GSAR Journal of Agriculture and Veterinary Sciences
ISSN: 3048-9075 (Online)
Abbreviated key title: Glob.J. Agri.Vet.Sci.
Frequency: Monthly
Published By GSAR Publishers
Journal Homepage Link- https://gsarpublishers.com/journal-gjavs-home/

BUTTERFLY SPECIES DIVERSITY AND ECOLOGICAL INSIGHTS AT LOWER DIR, PAKISTAN

By

FAWAD KHAN[1*], SAMINA YASMIN[2], INAM ULLAH[3], AKHTAR BADSHAH KHAN[4], SUMBAL BIBI[5], KEHKASHAN[6], MAJEED ULLAH[7], MUHAMMAD YOUNAS[8].

[1*]Health Department Khyber-Pakhtunkhwa
[2]Zoology Department Hazara University Mansehra
3-5-6 Entomology Department Abdul Wali Khan University Mardan Khyber-Pakhtunkhwa
[4]Zoology Department University of Malakand
[7-8] Department of Zoology Shaheed BB University Dir Upper

Article History

Received: 15/03/2025
Accepted: 26/03/2025
Published: 31/03/2025

Vol – 2 Issue – 3

PP: -75-84

Abstract

This work outlines the general diversity of butterflies in Lower Dir, Khyber Pakhtunkhwa, and records an overall noteworthy assemblage of 79 species representing six families. The general survey conducted throughout different localities in the area reflects particularly high levels of diversity within the family Nymphalidae, wherein species such as Junonia orithya and Argynnis kamala have been found with both widespread and localized distributions. Record of Junonia orithya from Timergara, Khall, and Balambat and the rarity of Argynnis kamala confirm not only the earlier-recorded distribution but also extend new information on their ecological adaptability. Members of the family Pieridae were very common especially Colias erate and Eurema hecabe while Catopsilia pyranthe was uncommon which corroborates the earlier recorded distribution of the latter. Hipparchia parasites and Ypthima asterope form the record in the Satyridae family, confirming their previous distribution and rarity. The established pattern of the distribution and rarity in the Papilionidae family is shown by abundant Papilio demoleus and rare Papilio polyctor. Danaus chrysippus was found to be abundant, and this corresponds with its wide distribution in Pakistan, while the family Libytheidae was represented by the rare Libytheia lepita. This study will not only enrich our understanding of butterfly fauna in Lower Dir but also integrate new species records with historical data regarding the ecological importance of the region and the need for ongoing conservation efforts.

Keywords: *Butterflies, species diversity, entomological survey, Lower Dir, Khyber Pakhtunkhwa*

INTRODUCTION

Butterflies belong to the order Lepidoptera, derived from two Greek words, i.e. "Lepis" and "Ptera". The meaning of the word "Lepis" is scale, and the meaning of "Ptera" is wings, which means the insects whose wings are covered with scales (Stroke, 1964). The order Lepidoptera is further divided into two suborders on the types of antennae and the base of wing coupling structures. Sub-order Rhophalocera (butterflies) and Heterocera (moths). In this respect, the suborder Rhophalocera has been further divided into two superfamilies: Superfamily Papilionoidea (actual butterflies) and Superfamily Hesperoidea (skippers) Ross 1965. In the superfamily Hesperoidea (skippers), the color is usually brown or orange-brown, and the antennae are clavate but hooked and recurved apically. However, the superfamily Papilionoidea (actual butterflies) is brightly colored, and the antennae are club-shaped more are less rounded apically. Skippers are different from butterflies by darting flights. butterflies are fascinating insects. Due to their beautiful color pattern, a dramatic transformation in the life cycle, and the exciting phenomenon of mimicry and transmigration, they have acquired an uncommon status among insects (Gay et al., 1992). Most of us draw pleasure from their fantastic colors. All the butterflies, though similar in appearance, vary from one another in their characters, which may either be inborn or due to external climatic appearance. They have complete metamorphosis: egg, larva or caterpillar, pupa or chrysalis, and adult or imago.

*Corresponding Author: **FAWAD KHAN..**

The compound eyes of the adult butterfly are large, antennae club shaped, while long coiled proboscis is used to feed nectar. Their wings are colored and membranous with rare wing venation. The pad is present at their legs, which are typically walking type. Female butterflies usually select the proper places to deposit their eggs after fertilization. Some species lay their eggs in chains or ringlets singly or in rows or groups (Stanek, 1977). Butterflies can be easily identified. Among the species, their size is different and may range from a few millimeters to over 300 millimeters (Hassan, 1994). West pugmy blue has a minimum size of 15mm whereas the Alexandra bird has a maximum size that is 250mm (Carter 1992, Collins and Morris 1985). There are more than 28,000 species of butterflies in the world out of which approximately 80 % of butterflies are found in the tropical regions. A total number of 5,000 insect species have been reported in Pakistan among which up to 400 spp. of moths and butterflies are reported. (Khan et al. 2015).

Butterflies can be treated both as enemies and friends of man. The butterflies can relate to agriculture in three ways. Adult butterflies use flowers for nectar which also assists in pollination. Caterpillars of the butterflies are mostly herbivorous, some species are likely to nourish on carpets, crops, and clothes (Owen, 1971). It is said that their fauna exists in all parts of the world, wherever their host flowering plants are found. They are capable of colonizing even high altitudes excluding the Antarctic, Arctic, and snow and glacier-concealed mountain peaks of Mani, 1986 and Hassan, 1994. Each species possesses its geographical region and some could be endemic or cosmopolitan in distribution. Due to its geographical location at the junction of the oriental and Palaearctic zones, Pakistan possesses an interesting fauna of butterflies containing all types of habitats: mountains, forests, rivers, deserts, grasslands, tropical, subtropical, plains, etc. (Mani, 1986).

The human endeavors for increased production have rendered the butterfly fauna of the region insecure. Pakistan already has scanty natural resources. If these resources are spoiled by disturbing the habitats, many species of butterflies will lead to extinction Gay et al. 1992; Hassan, 1994.

MATERIALS AND METHODS

Dir Lower

The investigation narrows down to the bumblebee populations in Lower Dir, Khyber Pakhtunkhwa, Pakistan. It is located south of District Chitral and shares borders with Swat, Afghanistan, and others. There was a princely state called Lower Dir until 1970 when it joined Pakistan. In 1996, the bifurcation of the sub-division of lower and upper Dir was carried out. The district covers an area of approximately 1,584 km², ranging from valleys to mountains and plains. It is essentially a hilly district with severe winters and aboveaverage snowfall and distinct temperature variations. The entomological survey was conducted in four tehsils, namely, Timergara, Balambat, Khall, and Arang.

Timergara: This is a central tehsil and also an important commercial hub, consisting of a combination of villages. Collection of bumblebees was collected from 15-20 spots within seven villages.

Balambat: This region consists of both plain and mountainous areas along with riverbank soil. In this area, the survey has covered 17 villages, depicting some villages to have leishmaniasis.

Khall: Comprises mountainous terrain and fertile land. From this area, the bumblebee samples were collected from eight villages each depicting variation in building structures and biodiversity.

Collection:

The butterflies were collected using an aerial net during the daytime. The aerial net has a handle about 3 to 4 feet long, the diameter of the ring is 25 cm while the net is transparent mesh. The specimens were collected by netting in one square kilometer area from each sample site. Each site was netted for 30 – 60 minutes. Each site was sampled after an interval of 10-15 days till the end of November.

Killing and Preservation:

A killing jar containing ethyl acetate-soaked cotton swabs which are used for killing the collected specimen. After killing, with the help of a stretching board, the butterfly specimen was stretched. The specimens were first transfixed by entomological pins, passing through the thorax above. The antennae and body were straightened. Some dry specimens that are difficult to stretch were relaxed by putting them in the relaxing jar for 2-3 days before stretching. To maintain their permanent spread position, the specimens were left on the stretching board to dry at least for 4 days. Each specimen was provided with a field label. Then all the dried specimens are transferred from the stretching board to wooden boxes. Special care was taken to safeguard the specimen from museum pest attacks. To prevent the attack of ants and dampness, naphthalene balls and complex powder were sprinkled in the collection box.

S

Fi.g. 2.1: Google Earth map of the study sites

Photography was done with a digital camera of the whole specimen body, and with the help of the microscopic camera, the important taxonomic character was captured.

Identification:

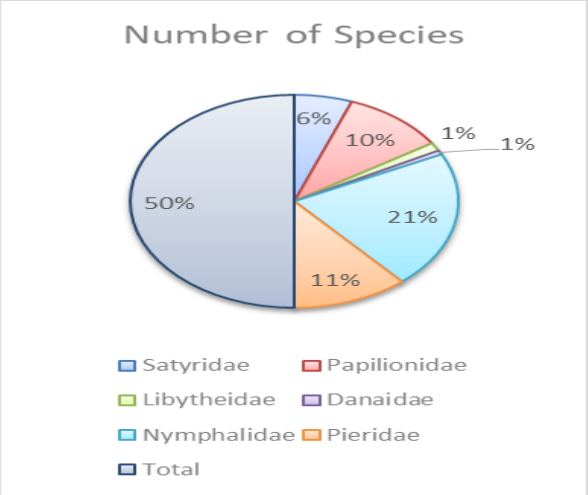
The specimens collected were identified with the help of available literature up to the lowest possible taxa. The identification of the specimens was done through the help of

*Corresponding Author: **FAWAD KHAN..**

previously identified ones and those present in the National Insect Museum (NIM), NARC Islamabad. Taxonomic keys for the classification of the families, genera, and species collected were worked out for the area under study.

Depository: The identified specimens after identification were deposited in AWKUM

The survey was conducted in district Dir lower, and a total of about 150 specimens of butterflies were collected from all three tehsils of Dir lower localities. The specimens up to the species level were identified. Results showed that 79 species are occurring in these areas of 6 families, as shown in below Table No.1. Key to the classification of the species and details of these species are given in the following text.



DISCUSSION

A good diversity of butterflies was recorded during the extensive study, and a total of 79 species belonging to six families were recorded in Lower Dir, Khyber Pakhtunkhwa. The paper will contribute considerably towards enriching the knowledge of local biodiversity as well as in comparing previous records against species found in Pakistan. Family Nymphalidae Family Nymphalidae was better represented in the study area, represented by 11 species in Lower Dir. Of these, the blue-winged Junonia orithya was very common in the areas of Timergara, Khall, and Balambat. This species was recorded for the first time from Karachi by Swinhoe in 1887. Reports from various regions of Pakistan prove its wide adaptability. Another common species, Junonia almana showed a wide distribution, which ranged from Karachi to Lahore with new records from Lower Dir. Although rare, Junonia hierta was present in both Timergara and Khall, which reflects its incidental occurrence in the country. The species Argynnis kamala was exclusively collected in Timergara, but its historical records were recorded from Chitral and Karachi, which proves that it has limited distribution within these districts. Argynnis hyperbius was fairly common at all the sites surveyed and appeared to be quite widely distributed. Vanessa cardui is a migratory species and showed up everywhere in Lower Dir, with records as farreaching as major cities in Pakistani territory. The rarer Neptis hylas were recorded at Timergara and Khall, with historical records extending from Chitral to Islamabad. Hypolimnas bolina, relatively rare, at Timergara and Khall, reaffirms its scattered distribution. In contrast, Ariadne merione was relatively common and is widely spread over Pakistan. Family Pieridae The family Pieridae was represented by nine species. Colias erate and Colias electo were particularly ubiquitous throughout Lower Dir and ranged from Chitral to Azad Kashmir. Catopsilia pyranthe, flying with its characteristic greenish tint, was infrequent and sighted only at Timergara and Khall; Catopsilia crocale was a less common yellow butterfly recorded at Balambat. Eurema hecabe, another bright yellow species, was collected both in Timergara and Balambat and demonstrated a wide distribution across Pakistan. Pontia daplidice was particularly common throughout all the sites in Lower Dir and it has also been recorded from different other areas of Chitral and Kohat etc. Gonepteryx rhamni is a spring flying and recorded at Timergara and Balambat while Pieris brassicae was quite common and widely distributed indicating that it is adaptable to all kinds of habitats Family Satyridae A total of three species belonged to the family Satyridae. The rare species, Hipparchia parasites, was collected from Khall with old-time records from Chitral and elsewhere. Lethe rohria was collected in Timergara and Khall and is a relatively uncommon species that had been previously recorded from Islamabad and Murree hills. Ypthima asterope was relatively common and was collected in Timergara and Balambat, reflecting a wide distribution in Pakistan. Family Papilionidae The Papilionidae family was represented by four species. Papilio demoleus was very abundant in Lower Dir, and records extended across Pakistan. Papilio polyctor was rare, collected from Khall, and historical records were reported from hilly areas like Chitral and Dir Lower. Papilio polytes and Papilio mechaon were also rare; observed in Timergara and Khall respectively, and their distributions were limited.

Family Danaidae This small family was represented by Danaus chrysippus, which was abundant in Timergara and Balambat. It has a wide distribution in Pakistan, extending to other parts also; thus, indicating its ecological success.

Family Libytheidae the Libytheidae family was represented by the Libythea lepita, which was not abundant and was collected from Timergara and Khall. Previous records from Chitral and Dir Lower give an insight into its distribution.

Generally speaking, the paper gives an overview of butterfly diversity in Lower Dir with the addition of new records and confirmation of many species that belong to different families. The study develops an understanding of local biodiversity and, at the same time, increases knowledge about the distribution and adaptiveness of various butterfly species in Pakistan.

Family Nymphalidae: Indeed, the survey highlighted remarkable diversity in the family Nymphalidae, which included the species Junonia orithya and Argynnis kamala, whose distribution and abundance were in congruence with historical records from many parts of the Pakistani districts. Junonia orithya has been recorded previously from Karachi and other cities due to its adaptable and widespread range and was reported widely within the Lower Dir District. The

*Corresponding Author: **FAWAD KHAN..**

Argynnis kamala was exclusively collected in the Timergara District, reflecting its already-known localized distribution. The resultant distribution patterns for Junonia almana, Argynnis hyperbius, and Vanessa cardui further confirm the established range across Pakistan mentioned in past studies by Ali (1990) and Khan et al. (2015). Results for Neptis hylas, Hypolimnas bolina, and Ariadne merione further confirm their recorded presence and rarity from earlier surveys, reinforcing the continuity of butterfly distributions reported from historical surveys.

Family Pieridae: The range within the Pieridae family, comprising Colias erate and Eurema hecabe, boasts their longestablished presence and distribution patterns throughout Pakistan, which were recorded in previous studies. Similarly, the abundance of Colias erate and Colias electo in Lower Dir agreed with its known distribution from Chitral to Azad Kashmir. Contrariwise, Catopsilia pyranthe was rare, agreeing with the population presence being reported earlier as smaller within Chitral. The high abundance of Pontia daplidice, and the extensive distributions of Gonepteryx rhamni and Pieris brassicae confirm their common country status in the literature, hence it assured the authenticity of the survey result.

Family Satyridae: Hipparchia parasites and Ypthima asterope were the species recorded during this survey, the distributions of which agree with the earlier recordings. Rarity in Hipparchia parasites and abundance in Ypthima asterope in Lower Dir agree with previous records for Chitral and Islamabad; hence, this is in correlation with the historical trend of these butterflies. Findings for Lethe rohria also agree with the earlier records, which confirm its relatively rare presence in particular areas.

Family Papilionidae: The recorded abundance of Papilio demoleus as very abundant in Lower Dir corroborates its wide distribution in Pakistan as stated in the literature. The records of Papilio polyctor, Papilio polytes, and Papilio mechaon as rare species agree with prior knowledge regarding their restrictive occurrence in hilly Chitral and Dir Lower. These records thus further establish the established pattern of rarity and distribution of these species.

Family Danaidae: The abundance of Danaus chrysippus in Lower Dir further corroborates its wide distribution reported across Pakistan, which has established the species as ecologically successful and widespread.

Family Libytheidae: The sighting of Libythea lepita in Lower Dir was rarely recorded, which also comes from previous records in Chitral and Dir Lower, further establishing its sporadic distribution and consistency with earlier records. This study further expands the knowledge of butterfly fauna in Lower Dir by amalgamating new records with previous knowledge to present an overall regional biodiversity.

SUMMARY

The research project was related to the diversity and distribution of butterflies in District Dir Lower, reporting a total number of 79 species that belonged to six families. Collection and preservation technique was done in different localities for the specimen to be identified in detail. The result indicated that the butterfly fauna in the area is rich and the family Nymphalidae is the most represented, with the genera Junonia, Argynnis, and Vanessa. Other families included Pieridae, which contains such genera as Colias and Eurema; Papilionidae, represented by species of the genus Papilio; and smaller families like Satyridae, Libytheidae, and Danaidae. The order of Lepidoptera for this study provided information with detailed descriptions, images, distribution data, and flight seasonality in pointing out the rich diversity of butterflies within this region. The study underlines the ecological value of butterflies and the need for conservation conducive to environmental threats.

Table 1 Comprehensive Survey of Butterfly Species Diversity in Lower Dir, Khyber Pakhtunkhwa, Pakistan

Family	Genus	Species	Common Name	Appearance	Wingspan	Activity Months	Localities
Papilionidae	*Papilio*	Papilio demoleus	Lime Butterfly	Females: black with yellow specks and spots; males: similar but less pronounced	80-110 mm	April to August	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2), Yarkhan Banda, Danvah, Siar, Saddo, Sikaolae

*Corresponding Author: **FAWAD KHAN..**

Pieridae	Danaidae	Libytheidae			Satyridae				
Pontia	*Danaus*	*Libythia*	*Lethe*	*Ypthima*	*Hipparchia*				
Pontia daplidace	Danaus chrysippus	Libythia lepita	Lethe rohria	Ypthima asterope	Hipparchia parasitas	Papilio mechaon	Papilio polytes	Papilio polyctor	
Bath White	Plain Tiger	Common Beak	Common Tree Brown	African Ringlet	White-edged Rock Brown	Mechaon Butterfly	Common Marmon	Common Peacock	
Both sexes: distinctive black	Females: black forewings and tawny hindwings with black spots; males are similar but without sex marks	Females: dark brown with orange-yellow streaks and dark spots	Females: brown with white spots and oblique discal band; hindwings with ocellar spots	Both sexes: brown with ocelli and fringed hindwings	Females: dark brown with white border and ocelli; underside with larger ocelli and stripes	Females: yellow scaling on forewings; hindwings with red tornal spots and slender tail	Females: black with light brown flash; hindwings with yellow and reddish-yellow marks	Females: dark green with scent strips; forewings with narrow band, hindwings with blue-green patch	
40-50 mm	70-80 mm	35-43 mm	60-70 mm	40-50 mm	65-70 mm	66-75 mm	100-110 mm	100-115 mm	
April to August	April to August	March to August	April to July	May to August	May to July	May to August	May to August	March to August	
Timergara, Khall,	Timergara, Balambat, Afghan Refugee Camps (1 and 2), Yarkhan Banda	Timergara, Khall, Afghan Refugee Camps (1 and 2)	Timergara, Khall, Balambat	Timergara, Balambat, Khall, Afghan Refugee Camps (1 and 2), Yarkhan Banda	Khall, Danvah, Siar	Timergara, Khall, Danvah	Timergara, Khall, Afghan Refugee Camps (1 and 2), Yarkhan Banda	Timergara, Khall, Danvah, Siar	

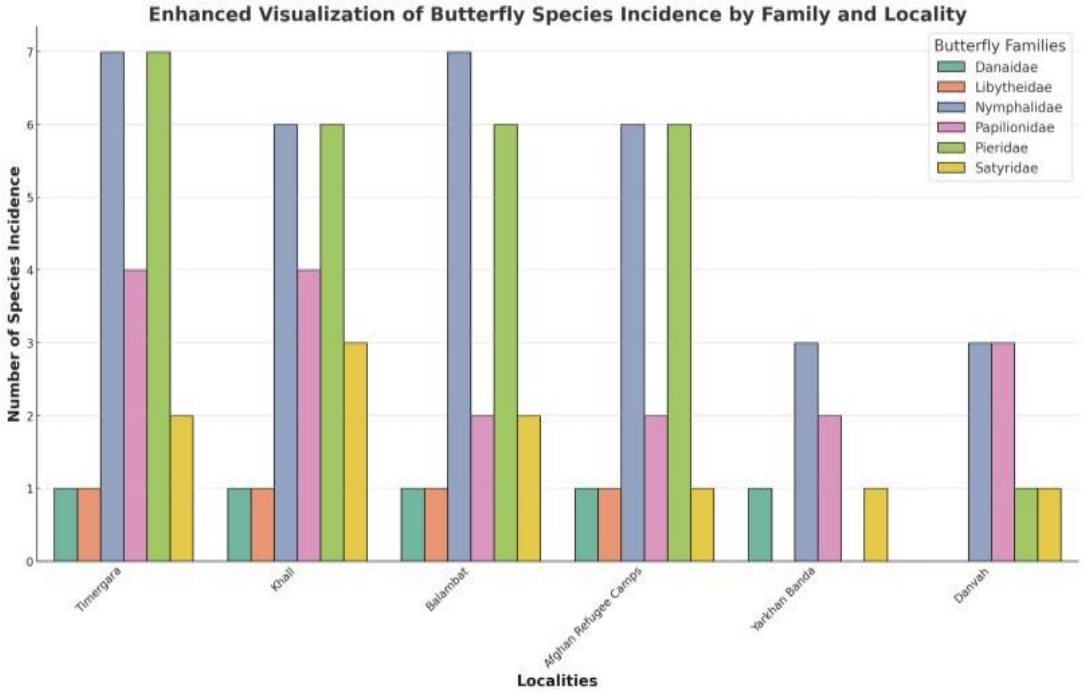
*Corresponding Author: **FAWAD KHAN..**

	Eurema							markings and white spots
		Eurema hecabe	Common Grass Yellow	Females: may be white; males: cell spots and distinct sex brand	20-30 mm	May to August	Timergara, Balambat, Afghan Refugee Camps (1 and 2)	Balambat, Afghan Refugee Camps (1 and 2), Danvah
	Pieris							
		Pieris brassicae	Large Cabbage White	Females: black apex and forewing spots; males similar but without discal spots	57-66 mm	February to August	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2)	
	Catopsilia							
		Catopsilia pyranthe	Mottled Emigrant	Females: black edging; males: white with green tint	50-60 mm	June to August	Timergara, Khall	
		Catopsilia crocale	Common Emigrant	Females: yellow with black edging; males: greenish white with yellow base	55-65 mm	June to August	Timergara, Balambat, Afghan Refugee Camps (1 and 2)	
	Gonepteryx							
		Gonepteryx rhamni	Common Brimstone	Females: creamy white with discocellular spot; males: sulphur yellow with orange spot	60-70 mm	February to July	Timergara, Balambat, Khall, Afghan Refugee Camps (1 and 2)	
	Colias							
		Colias erate	Pale Clouded Yellow	Yellow or white with sub-marginal spots	-	February to August	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2)	
		Colias electo	Dark Clouded Yellow	Deep orangeyellow with black borders	-	February to August	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2)	

*Corresponding Author: **FAWAD KHAN..**

Nymphalidae	*Argynnis*	Argynnis hyperbius	Indian Fritillary	Females: dark brown with blue band and white spots	50-60 mm	March to August	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2)	
		Argynnis kamala	Common Silver Trip	Golden yellow with black spots and transverse lines	50-55 mm	March to July	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2)	
	Junonia	Junonia almana	Peacock Pansy	Females: orangeyellow with dark bands and ocelli	60-65 mm	February to September	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2), Yarkhan Banda	
		Junonia hierta	Yellow Pansy	Males: yellow with black borders and blue patches	45-55 mm	April to November	Timergara, Balambat	
		Junonia orithya	Blue Pansy	Females: dark forewing and blue hindwing	40-50 mm	February to October	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2)	
	Vanessa	Vanessa cardui	Painted Lady	Females: reddishyellow forewings and olive-brown hindwings	54-64 mm	March to July	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2)	
		Vanessa indica	Indian Red Admiral	Females: dark brown forewings and red hindwings with black spots	52-60 mm	February to May	Timergara, Khall, Balambat, Afghan Refugee Camps (1 and 2)	

*Corresponding Author: **FAWAD KHAN..**



LITERATURE CITED

1. Abbas, M., M. A.Rafi, M. Inayatullah, and P. Pavulaan.2002 .Taxonomy and distribution of butterflies of the Skardu region, Pakistan. Int. Lepidop. Survey (TILS), USA. Taxonomic Report. 3 (9):1-9.
2. Afshan, N., M. A. Khan, S. F. A. khan, N. Akbar, A. Azam, and A. Naseem. 2015. A Preliminary Study of Butterfly Fauna of Tehsil and District Chitral, Khyber Pakhtunkhwa, Pakistan. Acad. J. Entomol. 8(3): 160-167.
3. Ahsan, M. and J.Iqbal .1975.A contribution to the butterflies of Lahore with the addition of new records. Biologia 24(2): 238-247.
4. Bingham, C.T.1905. The fauna of British India includes Ceylon and Burma Butterflies. Vol. 1, Taylor and Francis Ltd. London XV.528 pp.
5. Carter, D. 1992. Butterflies and Moths. Dorling Kindersley London.304 pp.

*Corresponding Author: **FAWAD KHAN..**

6. Collin, N.M., and M.G. Morris. 1985. Threatened swallowtail. Butterfly of the World by ICUN. Published. Gland, Switzerland, and Cambridge. U.K. 401 pp.
7. Dal, B. 1978.The Butterflies of Northern Europe. Goom Helm, London.128 pp.
8. De-Niceville, L. and G.F.L. Marshal 1882-1890.
9. The butterflies of India, Burma, and Ceylon. Vols. 1-3, Central Press Company, Calcutta, pp. 327,332,503.
10. Doherty, W. 1886. List of Butterfly taken in Kashmir. J. Asiatic Soc. Bengal. 55(2) (3): pp. 103140.
11. Evans, W.H. 1923. The identification of Indian butterflies (Paplionidae, Pieridae). J. Bombay Nat. Hist., 36; 195-209 pp.
12. Evans, W.H. 1932. The Butterflies of Baluchistan.
13. J. Bombay Nat. Hist. Soc., 29; 230-260 pp.
14. Gay, T., I.D. Kelimkar and J.C. Punetha. 1992. Common Butterflies of India. Oxford University Press, Bombay. 67 pp.
15. Hassan, S. A. 1994. Butterflies of Islamabad and the Murree Hills. Asian Study Group, Islamabad. 68pp.
16. Hassan, S. A. 1997. Biogeography and diversity of butterflies of North East Himalaya 181-204 In: Mufti, S.A., Woods, CA and Hassan, S.A (Eds). 1997. Biodiversity of Pakistan. Pakistan Museum of Natural History, Islamabad Florida Museum of Natural History Gainesville. Plastic Press Islamabad. 537pp.
17. Iqbal, J. 1978. A preliminary report on Butterflies of District Rawalpindi and Islamabad. Biologia. 24 (2); 237-247.
18. Khan, M.R., M.A. Rafi and M. Munir. 2007. Biodiversity of butterflies from districts Kotli, Mirpur, and Azad Kashmir. Pakistan Journal of Zoology, 39(1): 27-34.
19. Khan, M. R., M. A. Rafi, M. Ilyas and M. Safder. 2000. Distribution and diversity of Papilio spp. (Lepidoptera: Papilionid) Rawalpindi and Islamabad. Pak. J. Sci. Res. 52(1-2): 1-3.
20. Khan, M. R., M. Nasim, M. R. Khan, and M. A. Rafi. 2004. Diversity of butterflies from district Muzaffarabad, Azad Kashmir. Pak. J. Biol. Sci. 7(3): 324-327.
21. Khan, M. I., H. Ullah, Suleman, M. A. S. Khan, F. Naz, M. A. Rafi and S. A. Mehmood. 2016. Diversity and distribution of butterflies (Insecta:
22. Lepidoptera) of district Dir lower, Khyber Pakhtunkhwa, Pakistan. Arthropods, 2016, 5(1): 1122.
23. Khan, S.A. and H. Hanif. 2016. Butterfly species and Habitat of Tehsil Choa Saiydan Shah Punjab Pakistan. International Journal of Entomology Research. 1(1): 27-30.
24. Lefroy, H.M. (ed) 1909. The Indian Insect Life. Calcutta, 786 pp.
25. Leslie, G.A, and W.H. Evan. 1903. The butterflies of Chitral. J. Bombay Nat. Hist. Soc. Vol. XIV, pp.666.
26. Mal, B., S. Memon, S. A. Memon, M. A. Shah, N. A. Shah, and J. K. Turk. 2014. Diversity of Pierid butterflies (Lepidoptera: pieridae) in Jamshoro district, Sindh, Pakistan. J. Entomol. Zool. Stud. 2(5):164-170.
27. Mal, B., S. Memon, S. A. Memon, M. A. Shah, N. A. Shah, and J. K. Turk .2014. Checklist of butterfly fauna (Lepidoptera: Rhopalocera) of Sindh, Pakistan. J. Pure Appl. Bio., 3(4): 199-203.
28. Malik, J.M. 1970. Notes on the butterflies of Pakistan in the collection of the Zoological Survey Department, Karachi. Part I. Rec. Zool. Sur. Pak. 2(2): 25-54.
29. Malik, J.M. 1973. Notes on the butterflies of Pakistan in the collection of the Zoological Survey Department, Karachi. Part II. Rec. Zool. Sur. Pak. 5(1-2): PP. 11-28.
30. Menssee, N.H. 1952. Butterflies of Sindh. J, Bombay Nat. Hist. Soc., Mumbai, India, 49(1): 2023 pp.
31. Mani, M.S. 1986. Butterflies of the Himalayas. Oxford and IBH Publishing Co. New Delhi. 181 pp.
32. Naz, F., Rafi, M. A., Inyatullah, M., Khan, M. R. and Tuzov, V. 2001. The butterflies of the Buner district, North-West Frontier Province, Pakistan. In: Helios. Collection of Lepidopterological articles. (Churkin, S. ed.) 2: 123-224.
33. Owen, D.F. 1971. Tropical Butterflies. Clarendon Press Oxford.214 pp.
34. Perveen, F. and A. Ahmad. 2012. Checklist of butterfly fauna of Kohat, Khyber Pakhtunkhwa, Pakistan. Arthropods 1(3): 112-117.
35. Perveen, F. and F. Fazal. 2013. Biology and distribution of butterfly fauna of Hazara University, Garden Campus, Mansehra, Pakistan. Open Journal of Animal Sciences, 3(2): 28-36.
36. Perveen, F. and Haroon. 2015. Diversity of Butterflies Fauna in Tehsil Tangi, Khyber Pakhtunkhwa, Pakistan. World Journal of Zoology 10 (4): 302-309.
37. Philipe, W.V. Geo and De Rhe. 1917. The butterflies of Lahore. J. Bombay Nat. His. Soc. 25: pp 136-142.
38. Puri, D.R. 1931. Butterflies of Lahore. Govt. College Lahore. 61 pp.
39. Pyle, R.M. 1981. The Andubon Society Field Guide to North American Butterflies. Alfred A. Knopf Inc. New York. 916 pp.
40. Ross, H.H. 1965. A Text Book of Entomology (3rd edition). Johan wiley and Sons Inc. 385 pp.
41. Sabir, A. M., Bhatti, A. H., Rafi, M.A. and Suhail, A. 2000. Distribution of Nymphalid butterflies (brush-footed) in districts Rawalpindi and Islamabad. Pakistan Journal of Biological Sciences, 3: 1253-1254.

*Corresponding Author: **FAWAD KHAN..**

42. Shah, M., M. Inyatullah and M. A. Rafi. 2001. Some Pierids of Kohat District. Sarhad J. Agric. 17(3): 407-413.
43. Smith, D.S. and S. A. Hassan. 1997. A preliminary survey of diversity and distribution of Northern Pakistan, Gilgit to Khunjarab. In Mufti, S. A; C.A. Woods and S.A. Hassan (edit.). Biodiversity of Pakistan.Pakistan Museum of Natural History, Islamabad.537 pp.
44. Stanek, V.J. 1977. Encyclopedia of Butterflies and Moths, Octopus. Book Ltd.59 Grosvenor Street. London. 351 pp.
45. Stroke, W.J. 1964.The Observer's Book of Butterflies. Frederick Wame & Co. London.95 pp.
46. Swinhoe, C. 1887. On the Lepidoptera of Karachi and its neighborhood. Part I. J. Bombay Nat. Hist. Soc. 11: 269-280.
47. Talbot, G. 1939. Fauna of British India, Including Ceylon and Burm butterflies 1 and 2. Taylor and Ltd. London.835 pp.
48. Wynter-Blyth, M.A. 1940-1957. Butterflies of Indian region.1st ed. Bombay Nat. Hist. Soc. Bombay.275 pp.

*Corresponding Author: **FAWAD KHAN..**