

Article

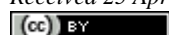
A contribution key for identification of butterflies (Lepidoptera) of Tehsil Tangi, Khyber Pakhtunkhwa, Pakistan

Farzana Khan Perveen, Haroon

Department of Zoology, Shaheed Benazir Bhutto University (SBBU), Main Campus, Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan

E-mail: farzana_san@hotmail.com

Received 25 April 2016; Accepted 31 May 2016; Published online 1 September 2016



Abstract

The butterflies are the useful bio-indicators of an ecosystem, sensitive to any change in environment, such as temperature, microclimate and solar radiation etc, however, they utilize host plants for their oviposition and larval development. Therefore, the present study was conducted to prepare the contribution key for identification of butterflies of Tehsil Tangi during August, 2014-May, 2015. The specimens ($n_i = 506$) were collected belong to 3 families with 18 genera and 23 species. However, the collected butterflies were comprised of families Nymphalidae 50% > Pieridae 43% > Papilionidae 7%. The family Nymphalidae were primarily, blue, pale brown or orange and antennae-tips with large conspicuous knobs, while, family Pieridae were mostly creamy, white, yellow or light orange, although, the family Papilionidae were multi-colours, i.e., yellow, blackish-brown, white or orange and antennae-tips with or without knobs. The largest butterfly was great black mormon, *Papilio polytes* Linnaeus (Family: Papilionidae) with body length 26.0 ± 0.0 ($n_{P. polytes} = 1$; $M \pm SD$) mm, while the smallest butterflies Indian little orange tip, *Colotis etrida* Boisduval (Family: Pieridae) with body length 11.5 ± 0.6 ($n_{C. etrida} = 4$; $M \pm SD$) mm. The key of butterflies (Lepidoptera) of Tehsil Tangi, Khyber Pakhtunkhwa, Pakistan has been established in this paper. It is recommended to evaluate the butterfly fauna of District Charsadda to educate and create awareness in the local community for conservation and protestation of their habitats.

Keywords butterflies; Danainae; Nymphalinae; Papilioninae; Satyrinae.

Arthropods

ISSN 2224-4255

URL: <http://www.iaees.org/publications/journals/arthropods/online-version.asp>

RSS: <http://www.iaees.org/publications/journals/arthropods/rss.xml>

E-mail: arthropods@iaees.org

Editor-in-Chief: WenJun Zhang

Publisher: International Academy of Ecology and Environmental Sciences

1 Introduction

On the earth surface more than 53% insects were present, where 15,000-16,000 species of butterflies are known worldwide recently (Perveen and Ahmad, 2012). However, 5,000 insect species were reported from Pakistan, comprising 400 of butterflies and moth species. Moreover, the butterfly is a beautiful creature as

regarded the symbol of beauty and grace (Perveen and Ahmad, 2012). Additionally, they were found in all type of environment in the universe (Perveen et al., 2014). Furthermore, they can help in the food chain and good food for spiders, birds, reptiles and predatory insects (Haroon et al., 2013). Therefore, they are the possibly useful bioindicators of an ecosystem, sensitive to changes in the environmental conditions, temperature, microclimate, solar radiation and availability of host plants for ovipositing and larval development (Haroon et al., 2014). Although, they have the commercial values like ecological indicators, pollinator and great aesthetic values (Khan and Perveen, 2015). However, some entomologists and biologists made surveys to collect the butterflies and others insects for monitoring and identified the butterflies species and their distribution status in Pakistan. Some selected site for the distribution of butterflies has been studied by Pakistan Museum of Natural History (PMNH) and Oxford University Museum (OUM) from Gilgit along Karakoram Highway to the Sino-Pakistan border at Khunjerab pass (Perveen and Ahmad, 2012).

District Charsadda lies 29 km from provincial capital Peshawar, Khyber Pakhtunkhwa (KP), Pakistan. Therefore, it is divided into 3 Tehsils, viz., Charsadda, Shabqadar and Tangi. Additionally, it is circumambient in North by Malakand agency, in the East by Mardan division, in the East South by Nowshera District, in the South by District Peshawar, in the West by Mohmand agency. The study area Tehsil Tangi is the largest Tehsil of the District Charsadda, KP, Pakistan. Tehsil Tangi is located at 34°18'00.17" N latitude, 71°39'14.09" E longitude, elevation 1174.2 feet (358 m). The study area is divided in to 8 quadrats. Population is more than 10, 22,000 (Census Report, 1998) and area of the total District Charsadda is about 996 km² (243753 acres) (Fig. 1; Online, 2015). Accordingly, the animals of the study area are pangolin, *Manis javanica* Desmarest, 1822; porcupine, *Hystrix indicus* Kerr, 1792; cow, *Bos taurus* Linnaeus, 1758; donkey, *Equus asinus* Linnaeus, 1758; pigeon, *Columbia livia* Gmelin, 1789; sheep, *Ovis aries* Linnaeus, 1758; goat, *Capra hircus* Linnaeus, 1758 and buffalo, *Bubalus, bubalis* Linnaeus, 1758. Therefore, the main crops of Charsadda are tobacco, *Nicotiana tabacum* Linnaeus, 1758; sugarcane, *Saccharum officinarum* Jewiet, 1935; sugar beet, *Beta vulgaris* Linnaeus, 1758; wheat, *Triticum turgidum* Linnaeus, 1758 and maize, *Zea mays* Linnaeus, 1758. Vegetables include potato, *Solanum tuberosum* Gasper and Bauhin, 1596; tomato, *Solanum lycopersicum* Linnaeus, 1753; cabbage, *Brassica oleracea* Linnaeus, 1753; brinjals, *Solanum melongena* Linnaeus, 1753; okra, *Abelmoschus esculentus* Linnaeus, 1753 and spinach, *Spinacia oleracea* Linnaeus, 1753 among fruit orchards, *Phalaenopsis schilleriana* Rchb, 1860; apricot, *Prunus armeniaca* Linnaeus, 1753; citrus, *Citrus medica* Linnaeus, 1753; plum, *Prunus mume* Piebold and Zucc, 1820; strawberry, *Fragaria ananassa* Duchesne, 1764 and pears, *Pyrus communis* Linnaeus, 1753 are famous fruits. Additionally, in Charsadda there are 3 rivers: the Kabul, Swat and Jindi are main source of irrigation. Although, River Swat merges with Kabul at Shahbara near to District Peshawar and Kabul River merges with River Indus at Attack. The area surrounded by River Swat and River Kabul is called Doaba and has a great importance in the district (Fig. 1; Haroon et al., 2013). The aim of the present research is to prepare key for the identification of butterfly families and species of Tehsil Tangi, KP, Pakistan.

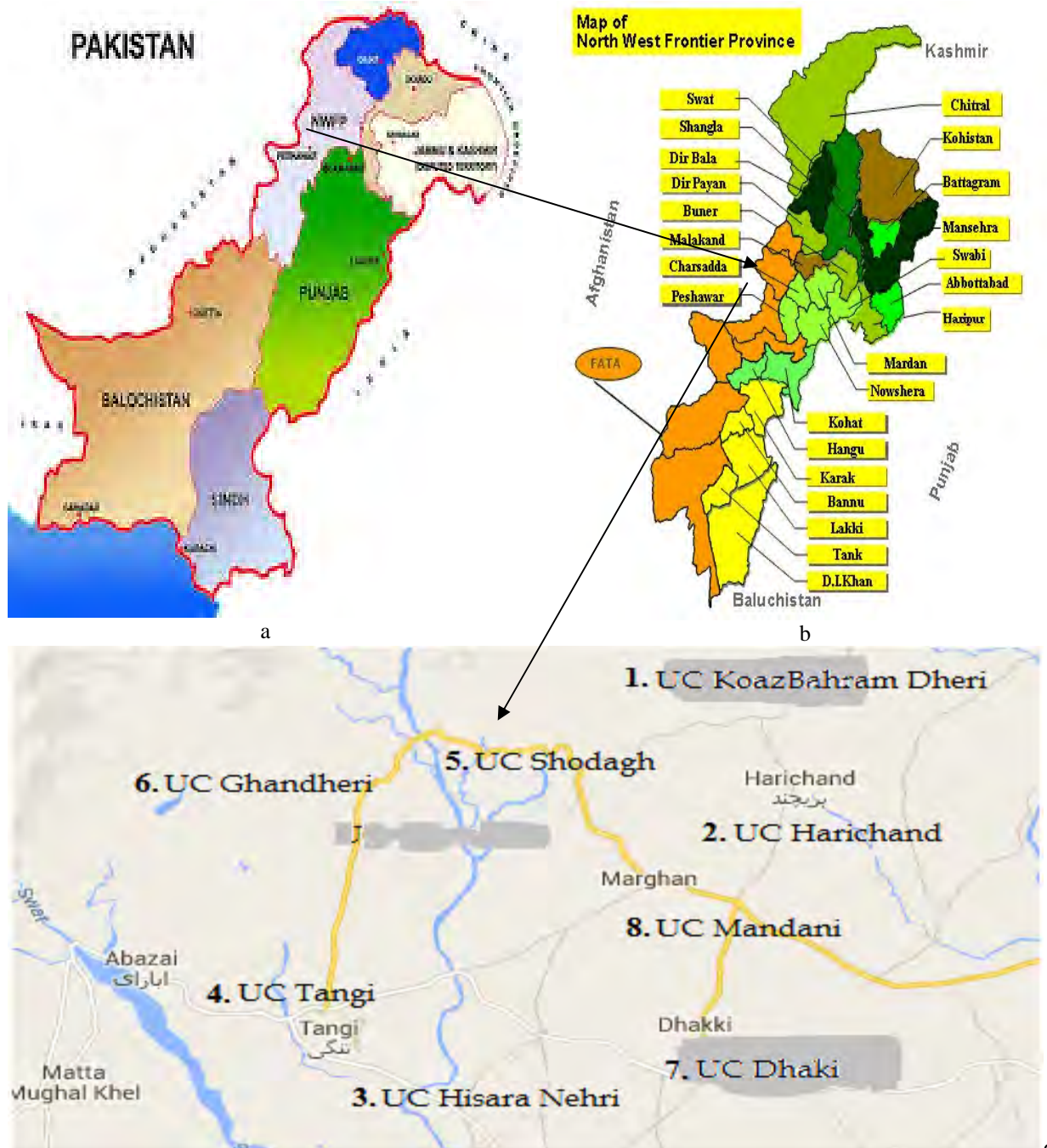


Fig. 1 The map of Tehsil Tangi, Khyber Pakhtunkhwa, Pakistan, where the present research on butterflies was conducted during August 2014-May 2015: a) map of Pakistan; b) map of Khyber Pakhtunkhwa; c) map of Charsadda showing Tehsil Tangi with the 8 quadrates of the study area viz., 1) Union Council (UN) Koaz Bahram Dheri; 2) UN Harichand; 3) UN Hisara Nehri; 4) UN Tangi; 5) UN Shodagh; 6) UN Ghandheri; 7) UN Dhaki; 8) UN Mandani (Online, 2015)

2 Materials and Methods

2.1 Study area

The study was conducted in the 8 quadrates of Tehsil Tangi, District Charsadda (CHD), Khyber Pakhtunkhwa (KP), Pakistan, viz., 1) Union Council (UN) Koaz Bahram Dheri; 2) UN Harichand; 3) UN Hisara Nehri; 4) UN Tangi; 5) UN Shodagh; 6) UN Ghandheri; 7) UN Dhaki; 8) UN Mandani during August, 2014-May, 2015. However, the most of the people in the study area are agriculturists, moreover, literacy rate is 57%. It is

located at the 34°8'43 north and 71°43'51 east with an altitude of 276 m (908 feet) and situated 29 km from the provincial capital Peshawar (Fig. 1).

2.2 Collection

For the present research, the butterflies were collected from 8 quadrates of the study area which is the most representative agriculture lands used for cultivating vegetables and fruits. For the collection of specimens, an insect net (length: 3.0 m; net cloth length: 1.0 m; diameter (dm): 1.0 m) and transect net (length: 3.0 m; width: 1.0 m; height: 2.0 m) were used, as well as they were collected manually by hand picking.

2.3 Starching

They were brought to the laboratory, Department of Zoology (DOZ), Shaheed Benazir Bhutto University (SBBU). The collected live specimens were put in the cyanide bottle for killing. Then they were pinned by insect pins into their thoracic region. They were preserved by stretching and set their wings at 180° on thermopile setting board for 2 days. They were tagged for their locations and date of collection.

2.4 Identification

The collected butterflies were identified with the help of already published keys (Layberry et al., 1998; Abbas et al., 2002; Munir et al., 2008), literature available (Sabir et al., 2000), experts, already identified specimens from National Insect Museum (NARC), Islamabad, Pakistan and Laboratory, DOZ, SBBU, pictorials and internet, on the bases of their colors and spots which are present on their wings upper and lower sides.

2.5 Preservation

Finally, when their wings dried they were mounted and arranged in the wooden insect boxes (length: 45 cm; width: 25 cm; height: 10 cm) with naphthalene balls to keep the specimens safe from the pests.

2.6 Deposition

All the identified specimens were deposited in the Laboratory cum Museum (NHM), DOZ, SBBU, Pakistan for recode.

2.7 Statistical analysis

The data were analyzed by using computer program Microsoft excel (CPMSE) (Perveen and Jamal, 2012a, b and c; Perveen et al., 2012) and mean, standard deviation (SD), standard error (SE) and percentage (%) were determined. However, graphs were prepared by scientific software program GraphPad Prism 6® (Perveen and Hussain, 2012).

3 Results

The present study was conducted to prepare identification and contribution dichotomous key (Table 1) for the butterflies of Tehsil Tangi, KP, Pakistan. From the present study, it was reported that a total of 506 specimens ($n_i=506$) were collected, which belong to 3 families and 18 genera. The most abundant family Nymphalidae contributed maximum number of specimens ($n_{\text{Nymphalidae}}=252$) followed by Pieridae ($n_{\text{Pieridae}}=217$) and minimum specimens were recorded of family Papilionidae ($n_{\text{Papilionidae}}=37$). While *Danaus chrysippus* is the dominant species in study area [$n_{D. chrysippus}=122$ (24%)] followed by *Pieris canidia* [$n_{P. canidia}=64$ (13%)] and the minimum species collected *Papilio polytes*, *Junonia hierta* and *Euthalia garuda* [$n_{P. polytes}$; $J. hierta$ and $E. garuda=1$ (0.2%)], followed by *Venesa indica*, *Lethe confuse*, *Colias erate* and *Neptis mahendra* [$n_{V. indica}$, $L. confuse$, $C. erate$ and $N. mahendra=2$ (0.4%)] and *Tirumala liminniae* [$n_{T. liminniae}=2$ (0.4%)].

Table 1 The identification dichotomous key for the butterfly fauna ($n_1=506$) collected from Tehsil Tangi, Khyber Pakhtunkhwa (KP), Pakistan during August 2014-May 2015.

Key for the phylum, class and orders of butterfly fauna of Tehsil Tangi, KP, Pakistan	
1a:	Chitineous exoskeleton, jointed legs, wings present or absent.....Phylum: Arthropoda.
1b:	Skeleton not chitineous, legs are not jointed.....2
1a(i):	Thorax with 3 segments, 3 pairs of jointed legs and segmented abdomen.....Class: Insecta.
1a(ii):	Compound eyes, 2 pairs of wings, 1 pair of antennae, siphoning type of mouth partsOrder: Lepidoptera.
Key to the butterfly families of Tehsil Tangi, KP, Pakistan	
1a:	Forelegs are reduced.....2
1b:	Forelegs are not reduced.....3
2a(1a):	Primarily, blue, pale brown or orange colours, antennae tips with large conspicuous knobs.. Family: Nymphalidae
2b(1b):	Multi-coloration, i.e., yellow, blackish-brown, white or orange and antennae tips are with or without knobs.....4
4a(2b):	Medium to large in size..... Family: Papilionidae
4b:	Mostly with creamy, white, yellow or light orange colours.....5
5(4b):	Underside and upper side of wings with distinct spots..... Family: Pieridae
Key to the butterflies' genus of family Nymphalidae from Tehsil Tangi, KP, Pakistan	
2a(1a)(i):	A pale greyish-buff under hind wings is present but brown bands are almost obsolete, across cell narrow black paired lines are present under forewings..... <i>Junonia</i>
2a(1a)(ii):	Both wings are heavily marked with black and white, apical half of forewing with white spots, apex is round at tip, smooth brown hairs (cilia) are present on base of hindwings, sexes are alike..... <i>Cynthia</i>
2a(1a)(iii):	Body colour is tawny, upper margin of forewing is black with white spots, hindwings have a thin black border enclosing a sequence of hemispherical white spots..... <i>Danaus</i>
2a(1a)(v):	Dark brown with slight traces of olive, transverse short black lines at the base, black loop across beyond apex of cell, black spot below median vein discal and preapical white spots as on the upper side, antennae, head, thorax and abdomen dark brown, the body paler beneath..... <i>Euthalia</i>
2a(1a)(vi):	Underside is a more greyish brown, upper surfaces of both wings are rich chestnut and male bears a triangular black patch of scent scales..... <i>Ariadne</i>
2a(1a)(vii):	Upper surface of both wings is dark blackish-brown, within certain lights bluish velvet sheen. Forewing having there are two to three small white dots, underside of wings has larger ocelli, which are pupil led..... <i>Hipparchia</i>
2a(1a)(ix):	Hind wing dentate at apex, fore wing crossed by an oblique, slightly curved, discal white band, hind wing uniform and fore wings with subbasal, subterminal and terminal sinuous, with the oblique discal white bar..... <i>Lethe</i>
2a(1a)(x):	They exhibits sexual dimorphism, both sexes are tawny-orange on the upper surface with scattered black spots, with a dull blue border to the hind wing margin with double black looped lines and a sub marginal ring of black spots. Under hind wing is bend with buff and broken bands of olive green..... <i>Argynnis</i>
2a(1a)(xi):	Hind wing and fore wing consist of white bluish with semi hyaline spots and streaks, both of the wings upper black in colour while under side are dusky black. Underside are basal two-thirds of fore wing dusky black, the apex and hind wing olive-brown..... <i>Tirumala</i>
2a(1a)(xii):	Upper side patterning consists of white spots and bars on a black ground colour. Underside patterns are yellowish to reddish-brown, alternating with white bands. The legs are rather short and stout, while abdomen is much slender..... <i>Neptis</i>
2a(1a)(xiii):	Upper side, three small transversely blue spots placed beyond the cell, hind wing mostly comparatively very dark, purplish blade, with slender white margins, shaded on disc with rich dark olive-brown..... <i>Vanessa</i>
Key to the butterflies' genus of family Papilionidae from Tehsil Tangi, KP, Pakistan	
1a:	Hind wings with plain margin, no heavily patterned with black color on hind wings.....2
1b:	Hind wings with or without swallow tails, more heavily patterned with black color on hind

wings.....*Papilio*

Key to the butterflies' genera of family Pieridae from Tehsil Tangi, KP, Pakistan

- 4a(1c)(i): The upper side of the male is chalky-white female upper side the ground-colour antennae red, obscurely dotted with black, palpi and head above red, thorax clothed with long yellow, sometimes greenish hairs, abdomen pale yellow; beneath palpi and thorax pale to dark yellow, abdomen white.....*Catopsilia*
- 4a(1c)(ii): Underside forewing white, cell and costa lightly forced with black scales, apex somewhat broadly tinged with ochraceous yellow, hind wing, from pale, almost white, to dark ochraceous, antennae black with minute white specks, the long hairs on head and thorax greenish grey, abdomen black, beneath, head, thorax and abdomen white.....*Pieris*
- 4a(1c)(iii): Commonly yellow with expansive black apical and terminal area of forewings, forewings with black inner margin, sexes are alike.....*Eurema*
- 4a(1c)(iv): Underside is ground colour and similar, forewing and hindwing with generally an obscure disco cellular reddish brown spot, antennae reddish, head and thorax anteriorly brown, thorax clothed posteriorly with long white hairs, abdomen white.....*Catopsilia*
- 4a(1c)(v): Underside has the veins broadly outlined with dark brown, though the disco-cellular bank is jet-black, apical region and hind wing being pale buff. The female has the apical area more broadly black with the white spots almost obsolete and the costa of the forewing is black.....*Belonias*
- 4a(1c)(vi): Hind wing is uniform and a series of terminal black spots, hind wing has the preapical short transverse, fore wing has a narrower orange patch enclosed within the black apical area. Head, thorax and abdomen black.....*Colotis*

Key to the butterfly species of Tehsil Tangi, KP, Pakistan

- 1a: Primary orange or pale brown colour.....2
- 1b: With predominantly black or dark colour.....3
- 1c: With predominantly white, creamy, yellow or light orange colour.....4
- 2(1a): Forelegs are reduced, antennae tips are with large conspicuous knobs.....**Family: Nymphalidae**
- 2a(1a)(i): A pale greyish-buff under hind wings is present but brown bands are almost obsolete, across cell narrow black paired lines are present under forewings.....*Junonia orytha*
- 2a(1a)(i)I: Excluding apex upper forewing is black, apex is a buffy white with narrow brown bands and a small section of blue in tonal area is absent, iridescent blue upper hind wings with two red-brown centred black ringed, more conspicuous ocellifemale
- 2a(1a)(i)II: Apex of upper forewing is a buffy white with contracted brown bands and a tonal area with small blue panel, Black upper forewing, iridescent blue upper hindwings with two red-brown centred black ringed ocelli.....male
- 2a(1a)(ii): Both wings are heavily marked with black and white, apical half of forewing with white spots, apex is round at tip, smooth brown hairs (cilia) are present on base of hindwings, sexes are alike...*Cynthia cardui*
- 2a(1a)(iii): Body colour is tawny, upper margin of forewing is black with white spots, hind wings have a thin black border enclosing a sequence of hemispherical white spots*Danaus chrysippus*
- 2a(1a)(iii)I: Smaller than female with 3 black spots on hindwing, bright coloration, 2 brush-like organs, which can be pushed out of tip of the abdomen.....male
- 2a(1a)(iii)II: Hind wings with 2 black spots.....female
- 2a(1a)(iv): Upper side rich orange-yellow, fore wing with a pale dusky, costal margin, terminal line dusky black, hindwing a small minutely white-centred black-ringed, discal ocellus, antennae dark brown, head, thorax and abdomen slightly darker, both sexes are looking same.....*Junonia almana*
- 2a(1a)(v): Dark brown with slight traces of olive, transverse short black lines at the base, black loop across beyond apex of cell, black spot below median vein discal and preapical white spots as on the upper side, antennae, head, thorax and abdomen dark brown, the body paler beneath.....*Euthalia garuda*
- 2a(1a)(vi): Underside is a more greyish brown, upper surfaces of both wings are rich chestnut and male bears a triangular black patch of scent scales.....*Ariadne merione*
- 2a(1a)(vii): Upper surface of both wings is dark blackish-brown, within certain lights bluish velvet sheen. Forewing having there are two to three small white dots, underside of wings has larger ocelli, which are pupil led.....*Hipparchia parisatis*
- 2a(1a)(viii): Upper side of male is bright yellow, forewing has a broad triangular jet-black projection, anterior half and the terminal margin of the hind wing is black, cilia of both fore and hind wings are white alternated with brown. The underside of the forewing is pale yellow.....*Junonia hierta*
- 2a(1a)(ix): Hind wing dentate at apex, fore wing crossed by an oblique, slightly curved, discal white band, hind wing uniform and fore wings with subbasal, subterminal and terminal sinuous, with the oblique discal white bar.....*Lethe confuse*

- 2a(1a)(x): Sexual dimorphism, both sexes are tawny-orange on the upper surface with scattered black spots, with a dull blue border to the hind wing margin with double black looped lines and a sub marginal ring of black spots. Under hind wing is bend with buff and broken bands of olive green.....*Argynnis hyperbius*
- 2a(1a)(xi): Hind wing and fore wing consist of white bluish with semi hyaline spots and streaks, both of the wings upper black in colour while under side are dusky black. Underside are basal two-thirds of fore wing dusky black, the apex and hind wing olive-brown.....*Tirumala limniace*
- 2a(1a)(xii): Upper side patterning consists of white spots and bars on a black ground colour. Underside patterns are yellowish to reddish-brown, alternating with white bands. The legs are rather short and stout, while abdomen is much slender.....*Neptis mahendra*
- 2a(1a)(xiii): Upper side, 3 small transversely blue spots placed beyond the cell, hind wing mostly comparatively very dark, purplish blade, with slender white margins, shaded on disc with rich dark olive-brown.....*Vanessa indica*
- 3(1b): Mainly with black or dark colours **Family Papilionidae**
- 3a(1b)(i): Body is black with pale yellow and orange markings, a single large red spot along with bluish black spot is present on hindwings and both sexes are alike.....*Papilio demoleus*
- 3a(1b)(ii): Mainly black with conspicuous tails on hind wings, post-marginal area of hindwings are with distal band of elongated white spots.....*Papilio polytes*
- 3a(1b)(ii)I: Lacks white spots band on hindwings.....female
- 3a(1b)(ii)II: Band of white spots or often creamy-yellow spots are present on hindwings prolonging up to vein 7.....male
- 4(1c): With distinct spots underside and upper side of wings..... **Family Pieridae**
- 4a(1c)(i): Upper side of the male is chalky-white female upper side the ground-colour antennae red, obscurely dotted with black, palpi and head above red, thorax clothed with long yellow, sometimes greenish hairs, abdomen pale yellow; beneath palpi and thorax pale to dark yellow, abdomen white.....*Catopsilia ponoma*
- 4a(1c)(ii): Underside forewing white, cell and costa lightly forced with black scales, apex somewhat broadly tinged with ochraceous yellow, hind wing, from pale, almost white, to dark ochraceous, antennae black with minute white specks, the long hairs on head and thorax greenish grey, abdomen black, beneath, head, thorax and abdomen white.....*Pieris canidia*
- 4a(1c)(ii)I: Upper side white to pale cream colour, black scales, fore wing and the basal portion of the costa, upper margin of cell upper side white to pale cream colour, hind wing has a sub costal black spot but is generally larger and more conspicuous.....male
- 4a(1c)(ii)II: Underside similar to male but black scales more prominent, black on the apex and termen of the hind wing broader, fore wing there is an additional spot in inter space.....female
- 4a(1c)(iii): Commonly yellow with expansive black apical and terminal area of forewings, forewings with black inner margin, sexes are alike.....*Eurema hecabe*
- 4a(1c)(iv): Underside is ground colour and similar, forewing and hindwing with generally an obscure disco cellular reddish brown spot, antennae reddish, head and thorax anteriorly brown, thorax clothed posteriorly with long white hairs, abdomen white..... *Catopsilia pyranthe*
- 4a(1c)(v): Underside has the veins broadly outlined with dark brown, though the disco-cellular bank is jet-black, apical region and hind wing being pale buff. The female has the apical area more broadly black with the white spots almost obsolete and the costa of the forewing is black*Belonias aurota*
- 4a(1c)(vi): Hind wing is uniform and a series of terminal black spots, hind wing has the preapical short transverse, fore wing has a narrower orange patch enclosed within the black apical area. Head, thorax and abdomen black.....*Colotis etrida*
- 4a(1c)(vii): Upper surface of hid and fore wing is cloudily yellow greenish with black spots, hind wings apex with black in colour and fore wing in underside having white spots.....*Colias erate*
- 4a(1c)(viii): Usually it is like shade of yellow, orange, or white. Their upper sides feature black borders and they always perch with wings closed, but upper side pattern may be seen faintly through the wing, or glimpsed in flight.....*Colias fieldii*

The cluster analysis of order Lepidoptera showed their families: Nymphalidae; Pieridae and Papilionidae. However, family Nymphalidae comprised the largest number of butterflies 49.8%, Pieridae 42.9% and Papilionidae 7.3% (Fig. 2).

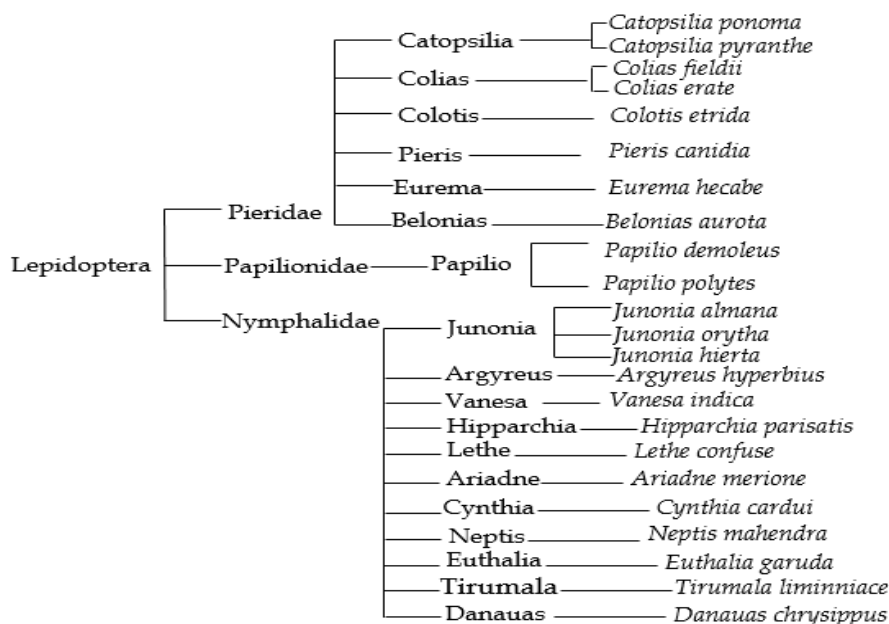


Fig. 2 The cluster analysis of order Lepidoptera with families ($n_F=3$), genus ($n_G=18$) and species ($n_{sp}=23$) collected from Tehsil Tangi, Khyber Pakhtunkhwa, Pakistan during August 2014-May 2015; family Pieridae having 2 subfamilies, i.e., Coliadinae and Pierinae; Nymphalidae having 7 subfamilies, i.e., Danainae, Nymphalinae, Vespidae, Satyrinae, Biblidinae, Trogidae and Limenitidinae; Family Papilionidae having only one subfamily, i.e., Papilioninae; sample size of identified specimens: $n_i=506$

The frequency of occurring of collected butterfly families with their subfamilies are: Danainae 25%; Nymphalinae 6%; Vespidae 12%; Satyrinae 4%; Biblidinae 2%; Trogidae 1% and Limenitidinae 1%; Pieridae: Coliadinae 21%; Pierinae 21% and Papilionidae: Papilioninae 7% (Fig. 3).

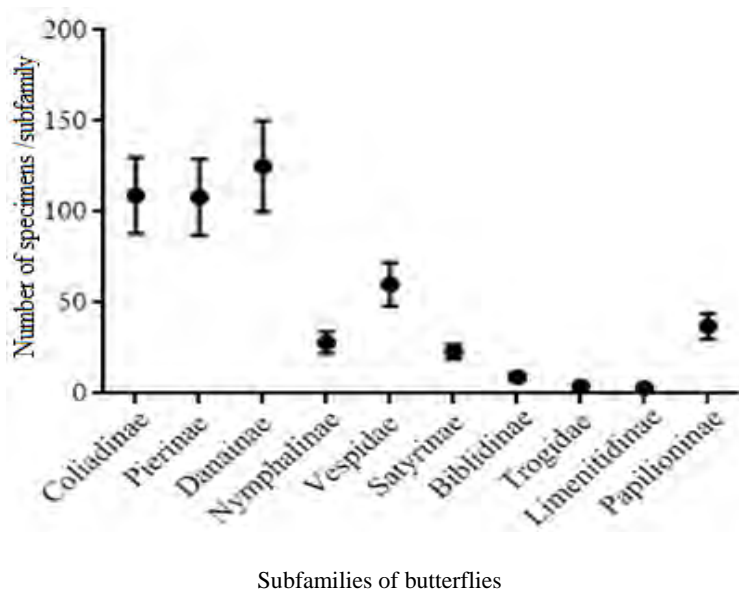
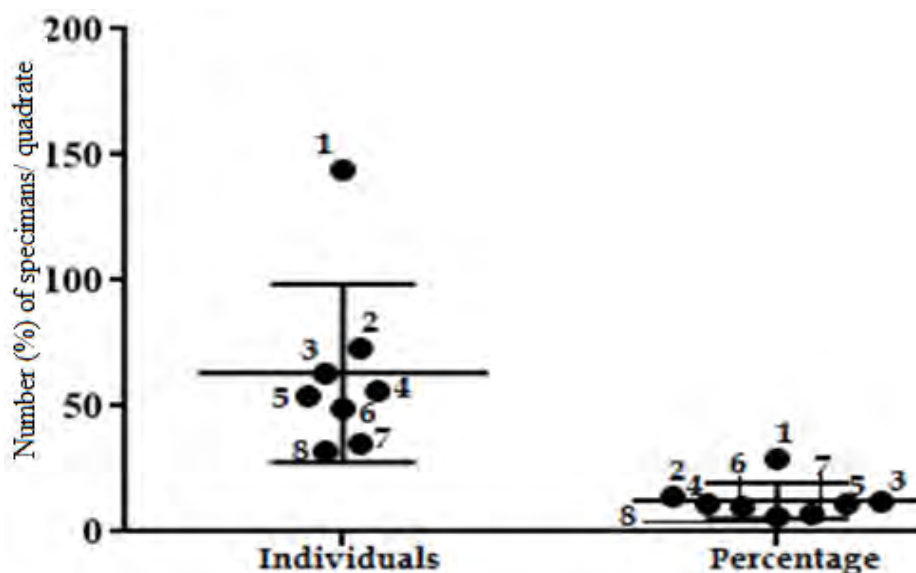


Fig. 3 The frequency of occurring of butterfly subfamilies collected from Tehsil Tangi, Khyber Pakhtunkhwa, Pakistan during August 2014-May 2015; graphs were prepared by scientific software program GraphPad Prism 6[®]; ●: specimen in subfamily; up (↑) and down (↓) bars on circle: standard error of means; Family Pieridae having 2 subfamilies, i.e., Coliadinae and Pierinae; Nymphalidae having 7 subfamilies, i.e., Danainae, Nymphalinae, Vespidae, Satyrinae, Biblidinae, Trogidae and Limenitidinae; Family Papilionidae having only one subfamily, i.e., Papilioninae; sample size of identified specimens: $n_i=506$.

The butterflies were collected from 8 quadrates, however, the maximum number of butterflies reported from UC Koaz Bahram Dheri 144 (29%) followed by UC Mandani 73 (14%), where the minimum number of species were collected from UC Shodagh 32 (6%) trail by UC Tangi 35 (7%) and UC Harichand 49 (10%) (Fig 4).



Number of quadrates of study area for collection of butterflies

Fig. 4 The contribution key for identification of butterflies (Lepidoptera) was prepared for the study area, Tehsil Tangi, District Charsadda (CHD), Khyber Pakhtunkhwa (KP), Pakistan during August 2014-May 2015; the collection was made in the 8 quadrates as numbers are given in Figure viz.: 1) Union Council (UN) Koaz Bahram Dheri; 2) UN Harichand; 3) UN Hisara Nehri; 4) UN Tangi; 5) UN Shodagh; 6) UN Ghandheri; 7) UN Dhaki; 8) UN Mandani; ●: specimen number and percentage (%) per quadrates, i.e., 1-8; graphs were prepared by scientific software program GraphPad Prism 6[®]; sample size of identified specimens: $n_1=506$

4 Discussion

In this paper, the contribution key has been prepared for identification of butterflies collected from Tehsil Tangi, Khyber Pakhtunkhwa, Pakistan during August 2014-May 2015. However, this is the first documentary report of the said area. Moreover, the study was conducted in 8 quadrates of Tehsil Tangi, Khyber Pakhtunkhwa, Pakistan, viz., 1) Union Council (UN) Koaz Bahram Dheri; 2) UN Harichand; 3) UN Hisara Nehri; 4) UN Tangi; 5) UN Shodagh; 6) UN Ghandheri; 7) UN Dhaki; 8) UN Mandani. Further, the collected species belong to 3 families, 18 genera and 23 species. Furthermore, the collected family was Pieridae with species viz., *C. ponomia*, *B. aurota*, *C. pyranthe*, *E. hecabe*, *C. fieldii*, *C. etrida*, *C. erate* and *P. canidia*. While the species of family Nymphalidae were *D. chrysippus*, *J. orytha*, *H. parisatis*, *A. hyperbius*, *J. almana*, *A. merione*, *C. cardui*, *T. limniace*, *V. indica*, *L. confuse*, *N. mahendra*, *E. garuda* and *J. hierta*. Additionally, the family Papilionidae with species were *P. demoleus* and *P. polytes*.

Naz et al. (2001) reported a total of 450 specimens of butterflies from Buner, which belong to family Pieridae. However, in the present study, the family Nymphalidae was reported as a dominant family from Tehsil Tangi. Moreover, both study areas were very dissimilar, as Buner was totally hilly, where the butterfly fauna was limited as compared to Tehsil Tangi, which was totally plain and cultivated agriculture area.

Perveen and Ahmad (2012) reported a total of 21 species belong to 3 families from Kohat. Moreover, these families were Pieridae with their abundance and covered 57%, followed by Nymphalidae 33% and Papilionidae 10%. However, from the present study, reported 3 families were Nymphalidae comprising 50%, Pieridae 43% and Papilionidae 7%. Therefore, the flora and fauna of Kohat was rarely similar to the present study area Tehsil Tangi. Mostly, the weather condition of both study areas were very similar to each other.

Haroon et al. (2013) examined a total of 232 specimens of butterflies belonging to 3 families 11 genera and 13 species from 12 localities UC Koaz Bahram Dheri. The collected families were with their richness, viz., family Nymphalidae covered the largest number of butterflies 49% specimens, followed by Pieridae 37% and 14% of Papilionidae. In present study, from Tehsil Tangi a total of 506 specimens were collected belong to 3 families, 18 genera and 23 species. However, the similar families were reported from the present and forhead researches, family Nymphalidae covered 50%, Pieridae 43% and Papilionidae 7%. Although, both study areas had the same type of cultivation land, climatic condition and flora.

Perveen (2012) analysed the families and sub families of Kohat and reported a total of 21 species with 3 families and 6 subfamilies. The captivity families over 2 subfamilies of Nymphalidae, viz., Nymphalinae covered 28% and Satyrinae 5% species. Additionally, family Pieridae including 3 subfamilies, viz., Pierinae covered 24%, Coliactinae 5% and Coliadinae 28%. Furthermore, the largest size of butterflies were belonging to family Papilionidae including 1 subfamily, Papilioninae covered 10% species. Consequently, from the present study, the same 3 families, however, Nymphalidae with their subfamilies were Danainae 25%, Nymphalinae 6%, Vespidae 12%, Satyrinae 4%, Biblidinae 2%, each Limenitidinae and Trogidae 1%, moreover, Pieridae with their subfamilies were Coliadinae 21% and Pierinae 21%, further, Papilionidae with its subfamily was Papilioninae 7%. Furthermore, the Tehsil Tangi flora and fauna were mostly dominant as compared to Kohat due to larger amount of cultivated agriculture land. On the other hand both of the study areas were infrequently similar to other aspects, e.g., topography, geography, climates etc.

Perveen and Khan (2013) described the fauna of Kabal, Swat, KP, Pakistan and reported a total of 170 specimens belong to 3 families and 10 genera. While, from the present study a total of 506 individuals belong to 23 species 18 genera and 3 families. Conversely, both of the study areas were very dissimilar to each other, because the climatic ailments of Kabal were mostly extrem and cold conditions, while in Tehsil Tangi had moderate and warm conditions.

Perveen and Fazal (2013) explored the butterfly fauna of Hazara University, Mansehra, KP, Pakistan and reported 170 specimens from 3 quadrates. The collected specimens belong to 10 species 8 genera and 3 families. However, each quadrants covered species in descending order: residential area: 53% > main campus: 34% > administration area: 12%. However, the reported families covered collected specimens were in descending order: Pieridae > Nymphalidae > Papilionidae. On the other hand, from the present research, a total of 506 specimens were collected from 8 quadrates (UC), these were as follows: Koaz Bahram Dheri: 29% > Mandani: 14% > Ghandheri: 12% > Dhaki = Hisara Nehri: 11% > Harichand: 10% > Tangi: 7% > Shodagh: 6%. Moreover, both of study areas were very dissimilar to each other because Tehsil Tangi had plain-agriculture land, while Hazara University was mostly hilly and lesser land for agriculture.

Abbas et al. (2002) reported a total of 61 species belong to 14 genera and 5 families from 6 quadrates of Skardu, Pakistan. The collected families with their genera embraced: family Papilionidae represented only by the genus, viz., *Parnassius*, however, family Pieridae represented by the genera, viz., *Pieris*, *Pontia* and *Colias*. Moreover, family Lycaenidae represented by the genera, viz., *Lycaena*, *Everes*, *Aricia*, *Plebejus*, *Zizeeria* and *Zizina*. Further, family Nymphalidae represented by only 2 genera, viz., *Aglais* and *Cynthia*, furthermore, family Satyridae also represented by 2 genera, viz., *Pararge* and *Maniola*. However, from the present study, a toal of 506 individuals belong to 23 species, 18 genera and 3 families from 8 quadrates of Tehsil Tangi,

Pakistan. The collected families with their genera comprised: family Papilionidae represented only by the genus, viz., *Papilio*, however, family Pieridae represented by the genera, viz., *Belonias*, *Catopsilia*, *Colias*, *Colotis*, *Eurema* and *Pieris*. Moreover, family Nymphalidae represented by the genera, viz., *Ariadne*, *Cynthia*, *Argyreus*, *Danaua*, *Euthalia*, *Hipparchia*, *Junonia*, *Lethe*, *Neptis*, *Tirumala* and *Venesa*. The fauna of Tehsil Tangi was always dominant with respects to fauna and flora when compared with Skardu region, Pakistan. However, from Skardu more species belong to more families but lesser genera from lesser quadrates were reported as compared to Tehsil Tangi, it may be due to differences in collection periods and methods in both studies.

Tehsil Tangi is rich, developed, plain and agriculture land having amusing flora and fauna. Therefore, the local population is efficient to care about use of insecticides. In recent times, the population is increased and the agriculture land is urbanized day by day. The sewage system is not good to find the proper way, which destroys the many herbs, shrubs and harbors of insects. However, the duration of the study period was very short, if it was more, the new and more species of butterflies will be collected. Therefore, the present research is lightening the austerity issues of Tehsil Tangi, e.g., unawareness, urbanization and misuse of insecticides.

5 Conclusions

The contribution key for identification of butterflies of Tehsil Tangi has been prepared. From the present study, it was also concluded that *D. chrysippus* is the dominant species [$n_{D. chrysippus}=122$ (24%)] followed by *P. canidia* [$n_{P. canidia}=64$ (13%)].

6 Recommendation

In order to conserve and restore the butterfly fauna of District Charsadda with its Tehsil Tangi, the following specific suggestions for protection at the local level must be taken: 1) to explore the whole butterfly fauna of Charsadda, Khyber Pakhtunkhwa, Pakistan, a detail study and research are required; 2) their habitats should be conserved and protectd from urbanization; 3) the rules regarding conservation of butterflies, related fauna and flora in Charsadda need to be established and oriented more towards protection should be reinforced to the community; 4) expand cooperation and collaboration among the entomologists, conservationists, researchers, integrated pests managers, students and farmers working related to any aspect of butterflies and related fauna and flora; 5) eco-tourism measures should be taken to extend public awarness and education involving farmers; 6) the area should be protected from agro-industrial chemicals, discharge of pollutants, throw of garbage, drain of sewage, house-hold pollutions etc; 7) During cultivation, miss and extraordinary use of agricultural pratices, e.g., use pesticides and other pests control methods should be avoided which effects the non-target species; 8) rangers or security guards should be appointed and placed at adequate distances throughout the area to look after miss-used of resources, fauna and flora etc; 9) those found to be conducted or involved in such activities, i.e., spoiling of butterflies or related fauna and flore should be punished; 10) the seminars, conferences, congresses, workshops and symposiums may be conducted for awareness and education of community of Tehsil Tangi.

Acknowledgments

This paper is based on MPhil research of the 2nd author. The authors are grateful to the Department of Zoology, Shaheed Benazir Bhutto University (SBBU), Main Campus, Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan for providing laboratory facilities. They are also grateful to all people, who assisted in conducting the present research. The authors declare no conflict interest. The present research complies with the current laws of the institute and country, in which they were performed.

References

- Abbas M, Rafi MA, Inayatullah M, Khan MR, Pavulaan H. 2002. Taxonomy and distribution of butterflies (Papilionoidea) of the Skardu region, Pakistan. *The Taxonomic Report*, 3(9): 1-15
- Haroon, Ahmad T, Ahsan A, Ahmad I. 2013. Diversity pattern of Butterfly Lepidoptera (*Papilio demoleus*) in Union Council Koaz Bahram Dheri Khyber Pakhtunkhwa Pakistan. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 9(1): 94-99
- Haroon, Mehmood SA, Ahmad T. 2013. Diversity of butterfly fauna of Union Council Koaz Bahram Dheri, Pakistan. *Journal of Entomology and Zoology Studies*, 1(6): 113-117
- Khan H, Perveen F. 2015. Distribution of Butterflies (Family Nymphalidae) in Union Council Koaz Bahram Dheri, Khyber Pakhtunkhwa, Pakistan. *Social and Basic Sciences Research Review*, 3(1): 52-57
- Munir M, Jasra1 AW, Rafique S. 2008. Lamb production under different systems of management on rangelands of Balochistan. *Pakistan Veterinary Journal*, 28: 68-70
- Perveen F, Ahmad A. 2012. Checklist of butterfly fauna of Kohat, Khyber Pakhtunkhwa, Pakistan. *Arthropods*, 1(3): 112-117
- Perveen F, Fazal F. 2013. Key for Identification of Butterflies (Lepidoptera) of Hazara University, Garden Campus, Mansehra, Pakistan. *International Journal of Agriculture Innovations and Research*, 1(5): 2319-1473
- Perveen F, Fazal F. 2013. Biology and distribution of butterfly fauna of Hazara University, Garden Campus, Mansehra, Pakistan. *Open Journal of Animal Sciences*, 3(2): 28-36
- Perveen F, Fazal F. 2013. Checklist of Butterfly Fauna from Hazara University, Garden Campus, Mansehra, Pakistan. *SOAJ Entomological Studies*, 2: 26-33
- Perveen F, Hussain Z. 2012. Use of statistical techniques in analysis of biological data. *Basic Research Journal of Agricultural Science and Review*, 1(1): 01-10
- Perveen F, Jamal A. 2012a. Checklist of spider fauna of FR Peshawar, FATA, Pakistan. *Arthropods*, 1(1): 35-39
- Perveen F, Jamal J. 2012 b. Exploring spider fauna of FR Peshawar, FATA, Pakistan. *Signpost Open Access Journal of Entomological Studies*, 1: 55-67
- Perveen F, Jamal A. 2012 c. Biodiversity of spiders' fauna in FR Peshawar, FATA, Pakistan. *Journal of Entomology and Nematology*, 4(3): 22-33
- Perveen F, Jamal A, Yasmin N, Khatak KU. 2012. Key for identification of spiders fauna of FR Peshawar, FATA, Pakistan. *Pakistan Journal of Entomology Karachi*, 27(1): 39-48.
- Perveen F, Khan A, Sikander. 2014. Characteristics of butterfly (Lepidoptera) fauna from Kabal, Swat, Pakistan. *Journal of Entomology and Zoology Studies*, 2(1): 56-69
- Perveen F, Khan A. 2013. Checklist of Butterfly Fauna from Kabal, Swat, Pakistan. *Journal of Advances in Biology*, 2(2): 115-121
- Perveen F, Yasmin N, Ahmad A. 2012. Characteristics of Butterfly Fauna of Kohat, Khyber akhtunkhwa, Pakistan. *Pakistan Journal of Entomology Karachi*, 27(1): 15-26
- Perveen F. 2012. Distribution of butterflies (Lepidoptera) of Kohat, Khyber Pakhtunkhwa, Pakistan. *Agricultural Science Research Journals*, 2(9) 539- 549
- Sabir AM, Bhatti AH, Rafi MA, Suhail, A. 2000. Distribution of Nymphalid butterflies (brush footed) in districts Rawalpindi and Islamabad. *Pakistan Journal of Biological Sciences*, 3: 1253-1254