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TAXONOMIC STUDIES ON SOME SPECIES OF BUTTERFLIES FROM DHARAMPUR AREA IN DISTRICT MANDI, HIMACHAL PRADESH

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ABSTRACT: In the present study, diversity and distribution of butterflies in Dharampur area showed a total of 33 species belonging to 25 genera, six families, and two superfamilies. Besides, these external genitalia of nine species of butterflies have been studied in detail and specimens of these species were collected from different localities in and around Dharampur area (between 30°-22´ to 33°-12´ North latitude and 75°-47´ to 79°-04´ East longitudes; elevation ranging from 350 to 6500 m). Variation in the genitalia of nine species (*Papilio polytes romulus* Cramer, *Delias belladonna horsfieldi* [Gray], *Pieris brassicae nepalensis* Doubleday, *Catopsilia crocale* Cramer, *Parantica aglea melanoides* Moore, *Parantica sita sita* [Kollar], *Junonia iphita* [Cramer], *Cynthia cardui* [Linn.], and *Sarangesa dasahara* [Moore]) study has proved very promising for their use at different levels of taxonomic treatments in these species.

INTRODUCTION

Taxonomic diversity is a measure of the number of known phyla of organisms and was greatest during Cambrian time. Species diversity and the number of families have further been divided into classification, identification, and nomenclature. The ultimate task has undergone, a net increase between the Cambrian and Pleistocene epoch (Groombridge, 1992). Systematics provides the basis framework for whole of the biology and it is the fundamental discipline of biodiversity (Alfred et.al., 1998). Diversity can be measured by the species richness in an area and genetic differences. Genetic difference is now being prepared to measure directly or indirectly through the use of taxonomic (cladistic) hierarchy (Williams *et al.* 1991).

The complex nature of reproductive organs of butterflies plays a crucial role in the identification of certain groups of butterflies. Subtle differences in genitalia structure may prevent mating between individuals of the same species, thus giving rise to two sexually isolated groups in a species. These structural

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differences in genitalia then maintain differences in other characters among closely related groups Heppner, 1998).

MATERIALS AND METHODS

Diversity and distribution

Intensive and extensive random surveys were conducted to explore the study of some butterflies in Dharampur area ((between 30 ˚-22´to 33 ˚-12´North latitude and 75˚-47´to 79˚-04´East longitudes; elevation ranging from 350 to 6500 m).

Collection of Butterflies

During field surveys an insect net was used in order to collect butterflies, the net was placed over a resting insect settled on the ground. A net consisted of a cloth bag or nylon net bag attached to a metal ring, which holds the mouth of the open bag and a handle to which the metal ring was attached. A ring made up of thick wire 38cm in diameter was used. The depth of the bag was 75 cm. Butterflies were removed gently after they became enclosed in the bag by a rapid twist of the handle (Arora, 1990).

Preservation

During field surveys, the freshly collected specimens were kept in a triangular paper envelope. Each envelope contains temporary label, bearing physiographic details about locality such as latitude, altitude, longitude, temperature, humidity etc. for taxonomic study with a lead pencil. Butterflies were pinned with stainless steel needle of 38 mm length, nos. 3 and 5 large and 20 for small specimens. Afterwards the packets cointaining butterflies were kept inside the insect boxes, with thin layer of cotton surrounding them. Paradichlorobenzene was also kept in boxes for better preservation of lepidopterans. In laboratory, butterflies were put in a relaxing chamber, followed by pinning perpendicularly through the middle of thorax at a point equidistant between the bases of forewings. The wings were spread by using paper strips. Thereafter, the butterflies were allowed to dry in a dessicator for

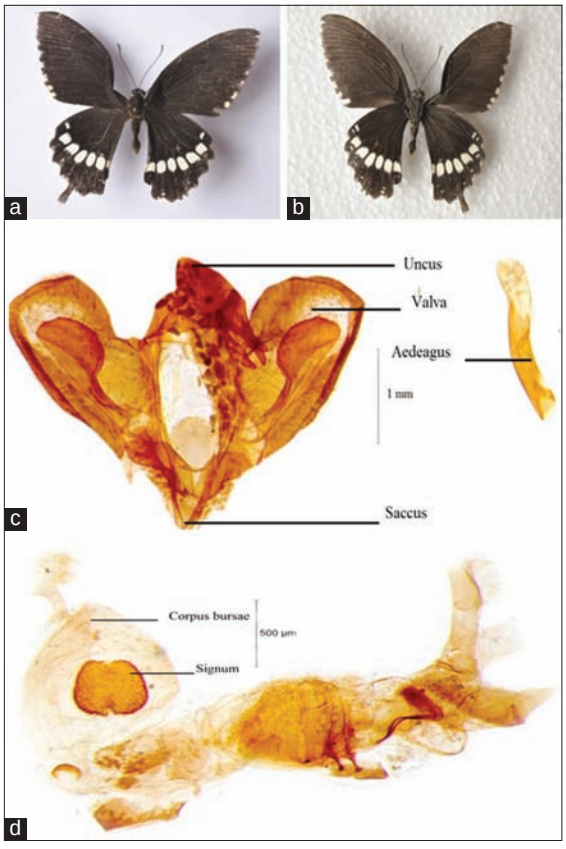

Figure 1: (a) *Papilio polytes romulus* (Cramer) UP. (b) *Papilio polytes romulus* (Cramer) UN. (c) Male genitalia of *Papilio polytes romulus* Cramer. (d) Female genitalia of *Papilio polytes romulus* Cramer.

2-3 weeks depending upon the climatic conditions. The dried specimen were transferred to air tight insect boxes containing powdered naphthalene and already treated with benzene. A label written with black Indian ink was fixed for each specimen (Arora, 1990).

Wing venation

Before preparing the temporary mounts of the wings of all the individuals, series of individuals representing different specimens, were randomly selected. Reference numbers were allocated to the individual/species. The individuals differing in minor morphological variations were given separate number for the confirmation of their conspecific native at a later stage, the studying of veins by toluene or

Table 1: Distribution of some butterflies species in different localities of Dharampur area of Mandi, Himachal Pradesh.

S. No.	Taxon	Dharampur	Sajao Piplu	Jodhan	Mohin	Tihra	Marhi	Bnehardi
	Family: *Papilionidae*							
1.	*Papilio polytes romulus* Cramer	–	+	+	–	+	–	+
2.	*Papilio polytes* form *stichius* Cramer	+	–	–	+	–	+	–
3.	*Papilio demoleus demoleus* (Linn.)	+	+	–	–	+	–	+
4.	*Graphium doson* Felder	–	+	–	+	–	–	–
	Family: *Pieridae*							
5.	*Delias belladonna horsfieldi* (Gray)	+	–	+	–	–	–	–
6.	*Pieris canidia indica* Evans	–	+	+	–	–	+	–
7.	*Pieris brassicae nepalensis* Doubleday	+	+	+	–	+	+	+
8.	*Catopsilia crocale* (Cramer)	+	–	+	–	+	–	–
9.	*Gonepteryx rhamni nepalensis* Doubleday	+	+	–	+	–	+	–
10.	*Eurema laeta laeta* (Boisduval)	–	+	+	–	+	–	+
11.	*Eurema hecabe fimbriata* (Wallace)	+	–	+	–	–	–	+
12.	*Coliaselecto fieldi* Menetries	+	–	+	–	+	–	–
	Family: *Danaidae*							
13.	*Danaus chrysippus chrysippus* (Linn.)	+	+	+	–	+	+	+
14.	*Parantica aglea melanoides* (Moore)	–	+	–	+	–	–	+
15.	*Parantica sita sita* (Kollar)	+	–	+	–	–	+	–
16.	*Euploea core core* (Cramer)	–	+	–	–	+	–	–

(Contd...)

Table 1: ***(Continued).***

S. No.	Taxon	Dharampur	Sajao Piplu	Jodhan	Mohin	Tihra	Marhi	Bnehardi
	Family: *Satyridae*							
17.	*Mycalesis mineus mineus* (Linn.)	–	–	–	+	+	–	+
18.	*Ypthima ceylonica hubneri* (Kirby)	–	+	+	–	–	–	-
	Family: *Nymphalidae*							
19.	*Neptis hylas astola* (Moore)	–	+	–	+	–	+	–
20.	*Junonia lemonias* (Linn.)	+	–	+	–	–	+	–
21.	*Junonia iphita* (Cramer)	–	–	+	–	+	–	–
22.	*Cynthia cardui* (Linn.)	+	–	+	–	+	–	+
23.	*Phalanta phalantha* (Drury)	–	–	+	–	+	–	–
24.	*Ariadne merione* (Cramer)	+	–	+	–	–	+	–
	Family: *Erycinidae*							
25.	*Libythea myrrha* Godart	–	+	–	+	+	–	–
26.	*Dodona durga* (Kollar)	+	–	+	–	–	–	–
27.	*Dodona eugenes* Bates	–	+	–	–	–	–	+
	Family: *Lycaenidae*							
28.	*Pseudozizeeria maha* (Kollar)	–	–	+	–	–	+	–
29.	*Heliophorus epicles*	–	–	–	–	+	–	–
	Family: *Hesperiidae*							
30.	*Tagiades menaka* (Moore)	+	–	–	+	–	–	+
31.	*Sarangesa dasahara* (Moore)	–	+	–	+	–	–	+
32.	*Potanthus dara* (Kollar)	–	+	–	–	–	–	–
33.	*Parnara guttatus* (Bremer and Gray)	–	–	–	–	–	+	–

chloroform provide only a momentry clarity to the surface of the wings. The permanent slides of the wings were prepared in order to have a clear picture of venation, which provide stable diagnostic characters

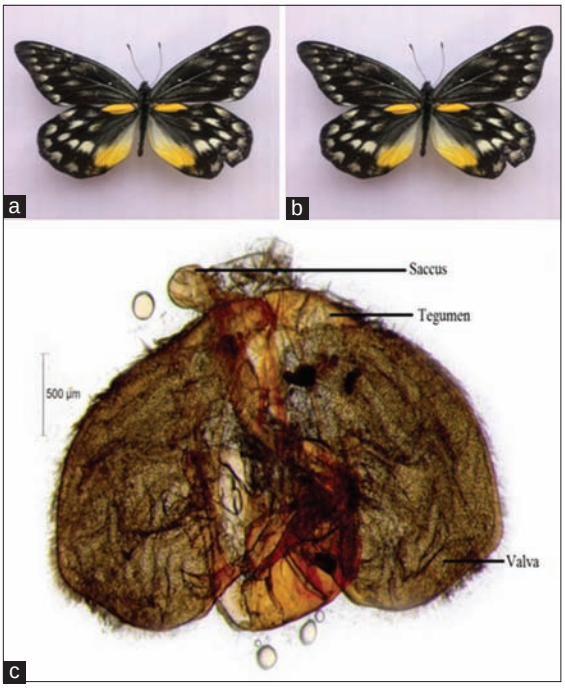

Figure 2: (a) *Delias belladonna horsfieldi* (Gray) UP. (b). *Delias belladonna horsfieldi* (Gray) UN. (c) Male genitalia of *Delias belladonna horsfieldi* (Gray).

for identification and classification of lepidopterans in general (Evans, 1932; Talbot, 1947). Both the fore and hindwings were removed from dried specimen with an upward jerk and then dipped in 70% alcohol for about twelve to fourteen hours for automatic descaling. However, in the case of bigger and harder wings, the process of descaling was facilitated with the help of a camel hair brush (No. 2). The descaled wings were dehydrated and stained in 90% alcoholic eosin. After complete dehydration, these were cleared in clove oil before mounting them on glass slides in Canada balsam.

Genitalia Preparation

For the examination of genitalia, the abdomen of Lepidopterans was detached by applying a little jerk in upward direction. The detached abdomen was then put in to 10% KOH solution and the same was put in an oven for 10-12 hours at about 45 ºC in order to soften the chitin and to dissolve away the muscles.

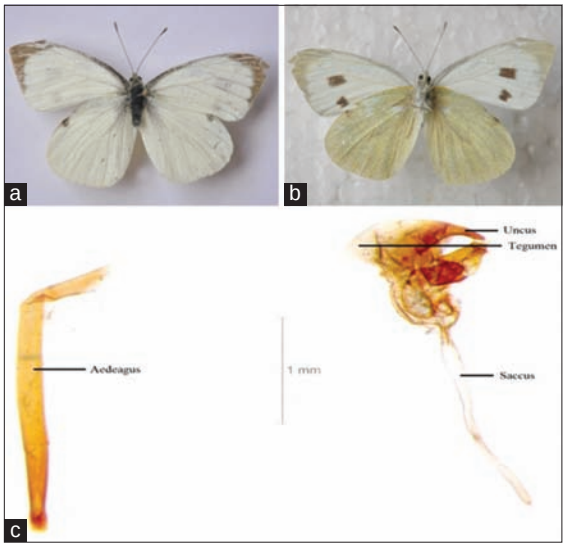

Figure 3: (a) *Pieris brassicae nepalensis* (Doubleday) UP. (b) *Pieris brassicae nepalensis* (Doubleday) UN. (c) Female genitalia of *Pieris brassicae nepalensis* Doubleday

The material was then washed in distilled water. After proper washing, material was dissected in 10% alcohol and genitalia were removed with the help of fine needles and forceps, watching under Zoom binocular microscope. For dissection, different processes were followed for removal of male and female genitalia (Martin, 1996).

It was then gradually upgraded and dehydrated in various grades of alcohol cleared in clove oil and mounted in Canada balsam. Mounting of female genitalia done on ordinary plain shades as compare to cavity slides for the male so as to preserve curvature of its various component parts under the stereomicroscope.

RESULTS AND DISCUSSION

Taxonomic studies were conducted on some butterflies species of Dharampur area in Himachal Pradesh. Insect collections were made at regular intervals from seven localities of this area from April 2017 to November 2017. Present studies explored 33 species of butterflies belonging to 8 families and 25 genera in this area. Out of this diversity, distribution and wing venation were conducted on all 33

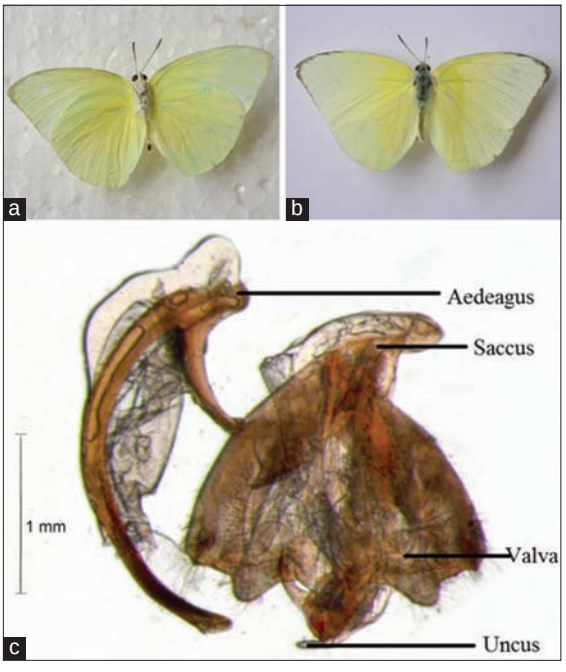

Figure 4: (a) *Catopsilia crocale* (Cramer) UP. (b) *Catopsilia crocale* (Cramer) UN. (c) Male genitalia of *Catopsilia crocale* (Cramer).

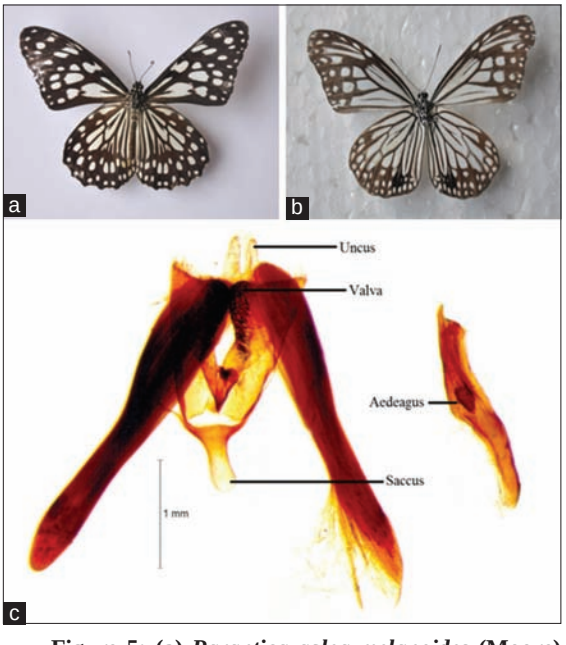

Figure 5: (a) *Parantica aglea melanoides* (Moore) UP, (b) *Parantica aglea melanoides* (Moore) UN. (c) Male genitalia of *Parantica aglea melanoides* (Moore).

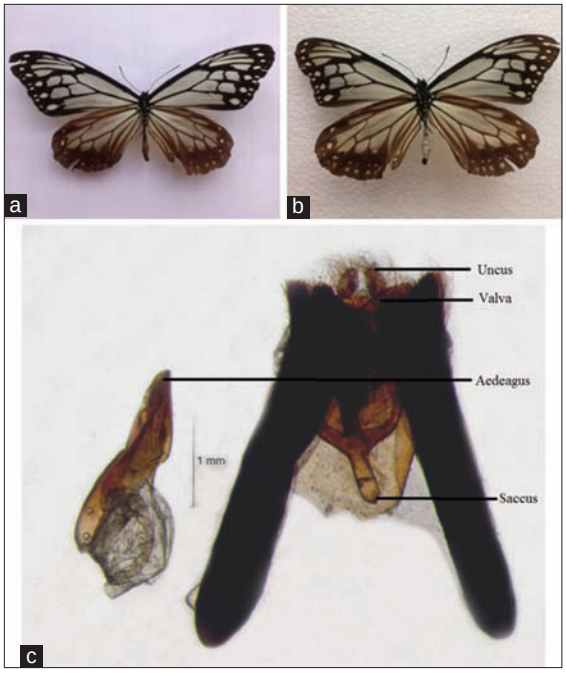

Figure 6: (a) *Parantica sita sita* (Kollar) UP, (b) *Parantica sita sita* (Kollar) UN. (c) Male genitalia of *Parantica sita sita* (Kollar).

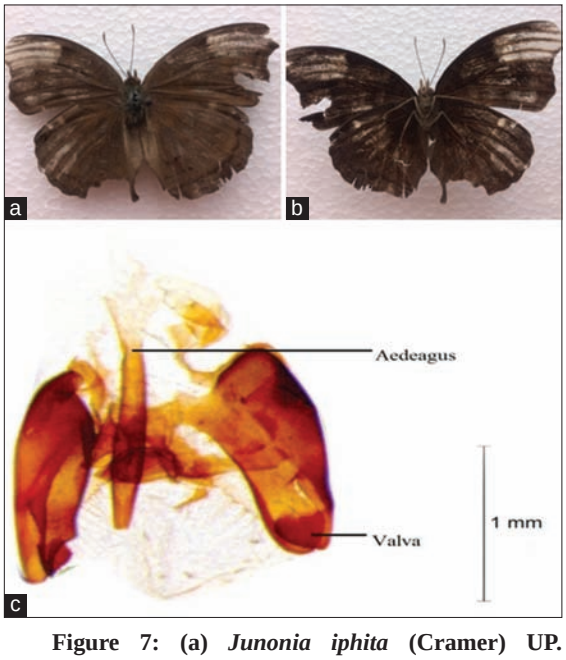

Figure 7: (a) *Junonia iphita* (Cramer) UP. (b) *Junonia iphita* (Cramer) UN. (c) Male genitalia of *Junonia iphita* (Cramer)

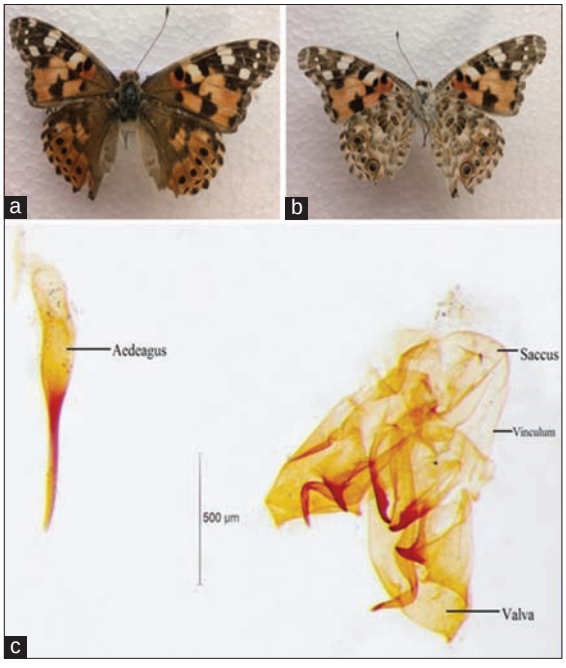

Figure 8: (a) *Cynthia cardui* (Linn.) UP. (b) *Cynthia cardui* (Linn.) UN. (c) Male genitalia of *Cynthia cardui* (Linn.).

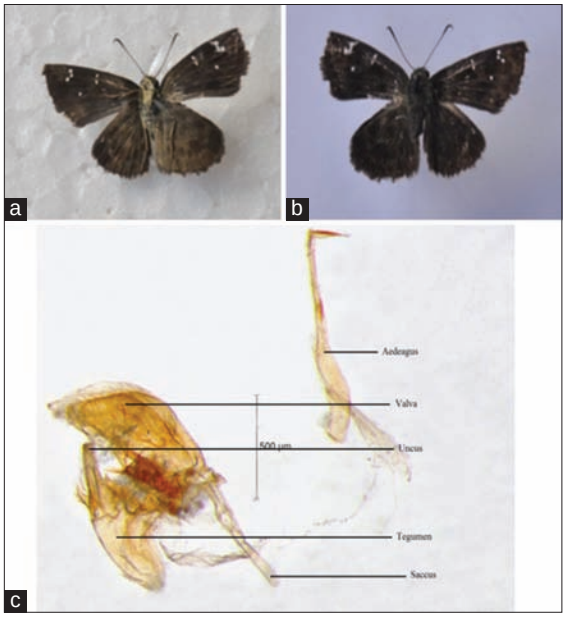

Figure 9: (a) *Sarangesa dasahara* (Moore) UP. (b) *Sarangesa dasahara* (Moore) UN. (c) Male genitalia of *Sarangesa dasahara* (Moore).

species (Table 1), while genitalia study was conducted only on 10 species, i.e., *Papilio polytes romulus* Cramer, *Delias belladonna horsfieldi* (Gray), *Pieris brassicae nepalensis* Doubleday, *Catopsilia crocale* Cramer, *Parantica aglea melanoides* Moore, *Parantica sita sita* (Kollar), *Junonia iphita* (Cramer), *Cynthia cardui* (Linn.), and *Sarangesa dasahara* (Moore). The results were summarized as follows:

Papilio polytes romulus Cramer – The Common Mormon (Figure 1a, b, c♂, d♀, Table 1)

Material examined: 1ex, 3.v.17, Sajao Piplu, Tanuja Rana; 2ex, 3.v.17, Jodhan, Tanuja Rana; 1ex, 4.v.17, Tihra, Tanuja Rana.

Wing expanse: 90-95 mm.

Male genitalia: The structure of male genitalia is broad bilobed structure, in which uncus is short and finger shaped. Valvae broad, oval with a broad, sclerotized band bearing a fringe of short setae. Saccus U shaped and broad structure. Aedeagus broad, straight, well sclerotized.

Female genitalia: Ovipositor lobes broad with sclerotized sides and thickly fringed with short hairs. Posterior shorter than the anterior. Corpus bursae elongated, with the basal half narrower than the apical half. Signum very long, broad in the middle and tapering at the ends.

Delias belladonna horsfieldi (Gray) – The Himalayan Hill Jezebel (Figure 2a-c♂, Table 1)

Material examined: 1ex, 16.ix.17, Dharampur, TanujaRana; 1ex, 7.ix.17, Jodhan, TanujaRana.

Male genitalia: Saccus broad, round in shape; tegument broad and well sclerotized; valve broad, elongated.

Wing expanse: 79-100 mm.

Pieris brassicae nepalensis Doubleday – The Large Cabbage White (Figure 3a-c♂, Table 1)

Material examined: 1ex, 19.v.17, SajaoPiplu, TanujaRana; 2ex, 21.v.17, Marhi, TanujaRana; 2ex, 19.v.17, Bnehardi, TanujaRana; 1ex, 27.v.17, Jodhan, TanujaRana; 3ex, 21.v.17, Tihra, Tanuja Rana.

Male genitalia: Uncus small, curved conical shaped, broader basally, beset with small hairs. Tegumen broad and sclerotized, saccus long and straight. Aedeagus long, straight.

Wing expanse: 40-50 mm

Catopsilia crocale Cramer – The Common Emigrant (Figure 4a-c♂, Table 1)

Material examined: 3ex, 12.vi.17, Dharampur, Tanuja Rana, 2ex, 5.vi.17, Jodhan, Tanuja Rana, 5ex, 7.vi.17, Tihra, Tanuja Rana.

Male genitalia: Uncus broad and bilobed. Valvae broad and elongated. Saccus slightly rounded. Aedeagus long slightly curved from the middle and the tip of aedeagus is arched in shape.

Wing expanse: male 40-50 mm and female 52-65 mm.

Parantica aglea melanoides Moore – The Glassy Tiger (Figure 5a-c♂, Table 1)

Material examined: 1ex, 17.v.17, Sajao Piplu, Tanuja Rana, 1ex, 21.vi.17, Mohin, Tanuja Rana, 1ex, 19.v.17, Bnehardi, Tanuja Rana.

Male genitalia: Uncus bilobed, rounded; valvae broad and dark, elongated; saccus slightly rounded and broad. Aedeagus tip broad and round slightly curved from middle.

Wing expanse: 70-75 mm.

Parantica sita sita (Kollar) – The Chestnut Tiger (Figure 6a-c♂, Table 1)

Material examined: 1ex, 19.viii.17, SajaoPiplu, TanujaRana; 1ex, 3.ix.17, Tihra, TanujaRana.

Male genitalia: Uncus bilobed, hairy, and rounded; valvae broad, elongated; saccus slightly narrow and tapering. Aedeagus broad, tapering, slightly curved.

Wing expanse: 85-110 mm.

Junonia iphita (Cramer) – The Chocolate Pansy (Figure 7a-c♂, Table 1)

Material examined: 1ex, 27.v.17, Jodhan, Tanuja Rana; 3ex, 17.v.17, Tihra, Tanuja Rana.

Male genitalia: The male genitalia are broad and bilobed structure. Aedeagus straight, long and tapering from one end; valvae broad, elongated, and sclerotized.

Wing Expanse: 55-80 mm.

Cynthia cardui (Linn.) – The Painted Lady (Figure 8a-c♂, Table 1)

Material examined: 1ex, 19.x.17, Dharampur, TanujaRana; 2ex, 1.x.17, Jodhan, TanujaRana; 2ex, 19.x.17, Bnehardi, 3ex, 21.viii.17, Tihra, TanujaRana.

Male genitalia: Uncus V shaped, sclerotized; tegument broad, sclerotized; valvae elongate, costa margin straight, apex pointed with long hairs, sclerotized; saccus U shaped; aedeagus sharply pointed at distal end.

Wing expanse: 56 mm.

Sarangesa dasahara (Moore) – The Common Small Flat (Figure 9a-c♂, Table 1)

Material examined: 1ex, 19.x.17, Sajao Piplu, Tanuja Rana; 2ex, 21.xi.17, Mohin, Tanuja Rana; 2ex, 19.xi.17, Bnehardi, Tanuja Rana.

Male genitalia: Uncus straight, scleritized; valvae broad, arched shape; tegument broad, sclerotized; saccus long, straight. Aedeagus long, straight, sharply pointed at one end.

Wing expanse: 26-35 mm.

CONCLUSION

All the species of butterflies collected from different localities of Dharampur area. Species described on the basis of external morphological characters and external genitalia. Genitalia study of different species of butterflies will be useful for future research studies.

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