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Original article

Butterfly (Order: Lepidoptera) species Richness, diversity and distribution in different localities of Battagram, Pakistan

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ABSTRACT

Butterflies are the beautiful creatures and need to be conserved. The present survey was conducted to explore the biodiversity of butterflies of District Battagram Khyber Pakhtunkhwa Pakistan, from March to September 2021. During this study the butterflies were collected from 2 Tehsil including 12 localities using line transect method. A total of 572 specimens were collected from all localities. Species identified were belonging to 3 families and 7 genera. The species were *Cynthia cardui. Danaus chrysippus, Junonia orithya, Papilio demoleus, Papilio polytes, Colias croceus, Pieris ajaka, Pontia daplidice* and *Pieris napi.* In the recorded 9 species *Papilo demoleus* was the most common species of the district Battagram and the most rear specie was *Pieris ajaka* during this study. The current study is new detailed work on the butterflies from district Battagram . It is concluded from the present study that district Battagram is rich in flora and provide a much suitable environment and place for biodiversity to insects. As this study is the first survey of butterflies population in the district and recorded rich diversity, so more explorative work is needed for its population estimation and specie abundance.

1. Introduction

To understand the biodiversity we study biological indicators and they clarify us the importance of ecosystem of forests and their management (Pearce and Venier, 2006, Maleque et al., 2009). Mostly the biodiversity of insects are studied for the ecosystem of forests (Kwon et al., 2013; Lee and Kwon 2014; Lee et al., 2014). In insects, the butterfly fauna is the best indicator as they are high in number, their generation is short, their movement is good and they have high sensitivity for change in environment (Lee and Kwon, 2012; Lee and Kwon, 2014; Kwon et al., 2014). The butterflies are easily studied using the line transect technique (Pollard and Yates 1993).

We have 1.4 million species on earth, among which insects are 53% and approximately 15 to16 thousands butterfly species are present globally (Hassan, 1994). Approximately 5 thousand insect species in which 400 butterflies species and moths are present in Pakistan (Khan et al., 2007). Butterfly is identified as the representation of grace and beauty (Rafi et al., 2000). They are the diurnal insects and are easily identified due to its cheerful colour and stunning shapes (Javaid, 1978). Butterflies are best for pollination and has good artistic and merket values (Ahsan and Javaid, 1975).

The Butterflies belong to order Lepidoptera which is the second big class in the insects and comprising of approximately 1,50,000 species up till now. The order Lepidoptera includes Butterflies and Moths of which about 17,820 are Butterflies (Shields, 1989). Butterflies are most familiar insect to mankind due to their large size, brilliant coloration and sunshine loving habits. They amuse us by their brilliant coloration. Due to their attractiveness and omnipresence they have acquired a niche in the prose and poetry of various cultures. The children are more fascinated by them. Butterflies are the next pollinating agents after the bees and in fact success of angiosperms depends on these pollinating agents. The number of Indian Butterflies count to one fifth of the world total of Butterfly species. The Himalayan mountain range harbors major share of the Indian Butterfly diversity (Haribal, 1992).

Butterflies are one of the attractive and lovely comparing to other insects, which distinguish them from other order lepidoptera. The butterflies helps in pollination as they fly from one plant to the other. Most of the butterflies species are season specific and select a specific habitat (Kunte, 1997) and they are the best good indicators which show the unwanted activites and disruption in the environment (Kocher and Williams, 2000). Butterflies are

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called dayflying insects which are in the order of Lepidoptera, Lepidos means "scales" and Ptera means "wings". The order Lepidoptera is ecologically very important. The adult butterflies generally feed on nectar and serve as important pollinators of flowering plants and their larvae feed on foliage frequently as the primary herbivores in ecosystems and are important in the transfer of radiant energy fixed by plants, making it available to the other organisms in the ecosystem. Butterflies are potentially useful ecological indicators of urbanization because sensitive to changes in microclimate, temperature (Thomas et al., 1998).

The biodiversity of district Battagram is mostly unexplored. The current research was designed to explore the variety, seasonal variation in population density and abundance of butterflies in different areas of district Battagram.

2. Material and Methods

2.1. District Battargam

Battagram is present between 34°33′ and 34°47′ N and 72°54′ and 73°15′ E in the west of Khyber Pakhtunkhwa Pakistan, having an area of 1,301 square kilometer (Haq, 2012). Battagram has lush green mountains with an altitude from 525 m at Thakot and at sukaisar the altitude is above 4690 m. Climatic conditions is variable and varies form sub-tropical to "alpine" conditions. Battagram has variety of agriculture lands, waste-land, forests and meadows (Haq et al. 2010). Mostly peoples has agriculture as a source of living, followed by animal husbandry. They cultivate maize, rice, red beans, vegetables and wheat (Muhammad 2004) (Fig. 1).

2.2. Study area

Data was collected from 12 different localities of the district Battagram. Coordinates of each locality is presented in Table 1.

2.3. Sample collection

The current research study was conducted from March to September 2021 from 2 Tehsils of District Battagram for the collections of butterflies' species. The line transect method was used for the collection of butterflies species. A total of 12 line transect were installed in different potential sites of the study area, length of transect was 300m while width is normal 15m. In this method three peoples were involved, two of them walking on zigzag direction to search the specimens and one person walking in middle of transect to record the species detail. Most of the transects were placed in the field with the suitable habitat surrounded. Butterflies were also collected using aerial nets method near by the transect of each potential sites. After collection, the specimen were tagged temporally by writing the current date, time, locality, and collector, than keep the particular record with each specimen in small glass bottles.

2.4. Killing method

A small piece of cotton soaked with chloroform and was kept in each glass bottle individually which contains the collected specimens.

2.5. Identification

Identifications of the specimens was carried out with help of standard available literature already identified species, thesis,

Table 1
Selected localities of district Battagram.

S.NO	Localities	Latitude	Longitude
1	Tamai	34°67′52.3″N	73°04′86.4″E
2	Battagram	34°67′24.8″N	73°02′43.1″E
3	Chapargram	34°66′38.9″N	73°05′14.3″E
4	Shumalai	34°70′46.1″N	73°11′45.2″E
5	Bansair	34°70′01.6″N	73°11′01.6″E
6	Qala	34°68′73.0″N	73°08′54.7″E
7	Dehri	34°67′26.3″N	73°02′48.9″E
8	Ajmera	34°67′21.9″N	73°01′75.9″E
9	Ziarat	34°67′13.3″N	73°00′97.2″E
10	Jabar	34°64′48.7″N	73°07′35.2″E
11	Thakot	34°79′44.0″N	72°93′33.0″E
12	Alai	34°51′21.1″N	73°08′05.9″E

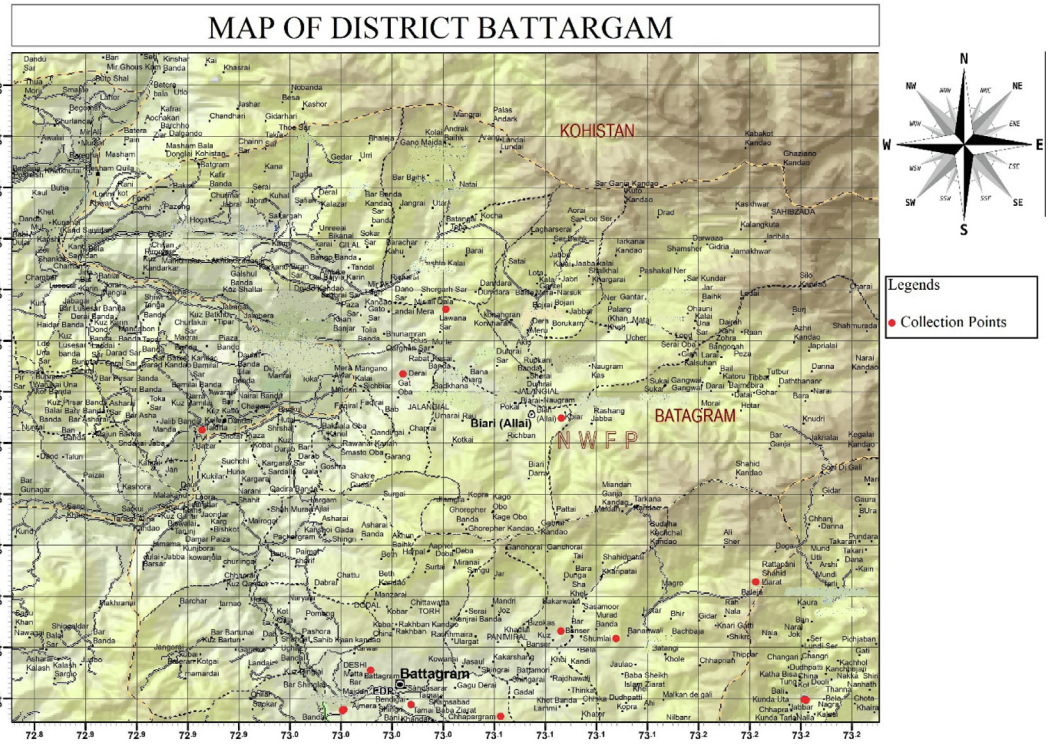

Fig. 1. Map of district Battagram. Collection points are highlighted in red colour.

research articles (Sabir et al., 2000)(Munir et al., 2008)(Abbas et al., 2002).

2.6. Pinning and Preservation

After Identifications, For the small specimens a small drop of hydro soluble glue was put on the small hard whites card the than the specimens were put/mounted on it an d than the cards were hang through the small entomological pen in the wooden insects box. The large specimens were pinned on the right elytra behind the pronotum and keep for the permanent storage in the wooden insect's boxes and keep Naphthalene balls in each box to protect against microbes and fungal infections. All the identified specimens were kept in the Zoology Museum Hazara University, Sub Campus Battagram.

3. Results

In this study a totals of 572 specimens were collected from all localities. In this study 9 different species were identified belonging to 3 families and 7 genera. The species were *Cynthia cardui. Danaus chrysippus, Junonia orithya, Papilio demoleus, Papilio polytes, Colias croceus, Pieris ajaka, Pontia daplidice* and *Pieris napi.* In the recorded 9 species *Papilo demoleus* was the most common species of the district Battagram and the most rear specie was *Pieris ajaka* during this study. The current explorative work was the new detailed work on the butterfly from district Battagram KP Pakistan. The details of collected species are given in Table 2.

3.1. Description of collected species

3.1.1. Cynthia cardui

The body length of the specie is 1.7 cm and width about 6.2 cm. It has blackish to light pink red colour marking on body. Wings contain black and white dots. The colour of the specimens was shiny and light but after collection the colour become dull Fig. 2 A.

3.1.2. Danaus chrysippus

The body length of the specie is 2.9 cm and width is 7.2 cm. Body has grey and black colour combination. The fore wings is much brighter in colour. The hind wings has 3 to 4 black patches. Over all body of the specie is covered by black lining Fig. 2B.

3.1.3. Papilio demoleus

The body length of the specie is 2.8 cm and width is 7.3 cm. Over all body colour is black with creamy to white colour patches of different size. The fore wings has almost similar colour of creamy colour patches whereas the hind wings has 2 unique red to brown patches Fig. 2C.

3.1.4. Junonia orithya

The body length of the specie is 1.6 cm and width of the specie is 4.1 cm. Body colour is very attractive containing blue, black and grey colour combination. Wings contain 8 blue round ocelli covered by brown lining. The color was very shiny and bright at collection time but become dull after preservation Fig. 2D.

Table 2
Taxonomic position of collected species from different localities of Battagram.

Family	Genus	Species
Papilionidae	*Papilio*	*Papillio polytes* *Papillio demoleus*
Nymphalidae	*Dannus* *Cynthia* *Junonia*	*Dannus chrysippus* *Cynthiacardui* *Junonia orithya*
Pieridae	*Colias* *Pontia* *Pieris*	*Colias croceus* *Pontiadaplidice* *Pierisajaka* *Pierisnapi*

3.1.5. Papilo polytes

The body length of the specie is 3.5 cm and width is about 7.8 cm. Body colour is black with yellow patches present on fore and hind wings. Patches present on fore wings are small and are not very much distinctly clear, whereas the hind wings has clear patches present in series Fig. 2E.

3.1.6. Colias croceus

The body length is 2 cm and width is 4.7 cm. Body colour is orange which is covered by blackish colour. Fore wings has two black dots, whereas hind wing has bright orange disco-cellular patches and is basally dusted with blackish orange Fig. 2F.

3.1.7. Pieris ajaka

The body length is 1.95 cm and width is 6.1 cm. Body colour is creamy white with black lining wings. The fore wings has greyish large patches whereas the hind wings has small black patches. At collection time the colour was very shinny but become dull after preservation Fig. 2G.

3.1.8. Pontia daplidice

The body length is 1.42 cm and width is 4.1 cm. The body is pearl white with different size patches. The fore wings has two linings of grey colour patches on the endings whereas the hind wings has no patches present. The specie colour was very shinny but become dull in colour with time as they were preserved Fig. 2H.

3.1.9. Pieris napi

The body length is 1.8 cm and width is 6.2 cm. The body colour is creamy white with distinct patches present on the wings. The fore wings is divided into white and black colours with small creamy white patches. The hind wings has light grey colour on tips Fig. 2I.

3.2. Collection of butterflies from different localities

During this study a total 572 specimens were collected form 12 different localities of district Battagram. Species richness and collection from each locality is shown in Fig. 3.

3.3. Month wise collection from each locality

The present study was conducted from the period of March to August 2021 in 12 different localities of district Battagram. The graphical representation of month-wise collection from each locality is given below in Fig. 4.

4. Discussion

The present survey was conducted to explore the biodiversity of butterflies of Battagram in the period of March to September 2021. During the course of the study the butterflies were collected from 2 Tehsil including 12 localities. The totals of 572 specimens were collected from all localities. During this research 9 different species were recognised belonging to 3 families and 7 genera. The species were *Cynthia cardui. Danaus chrysippus, Junonia orithya, Papilio demoleus, Papilio polytes, Colias croceus, Pieris ajaka, Pontia daplidice* and *Pieris napi.* In the recorded 9 species *Papilo demoleus* was the most common species of the district Battagram and the most rear specie was *Pieris ajaka* during this study. The current explorative work is the new detailed work on the butterfly from district battagram KP Pakistan.

A study was conducted in district Charsadda to explore the diversity and to prepare key for documentation of butterfly fauna from August 2014-May 2015. The reported species were belonging to 3 different families, 18 genera and 23 species. The collected butterflies were comprised of families Nymphalidae 50% > Pieridae

Fig. 2. Representation of collected species from district Battagram.

43% > Papilionidae 7% (Khan and Haroon 2016). To study the 3 different territories around the botany garden the line transect method was used from June to July 2010. A total of 57 species of butterflies were identified belongs to 9 different families (Alarapae et al. 2015). In present study a total of 572 specimens were collected which belong to 3 families, 7 genus and 9 species. The highest recorded species were belonging to family pieridae. The variation in the species might be due to seasonal and environmental change in the study area.

The Botanical garden of Ibadan University has variety of flora which is good source of butterflies' conservation. Result obtained from the study showed that the most dominant family was Pieridae with highest number of species reported whereas the family nymphalidae and papillionadae had the low number of species respectively (Alarapae et al. 2015). In our study is observed that district Battargam has rich flora which gave the most suitable environment for biodiversity. In present study it is observed that *Papilo demoleus* was the most common and rich species whereas the lowest recorded species was *Pieris ajaka*.

A study was conducted on butterflies of Takht-e-Nusrati Karak region of Pakistan in which 17 species from families Namphalidae, Papilionidae and Pieridae cover 35%, 12%, and 53% of the butterflies were reported. Family Namphalidae included species *Argynnis hyperbius, Cynthia cardui, Ariadne merione, Junonia orithya, Phalanta phalantha and Hipparchia parisati. Family Papilionidae: Catopsilia Pomona, Colias croceus, Colotis etrida, C. protractus, Eumera hecab, Pieris ajaka, P. brassicae, P. rapae* and *P. napae* respectively. While Pieridae included *Papilio demoleus* and *P. polytes* only (Usman et al. 2017). In our study the species were *Papillio Dannus, Papillio demoleus, Dannus plexippus, Dannus danaini, Junonia limenitis, Lemenitis reducta, Limentis archippus* and *Colias croceus*. In the recorded 9 species *Papilo demoleus* was the most common species of the district Battagram and the most rear specie was *Pieris ajaka* during this study.

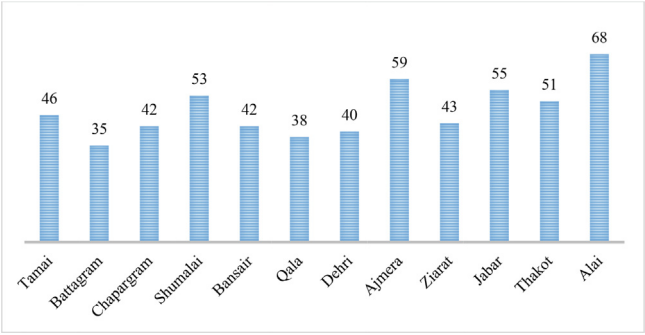

Fig. 3. Number of specimens collected from different localities of district Battagram.

A butterfly's estimation study was carried out in Doag Dara, Dir Upper, KP, Pakistan in in which ten species belonging to 3 families and 8 genera were identified. Five species belonged to family Pieridae, three species to family Nymphalidae and two species to family Papilionidae. Five species of the family Pieridae were *Pieris brassicae*, *Pontia daplidice, Gonepteryx rhamni, Colias croceus, Colias erate,* 2 species of the family Nymphalidae were *Danaus chrysippus, Cynthia cardui* and *Junonia orithya* and 2 species belonging to family Papilionidae were *Papilio demoleus* and *Papilio Machaon* (Attaullah et al. 2018). In our study 9 different species were identified belonging to 3 families and 7 genera. The species were *Cynthia cardui. Danaus chrysippus, Junonia orithya, Papilio demoleus, Papilio polytes, Colias croceus, Pieris ajaka, Pontia daplidice* and *Pieris napi*. In the recorded 9 species *Papilo demoleus* was the most common species of the district Battagram and the most rear specie was *Pieris ajaka* during this study.

5. Conclusion

The current study was the first attempt to explore the butterflies' fauna of district Battargam, KP, Pakistan. In present study 9 different species were identified belonging to 3 families and 7 genera. The species were *Cynthia cardui. Danaus chrysippus, Junonia orithya, Papilio demoleus, Papilio polytes, Colias croceus, Pieris ajaka, Pontia daplidice* and *Pieris napi*. District Battagram is rich in flora and provide a much suitable environment and place for biodiversity. It is concluded from this study that the butterflies' fauna of district Battargam is very rich.

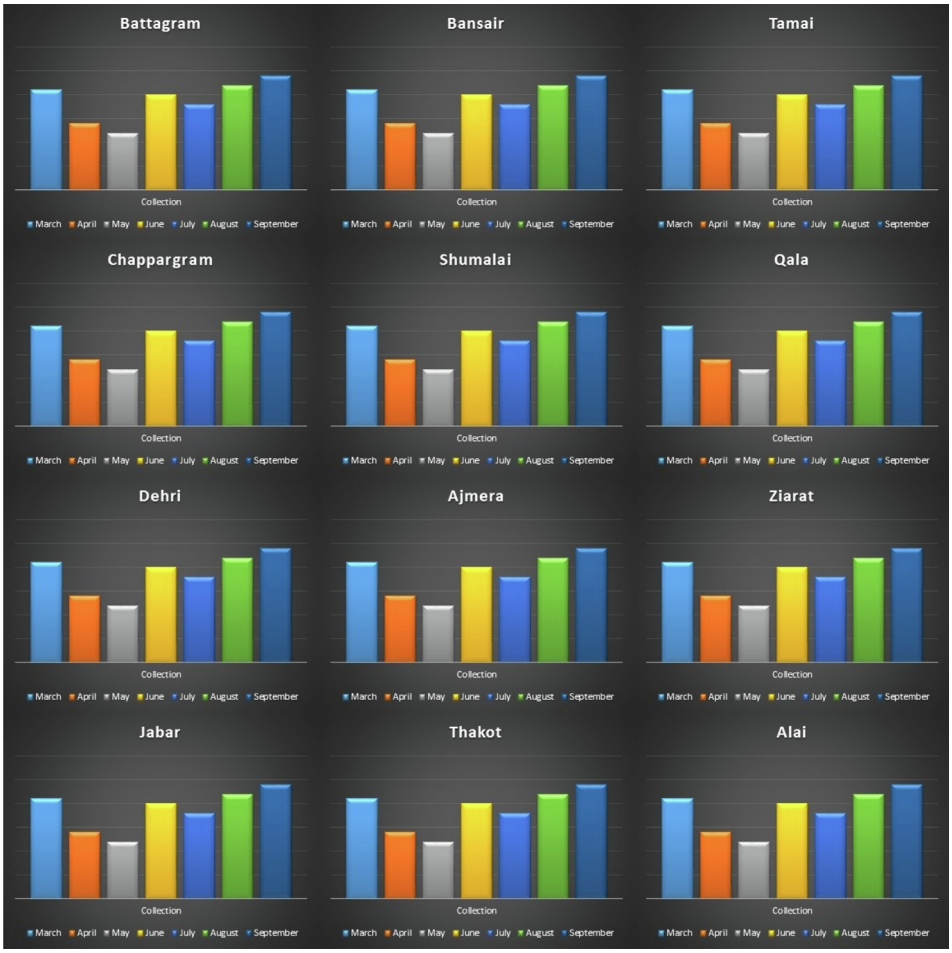

Fig. 4. Graphical representation of month-wise collection from each locality.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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