (represented only by the genus *Parnassius*); Pieridae (genera *Pieris*, *Pontia* and *Colias* are represented); Lycaenidae (genera *Lycaena*, *Everes*, *Aricia*, *Plebejus*, *Zizeeria* and *Zizina* are represented); Nymphalidae (only two genera, *Aglais* and *Cynthia* are represented); and Satyridae (represented by the genera *Pararge* and *Maniola*).

INTRODUCTION

Butterflies have been studied systematically since the early 18th century and 19,238 species had been documented worldwide by 1998 (Heppner, 1998). This figure is not constant because of the continuous discovery of new butterflies (Goodden, 1977; Stokoe, 1974; Green and Huang, 1998), and also due to ongoing disagreements between taxonomists over the status of many species.

The distribution of butterflies involves both expanding and contracting ranges. Natural changes in the distribution of species can be difficult to deduce because they tend to be slower and subtler than the dramatic changes caused by man. Unfortunately, most expanding ranges involve introduced species and most contracting ranges are due to the destruction of natural habitats (Lafontaine, 1997). Expansion in a species' range may often be in response to human activities favoring these species, making these butterflies opportunists. In order to document such temporal changes over time, a baseline faunal inventory must first be established.

It is essential that we document the butterfly fauna of certain regions so that steps may be taken to ensure the survival of these fascinating creatures for future generations. There is little that can be done to save our butterflies once their habitats are destroyed. Thus, it is important to manage our environment and avoid further damaging the already fragile balance of nature (Whalley, 1992).

In spite of their aesthetic appeal, we have comparatively little information on the butterfly fauna of many regions of Pakistan, especially Skardu. No documented collections had been made or faunal surveys conducted in this rather remote region prior to this study. The region known as the Northern Areas of Pakistan is spread over a vast area of 74,200 sq. km. It lies beside the lofty peaks and great mountainous ranges of the Karakorams, Hindu Kush, Himalayas and Pamir, which are largely uninhabited. Within this

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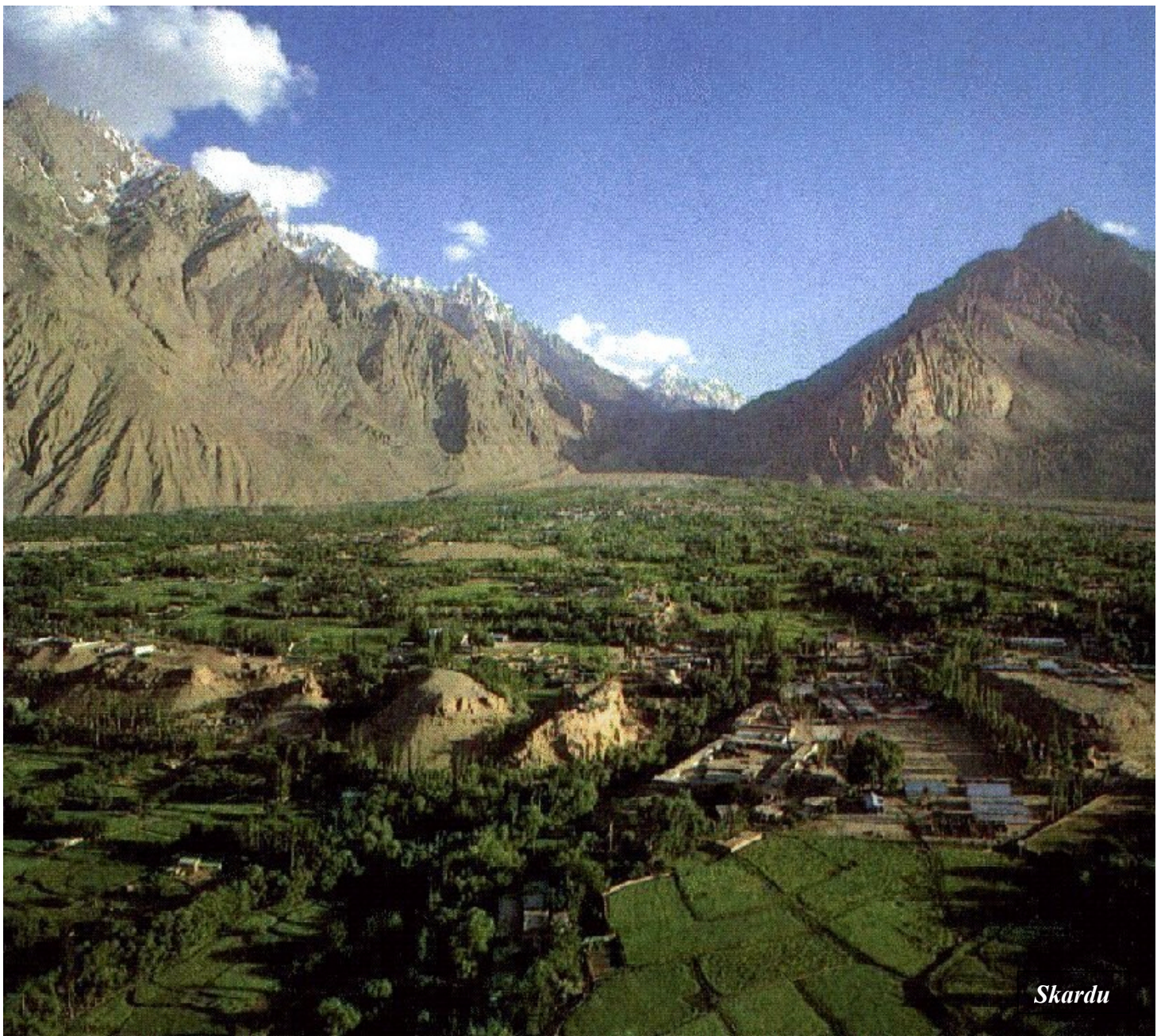
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area, the Skardu Region covers an area of 28,850 sq. km. with a population of 272,000 (census, 1986). Elevations in the study area range from approximately 2,270 m. along the river Indus to over 4,000 m. on the Deosai Plains, with Skardu city itself at 2,438 m. Skardu is well known for its peculiar geographical and climatic conditions. The climate is temperate and very arid. In summer the temperature reaches to a maximum of 35.2°C while the minimum temperature in winter is around -25°C.

Most settlements in the region occur along rivers and are built on alluvial deposits. With irrigation, crop agriculture is possible. The people of Skardu are largely subsistence agriculturists, but crops are produced for market as well. Skardu is famous not only for its beautiful scenery, but due to the temperate climate it also holds its place as a commercial fruit production region for Pakistan and abroad, producing cherries, almonds, apricots, apples, pears, peaches, grapes, plums, mulberries, among others. Important regional crops are wheat, maize, barley, alfalfa, barseem, potatoes, tomatoes, turnips, cabbages and carrots (agricultural statistics, 1993-94). Thus, the settled areas contain largely disturbed habitat. The surrounding region, most of it arid, is thinly populated by shepherd farmers.



Skardu

The present study was conducted to document for the first time the butterfly species in Skardu. The objectives of this study were foremost to study the distribution and diversity of butterflies in various habitats found in the region.

REVIEW OF LITERATURE

Distribution Studies

Despite their great importance to researchers, aesthetic value to lepidopterists and despite numerous studies of butterflies on the Indian subcontinent, there is very little information on the butterfly fauna of Pakistan and especially about the Skardu region. Thus, literature references are relatively scarce.

Doherty (1886) explored the butterfly fauna of Kashmir for the first time. Swinhoe (1887) reported 4 families of butterflies from Karachi and neighboring areas, including Papilionidae (4 species), Lycaenidae (18 species), Nymphalidae (17 species), and Hesperioidea (7 species).

Marshall and de Niceville (1883-1890) worked on the butterfly fauna of the Indian sub-continent. Leslie and Evans (1903) reported the butterflies of Chitral. Bingham (1905) and Lefroy (1909) reported on butterflies from the Indian region. Rhe-philipe (1917) reported 5 families from Lahore, including Papilionidae (3 species), Pieridae (17 species), Lycaenidae (11 species), Nymphalidae (16 species) and Hesperioidea (7 species). In another study, Evans (1923) explored the butterfly fauna of the Indian region.

Puri (1931) explored the butterfly distribution of Lahore. He reported 57 species belonging to 34 genera and 5 families. Similarly Evans (1933) studied the butterfly fauna of Baluchistan. Talbot (1939) and Wynter-Blyth (1940-1957) described the butterfly fauna of the Indian subcontinent. Menesse (1950) worked on the butterflies of Sind.

Malik (1970) reported 8 species of butterflies from Rawalpindi and Murree. In another study Malik (1973) reported 9 families of butterflies from West Pakistan, including Papilionidae (9 species), Pieridae (21 species), Lycaenidae (21 species), Nymphalidae (19 species), Satyridae (1 species), Danaidae (9 species), Acaeridae (1 species), Erycinidae (2 species) and Hesperioidea (9 species). Ahsan and Iqbal (1975) reported 66 species of butterflies from Lahore, belonging to 44 genera and 7 families, among which 12 species were reported for the first time from Lahore. Iqbal (1978) recorded 51 species in 35 genera and 8 families from Rawalpindi and Islamabad, including: Papilionidae (3 species), Pieridae (12 species), Lycaenidae (7 species), Nymphalidae (11 species), Satyridae (6 species), Danaidae (3 species), Erycinidae (3 species) and Hesperioidea (5 species).

Hasan (1994) explored the fauna of Islamabad and Murree, reporting Papilionidae (4 species), Pieridae (13 species), Lycaenidae (11 species), Libytheidae (1 species), Nymphalidae (17 species) and Danaidae (3 species). More recently, Hasan (1997) reported 80 butterfly species in 9 families from Northwest Himalaya (Galgit and Azad Kashmir), including Papilionidae (6 species), Pieridae (15 species), Lycaenidae (17 species), Libytheidae (1 species), Nymphalidae (24 species), Satyridae (8 species), Danaidae (3 species), Erycinidae (1 species) and Hesperioidea (5 species). In another attempt, Smith and Hasan (1997) reported 50 species from Northern Pakistan (Gilgit to Khunjerab). Khan, et al. (2000) studied the distribution and diversity of genus *Papilio* in Rawalpindi and Islamabad. Most recently, Rafi, et al. (2000) published a guide to the Papilionidae of Pakistan.

Taxonomy

The field of lepidopteran taxonomy is dynamic and the status of a great many named taxa or their higher level placement have been changed, many of them several times since their original descriptions. Little actual taxonomic work pertaining to the Lepidoptera of Pakistan has been done. Puri (1931) did systematic studies of the butterflies of Lahore. Ahsan and Iqbal (1975) prepared a revised list along with keys and brief description of the species recorded in Lahore. Similarly, Iqbal (1978) conducted a systematic account of the butterflies of Rawalpindi and Islamabad.

MATERIALS AND METHODS

During April 1999, six sites were selected for extensive sampling to determine the distribution, diversity and taxonomy of butterflies in Skardu (map pg. 14). The five localities were Skardu city, Shigar village, Kharmang village, Sadpara village, Kachura village and the Deosai Plains. These localities were selected on the basis of their position in topographic elevation, vegetation and accessibility.

In the center of the study area is Skardu city (photo page 2). The city lies on the banks of the river Indus amidst the towering mountains of the Karakoram range. Skardu city lies at the site of an oasis situated on an arid geological tableland 8 km. wide by 32 km. long. The landscape is made uneven by ancient sand dunes. Willows, poplars and the oriental plane tree grow here naturally among the cultivated apricots, peaches, mulberries, apples, pears, plums and cherries (Stewart, 1982). Grapes, vegetables and a variety of field crops are also widely cultivated.

Shigar village is about 32 km. to the north of Skardu along the banks of the river Shigar. It is situated within the lush green Shigar valley, an oasis which is surrounded by towering snow clad peaks. The valley is known for its crops of grapes, pears, apples, walnuts, peaches and apricots.

Kharmang village lies far to the southeast along the river Indus. It is situated near Kachura Lake, known for multitudes of wildflowers which line its shores in spring. Peaches, apricots, pears and apples are grown here.

The Deosai Plains (Fig. 1) south of Skardu are located on one of the world's highest plateaus, roughly 56 km. long by 40 km. wide, averaging 4,116 m. and are encircled by the Himalayan Mountains which reach heights of over 5,500 m. The cold alpine climate causes the plains to be snowbound under deep snows from November to May (Stewart, 1982). During the summer months, though arid due to a lack of rain, it becomes a morass of swamps from the melted snow much as the arctic tundra. Although above tree line, it is characterized by rich alpine snowmelt flora as evidenced by the abundance of flowering plants that make the plains glow with bright colors through the summer months. This region is uninhabited and much of it is now within Deosai National Park. The primary area of study here was at Burzil Top.

Kachura village (Fig. 2) is about 32 km. to the northwest of Skardu near the river Indus. Like the other areas, oasis conditions and irrigation support vegetation and cultivated crops. Without irrigation, such areas would quickly revert to arid steppe-like conditions.

Sadpara village (Fig. 3) lies directly south of Skardu on the way to the Deosai Plains. Here too, native vegetation is primarily found in oasis conditions and cultivation is totally dependent on irrigation.

Butterfly specimens were collected by means of netting within one square kilometer at each sample site. Each site was sampled for 30-60 minutes per visit at intervals of 10-15 days throughout the study period, from April 1999 until the end of September 2000. Four hundred specimens were vouchered, which were mounted for positive identification. Each specimen was labeled with (a) place of capture, (b) date of collection, (c) scientific name, (d) family name, and (e) collector's name. The specimens were identified with the help of available literature and already identified specimens from different collections of the country, such as the Institute of Plant and Environment Protection (IPEP), Islamabad, and Pakistan Forest Institute, Peshawar. All the identified specimens from this study have been deposited in the entomological collection of the Entomology Department, NWFP Agricultural University, Peshawar and Institute of Plant and Environment Protection (PMRP), Islamabad.

RESULTS

The present work is based on the collection of butterflies conducted in the study area during the years 1999 – 2000. Specimens were collected from various localities around Skardu. More than four hundred specimens were collected which were identified to species level. The survey revealed 16 species in 14 genera and 5 families, which occurred in the study areas. No species of the superfamily Hesperioidea (Latreille) were recorded.

Species Recorded

Superfamily **Papilionoidea** Latreille, 1809

Family **Papilionidae** Latreille, 1809

The *Papilionidae* consist of two major subfamilies: the *Papilioninae* Latreille and the *Parnassiinae* Duponchel. The Swallowtails (*Papilioninae*) are large, usually dark coloured butterflies that have the radius in the front wing five-branched. Most genera contain tailed species. These groups are not represented in the Skardu region. The Parnassians (*Parnassiinae*) are medium-sized, having very rounded wings usually white or gray with dark markings, the radius in the front wing is four-branched, and there are no tail-like prolongations on the hindwing. Females are unique among the butterflies in that they carry a distinct hardened pouch or “phragis” beneath their abdomen, which is produced by the male immediately after mating, to prevent other males from mating with the female. Only one species in genus *Parnassius* of this family has been recorded in the study area.

Subfamily **Parnassiinae** Duponchel, 1835

Tribe **Parnassiini** Duponchel, 1835

Genus *Parnassius* Latreille, 1804

The Apollo Butterflies are medium-sized, usually white or gray with dark markings, and with rounded, often translucent wings. Many species are adorned with red eyespot markings on the wings. They are also typically found in arctic/alpine habitats. Interestingly, only one species of this genus was recorded in the study area. It is frequently found with other members of the genus.

Parnassius charltonius Gray, 1853 - Regal Apollo (Figs. 8 & 9)

Wingspan: 80-90 mm.

Female: Forewing with vein R_2 from R_5 ; veins M_1 and R_5 well-separated at the origin; discal band usually broadened below the cells; the bases of areas Cu_{1b} and Cu_{1a} being usually entirely black; no red spot. Hindwing without a spot at base of area R_3 ; a small red or black spot at the middle of area R_3 ; a very large red ocellus extending from vein M_3 to vein M_1 , usually white-centered; a red or black basal bar above the anal angle in area 1 and Cu_{1b} ; a complete row of very distinct bluish-white centered black submarginal spots on a dark ground; a narrow black marginal line, more or less interrupted at the veins. Female phragis is heliciform (snail-shaped), being rolled upon itself, and furnished with a wide and longitudinal shallow groove. Females are larger and wings are more diaphanous (transparent) than the male.

Male: Smaller, and wings generally less diaphanous (transparent) than the female.

Flight period: July–August.

Distribution & Habitat: This butterfly is broadly distributed over the mountain ranges of central Asia, but within the study area was found only in restricted locations at Burzil Top in the Deosai Plains region, at elevations above 4,250 m. Previously reported from nearby Chitral by Mani (1986). Leslie and Evans (1903) recorded it from Shandur and the Burzil pass. The habitat includes mountain passes and steep rocky or clay slopes near glaciers. Males have been observed patrolling along cliff faces. Females are known to descend to a lower elevation than the males.

Taxonomy: About 20 subspecies are described, however specimens from the study area have not been identified to subspecies.

Comments: The larvae are known to feed on species of *Corydalis* in other portions of the species' range.

Family **Pieridae** Duponchel, 1832

This family includes small to moderately sized butterflies of mainly white, yellow or orange ground color bearing a variety of black margins, spots or other markings. They are characterized by pronounced sexual dimorphism and seasonal variation. Antennae gradually stouter towards the tip; there are six normally developed legs, fore tibia without cleaning spur, claws bifid; wings generally rounded, cell closed in both wings, one anal vein; hind wing with pre-costal vein or with a very short one turned towards wing base apically, two anal veins. They are also generally known to be species of open areas. Six species in three genera of this family were recorded in the study area.

Subfamily **Pierinae** Duponchel, 1832

Tribe **Pierini** Duponchel, 1832

Genus **Pieris** Schrank, 1801

This genus, traditionally known as the “Whites” consists of about 30 similar-appearing species, several of which are difficult to distinguish. These are all white with varying degrees of development of similar spots on the wings. There is considerable disagreement between taxonomists over the status of several of these. Two species of this genus were recorded in the study area.

Pieris rapae (Linnaeus, 1758) - Small White

Wingspan: 45-55 mm.

Female: Upperside white, bases of both wings and costa of forewing for a short distance sparsely dusted with black. Forewing with blackish gray apex; two round black spots at the middle of cells M_3 and CuA_2 . Hindwing with a small diffuse black spot in area $Sc+R_1$ near hindwing apex. Underside forewing white; apex cream yellow with black spots in cells M_3 and CuA_2 corresponding to the upperside. Hindwing cream yellow, suffused with black dusting that is more evident in the spring. Very similar to *P. brassicae* (Linnaeus), but mainly smaller in size.

Male: Upperside as in female except black markings considerably reduced; spot in cell CuA_2 generally absent. Underside like female.

Flight period: April–September.

Distribution & Habitat: This widely distributed Holarctic species has been recorded in all localities in the study area. Leslie and Evans (1903) reported *Pieris rapae* from Chitral, while Malik (1970) reported it from Murree and Quetta, but the species is generally known to occur throughout Pakistan. It is common in cultivated areas and around settlements.

Taxonomy: The subspecies *debilis* (Alpheraky, 1889) has been described from the region north and west of here.

Comments: Malik (1970) reported a number of plants in family *Cruciferae* as host of this species in Murree and Quetta.

Pieris brassicae (Linnaeus, 1758) - Large White

Wingspan: 57-66 mm.

Female: Upperside white. Forewing with broad black gray apex, extending back along the margin; two round black spots at the middle of cells M_3 and CuA_2 ; gray edge along the inner margin along the hindwing in cell $1A+2A$. Hindwing with a small black spot in area $Sc+R_1$ near hindwing apex. Underside forewing white; apex dirty cream yellow with black spots in cells M_3 and CuA_2 generally fused together across cell CuA_1 . Hindwing cream yellow, variably suffused with grayish scaling. Very similar to *P. rapae* (Linnaeus), but mainly larger in size.

Male: Upperside similar to the female but without any spots on forewing above. Underside like the female except the two forewing spots in cells M_3 and CuA_2 remaining distinct.

Flight period: April–September.

Distribution & Habitat: Common in all localities in the study area. It is also widely distributed throughout much of the Palearctic region. In Pakistan, it is found in both plains and hilly regions but frequents cultivated areas, settlements, flowery areas, fields and mountain meadows. Interestingly, this butterfly is known to be highly migratory in some regions, both by latitude and by altitude. It is apparently incapable of overwintering at higher elevations in the mountains. Altitudinal migrants repopulate the mountainous areas each spring.

Taxonomy: Iqbal (1978) reported *P. b. nepalensis* Gray, 1846 as the subspecies from northern Pakistan. This subspecies is morphologically similar to nominotypical *P. brassicae* but it is smaller in size.

Comments: Leslie and Evans (1903) reported it from Chitral, while Rhe-philipe (1917) and Puri (1931) reported it from Lahore. Talbot (1939) reported it from Balochistan. Malik (1970) reported it from Rawalpindi, Hassanabdal, Abbottabad and Peshawar. Ahsan and Iqbal (1975) reported this species from Lahore. Iqbal (1978) reported it from Rawalpindi and Islamabad. Hasan (1994) reported this species from Islamabad and Murree Hills. He described cabbage, cauliflower, radish and mustard as host plant of this species. Hasan (1997) again reported this species, this time from the northwest Himalayas.

Genus **Pontia** Fabricius, 1807

A group of similar-appearing species, all white with a series of black or gray markings on the upper surface. Undersides generally display heavy greenish gray patterns on yellow or white ground color. One species of this genus was recorded in the study area.

Pontia callidice (Hübner, 1800) - Peak White

Wingspan: 45-55 mm.

Female: Upperside forewing white with extensive black apical markings mainly in the outer portion of the wing and a large black discocellular mark; hindwing white with grayish appearance and a partially-developed band of black submarginal crescents. Underside forewing white with pattern of gray markings and greenish-yellow coloration near the apex; hindwing greenish-yellow with extensive gray pattern mainly aligned with the veins.

Male: Similar to the female but upperside much whiter; with black discocellular mark, and black submarginal markings considerably more reduced than in the female.

Flight period: June–August.

Distribution & Habitat: Found in only one locality near the permanent snow line on high alpine mountains, above 4,250 m. in northern areas of the Deosai Plains. It is rare. Known from tundra and cold steppe habitats from other parts of its range.

Taxonomy: Specimens are closest to subspecies *hinducucica* Verity, 1911, described from the Pamirs.

Comments: Prior to this study, *Pontia callidice* was not known from Pakistan. It was first discovered by the authors from the study area. It can be concluded that this species is not widely distributed in the country, and found only in restricted habitats.

Subfamily **Coliadinae** Swainson, 1827

Tribe **Coliadini** Swainson, 1827

Genus **Colias** Fabricius, 1807

Primarily a holarctic genus but with representatives as far south as South America and Africa. Most species are hues of orange or yellow, some greenish, many with heavy gray suffusion. Only a few species are white in both sexes, many have white female forms. There is marked sexual dimorphism in most species, and great individual variation, leading to a great number of named forms. Two species of this genus were recorded in the study area.

Colias erate Esper, 1805 - Eastern Pale Clouded Yellow (Fig. 5)

Wingspan: 40-60 mm.

Female: This is a highly variable species. Normal ground color is yellow but some females are of the white form *pallida* (Staudinger and Wocke, 1861). Upperside forewing with prominent black discocellular spot; broad black marginal area contains a row of several spots of the ground color; wing fringes reddish; hindwing black margin incomplete and broken at veins; discocellular spot orange or creamy white. Underside “olivaceous” yellow, hindwing dusted; forewing marginal postmedian area with band of black spots fading toward apex; hindwing discocellular spot pearly white, ringed with reddish.

Male: Similar to the female but with forewing marginal band narrower and hindwing black margin more complete. Ground color yellow. Upperside forewing with prominent black discocellular spot, marginal area black with band of yellow spots; hindwing with orange discocellular spot. Underside as in the female.

Flight period: July–September.

Distribution & Habitat: Widely distributed in all localities except the Deosai Plains. The species is an inhabitant of meadows and fields at lower elevations but is also found in a variety of montane and steppe habitats and around settlements.

Taxonomy: Specimens have been identified to subspecies *lativitta* Moore, 1882.

Comments: Reported by Swinhoe (1887) from Karachi. It is now known from several areas of northern Pakistan. This highly polymorphic species has many described forms and can often be confused with several similar-appearing species.

Colias fieldii Ménériés, 1855 - Dark Clouded Yellow (Fig. 6)

Wingspan: 45-55 mm.

Female: Upperside deep orange. Forewing with broad black marginal area containing several orange-yellow spots; prominent black discocellular spot; base of forewing heavily suffused with grayish green scales. Hindwing heavily suffused with dark grayish green scales; wide black marginal area containing a band of orange-yellow spots; prominent double discocellular orange spot. Underside greenish yellow; wing margin prominently edged with pink; hindwing with prominent silver double discocellular spot encircled with pink scaling.

Male: Similar to the female except upperside black margins more sharply-defined, lacking the orange-yellow spots.

Flight period: June–August.

Distribution & Habitat: Widely distributed, found in all localities. This is a south Palaearctic species occurring primarily in the Himalayas and is found throughout much of northern Pakistan. This is a common species of the arid-montane oases where cultivation is practiced.

Taxonomy: The nominotypical subspecies occurs here.

Comments: Leslie & Evans (1903) first reported this species from Chitral. Puri (1931) reported it from Lahore. Malik (1970) reported this species from Lahore, Abbottabad, Karachi and Peshawar. He recorded *Indigofera dosua* as food plant for this species. Ahsan and Iqbal (1975) reported it from Lahore, while Iqbal (1978) and Hasan (1994) reported it from Rawalpindi, Islamabad and the Murree Hills. Hasan (1997) reported it from the northwest Himalayas. Hosts are cultivated *Fabaceae* sp.

Family **Lycaenidae** Leach, 1815

These are small delicate butterflies, displaying a diverse range of colors from browns to bright blue or coppery-orange hues, and often have brilliantly colored uppersides. There is considerable sexual dimorphism as evidenced by the uppersides (the undersides of both sexes are usually identical). Males are generally more brightly colored while the females are usually duller in appearance. Some species are quite common but found as localized colonies adapted to very specialized habitats. The body is slender, the antenna is usually ringed with white, and there is a ring of white scales encircling the eyes. The front legs of the female are normal, but in males they are shorter and lack tarsal claws. Six species in six genera were recorded in the study area.

Subfamily **Lycaeninae** Leach, 1815

Genus **Lycaena** Fabricius, 1807

This genus consists of many coppery-orange butterflies, thus the familiar name “Coppers”. One species of this genus was recorded in the study area.

Lycaena phlaeas (Linnaeus, 1761) - Small Copper (Fig. 4)

Wingspan: 26–30 mm.

Female: Upperside: forewing pale reddish-copper adorned with several prominent black spots; black borders. The upperside of the hindwing grayish brown with broad orange marginal band; frequently with a row of faint blue spots inwards of this marginal band; a row of black marks bordering the outer edge of the orange margin. Underside: forewing with orange ground color adorned with black marks; apex brownish fawn; the entire hindwing brownish fawn with very small black spots.

Male: Similar to the female but slightly smaller.

Flight period: June–September.

Distribution & Habitat: Skardu city, Kachura and Sadpara. This species is known from meadow habitats and often frequents habitats disturbed by humans.

Taxonomy: Subspecies *comedarum* Grun-Grshimailo, 1890 has been named for this region.

Comments: A common butterfly of areas disturbed by humans, mainly utilizing various *Rumex* as the larval host.

Subfamily **Polyommatae** Swainson, 1827

Tribe **Zizeerini** Chapman, 1910

Genus **Zizeeria** Chapman, 1910

This genus consists of very small, dark blue and brown butterflies differentiated from other genera of “Blues” by minor wing and genitalic structures. Antenna slightly less than half the length of forewing; club elongate; concave on the underside. One species of this genus was recorded in the study area.

Zizeeria knysna (Trimen, 1862) - African Grass Blue.

Wingspan: 16-20 mm.

Female: Upperside dull brown, markings altogether absent; forewing with basal patches of purple. Underside is pale grayish brown adorned with a series of small black spots.

Male: Similar to the female but violet blue color above and wide, dark wing margins.

Flight period: June–August.

Distribution & Habitat: Widely distributed in all localities except the Deosai Plains. This small butterfly is found along damp streamsides at lower elevations.

Taxonomy: The subspecies *karsandra* (Moore, 1865) has been identified for this region.

Comments: *Zizeeria knysna* was first reported by Swinhoe (1887) from Karachi. Hasan (1994) reported it from Islamabad and the Murree hills, and again recently (Hasan, 1997) from the Murree foothills. The host plants have been reported to be *Polygonum plebejum* and *Amaranthus spinosus* (Hasan 1997). This species is widely distributed only in the eastern part of Pakistan according to available literature, and is widely distributed in the Skardu region.

Genus *Zizina* Chapman, 1910

This genus also consists of very small blue and brown butterflies. They are differentiated from other genera of “Blues” by minor wing and genitalic structures. One species of this genus was recorded in the study area.

Zizina otis (Fabricius, 1787) - Lesser Grass Blue

Wingspan: 30-40 mm.

Female: dull brown with a slight suffusion of blue towards the wing bases. The underside of both sexes pale gray with brown markings.

Male: Similar to the female, but dark lilac-blue.

Flight period: May–September.

Distribution & Habitat: Skardu city, Kharmong and Kachura, being found generally at lower elevations. It is very rare in other portions of Pakistan, elsewhere being found only in Chitral.

Taxonomy: Many subspecies have been described from the Oriental (Indo-Australian) zoogeographical region but none have been described from this region. Until more research is done, our populations are attributable to the nominotypical subspecies.

Comments: *Zizina otis* was first reported by Leslie and Evans (1903) from Chitral at low elevation. Later on it was also reported by Rhe-philipe (1917) from Lahore. Despite the fact that this species is not widely distributed in Pakistan, it is widely distributed in Skardu.

Tribe *Everini* Tutt, 1907

Genus *Everes* Hübner, 1819

The species in this small Holarctic genus are distinguished primarily by short, hairlike tails on the hindwings. Males are generally blue while females are generally brown. Some authors consider *Everes* a subgenus of *Cupido* Schrank, 1801. One species of this genus was recorded in the study area.

Everes argiades (Pallas, 1771) - Short-tailed Blue

Wingspan: 25-30mm.

Female: Upperside brown with two orange-ringed spots near tornus of hindwing. Underside pale gray with numerous small black spots. Spring brood females often have some blue suffusion at base of forewing.

Male: Upperside bluish-violet color. Underside like the female. Interestingly, the males are larger than the females.

Flight period: June-July.

Distribution & Habitat: Skardu city, Shigar. Found in meadow habitats.

Taxonomy: The subspecies *hellotia* Ménétré, 1857, has been identified for this region.

Comments: Prior to this study, *Everes argiades* was not known from Pakistan. It was first discovered by the authors from the study area.

Tribe *Polyommata* Swainson, 1827

Genus *Aricia* Reichenbach, 1817

This genus is characterized by both sexes being either all brown or brown with submarginal rows of orange lunules on all wings. There are only minor genitalic differences from other related genera. One species of this genus was recorded in the study area.

Aricia agestis (Denis & Schiffermüller, 1775) - Brown Argus or Orange Bordered Argus

Wingspan: 25-30 mm.

Female: Upperside dark brown with prominent submarginal row of orange crescents on all wings. Underside brownish gray with numerous black spots and row of orange crescents like that of the upperside.

Male: Like the female except orange crescents are greatly reduced.

Flight period: May–August.

Distribution & Habitat: Sadpara, Skardu city and Kachura. The species is known from dry meadow habitats and broad open habitats.

Taxonomy: Specimens appear to be of the nominotypical subspecies.

Comments: In this species, it is often difficult to distinguish males from females by the wings alone.

Genus *Plebejus* Kluk, 1802

In this genus, males are usually blue while the females are brown with orange submarginal lunules, usually on the hindwings. One species of this genus was recorded in the study area.

Plebejus argus (Linnaeus, 1758) - Silver-studded Blue

Wingspan: 20-30 mm.

Female: Brown with submarginal orange lunules on hindwing. There may be varying amounts of blue basal suffusion in some individuals. The underside is grayish brown with black spots and marginal orange markings.

Male: Similar to the female but deep purplish blue above.

Flight period: June–August.

Distribution and Habitat: All localities except the Deosai Plains. Known from a variety of open habitats including meadows, steppes, mountain slopes and also frequenting settled areas.

Taxonomy: The subspecies *pamira* (Forster, 1936) has been identified for this region.

Comments: Prior to this study, *Plebejus argus* was not known from Pakistan. It was first discovered by the authors from the study area.

Family *Nymphalidae* Swainson, 1827

These are medium-sized butterflies, with variable and elaborate markings, bright colors and angular-shaped wings. The hindwings of most species have a concave "channel" along the inner margin, which covers the abdomen when resting. The forelegs of both males and females are short, lack claws and are therefore useless for walking (only the middle and hind legs are used for walking). The forelegs are also clothed with long hairs, hence the name "Brush-footed Butterflies". These butterflies are known for their abilities of sustained flight over long distances and members of several genera hibernate as adults in cold regions. Only two species in two genera have been recorded in this family in the study area.

Subfamily *Nymphalinae* Swainson, 1827

Tribe *Nymphalini* Swainson, 1827

Genus *Aglais* Dalman, 1816

This is a distinct genus of medium-sized butterflies characterized by bright reddish uppersides marked with a series of bold black or dark brown markings, yellow markings and marginal blue lunules on the hindwings. The undersides are characterized by shades of brown, heavily mottled to resemble tree bark. Authors frequently err in assigning these species to other genera, such as *Vanessa* or *Nymphalis*. One species of this genus was recorded in the study area.

Aglais cashmiriensis (Kollar, 1844) - Kashmiri Tortoiseshell (Fig. 7)

Wingspan: 55-65 mm.

Female: Upperside orange-red with black and some pale yellow markings; underside mostly brown. The wings have a characteristic sculptured, angular appearance, with a ragged edge and characteristic tail stub.

Male: Similar to the female.

Flight period: May–June.

Distribution and Habitat: Skardu city and Shigar. Found in almost any habitat type and around settlements.

Taxonomy: The subspecies *nixa* Grun-Grshimailo, 1890 has been identified for this region.

Comments: Hasan (1994) reported this species for the first time, from Islamabad and the Murree Hills. Later, Mani (1986) reported this species from Murree Hills and Azad Kashmir. In the current study, it was collected from only two localities of Skardu. This shows that *Aglais chashmirensis* occurs only in some hilly areas and is not widely distributed.

Genus *Cynthia* Fabricius, 1807

This genus, which is primarily Nearctic, includes several similar-looking species including the cosmopolitan *C. cardui*. It differs from the darker colored members of the genus *Vanessa* Fabricius, most significantly in features of the male and female genitalia and in egg morphology (Field, 1971). A single species of this genus was recorded in the study area.

Cynthia cardui (Linnaeus, 1758) - Painted Lady.

Wingspan: 54-62 mm.

Female: Forewing above tawny orange brown (rosy hue in freshly-emerged individuals but fading with age) with dark brown markings; apex dark, containing several white markings including apical spots and a subapical bar. Hindwing similarly orange brown with dark markings; basal area pale brown, covered with fine hairs; band of five black submarginal ocelli. Underside forewing pale rosy orange; with a complex pattern of brown, gray, black and white markings. Underside hindwing with highly complex, intricate pattern of brown, gray, black and white markings; four prominent black submarginal ocelli corresponding to the upperside.

Male: Similar to the female.

Flight period: May–August, depending heavily on arrival of seasonal migrants.

Distribution and Habitat: Widely distributed in all locations except the Deosai Plains. Found in virtually any habitat type, but most frequently in fields and meadows and around settlements.

Taxonomy: Though some subspecies have been described, individuals in this region are typical ssp. *cardui*.

Comments: *Cynthia cardui* was first reported in Pakistan by Swinhoe (1887) from Karachi. Leslie and Evans (1903) collected it from Chitral. Rhe-philipe (1917) and Puri (1931) again reported it from Chitral. Menesse (1950) and Malik (1970) reported it from Rawalpindi and Islamabad. Ahsan and Iqbal (1975) reported it from Lahore. Again reported by Iqbal (1978) and Hasan (1994) from Islamabad and other areas, and recently from Gilgit by Hasan (1997). It can be concluded from the current study and these reports that this beautiful species is widely distributed throughout Pakistan. This species is a well-known migrant and is also known to utilize an astonishing diversity of host plants, in 21 genera of plants (Field, 1971), perhaps aiding in its nearly worldwide distribution. It's overwintering status in Pakistan is not well studied, but apparently it does not overwinter at the higher elevations of northern Pakistan, being replenished by seasonal migrants in spring.

Family *Satyridae* Boisduval, 1833

Small to medium-sized butterflies, usually brownish. Most species are characterized by eye spots on the wings and undersides having a distinct pattern resembling tree bark. The forewing has one or more veins swollen at the base. In the majority of species, sex brands and hair pencils are present in the males on one or both wings. Eyes are often hairy, the palpi more or less flattened laterally and densely covered with hairs. Antenna are delicate and of medium length. Like the Nymphalidae, the forelegs of both males and females lack claws and are useless for walking (this common character is why some authors combine the two families into a single family: the Nymphalidae). Male tarsus with one long segment; female tarsus with five long segments. Two species in two genera were recorded in the study area, at the Deosai Plains. These species area adapted to the cold, barren mountainous habitat.

Subfamily *Maniolinae* Grote, 1897

Genus *Maniola* Schrank, 1801

This is a Palearctic genus, consisting of several similar species, all generally brown with a black subapical ocellus. One species of this genus was recorded in the study area.

Maniola pulchra (C. & R. Felder, 1867) - Dusky Meadow Brown

Wingspan: 40–41mm.

Female: Upperside forewing dark orange (brighter than in the male), overlaid with dark brown scales, and the apical ocellus surrounded by paler buffy orange. There is also a second un-pupilled ocellus in the forewing tornal area. The underside hindwing bears a zig-zag line in the discal area as well as traces of a second dark line in the subapical area. The underside forewing ocellus is pupilled with white and ringed with paler buff.

Male: Similar to the female but darker overall and with heavier overlay of dark brown scales..

Flight period: July–August.

Distribution and Habitat: In the study area, only recorded in the Deosai Plains. Found in hilly northern areas of Pakistan and also in the northwest Himalaya (Mani, 1986). Generally not known from plains habitats but is known to occur at high altitudes, such as those at the Deosai Plains, which average 4,116 m. in elevation.

Taxonomy: No subspecies have been identified for this study.

Comments: Prior to this study, *Maniola pulchra* was not known from Pakistan. It was first discovered by the authors from the study area.

Subfamily **Pararginae** Tutt, 1896

Genus **Pararge** Hübner, 1819

This is a Palearctic group of several very similar species, all dark brown in appearance, with one subapical ocellus on the dorsal forewing and two or more ocelli on the dorsal hindwing. There are varying amounts of orange coloration overlaying the brown ground color in each species. One species of this genus was recorded in the study area.

Pararge menava Evans, 1932 - Dark Wall Butterfly

Wingspan: 50-60 mm.

Female: Wings above dark brown; subapical ocellus in forewing black, white-centered and ringed yellow, hindwing with two ocelli above.

Male: Like the female.

Flight period: June–July in the study area.

Distribution and Habitat: In the study area, only recorded in the Deosai Plains. Found in hilly northern areas of Pakistan and also in the northwest Himalaya (Mani, 1986). Generally not known from plains habitats but is known to occur at high altitudes, such as those at the Deosai Plains, which average 4,116 m. in elevation.

Taxonomy: The nominotypical subspecies has been identified for this region. This species is very similar in appearance to *P. schakra* (Kollar, 1844) and *P. maerula* (C. & R. Felder, 1867), neither of which were recorded during this study, but may be confused with these species. These can be distinguished from *P. menava* in that they contain three ocelli on the dorsal hindwing, while *menava* contains only two.

Comments: Prior to this study, *Pararge menava* was not known from Pakistan. It was first discovered by the authors from the study area.

SUMMARY

No butterfly survey work had previously been conducted in Skardu and surrounding region of the Northern Areas of Pakistan. Due to the lack of published information on butterflies in this region, the main aim of this research was to investigate the taxonomy and distribution of butterflies in the study area. New distribution records were established for all of the species listed in this study. Prior to this study, the species *Pontia callidice*, *Everes argiades*, *Plebejus argus*, *Maniola pulchra* and *Pararge menava* had not been previously reported from Pakistan and are established as new national records by the authors of this study. *Zizina otis* was found frequent in the study areas, but is known from only one other location in Pakistan.

Overall species diversity in the study area was found to be very low. This is due to the natural climate, which is generally cold-temperate and arid, and the distinctively central Asian “steppe-like” habitat of the region, which is rather unsupportive of great butterfly diversity. Thus, the lack of butterfly diversity is not entirely due to the climate, but is more directly a result of lower diversity of flora upon which to support greater butterfly diversity. However, some of the recorded species were very numerous in certain areas, especially around areas of cultivation and irrigation. The following species were found in all six of the study locations: *P. rapae*, *P. brassicae*, *C. erate*, *C. fieldii*, *Z. knysna*, *P. argus* and *C. cardui*. These species apparently function as opportunists, benefiting from the activities of humans, though they may have been present prior to human settlement. Certain other species were found in two or three of the study locations, and therefore may have more specific habitat requirements: *L. phlaeas*, *Z. otis*, *E. argiades*, *A. agestis* and *A. cashmirensis*. Four species: *P. charltonius*, *P. callidice*, *M. pulchra* and *P. menava* were

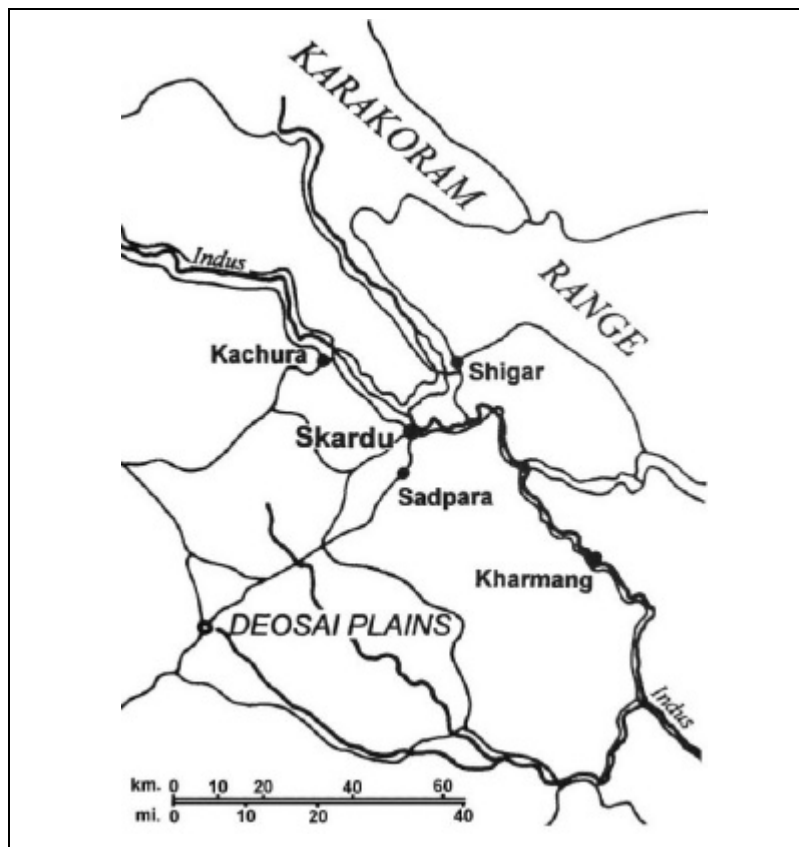
each found in only one of the study areas: the Deosai Plains. These are all high-altitude species and are very habitat specific.

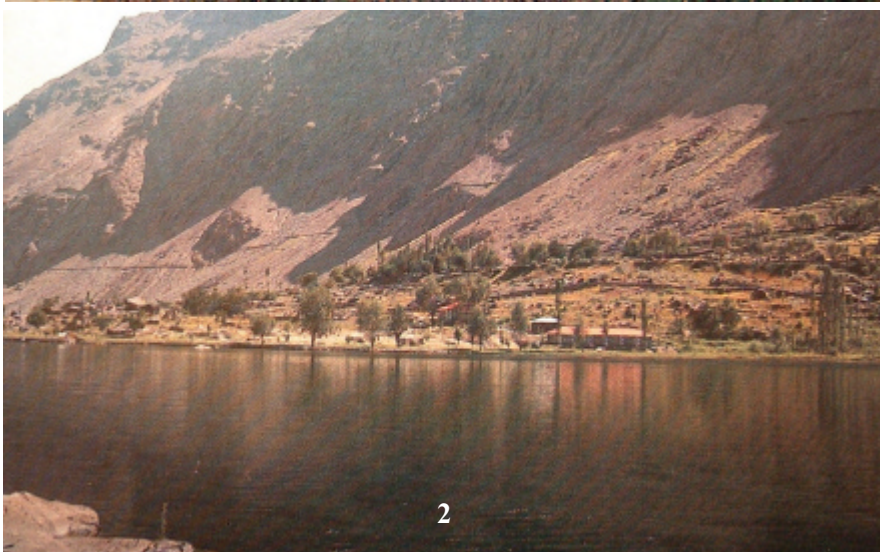
The species recorded in this study have their origins in two primary zoogeographical zones: the Palearctic region to the north and west and the Oriental (variously called Indo-Australian) region to the south and east. Those of the Palearctic region are well-adapted to cold temperate climates in all developmental stages and are primarily overwintering residents. These are: *P. charltonius*, *P. rapae*, *P. brassicae*, *P. callidice*, *C. erate*, *C. fieldii*, *L. phlaeas*, *E. argiades*, *A. agestis*, *P. argus*, *A. cashmirensis*, *M. pulchra* and *P. menava*. These thirteen species comprise 81% of our sample of 16 species. Three of the species in our sample have origins in the Oriental zoogeographic region and comprise 19% of our sample. These include: *Z. knysna*, *Z. otis* and *C. cardui*. The first two species are resident, with only one, *Z. knysna* being known as a permanent breeding resident. The status of *Z. otis* is not entirely clear, as it is generally known from lower elevations in northern Pakistan and thus may be a seasonal (not overwintering) breeding resident. *C. cardui* falls into a special class of its own, in that it manages to overwinter in the adult stage in the warmer region to the south, and immigrates seasonally into the higher, colder reaches of the north. Thus, butterflies in the study area have a predominantly central Asian character, well-adapted to a dry steppe climate and extreme cold temperatures in winter.

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Figs. 1-9. **Fig. 1.** Deosai Plains in summer. **Fig. 2.** Kachura Lake, Skardu Valley. **Fig. 3.** Lake Sadpara, Skardu Valley. **Fig. 4.** *Lycaena phlaeas* (Linnaeus, 1761) - Small Copper, Skardu. **Fig. 5.** *Colias erate* Esper, 1805 - Eastern Pale Clouded Yellow, Skardu. **Fig. 6.** *Colias fieldii* Ménétrés, 1855 - Dark Clouded Yellow, Skardu. **Fig. 7.** *Aglais cashmiriensis* (Kollar, 1844) - Kashmiri Tortoiseshell, Skardu. **Fig. 8.** *Parnassius charltonius* Gray, 1853 - ♂ Regal Apollo, Burzil Top, Deosai Plains. **Fig. 9.** *Parnassius charltonius* ♀ (same data as Fig. 8).