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# REDESCRIPTION OF TWO MILKWEED BUTTERFLIES OF GENUS *DANAUS*, KULK

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## ABSTRACT

Two species of genus *Danaus* Kluk (1802), *Danaus chrysippus* Linnaeus (1758) and *Danaus genutia* Cramer (1779), commonly called monarchs, queens and milkweed butterflies are re-described. This re-description is based on coloration of wings, structure of mouthparts, maxillary palpi and internal male and female genitalia. The occurrence of these species of butterflies is new record from Jamshoro, Sindh, Pakistan.

**Keywords:** Re-description, Butterflies, *Danaus* KULK, Jamshoro, Sindh.

## INTRODUCTION

The genus *Danaus* Kluk (1804) belongs to subfamily Danainae (Nymphalidae: Lepidoptera) commonly called Monarchs, Queens and Milkweed butterflies. By the end of the 18th century, four species of genus *Papilio* (*Papilio chrysippus* L., *Papilio plexippus* L., *Papilio genutia* Cramer and *Papilio gilippus* Cramer) which are now included in Old World species of genus *Danaus* Ackery & Vane-Wright (1984). During the nineteenth century European taxonomists especially from German added five further Old World species under the different generic names *Danais* Latreille, *Danaida* Latreille, *Euploea* Fabricius and *Limnas* Hübner, finally *Danaus* was considered as a genus. Eleven species of *Danaus* species are now recognized Ackery& Vane-Wright (1984). Out of eleven species, five old world species found in Australia, other five species are distributed worldwide and one species *Danaus chrysippus* L. is cosmopolitan. *Danaus* is divided into three subgenera, *Danaus* that comprises three species, *Salatura* Moore comprises four species and *Anosia* Hübner comprises four species. Species of the genus *Danaus* are most noticeable and abundant among all recorded butterflies; all the species are medium to large size and multicolored, such as orange, yellow or brown with black and white marking Larsen (1977, 1984). Mostly other group of the milkweed butterflies dwells in the forest, but species of the genus *Danaus* found in open country, ranging from semi-desert to light woodland and coastal areas. The color of *Danaus and* their bad taste serves as defense mechanism therefore predators avoid to eat them (Brower *et al.*, 1967).

Jamshoro district has variable geographical conditions such as semi desert, agriculture areas and revirine belt along with river Indus. To keep in mind such variable habitats, it was need to work on the genus *Danaus*. The larvae of these species feed on milkweed, which grows throughout Jamshoro. Many scholars carried out research on the butterfly fauna throughout the world including Pakistan; they reported different species of *Danaus* on morphological characters. Due to climatic change, pollution and use of pesticides the species of butterflies going to decline. Therefore, there was great need to work on the species of *Danaus* to know their recent status and these species are redescribed on the basis of morphological characters along with male and female genitalia.

## MATERIALS AND METHODS

The specimens were collected from the different localities of district Jamshoro. The terminology followed of Ehrlich (1958), with modifications from the classical and recent literature for the Lepidoptera Matsuda (1976); Scoble (1992); Mielke *et al.* (2004); Paluch *et al.* (2008); Leite *et al.* (2010 a, b, 2011). Color patterns were identified, following the descriptions of Owen *et al.* (1994). For the examination of male and female genitalia, the abdomen of the specimen was removed from the body, boiled into 10% potassium hydroxide (KOH) for five minutes. The abdomen was dissected with the help of fine pointed forceps from lateral side, genitalia was separated from abdomen, washed with tap water and then examined under the dissecting microscope. Genital material was preserved into micro vial with a drop of Glycerin and pinned with specimen. Genital terminology is followed of Klots (1970) and Winter (2000). All measurements were taken in millimeters. The measurements of various parts of the body were taken with the help of an ocular micro millimeter and illustration was made by using ocular graph on the dissecting microscope.

## RESULTS

**Genus *Danaus* KLUK (1804)**

**Coloration:** Head black with tufts of white scales, antennae and proboscis black, maxillary palpi covered with white and black scales; thorax black with white spots, fore and hind wings tawny; abdomen yellow.

**Shape:** Head round, antennae slender without scales, gradually clavate but without a distinct club-shaped, eyes large, maxillary palpi well developed, slightly compressed, proboscis long and highly coiled; thorax, fore wings simple, terminal margins never dentate or caudate, hind wings with terminal margin never dentate, cell closed, with patches of modified scales around the cell; legs with tibia as long as the femur with long hairs, in females wide and club-shaped, with four segments, all firmly joined together; abdomen slender.

**Key to the species of genus *Danaus* KLUK (1804) of Pakistan**

1. Fore wing tawny with black boarder, apical half of the wing black with white bands; hind wing tawny, black boarder with two irregular series of white spots, in male under side black and white spot; veins marked with black bands; apophysis posterior, thorn - like; ductus bursae long; corpus bursae balloon like with rod like cornuti (Fig. 1)……***Danaus genutia* Linnaeus**

--- Fore wing bright orange with black border, apical half of the wing black with white spots but shape of spots not as above .....……..…….……2

2. Hind wing bright orange, outer border black with two regular series of white spots, upper side one black spot in male; veins prominently marked with black bands……***Danaus plexippus* Linnaeus**

--- Hind wing tawny, outer boarder black with one series of white spots; veins without black bands.....3

3. Fore wing tawny with black boarder; hind wing tawny, black boarder with one series of white spots; corpus bursae stumpy; corpus bursae balloon like with plate like cornuti (Fig. 2)

***Danaus chrysippus* Cramer**

--- Fore wing furiginous black with very broad subhyaline streaks and bluish white spots; apophysis rod like, corpus bursae bean shaped

***Danaus limniace* Cramer**

***DANAUS GENUTIA* CRAMER (1779)**

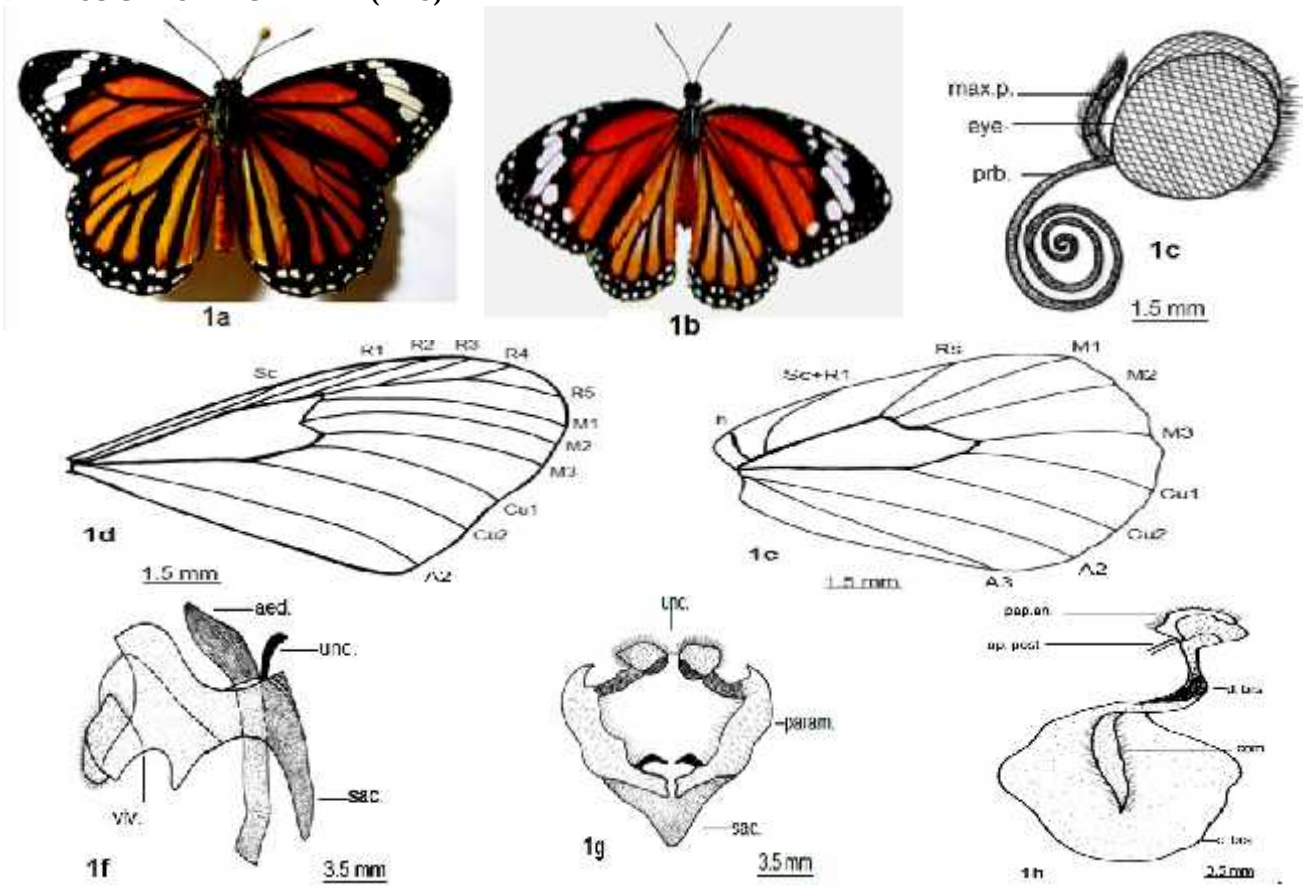



**Figure 1. *Danaus genutia* Cramer; 1a, male; 1b, female; 1c, head; 1d, fore wing; 1e, hind wing; 1f, male genitalia (lateral view); 1g, male genitalia (ventral view); 1h, female genitalia.**

**Coloration:** Head black, white spotted with tufts of white scales, eyes brownish black, antennae and proboscis black, maxillary palpi covered with black and white large scales; thorax black with white spots, forewings, ground color tawny, upperside brighter than underside, half of the apical part black with white bands, veins marked with broad black bands, costal margin, apex and terminal margin black with semicircular white spots, hind wings, ground color tawny, upperside brighter than underside, veins marked with broad black bands, apex and terminal margin black with two rows of semicircular white spots; abdomen yellowish.

**Shape:**

**Head** (Fig. 1c): Head round, eyes large, antennae slender, without scales, maxillary palpi well developed, third segment small, proboscis large, highly coiled.

**Thorax**:

***Fore Wing*** (Fig. 1d): Triangular, longer than hind wing, costa widely arched, apex round, termen slightly concave, discoidal cell elongated, covered half length of wing; veins, Sc (Subcosta) arises from the base of wing, ending at the middle of the costal margin, R (Radial) arises next to and parallel to Sc, at distally forks into $R_1$ and Rs, later being divided into $R_2$, $R_3$, $R_4$ and $R_5$, $R_2$ and $R_3$ parallel and ending before apex of the cell, $R_4$ ending at the apex of the cell, $R_5$ ending on the terminal margin, $M_1$ begins from upper apex of discal cell, $M_2$ begins from middle of the discal cell, $M_3$ begins from lower apex of the discal cell, $Cu_1$ and $Cu_2$begin separately from discal cell for an unequal distance, $A_2$ arises from the axillary region, separately from the distal cell up to the tornus of the wing.

***Hind Wing*** (Fig. 1e-1f): Somewhat oval shaped, costa straight, termen sinuated, dorsum straight, discoidal cell more than half length of the wing; veins, Sc+ $R_1$arises from the axillary region, short and separated from $R_1$, humeral (h) curves toward the proximal region of the costal margin begins from Sc+$R_1$ and Rs, $M_1$ originated from upper apex of the discal cell, $M_2$ originates from middle of the discal cell, $M_3$ originates from lower apex of the cell, $Cu_1$ parallel to $Cu_2$, two veins $A_2$ and $A_3$arise from the axillary of the wing, $A_2$ ending at the tornus of wing, $A_3$ ending at dorsal margin.

**Abdomen:** Abdomen slender, a pair of protrusible brushes of hairs at the abdomen end of male

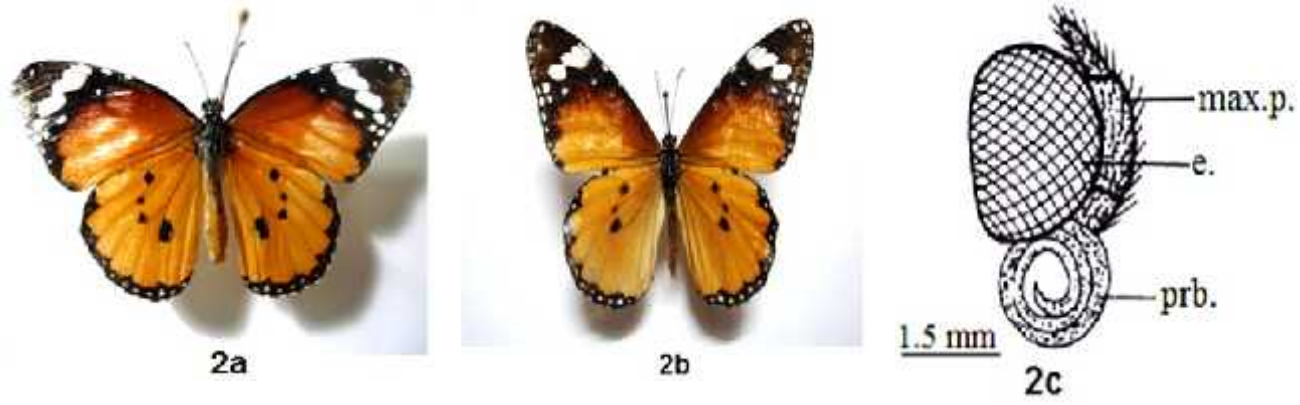
***Male genitalia*** (Fig. 1g): Symmetrical, Uncus sclerotised, elongated downward curved, slender at apex, tegumen short, broad dorsally, saccus V-shaped, valva elongated, basal part narrow, outer margin sinuated, inner margin sinuated with small hair, distally somewhat rounded lobe covered with hair, aedeagus broad, long, curved, anteriorly narrow, posteriorly broad.

***Female Genitalia*** (Fig. 1h): Papillae anal small, somewhat rounded, covered with hair, apophysis posterior large, thorn-like, apophysis anterior reduced, ductus bursae large, highly covered, corpus bursa large, balloon-like with pair of rod-like sclerotised cornuti.

**Material examined:** 15♂ and 13♀, Jamshoro, 23-24.iii.2013, 16-18.iv.2013. leg. (B. Mal). Deposited at Entomology laboratory, Department of Zoology, University of Sindh.

**Comparative notes:** *Danaus genutia* is closely related to *Danaus plexippus* having veins marked with black bands in both fore &hind wings but differ in having apical of fore wings black with white bands.

**1. *DANAIS CHRYSIPPUS* (L)**



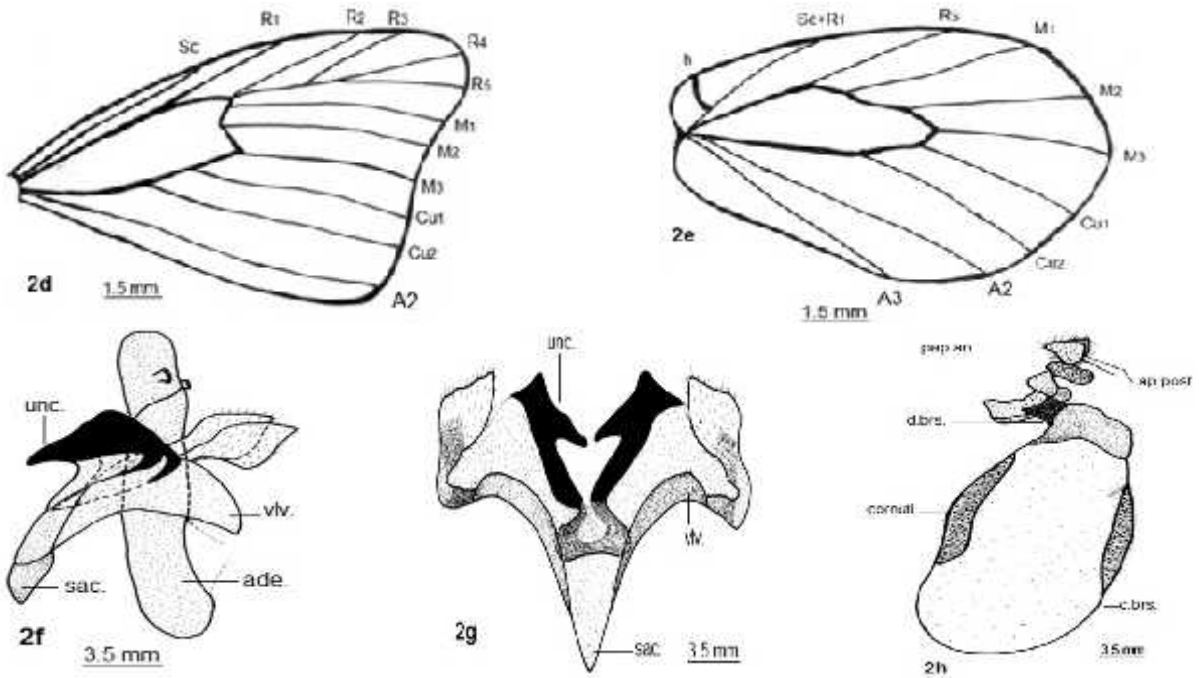



**Figure 2. *Danaus chrysippus* L.; 2a, male; 2b, female; 2c, head; 2d, fore wing; 2e, hind wing; 2f, male genitalia (lateral view); 2g, male genitalia (ventral view); 2h, female genitalia.**

**Coloration:** Head black, white spotted with tufts of white scales, eyes brownish black, antennae black, maxillary palpi covered with black and white large scales; thorax black with white spots, forewings, ground color tawny, upperside brighter than underside, half of the apical part black with white bands, costal margin, apex and terminal margin black with semicircular white spots, hind wings, ground color tawny, upperside brighter than underside, three black spots around the cell, in male one scent-producing white spot with a thick black border in post discal area, apex and terminal margin black with one row of semicircular white spots; abdomen yellowish.

**Shape**

**Head** (Fig.2c): Head round; antennae slender, eyes large, maxillary palpi well developed, second segment larger than first and third segment, proboscis large, highly coiled.

**Thorax**:

***Fore Wing*** (Fig. 2d): Triangular, slightly longer than hind wing, costa widely arched; apex round, termen slightly concave, discoidal cell closed, elongated, well over half length of wing; veins, Sc (Subcosta) arises from the axillary of the wing, ending at the middle of the costal margin, R (Radial) arises next to and parallel to Sc, at distally forks into $R_1$ and Rs, later being divided into $R_2$, $R_3$, $R_4$ and $R_5$, $R_2$ and $R_3$ ending before apex of the cell, $R_4$ ending at the apex of the cell, $R_5$ ending on the terminal margin, $M_1$ begins from upper angle of discal cell, $M_2$ begins from middle of the discal cell, $M_3$ begins from lower angle of the discal cell, $Cu_1$ and $Cu_2$ begin separately from discal cell for an unequal distance, $A_2$ arises from the axillary region, separately from the distal cell up to the tornus of the wing.

***Hind Wing*** (Fig. 2e): Pear shaped, costa straight, apex round, termen sinuated, dorsum straight, discoidal cell closed, more than half length of the wing; veins, Sc+ $R_1$ arises from the axillary region, short and separated from $R_1$, humeral (h) curves toward the proximal region of the costal margin begins from Sc+$R_1$ and Rs, $M_1$ originated from upper angle of the discal cell, $M_2$ originates from middle of the discal cell, $M_3$ originates from lower angle of the cell, $Cu_1$ parallel to $Cu_2$, two veins $A_2$ and $A_3$ arise from the axillary of the wing, $A_2$ ending at the tornus of wing, $A_3$ ending at dorsal margin.

**Abdomen**: Abdomen yellowish orange; a pair of protrusible brushes of hairs at the abdomen end of male

***Male genitalia*** (Fig. 2f-2g) Uncus sclerotised, curved, slender distally; tegumen broad; juxta plate-like, bilobed; saccus V-shaped, without saccular process; valva broad, outwardly curved, distally cone-shape lobe with small hair; aedeagus broad, rod-like, dorsoventrally curved, dorsally a pair of hex-dentate thecal appendage, ventrally membranous lobe

***Female Genitalia*** (Fig. 2h): Papillae anal small, triangular, beset with small scales, apophysis posterior large, thorn-like, apophysis anterior reduced, ductus bursae short, wide, corpus bursa large, balloon-like with pair of plate-like sclerotised cornuti.

**Material examined:** 23♂ and 30♀, Jamshoro, 23-27.iii.2013, 15-19.iv.2013.leg. (B. Mal). deposited at Entomology laboratory, Department of Zoology, University of Sindh.

**Comparative Notes:** *Danaus chrysippus* is closely related to *Danaus plexippus* having on obvious single scent-patch on hind wing of male but differ in having hind wing with a row of white spots on black terminal margin.

**Table No. 1. Measurements of different body parts of *Danaus genutia* C. (Sample sizen.10)**

| Body parts of specimens | (Male∪) Range (mm) | Mean (mm) | St. Dev. (mm) | (Female `) Range (mm) | Mean (mm) | St. Dev. (mm) |
|---|---|---|---|---|---|---|
| Length of head | (2.0-2.4) | 2.2 | ±0.14 | (2-2.5) | 2.26 | ±0.19 |
| Length of thorax | (7.1-7.4) | 7.3 | ±0.12 | (7.2-7.5) | 7.36 | ±0.14 |
| Length of abdomen | (11.9-12.4) | 12.1 | ±0.23 | (12-12.4) | 12.14 | ±0.14 |
| Total body length | (18.8-19.1) | 18.27 | ±0.13 | (19-19.4) | 19.14 | ±0.19 |
| Length of antenna | (12-12.2) | 12.06 | ±0.08 | (12-12.5) | 12.18 | ±0.21 |
| Span of fore wing | (34.8-35) | 34.7 | ±0.41 | (35-35.4 | 34.08 | ±0.17 |
| Span of hind wing | (27-27.3) | 27.16 | ±0.15 | (27-27.5) | 27.22 | ±0.22 |

Sample size of each stage of measurement was ten specimens

**Table No. 2. Measurements of different body parts of *Danaus chrysippus*L.**

| Body parts of Specimens | (Male∪) Range (mm) | Mean (mm) | St. Dev. (mm) | (Female `) Range (mm) | Mean (mm) | St. Dev. (mm) |
|---|---|---|---|---|---|---|
| Length of head | (2-2.3) | 2.2 | ±0.12 | (2-2.4) | 2.22 | ±0.14 |
| Length of thorax | (7-7.4) | 7.28 | ±0.16 | (7-7.4) | 7.22 | ±0.16 |
| Length of abdomen | (11.7-12.4) | 12.06 | ±0.28 | (11.9-12.4) | 12.12 | ±0.21 |
| Total body length | (18.8-19.1) | 18.9 | ±0.13 | (18.9-19.1) | 18.9 | ±0.10 |
| Length of antenna | (11.9-12.2) | 12.04 | ±0.11 | (12-12.3) | 12.12 | ±0.13 |
| Span of fore wing | (34.8-35.3) | 34.9 | ±0.23 | (35-35.4) | 35.01 | ±0.14 |
| Span of hind wing | (26.9-27.3) | 27.14 | ±0.18 | (27-27.4) | 27.19 | ±0.17 |

Sample size of each stage of measurement was ten specimens.


**Fig.3. Map of District Jamshoro showing the sampled sites**

## DISCUSSION

Two species of genus *Danaus* KLUK (1804) *Danaus genutia* C. and *Danaus chrysippus* L. recorded by many researchers from different localities of different provinces of Pakistan viz: Abbas *et al.* (2000) from Skardu region; Roberts (2001) from different localities of Pakistan; Zahoor *et al.* (2003) from Faisalabad; Akhtar *et al.* (2006) from Lahore; Mohammad and Ahmed (2013) from Bahram Dehri (Khyber Agency); Khan *et al.* (2007) from Azad Kashmir; Tayyab *et al.* (2012) from Bahawalpur; Parveen and Ahmed (2012, 2014) from Kabal, Swat and Kohat (KPK) and Sajjad and Burhan (2012) from Multan. These species have recorded for the first time from Jamshoro, Sindh. Previously, scholars described these species based on external morphological characters (shape of mouth parts, wing venation and wing coloration etc.), studies of this nature in comparison with presence of large and diverse fauna of butterflies is not sufficient for the taxonomists to distinguish from relative species or subspecies. Previously they ignored their genital structure, because most of the species are similar in the morphological characters but their genitalia is different from one another that is why these species are described on the basis of the genitalia.

Tables 1 & 2 show that, there was slight difference in body size of *Danaus genutia*(Cramer) and *Danauschrysippus* L., and their body color is also same. Sometime through morphological charaters, we cannot identify species of the same genus. Therefore, genital structure of male and female of the species is the most important source in taxonomy for clear identification of the different species and subspecies. Lepidoptera classification is based on genitalia. The shape, structure and dimensions of genital parts as uncus, tegumen, vinculum, vulvae and aedeagus of male and papillae, apophysis, ductus bursae and corpus bursae of female as the major parameters and played vital role in establishing species status. Therefore here we have described and illustrated internal and external male and female genitalia of both species which further provided the distinct differentiation in both species.

**Abbreviation:**

A - Anal vein
Aed- Aedeagus
Ap.ant- Apophysis anterior
Ap.postApophysis posterior
C.brs- Corpus bursae
Cu- Cubitus
D.brs- Ductusbursae
E- Eye
H- Humeral
Max.p- Maxillary palpi
M- Median vein
Prb- Proboscis
R- Radius vein
Sac- Saccus
Sc- Sub costal
Teg- Tegumen
Thec.apen- Thecal appendage
Unc- Uncus
Vlv- Valva

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