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## Biodiversity of Butterflies (Lepidoptera): a Regional Study of Larkana, Sindh Pakistan

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### Abstract

Butterflies are elegant, beautiful, and charming insects due to their colourful squamate. They are a great source of economic and beautification and indicators for biodiversity of agroecosystem. In addition to this, they are more important pollinators of flora than the flies and moths. An investigation of several locations in Taluka Larkana with the goal of collecting as many specimens of butterflies was carried out from March to July 2022. About 288 samples of butterflies were captured from different sites. The collected specimens were sorted out into 03 families: Pieridae, Papilionidae and Nymphalidae with 06 genera and 06 species: *Danaus chrysippus* (Linnaeus, 1758), *Vanessa cardui* (Linnaeus, 1758), *Junonia almana* (Linnaeus, 1758), *Papilio demoleus* Linnaeus, 1758, *Eurema hecabe* (Linnaeus, 1758) and *Pieris canidia* (Sparman, 1768). Description of the collected species, detailed genitalia, digital images and habitat of species are provided first time from the studied area. Hopefully, this study will be fruitful for the future researchers concerned with this group.

**Keywords.** *Butterflies, Pieridae, Papilionidae, Nymphalidae, Fauna*

### Introduction

Butterflies belong to order Lepidoptera. They are very elegant, beautiful, and charming due to their colourful squamate and long wings, considered as the symbol of beauty and grace (Rafi *et al.*, 2000; Khan *et al.*, 2007). They are diurnal into habits and easily recognized by their attractive colour, shape and stylish flight that give happiness to everyone. Butterflies are a great source of economic and beautification (Parveen and Ahmad, 2012). Besides bees and moths, butterflies are more important pollinators of flora than either of the other two. They contribute to the massive production in agricultural area, which is necessary for the survival of both humans and animals (Maheshwari, 2003; Echude *et al.*, 2020). Worldwide, more than 20,000 species of butterflies have been found from which eighty percent are present in tropical areas. Butterflies require food in a fluidic form. Their mouth is called proboscis (Lyytinen *et al.*, 2003; Stork *et al.*, 2003). More than 400 species of butterflies have been identified from Pakistan. Butterflies are present in every part of six continents excluding Antarctica because there is no fitness for the survival of butterflies (Khan *et al.*, 2015). Most of the distribution of butterflies is dependent on the presence of the host flora. Significant butterfly populations can be found in areas with undisturbed flora and a great deal of plant diversity, among other aspects. Specified host plants provide butterflies and their larval stage

(caterpillars) with food, including vegetation, nectar, and pollen. Butterflies and their larval stage are reliant on certain host plants for food, including vegetation, nectar, and pollen. Butterflies, particularly their larval stage, are a serious pest. They have a negative impact on the crops. Butterflies are often referred to as opportunistic hijackers since they visit a broad variety of flowers at the same time. Consequently, plant diversity represents the overall diversity of butterfly species. The butterflies are found in the areas where the plants are present (Bobo *et al.*, 2006; Ojjanwuna and Enwemiwe, 2021). Different researchers have focused on various elements of entomology, including the distribution of butterflies, the biology of butterflies, the taxonomy of butterflies, the kinds of butterflies, and so on. For example, Doherty was the first person to work on the diversity of butterflies from Kashmir, and he was the first person to do so (Doherty 1986). Following that, Swinhov (1987) from Pakistan investigated the taxonomy of butterfly species from Karachi and its surrounding areas, as well as from other parts of the world (Swinhov 1987). Robert (2001) conducted research on the Taxonomy of Butterflies from various places of Pakistan, Butterflies are crucial pollinators for many plant species because they can travel vast distances (3000 miles), but they may also be a significant pest for many crops and fruits since some of them are quite destructive. Several varieties of mustards (Family

Brassicaceae), beans, peas, pulses (Family Fabaceae or Legume), cabbage, and other vegetables are used by the larvae (larval stage) of most Pierid butterflies (family of butterflies) (Mal *et al.*, 2014). Butterflies are frequently used as biomonitors of ecosystems as well as agents for the conservation of overall biodiversity (Yu-Feng *et al.*, 2020). There has been no investigation on the taxonomy and distribution of butterflies in the Taluka Larkana region of Sindh, Pakistan. Therefore, the present study was designed from Taluka Larkana region in Sindh province of Pakistan.

## Materials and Methods

**Study area:** An investigation of several locations in Taluka Larkana with the goal of collecting as many specimens of butterflies (Lepidoptera) as possible was proposed. The survey took place from March to July 2022.

**Collection:** The collection of butterfly species was accomplished through the use of the line transect methodology. A total of 12 line transects were installed in various prospective study sites throughout the study region. The length of each transect was 300m, and the width was the standard 15m. In the field, most of the transects were located so that they would be surrounded by suitable habitat. Butterflies were captured using an aerial net approach near the transect of each possible site, which was completed in a few hours. Following collection, the specimens were temporally identified by writing the date, time, location, and collectors on the sample, and the specific record was kept with each specimen (Bibi *et al.*, 2021).

**Killing and preservation:** Most researchers kill specimens using chloroform, but the effect on the colouration of butterflies, makes identification difficult, that is why specimens are put in the jar and kept in the fridge for 24 hours. Then an insect pin is inserted in the thorax, extended on the stretching board, kept in that position for 24 hours. Transfer to the insect boxes with naphthalene balls for protection from the ants and other Entomophagous (Insectivores) (Mal *et al.*, 2021).

**Identification of samples:** Identification of different butterflies were done by literature available (Bingham, 1905 and Mal, 2015). Description of species were written and important were noted.

**Genitalia study:** The abdomen of the specimens was removed from the rest of the body and heated in 10 percent potassium hydroxide (KOH) for 5 minutes in order to observe the male and female genitalia. After doing a lateral dissection using fine pointed forceps, the genitalia was removed, rinsed with tap water, and studied under a stereomicroscope according to the techniques of Kaminski (2008), Pulido *et al.*, (2010). A sample was kept in a tiny vial with one drop of glycerin and then pinned to the same pin that was used to examine it. (Klots 1970 and Anthes *et al.*, 2008).

proposed genitalic nomenclature, which was followed.

## Results and Discussions

An investigation of several locations in Taluka Larkana with the goal of collecting as many specimens of Butterflies was carried out in the months of March to July 2022. About 288 samples of butterflies were captured from different sites of taluka Larkana Sindh, Pakistan. The specimens were sorted out into 03 families: Pieridae, Papilionidae and Nymphalidae with 06 genera and 06 species: *Danaus chrysippus* (Linnaeus,1758), *Vanessa cardui* (Linnaeus,1758), *Junonia almana* (Linnaeus,1758), *Papilio demoleus* Linnaeus,1758, *Eurema hecabe* (Linnaeus,1758) and *Pieris canidia* (Sparrman, 1768). Habitat preference of species is provided in Table.1 and Latitude and Longitude of study cited in Table.2. The percentage of species is given in Table. 3. Further description is as follows.

### Family Nymphalidae

#### Genus *Danaus* , Kluk,1802

##### 1. *Danaus chrysippus* (Linnaeus,1758)

**Diagnostic characteristics:** At dorsal side dark black round shape head with ten white dots, large slightly antennae with black in colour. Proboscis large attach down ward of the head. Thorax black in colour at the middle of thorax one white strip and small light black hairs. Fore wing is trigonal in shape, dark brown and orange in colour. Five large white spots, small white spots, large black spots and two black strips. Hind wing is elliptical shape, dark brown and orange in colour. One large and three small black spots are present at the middle position. Abdomen amber in colour. At ventral side black head with six large white spots. Proboscis down ward. Thorax dark black many white dots. Large legs with black colour. Fore wing dark brown and orange colour. Lower side has light brown and orange colour. Five large white spots, many small white spots and black shade. Two black strip at the epical side. Hind wing light orange colour. Three small black spots and one large spot, at the large spot the inner has white colour and outer side black colour and two strip are present. Abdomen white brown in colour (Figure 1 a-d).

#### Genus *Vanessa* ,Fabricius 1807

##### 2. *Vanessa cardui* (Linnaeus,1758)

**Diagnostic characteristics:** At dorsal side small head black colour , antennae black colour at the end of the antennae bulb like structure is present which is white in colour, large eyes. Thorax black colour with brown hair. Fore wing has red black and white spots, black strip. Hind wing red and black in colour has five black spots on each wings and three strip at the epical side. Abdomen dark black covered with brown hair. At ventral side head light yellow colour large proboscis black colour attached. Thorax light yellow, small light yellow hair and legs attached with light yellow colour. Fore wing has black and white spots and light yellow

in colour. Hind wings has 5 rings are present. First ring has 2 layer half white and brown colour. Second ring has 3 layers , outer black, second layer half white and third layer has purple and brown spot. Third ring has two layer first is half white and inner is green in colour. Fourth ring has 2 layer half white of outer side and inner green in colour. Fifth ring has four layer, outer black then yellow layer, then purple layer and inner black in colour layer is present. Abdomen light yellow colour (Figure 2 a-d).

**Genus *Junonia* Hubner (1819)**

**3. *Junonia almana* (Linnaeus,1758)**

**Diagnostic characteristics:** At dorsal side head round with light brown colour. Medium size antennae dark brown colour. Wide thorax light brown with orange colour small hair. Fore wing orange brown in colour, two rings one large ring and other small ring, ring consist of 4 layers; black, light orange, purple and white colour. Upper side of wing has three dark black segments and two small lines. At the epical region three dark black zigzag strip on each of the wing. Hind wing orange brown in colour. Two rings one large and second small ring . large ring consist of 4 layers; dark black, light brown, dark brown and dark black. At the dark brown layer two small white spots are present. Small ring outer black, second half white third orange and fourth inner black in colour. Abdomen light brown with small brown hair. At ventral side head compound brown eyes. Thorax half white colour attach of light black colour legs. At the fore wing three rings, two rings are small and one ring is large. Three black zigzag at the epical region. Abdomen half white brown (Figure.3 a-d).

**Family Papilionidae**

**Genus *Papilio*, Linnaeus, 1758**

**4. *Papilio demoleus* Linnaeus,1758**

**Diagnostic characteristics:** At dorsal side oval shape head black colour with light yellow strip. Large dark black antennae, bulb like structure is present at the end of antennae that is white in colour. Thorax wide black in colour with two half white strip. Fore wing half white and lack scales, large and small half white segments between the segments light black colour. Hind wing is smaller than the fore wing black and white scales are present. Large and small segments of half white segments light black shade is present one large brown spot on each of the hind wing. Abdomen black in colour with white scales with small light

black hair. At ventral side head oval with yellow white on colour and one black strip at the middle of head two round dark black eyes. Thorax yellow white in colour with black strips. Large legs with white and black in colour. Fore wing half white strip and half white large segments some small segments has large orange in colour and between the segments dark black colour. Hind wing consist of one ring with four layers; outer dark black, second light purple, than orange and last light black in colour. Many segments has half white in colour with light black boundary. Some segments has light orange with black boundary. One large brown spot on each f the hind wing (Figure.4 a-e).

**Family Pieridae**

**Genus *Eurema*, Hübner, [1819]**

**5. *Eurema hecabe* (Linnaeus,1758)**

**Diagnostic characteristics:** At dorsal side head round shape with black colour consist of two small compound eyes. Two small black antennae at the end bulb like structure. Thorax black in colour with yellow shade. Fore wing has yellow colour but their edge has dark black thick line and small black spots on the whole fore wing. Hind wing is yellowish in colour edge dark black thin line and small black spots on the whole wing. Abdomen black in colour. At ventral side head two small brown colour eyes, proboscis black in colour. Thorax yellow colour legs are yellow in colour attached to the thorax. Fore wing and hind are complete yellow colour no black margin are present at the edges area. Black spots on the fore wing and hind wing. Abdomen yellowish colour (Figure.5 a-d).

**Genus *Pieris* Schrank, 1801**

**6. *Pieris canidia* (Sparrman, 1768)**

**Diagnostic characteristics:** At dorsal side black head with two dark black medium antennae. Thorax black in colour with small hair and abdomen is white and black in colour. Fore wing is half white at the epical, small segments with light black lines at the fore wing one light black curved line is present at the top. At ventral side brown coloured eyes between the eyes white hairs are present , two dark black antennae. Thorax has jointed legs with white hair. Abdomen half white in colour. Fore /wing half white in colour with small segment at the epical side. Large curved line at the top of wing. Hind wing small and large segments are present in whole wing with black strip. Hind wing is half white in colour at the top of wing yellow strip (Figure.6 a-e).

Table 1: Study sites and Habitat of butterflies.

S. No	Species	Different localities of Taluka Larkana	Habitat
1	<i>Danaus chrysippus</i>	Akil , Agani, chooharpur, Dhamrah, Dodai, Mahmood dero, Mahhoota and Phul	Calotropis and flowers
2	<i>Vanessa cardui</i>	Akil and Mahmood dero	Tomato, lady finger
3	<i>Junonia almanac</i>	Akil, Agani, Dhamrah, Mahotta and Phul	Sunflower,
4	<i>Papilio demoleus</i>	Agani, Chooharpur, Dhamrah, Mahmood dero and Phul	Lemon and sunflower
5	<i>Eurema hecabe</i>	Akil, Agani, dhamrah, Dodai, Mahmood dero and Mahoota	Mustard and flowers
6	<i>Pieris canidia</i>	Agani, Chooharpur, Dhamrah and Dodai	Flowers

Table 2: Showing Latitude and Longitude of study sites

S. No	Study sites	Latitude (N)	Longitude (E)
1	Akil	27.5789	68.2780
2	Agani	27.6178	68.2978
3	Chootharpur	27.6076	68.2629
4	Dhamrah	27.6506	68.2482
5	Dodai	27.5887	68.2398
6	Mahmood dero	27.5570	68.2028
7	Mahotta	27.5546	68.2170
8	Rasheed Wegan	27.5678	68.2073

Table 3: No. of specimens & Percentage of butterflies species collected from different localities of Taluka Larkana , Sindh, Pakistan. (n=288)

S. No	Taluka	<i>Danaus chrysippus</i>	<i>Vanessa cardui</i>	<i>Junonia almana</i>	<i>Papilio demoleu</i>	<i>Eurema hecabe</i>	<i>Pieris canidia</i>	%
1	Akil	24	3	3	--	7	--	12.8
2	Agani	25	--	1	4	15	1	15.9
3	Chootharpur	30	--	--	6	--	2	13.1
4	Dodai	31	--	--	--	9	1	14.2
5	Dhamrah	35	--	1	2	6	--	15.2
6	Mahmood dero	35	5	--	10	7	2	20.4
7	Mahotta	8	--	2	--	2	--	4.1
8	Rasheed Wegan	10	--	--	1	--	--	3.8

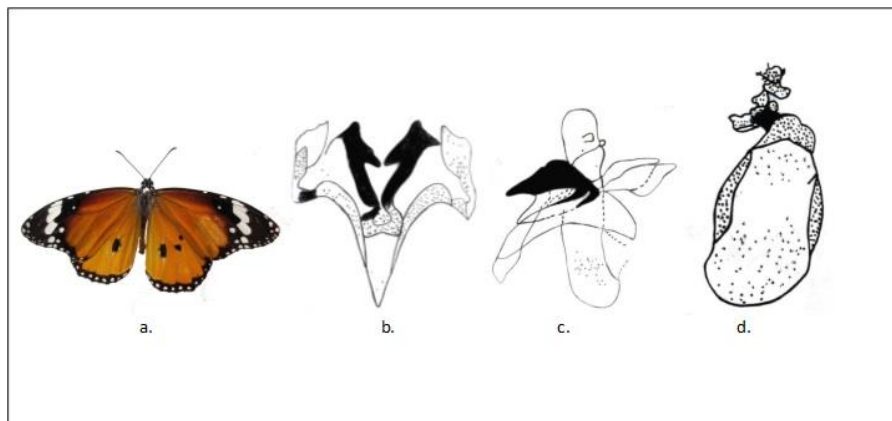


Figure 1: a. Showing *Danaus chrysippus*, b. showing male genitalia of *Danaus chrysippus* (dorsal side), c. showing male genitalia of *Danaus chrysippus* (Lateral side), d. showing female genitalia of *Danaus chrysippus*.

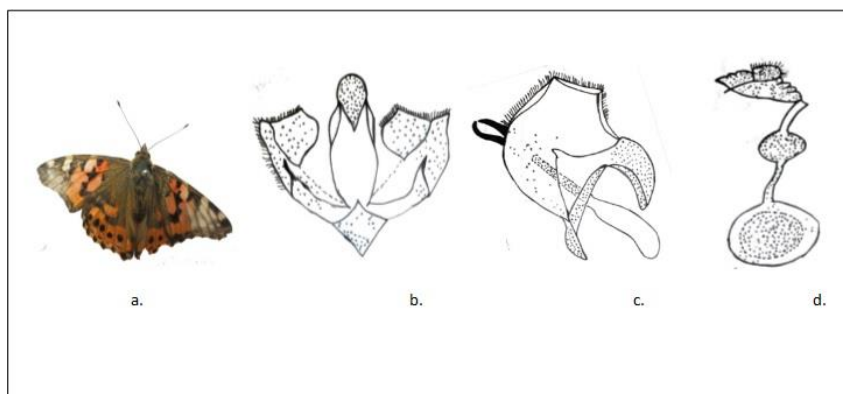


Figure 2: a. Showing *Vanessa cardui*, b. showing male genitalia of *Vanessa cardui* (ventral side), c. showing male genitalia of *Vanessa cardui* (Lateral side), d. showing female genitalia of *Vanessa cardui*,

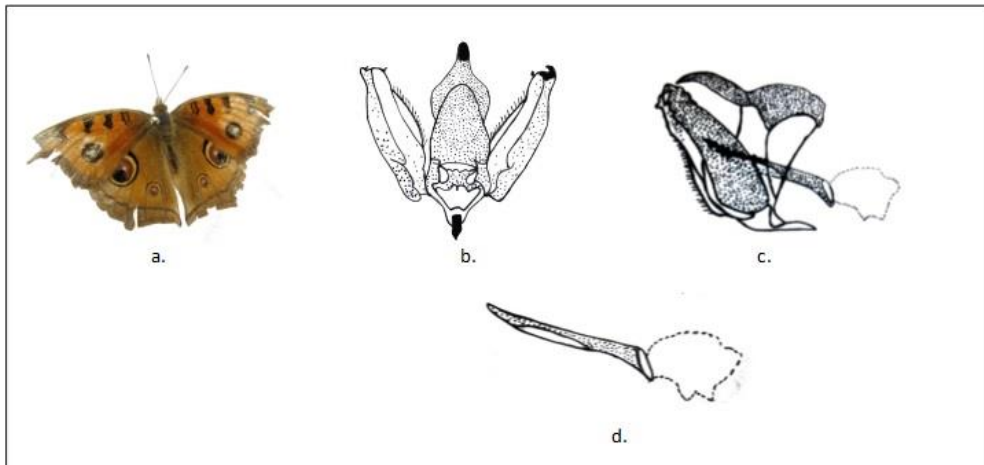


Figure 3: a. Showing *Junonia almana*, b. showing male genitalia of *Junonia almanac* (dorsal side), c. showing male genitalia of *Junonia almana* (Lateral side), d. showing aedeagus of *Junonia almana*.

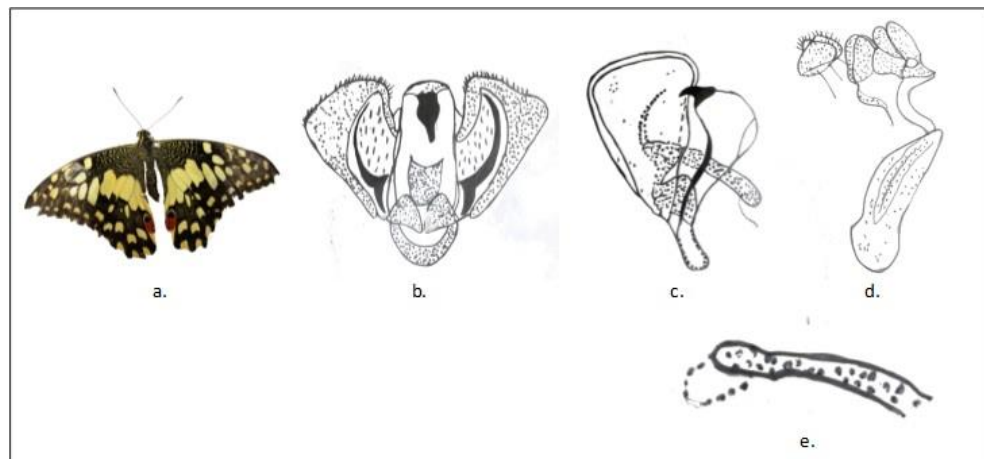


Figure 4: a. Showing *Papilio demoleus*, b. showing male genitalia of *Papilio demoleus* (ventral side), c. showing male genitalia of *Papilio demoleus* (Lateral side), d. showing female genitalia of *Papilio demoleus*, e. showing aedeagus of *Papilio demoleus*.

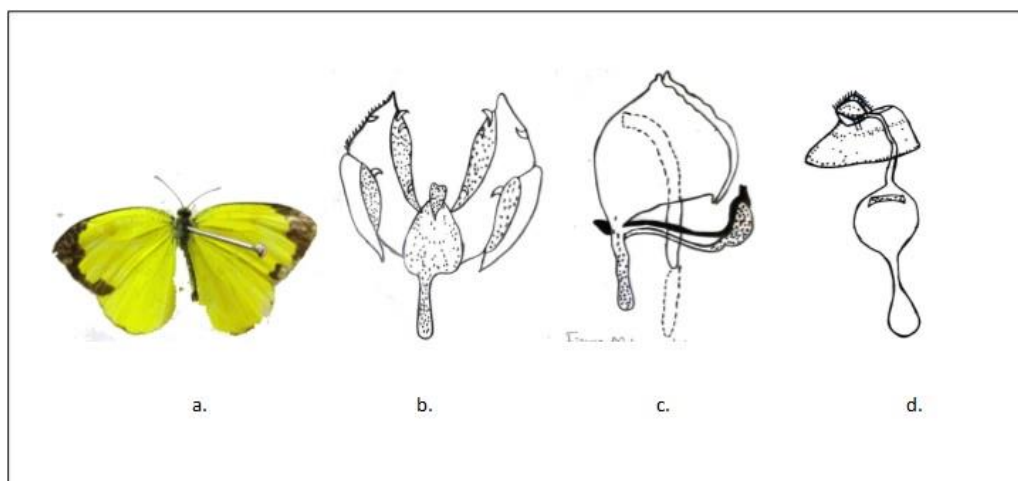


Figure 5: a. Showing *Eurema hecabe*, b. showing male genitalia of *Eurema hecabe* (ventral side), c. showing male genitalia of *Eurema hecabe* (Lateral side), d. showing female genitalia of *Eurema hecabe*.

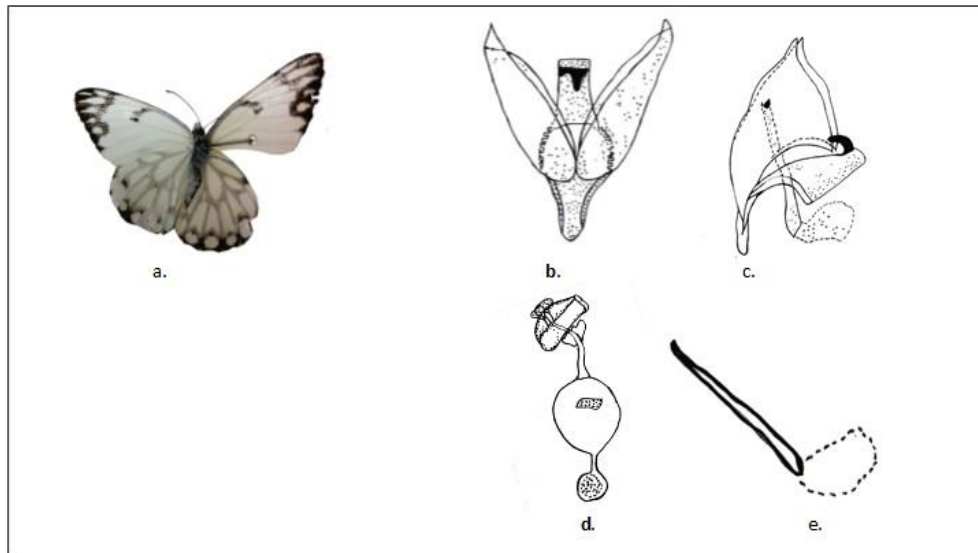


Figure 6: a. Showing *Pieris canidia*, b. showing male genitalia of *Pieris canidia* (dorsal side), c. showing male genitalia of *Pieris canidia* (Lateral side), d. showing female genitalia of *Pieris canidia*, e. showing aedeagus of *Pieris canidia*.

### Conclusions

The present study was concluded the finding of 06 species under 06 genera of butterflies from taluka Larkana. Further research work should be conducted to identify more species of butterflies from Sindh province of Pakistan.

### Authors' Contribution

Mangi, conducted the research; Shaikh, A and Soomro, S procced the data analysis, Mirbhar, A & Mustafa, SB made line drawings and captured the digital images, Panhwar, W wrote the manuscript, and Sirohi, M. identified the host plants.

### Conflict of Interest

Authors have no conflict of interest

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