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Taxonomic review of the tribe Nymphalini (Lepidoptera: Nymphalidae: Nymphalinae) from western Himalaya, India with special emphasis on external genitalic attributes.

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ABSTRACT: Taxonomic review for 11 species referable to six genera under the tribe Nymphalini has been presented. Taxonomic characterization, and elucidation of external genitalic attributes, has been done for five species namely, *Nymphalis xanthomelas* (Esper), *Polygonia c-album* (Linnaeus), *Kaniska canace* (Linnaeus), *Symbrenthia lilaea* (Hewitson) and *Symbrenthia hypselis* (Godart) from western Himalaya, India. Along with that, distribution and taxonomic remarks on species *Symbrenthia niphanda* Moore and *Symbrenthia brabira* Moore, and species under genera *Aglais* Dalman and *Vanessa* Fabricius from the western Himalaya has been discussed from the older literature. Major gaps in the taxonomic history of the tribe Nymphalini has been mentioned in the concluding remarks.

KEYWORDS: Nymphalini, five species, external genitalia, western Himalaya Running title: Taxonomic review of the tribe Nymphalini

INTRODUCTION

The type-subfamily Nymphalinae of family Nymphalidae consists of six tribes namely, Nymphalini, Melitaeini, Kallimini, Victorinini, Junoniini, and probably the Coeini (Wahlberg *et al*., 2005; Chengyong *et al*., 2017). The tribe Nymphalini consists of 13 genera distributed worldwide (Harvey, 1991). A total number of 15 species referable to seven genera are reported from India, out of which, 13 species referable to six genera are found in western Himalaya (Evans, 1932; Wynter-Blyth, 1957). The tribe Nymphalini is closely associated mainly with plants of the family Urticaceae, and it is likely that the ancestors of this tribe were specialist on this family (Janz *et al*., 2001).

The butterflies in this tribe are of moderate size. These butterflies also form important model system for investigating host-plant interactions, seasonal polymorphism, and adult diapause (such as *Polygonia* Hübner) (Nylin, 1988). Within the Nymphalini, systematics has been in a great deal of flux, although species circumscriptions have remained fairly stable (Nylin *et al*., 2001).

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The Himalaya, along the northern border of the Indian Subcontinent, extends 2500 km from Pamir Knot in the west to Arunachal Pradesh. In India, the Himalayan Ranges extending from Jammu & Kashmir, Himachal Pradesh and up to Uttarakhand is known as Western Himalaya, and has an arid, more temperate climate with greater Palearctic affinities (Mehra *et al*., 2017). Till date, no comprehensive taxonomic review/genitalic survey is available for western Himalayan Nymphalini. In many insects, genitalia often provide the only way to reliably distinguish the species using morphology (Özgül-Siemund and Ahrens, 2015). In insect systematics, the male genitalia have the species-diagnostic characters and its importance cannot be overlooked. Hence in the present study, morphology and external genitalia of five species under tribe Nymphalini (*Nymphalis xanthomelas* (Esper), *Polygonia c-album* (Linnaeus), *Kaniska canace* (Linnaeus), *Symbrenthia lilaea* (Hewitson), *Symbrenthia hypselis* (Godart)) from western Himalaya, India have been described and illustrated. Along with that, distribution and taxonomic remarks for species namely *Aglais ladakensis* Moore, A. *caschmirensis* Kollar, *Vanessa cardui* (Linnaeus), V. *indica* (Herbst), *Symbrenthia brabira* Moore, S. *niphanda* Moore from western Himalaya has been presented.

MATERIAL AND METHODS

Specimens were procured from the insect collection preserved in the museum of Department of Zoology and Environmental Studies, Punjabi University, Patiala and Zoological Survey of India (HARC), Solan (HP). The specimens were photographed from dorsal and ventral side, using a digital camera Nikon DSLR 3300 fitted with an 80 mm lens. In order to study the wing venation, permanent slides of fore and hind wings were made by following the methodology proposed by Common (1970). For dissection and preparation of the external genitalia, the method proposed by Robinson (1976) was adopted. The terminology for the male genitalia has been adopted from Sibatani et al. (1954), Shirozu and Yamamoto (1956), Klots (1970), and Sibatani (1972).

RESULTS AND DISCUSSION

Family Nymphalidae Rafinesque, 1815

Subfamily Nymphalinae Swainson, 1827

Tribe Nymphalini Rafinesque, 1815

Common name: The Angle-wings

Rafinesque, 1815. *Jean Barravecceia: Palermo*. 224 pages

The fore and hind wings strongly angular or notched, generally of dark brown or black colour above with fulvous to reddish or orange maculation; antennal club moderate, stout; body moderately stout, covered in black to brown coloured scales; last tarsal sub-segment of hind legs furnished with a pair of spines, except in genus Vanessa, which bears two paired rows of spines.

Genus *Nymphalis* Kluk, 1780

Common name: The Anglewings

Kluk, 1780; *Hist. nat. pocz. gospod*. 4: 86.

Aglais Dalman, 1816; K. VetenskAcad. Handl. 1816 (1): 56.

Eugonia Hübner, [1819]; Verz. bek. Schmett. (3): 36.

Inachis Hübner, [1819]; Verz. bek. Schmett. (3): 37.

Comma Rennie, 1832; Conspectus Butts. Moths: 8.

Grapta Kirby, 1837; in Richardson, Fauna Boreal Amer.: 292.

Scudderia Grote, 1873; Can. Ent. 5 (8): 144.

Euvanessa Scudder, 1889; Butts eastern U.S. Canada 1: 387.

Kaniska Moore, [1899]; Lepidoptera Indica 4: 91.

Ichnusa Reuss, 1939; Ent. Z. 53: 3.

Roddia Korshunov, 1995; Dnevnye babochki Aziatskoi chasti Rossii. Spravochnik.: 81.

Type-species: *Papilio polychloros* Linnaeus

polychloros Linnaeus, 1758; Syst. Nat. (Edn 10) 1: 477.

Type locality: Sweden

Eyes hirsute; labial palpi porrect, projecting beyond head, ascending; antennae almost as long as half costa, club prominent and gradual, tip round and deep orange in colour; fore wing inner margin straight; termen slightly concave and slightly scalloped; produced at vein M_1; hind wing tornus slightly produced; apex round; toothed at vein M_3; middle and hind legs with long and curved claws.

Remarks: The genus *Nymphalis* Kluk was erected on the type species *Papilio polychloros* Linnaeus. This taxon has Holarctic affinities. Shapiro (1981 and 1986) reported the phenotypic plasticity, and seasonal phenology and migration in the species *N.antiopa* Linnaeus in California. Miller and Miller (1990) discussed the taxonomic affinities of *Aglais* and *Nymphalis* Kluk. Nylin *et al*. (2001) studied the phylogenetic analysis of *Nymphalis* Kluk and other related genera.

Three species are found in India i.e. *N. antiopa* (Linnaeus) in Chumbi Valley, Sikkim; *N. l-album* (Esper) in Kashmir and N. *xanthomelas* (Esper) found in western Himalaya. There are no recent recordings in literature for species *N. l-album* (Esper) from Kashmir (northwest Himalaya). Its distribution in India hence is sceptical and needs attention.

Nymphalis xanthomelas (Esper)

Common name: The Large Tortoiseshell

(Figure 1)

xanthomelas Esper, 1781; Die Schmett. Th. I, Bd. 2 (3): 77 (*Papilio*).

Type locality: Mardan, Khyber Pakhtunkhwa Province, Pakistan

Adult (Male): Fore wing trigonate, costa arched at base, apex truncate, termen sinuate and produced at vein M_3 and Cu_2, upper side ground colour tawny orange, two black spots in discal cell, a very broad black band over end cell, an irregular, highly sinuate and broken black band across discal area, sub-marginal area black, margin broad and dull brown in colour, underside dried leaf like, smudged with dull violet pattern, a very broad light brown discal band traversed from costa to inner margin; hind wing round, costa straight, apex round, termen sinuate, inner angle straight, upper side ground colour same as forewing, a large black spot in discal area near costal margin, sub-marginal area black, followed by shiny blue spots, margin broad and dull brown, underside similar as fore wing, broad discal band in continuation from forewing and extends up to inner margin.

Venation: Fore wing with discal cell shorter than half length of wing, vein Sc long and terminates well before half costa, R_1 and R_2 parallel to vein Sc and well before upper apex of end cell, stalk of veins R_3+R_4+R_5 originates just before upper apex of end cell, vein R_2 and R_3 arises well before middle of R_5 and terminates just at apex, M1 arises from slightly below upper apex of end cell, vein M_2 closer to M_1 at origin than to M_3, latter arises just from lower apex of end cell, Cu_1 opposite to origin of vein M_2, discal cell closed; hind wing with forwardly curved precostal vein, vein Sc+R_1 parallel to costa and terminates just below apex, stalk Rs+M_1+M_2 and M_3+Cu_1+Cu_2 present, discal cell open, ldc absent.

Adult (Female): not examined

Male genitalia: Tegumen dorso-ventrally flattened, extended backwards, wide and somewhat rectangular dorsally; uncus straight, longer than tegumen, broad at base and gradually narrows down into a blunt tip assuming a y-shape from dorsal view, tubular in lateral view gnathos narrow, heavily sclerotized, concave; saccus short, thin, tubular, slender, well sclerotized, upturned obliquely towards dorsal side, tip blunt; vinculum quite broad along entire length, u-shaped from ventral view, much longer than latero-ventral projection of tegumen; juxta sclerotized, u-shaped; valvae large, quite broad, protrudes beyond tip of uncus, well sclerotized and hirsute with long and fine setae; costa and sacculus simple; ampulla sickle like but not deeply curved, tip blunt directed downwards; harpe well sclerotized, tapering into a pointed tip; aedeagus long, stout at base and sharply narrow beyond two-third of its length and descends into a sharp pointed tip directed towards dorsal side, robust, heavily sclerotized, acutely curved into a sickle shape;

vesica absent; ductus ejacultorius enters dorsad.

Female genitalia: Not examined.

Distribution: India (Jammu and Kashmir to Uttrakhand), Pakistan, Nepal.

Material examined: 1♂, 25.vii.2009, Sural, Pangi Valley, Chamba (H.P.).

Host plants: *Salix elegans*,Ulmaceae, Anacardiaceae (Wynter-Blyth (1957) and Smetacek (2012)).

Remarks: The nominate species *N. xanthomelas* (Esper) have Palearctic affinities, and is indeed very rare in Western Himalaya, and yet is not protected under the Wildlife (Protection) Act (1972). It has two broods per year (one pre-monsoon and another post monsoon) (Wynter-Blyth, 1957) and pupal diapause is reported and adults exhibit hibernation. It occupies subtropical evergreen forests above 1200m (Smetacek, 2012). It is a polyphagous species. It appears on wings in different months at different localities likewise, in early summer in Shimla and Kullu; in May at Khajjiar, Chamba; in July and August in Gulmarg, Jammu and Kashmir; from February to April in Mussorrie, Dehradun. Singh (2009) reported it from Kedarnath Musk Deer Reserve, Chamoli and Rudraprayag, Uttrakhand in months of April to May at an altitude of 3600m. Bhardwaj *et al*. (2012) reported the nominate species from Isratgad watershed, Tons Valley, Uttrakhand. Singh and Sondhi (2016) also reported it from February to May (Kedarnath Musk Deer Reserve; Kunwari Pass; Benog-Mussoorie; Gangotri National park). Ample records of the nominate species occur from Utttrakhand, but no recent recordings from Jammu and Kashmir and Himachal Pradesh were found in literature.

Adult morphology of *N. xanthomelas* Esper has been described and external genitalia has been illustrated in detail for the first time in the present research work.

Genus *Polygonia* Hübner

Common name: The Comma

Hübner, [1819]; Verz. bek. Schmett. (3): 36.

Type species: *Papilio c-aureum* Linnaeus

Linnaeus, 1758; Syst. Nat. (Edn 10) 1: 477.

Type locality: China, Penang.

Head moderate in size, fronto-clypeal region clothed with long hair; eyes hairy, labial palpi ascending, extending well beyond forehead, porrect and scaly, first joint curved and very short, second joint swollen in middle and tapering beyond, third joint very short with pointed apex; antennae shorter than half costa, club short and gradual; thorax moderately stout, ovate, dressed with greenish long hair; forewing triangular, costa straight, apex round, termen falcate, inner margin sinuate; forelegs with femur and tibia of equal length, middle and hid leg stout, femur and tibia equivalent in length, tibia bears spines and spurs, latter robust and long, tarsi as long as tibia, spines present except fifth joint, claws long and slightly curved and grooved below.

Remarks: The nominate genus was erected on the basis of the type species *Papilio c-aureum* Linnaeus. Genus *Polygonia* includes five Palaearctic species (*P. c-album*, *P. c-aureum*, *P. egea*, *P. gigantea* and *P. interposita*), and nine Nearctic species (*P. comma*, *P. faunus*, *P. gracilis*, *P. interrogationis*, *P. oreas*, *P. progne*, *P. satyrus*, *P. g-argenteum* and *P. haroldii*). Moore (1899) described the distribution of *P. interposita* (Staudinger) as Persia, Blauchistan, Chitral and Turkestan. However, Evans (1932) clearly mentioned that two species under the nominate genus are found in India i.e. *P. c-album* (Linnaeus) (from Kashmir to Bhutan) and *P. interposita* (Staudinger) (Kashmir, Ladakh). The latter was earlier considered as a subspecies of *P. c-album* due to morphological and genetic similarities in mtDNA (Wahlberg *et al*., 2009). But after analysis of nuclear DNA (nDNA), it became clear that *P. interposita* and *P. c-album* are a separate species (Wahlberg *et al*., 2009). There are recent or near past literature records of *P. interposita* (Staudinger) from Kashmir. However, Smith *et al*. (2007) reported the latter species from Hunza region in northern Pakistan and Afganistan and described its habitat as 'Juniper forests of Blauchistan, from drier

regions of Chitral and rarely in the Murree hills ranging downwards to 8000ft'. Its present status in India needs to be updated. In the present work, only *P. c-album* (Linnaeus) is taxonomically dealt.

Polygonia c-album (Linnaeus)

Common name: The Comma

Linnaeus, 1758; Syst. Nat. (Edn 10) 1: 477 (*Papilio*).

Type locality: Europe

f-album Esper, 1783; Die Schmett. Th. I, Bd. 2 (8): 168, pl. 87 (*Papilio*).

marsyas Edwards, 1870; Trans. amer. ent. Soc. 3 (1): 16 (*Polygonia*).

Polygonia c-album agnicula (Moore)

Common name: The Eastern Comma

(Figure 2)

Moore, 1872; Proc. zool. Soc. Lond. 1872 (2): 559 (*Grapta*)

Type locality: Gulmarg (Kashmir), Nepal.

Adult (Male): Fore wing upper side ground colour deep orange, wing base dressed with golden scales, one broad black bar in middle of discal cell, one at end cell and another near apex, three descending black spots in discal area, margin broad and dull brown, underside of fore wing with smudged pattern, blackish brown in colour; hind wing costa sinuate, apex round, termen sinuate, tail at vein M3, inner margin almost straight, upper side colouration same as forewing, basal half suffused with golden brown scales, an irregular series of black discal spots present, margins very wide, dull brown, underside colouration same as forewing, a shiny C-shaped shiny white lunular spot in discal area present.

Venation: Fore wing with discal cell shorter than half length of wing, vein Sc long and terminates at half costa, vein R_1 and R_2 parallel to Sc, vein R_1 well before upper apex of end cell and terminates at costa, vein R_2 and stalk R_3+R_4+R_5 just from upper apex of end cell, vein R_2 and R_3 arise well before middle of R_5 and terminates just at apex, M_1 arises from slightly below upper apex of end cell, vein M_2 closer to M_1 at origin than to M_3, latter arises just from lower apex of end cell, Cu_1 opposite to origin of M_2, discal cell closed; hind wing with Sc+R_1 parallel to costa and terminates just below apex, stalk Rs+M_1+M_2 and M_3+Cu_1+Cu_2 present, discal cell open, ldc absent.

Abdomen short and not stout, shorter than half length of inner margin.

Adult (Female): Similar as male except five jointed tarsi in forelegs; latter unfit for walking.

Male genitalia: Tegumen heavily sclerotized, convex, extended backwards, wide and rectangular dorsally; uncus straight, as long as length of tegumen, broad at base and gradually narrows down into a blunt tip assuming a V-shape from dorsal view, tubular in lateral view gnathos heavily sclerotized, horn like from dorsal view; saccus short, thin, tubular, slender, well sclerotized, upturned obliquely towards dorsal side, tip blunt and slightly swollen; vinculum moderately broad along entire length, u-shaped from ventral view, much longer than latero-ventral projection of tegumen; juxta sclerotized, U-shaped; valvae large, quite broad, not protruding beyond tip of uncus, well sclerotized and hirsute with long and fine setae; costa and sacculus simple; ampulla simple with blunt tip; harpe well sclerotized, tapering into a pointed tip sickle shaped; aedeagus long, stout at base and sharply narrow beyond two-third of its length and descends into a sharp pointed tip directed towards dorsal side, robust, heavily sclerotized, deeply curved.

Female genitalia: Not examined.

Distribution: India (Western Himalaya, Sikkim to Arunachal Pradesh), Nepal, Bhutan.

Material examined: 1♂, 2.iv.2012, Kalatop Wildlife Sanctuary, Dalhousie, Chamba (H.P.).

Host plants: Salicaceae, *Urtica dioica*, *Ulmus glabra*, *Salix caprea*, *R. uva-crispa*, *Betula pubescens*, *Ribes alpinum*, *R. nigrum*, *R. rubrum*, *Rubus idaeus*, *Betula spp*., *Corylus avellana*, *S.*

aurita, *S. cinerea*, *S. phylicifolia*, *Ulmus laevis*, *Humulus lupulus*, *Urtica dioeca* (Janz *et al*.,1994; Chou,1994; Seppänen,1970)

Remarks: Two distinct seasonal morphs of this species are known to occur (spring morph which enters into a reproductive diapause and hibernate as adult before ovipositing; summer morph which rapidly mature sexually and oviposit in summer giving rise new generation of the dark hibernation morph) (Nylin, 1988).

This species has a wide distributional range in Himalayan region from Kashmir to Sikkim, but is rare everywhere. Three subspecies are found in Himalaya namely, *P. c-album cognate* (Moore) (north western Himalaya); *kashmira* Evans (Kashmir, Ladakh); and *agnicula* (Moore). Moore (1872) originally described the latter subspecies as a distinct species: *Grapta agnicula* Moore distributed from 'Gulmarg (Kashmir) to Nepal'. However, later on, the same author (Moore, 1899-1900) lowered its status to a sub-specific level under *P. c-album* (Linnaeus) and described its distribution as from 'Nepal; Chumbi Valley, Sikkim; N.W. Bhutan'. Various authors like Evans (1932) and Kehimkar (2016) also followed the same and completely omitted its distribution in Western Himalaya. But in the present research work, the wet season form of this sub-species was collected from Kalatop Wildlife sanctuary, Chamba, Himachal Pradesh (Western Himalaya).

Singh (2009) also reported the nominate subspecies from Kedarnath Musk Deer Reserve, Garhwal

Himalaya during August-October at an altitudinal range 2700-3500m. Recently, Gogoi *et al*. (2015) also reported the range extension of *Polygonia c-album agnicula* into Tawang District, Arunachal Pradesh (north-eastern India). Hence, according to the present record and recent literature survey the older expanded distributional range of this subspecies should be considered i.e. Western Himalaya to Nepal to Sikkim, Arunachal Pradesh, Bhutan.

In the present work, the nominate sub-species from Kalatop Wildlife sanctuary, Chamba, Himachal Pradesh (Western Himalaya) has been studied for its morphological characters including external male genitalia.

Genus *Kaniska* Moore

Common name: The Admirals

Moore, [1899]; Lepidoptera Indica 4: 91.

Type-species: *Papilio canace* Linnaeus

Linnaeus, 1763, Amoenitates Acad. 6: 406.

Type locality: E. China

Eyes oval and densely hairy; labial palpi ascending, porrect, extends well beyond head; antennae longer than half costa, club prominent but gradual and long; thorax stout and oval.

Kaniska canace (Linnaeus)

Common name: The Blue Admiral

(Figure 3)

canace Linnaeus, 1763; Amoenitates Acad. 6: 406 (*Papilio*).

glauconia Motschulsky, 1860 (*Vanessa*).

canace siphnos Fruhstorfer, 1912; in Seitz, Gross-Schmett. Erde 9: 527. (*Vanessa*).

canace f. *mandarina* Matsumura, 1939; Bull. biogeogr. Soc. Japan 9 (20): 356 (*Vanessa*).

Adult (Male): Fore wing trigonate, costa arched, apex truncate, termen sinuate, angulate, tornus round, inner margin sinuate, upper side of fore wing greyish black in colour, a broad blue sinous band traversed from costa to inner margin in post discal area, under side dull brown, tinted violet, matte brown beyond half of wing; hind wing round, costa straight, apex round, termen sinous, inner margin straight, upper side ground colour similar as male, broad blue sinous band in continuation from fore wing, underside similar as forewing.

Venation: Fore wing with discal cell shorter than half costa, vein Sc long and terminates at half costa, vein R_1 and R_2 parallel to Sc and well before upper apex of end cell and terminates at costa, stalk R_3+R_4+R_5 just before upper apex of end cell, vein R_2 and R_3 arises well before middle of R_5 and terminates just at apex of wing, vein M1 arises

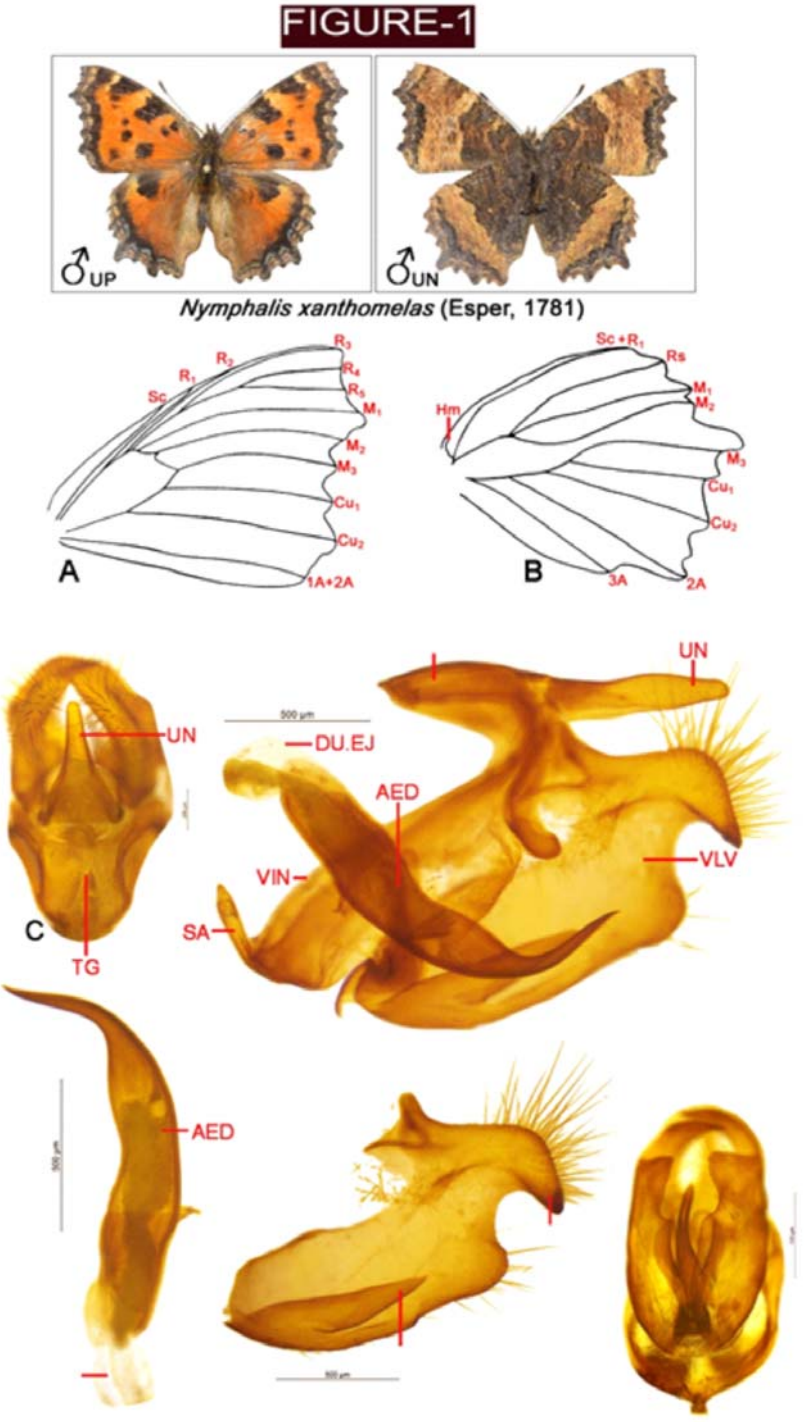

Fig 1. *Nymphalis xanthomelas* (Esper); A. Forewing, B. Hindwing, C. Uncus (Dorsal View), D. Male genitalia, E. Aedeagus, F. Right Valva (Inner View), G. Male genitalia (Ventral View).

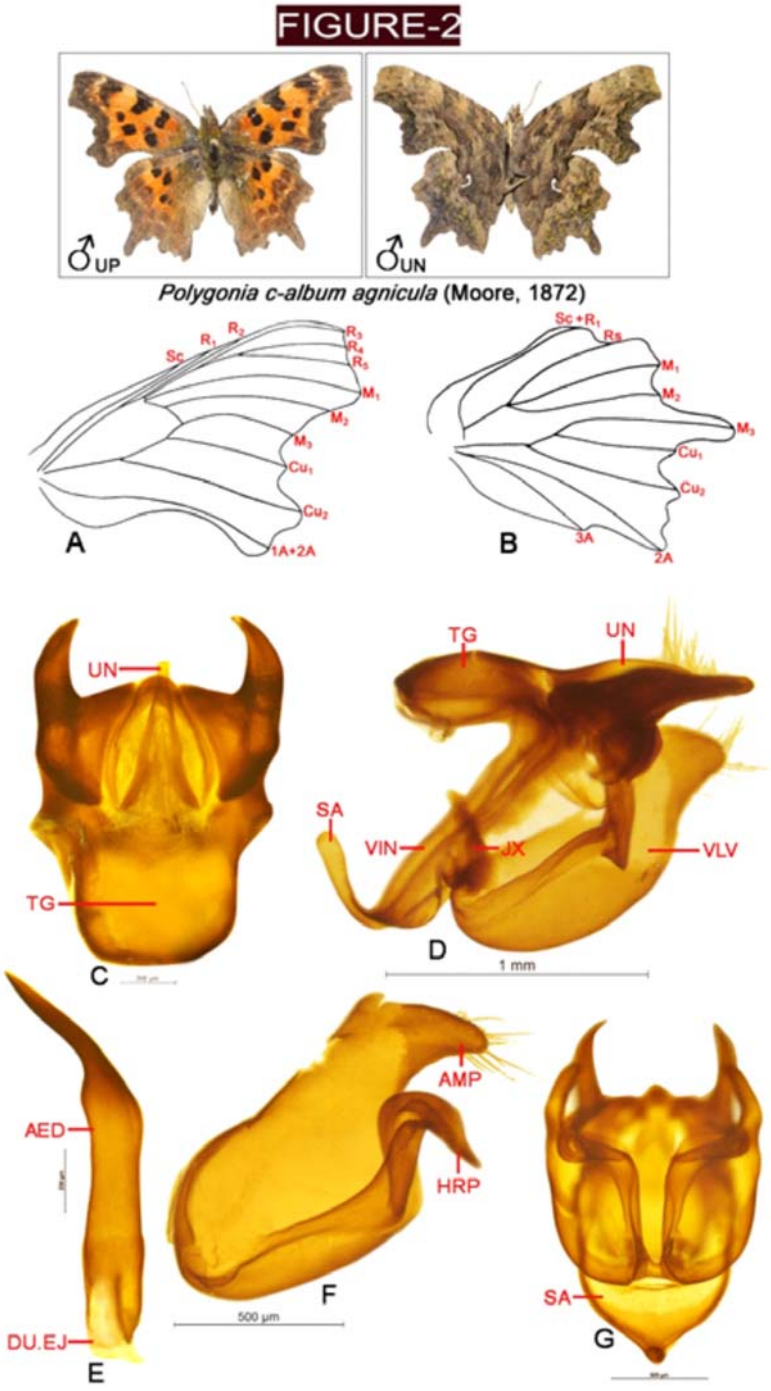

Fig 2. *Polygonia c-album agnicula* (Moore); A. Forewing, B. Hindwing, C. Uncus (Dorsal View), D. Male genitalia, E. Aedeagus, F. Right Valva (Inner View), G. Male genitalia (Ventral View).

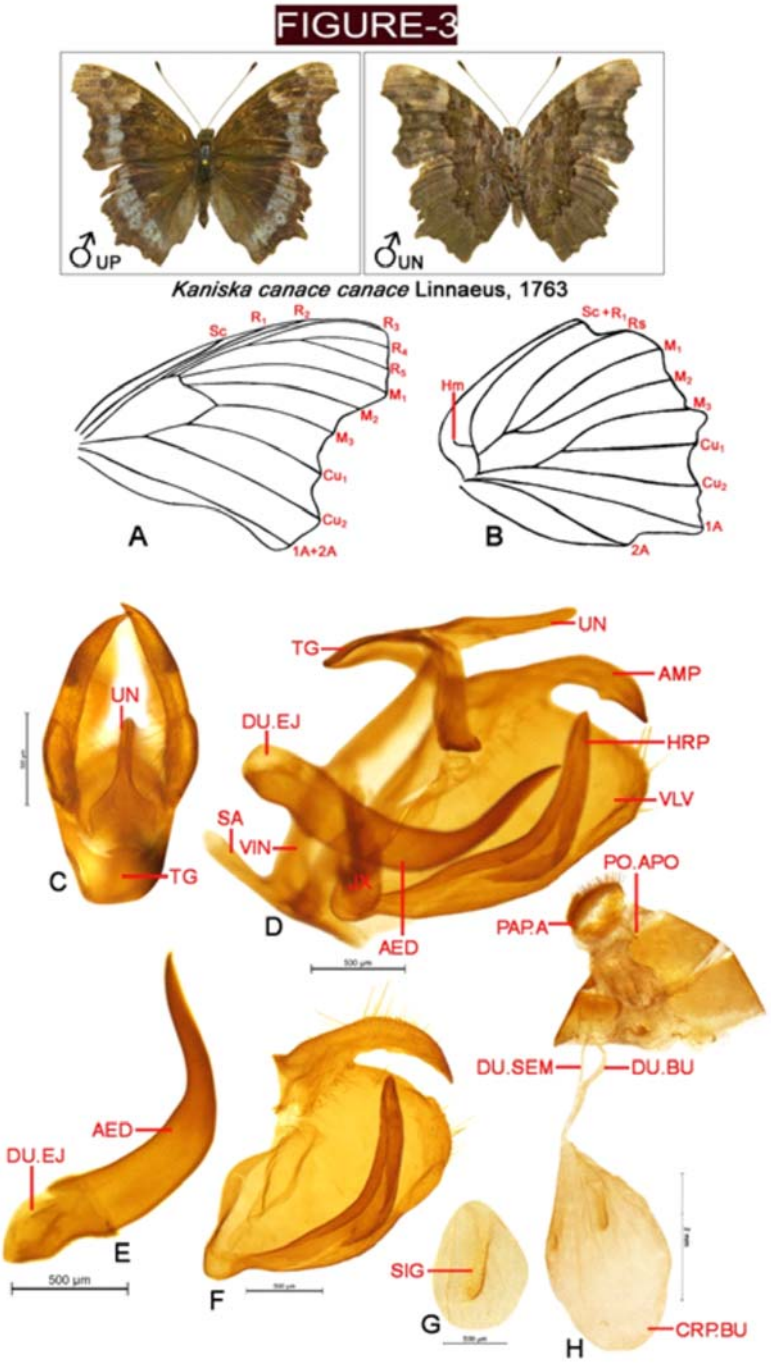

Fig 3. *Kaniska canace* (Linnaeus); A. Forewing, B. Hindwing, C. Uncus (Dorsal View), D. Male genitalia, E. Aedeagus, F. Valva, G. Signum, H. Female genitalia.

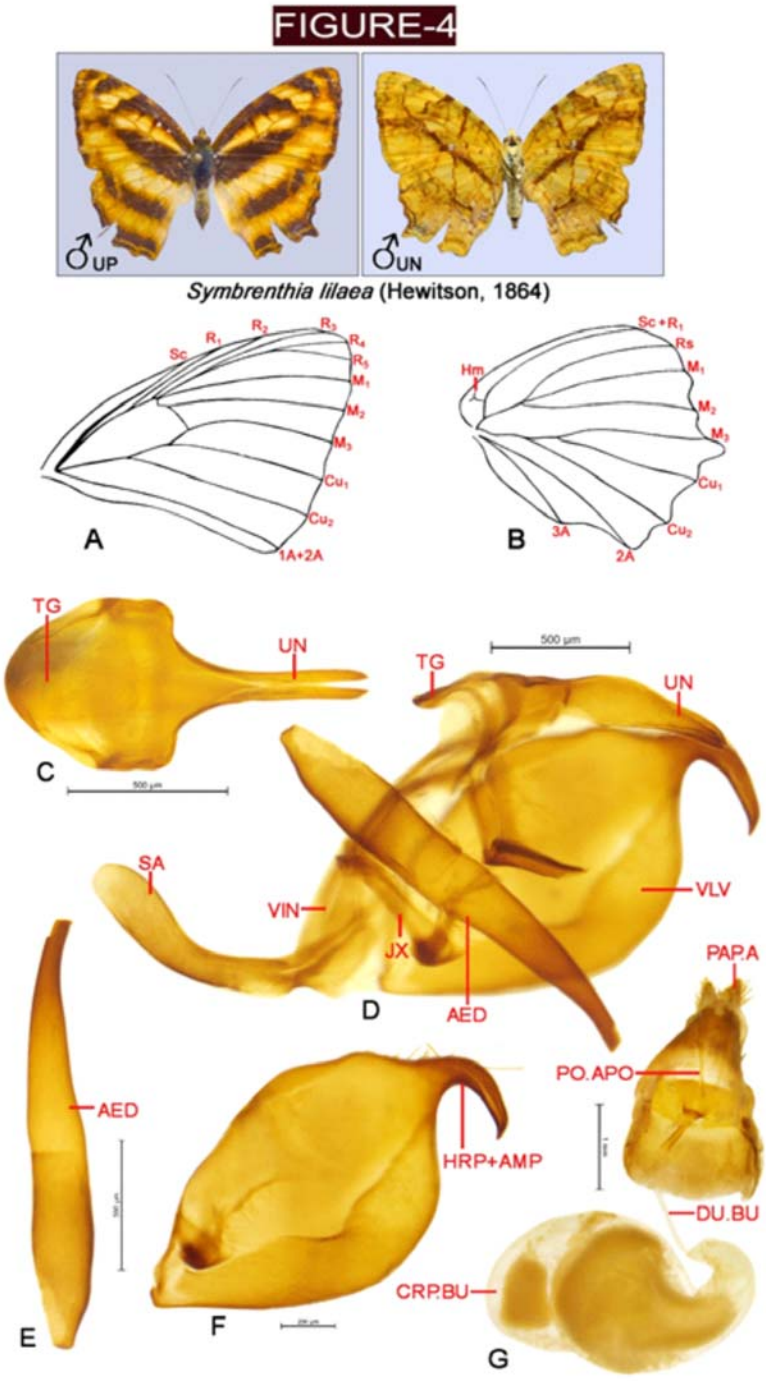

Fig 4. *Symbrenthia lilaea* (Hewitson); A. Forewing, B. Hindwing, C. Uncus (Dorsal View), D. Male genitalia, E. Aedeagus, F. Valva, G. Female genitalia.

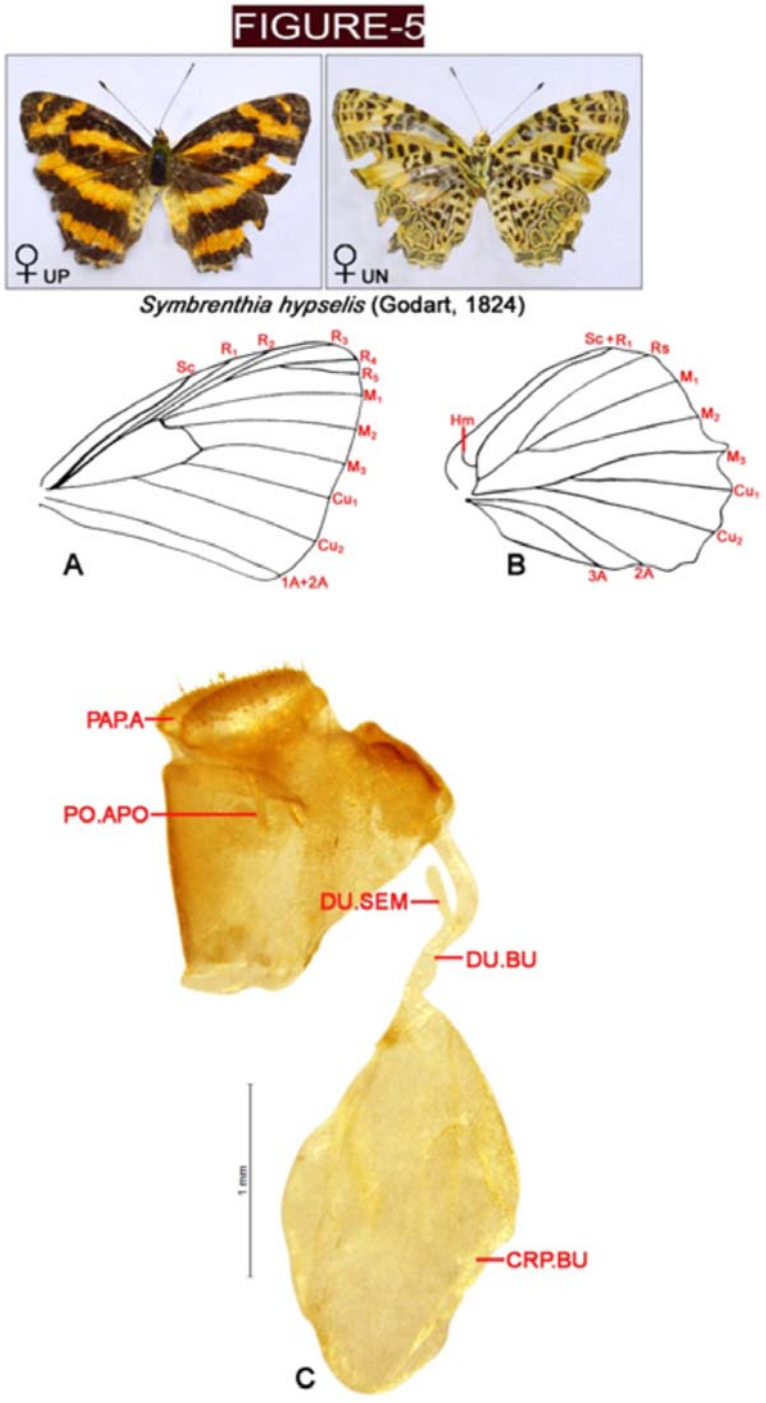

Fig 5. *Symbrenthia hypselis* (Godart); A. Forewing, B. Hindwing, C. Female genitalia

from slightly below upper apex of end cell, vein M_2 slightly closer to M_1 at origin than to M_3, latter just from lower apex of end cell, vein Cu_1 opposite to origin of M_2, discal cell closed, hind wing with forwardly curved humeral vein, Sc+R1 parallel to costa and terminates just below apex, stalk $Rs+M_1+M_2$ and $M_3+Cu_1+Cu_2$ present, discal cell open, ldc absent.

Adult (Female): Similar to male.

Male genitalia: Tegumen dorsoventrally flattened, extended backwards, wide and somewhat rectangular dorsally; uncus dorsoventrally falttened, slightly longer than tegument, broad at base and narrows down into a tubular shape, y-shaped from dorsal view, tip blunt; gnathos narrow, heavily sclerotized; saccus short, thin, tubular, slender, well sclerotized, directed obliquely towards dorsal side, tip blunt, saccus also extended caudally; vinculum narrow, u-shaped from ventral view, much laonger than latero-ventral projection of tegumen; juxta sclerotized, u-shaped; valvae large, broad, protrudes beyond tip of uncus, well sclerotized and hirsute with long and fine setae; costa round and broad; ampulla sickle like but not deeply curved, tip pointed directed downwards; sacculus broad, produced into a crest at base; harpe well sclerotized, sickle shaped with blunt tip directed towards dorsal side; aedeagus long, stout at base and narrow sharply beyond mid-length and descends into a pointed tip, directed towards dorsal side, robust, heavily sclerotized, deeply curved into a sickle shape.

Female genitalia: Sterigma well developed and weakly sclerotized, with both lamella antevaginalis and lamella postvaginalis fused to form a small cone or funnel like sclerotized plate; ductus seminalis tubular, opening dorsally into basal portion of ductus bursae; latter almost as long as corpus bursae, membranous, reception at corpus bursae well-marked; corpus bursae elongated, egg-shaped, membranous, a pair of streak-like signa present; apophyses anteriores absent; apophyses posteriores short, sclerotized and straight; papilla analis moderate in size, squarsh, outer margin more sclerotized, pilose.

Distribution: India (Jammu and Kashmir, Northeast, hills of Southern India), Pakistan, Nepal, Bhutan, Myanmar, Sri Lanka.

Material examined: 1♂, 28.iii.2015, Totu village, Shimla (H.P.); 1♀, 30.iii.2015, Totu village, Shimla (H.P.).

Larval host plants: Liliaceae, Smilacaceae, Dioscoreaceae (Smetacek, 2012).

Remarks: The nominate genus was established on the basis of the type species *Papilio canace* Linnaeus. This is a monotypic genus with type species *Kaniska canace* Linnaeus belonging to the Oriental region (D'Abrera, 1985). Three subspecies *viz*., *K. c. himalaya* Evans (North-West Himalaya (Pakistan to Kumaon); *canace* Linnaeus from North-East Himalaya (from Sikkim to North Burma)); and *viridis* Evans (Southern India) (Evans, 1932) are known under the nominate species in India. In Himalaya, this species occupies the elevation range from 609 to 2743 m (Wynter-Blyth, 1957). It is typically a forest species and prefers to fly swiftly through Oak and Rhododendron forest. Occasionally it settles on the tree trunks or rotting fruits to sip exude, and males can often be spotted while roosting. During a survey by Singh *et al*. (2016), this species was reported from Talwara village, Hoshiarpur for the first time. Additionally this species was also spotted in Ludhiana, Punjab. This species was previously known to be restricted to only hilly areas; however, reporting of this species from plains of Punjab is a new observation and extended range of this species (Singh *et al*., 2016).

Genus *Symbrenthia* Hübner

Common name: The Jesters

Hübner, [1819]; Verz. bek. Schmett. (3): 43.

Laogona Boisduval, [1836]; Hist. nat. Ins., Spec. gén. Lépid. 1: pl. 10.

Type-species: *Symbrenthia hippocla* Hübner

Hübner, [1819]; Verz. bek. Schmett. (3): 43.

Type locality: Amboina

Head moderate with fronto clypeal region hairy; eyes hairy; labial palpi projecting beyond head, ascending, dressed with long rather closely oppressed scales; antennae approximately as long as half costa, club inconspicuous, long and gradual; thorax oval, weak and hairy; abdomen weak; middle and hind legs with short and curved claws; hind wing toothed at vein M_3.

Remarks: The genus *Symbrenthia* Hübner was established on the basis of the type species *Symbrenthia hippocla* Hubner. The arrangement of species and races of this genus is in a state of profound confusion which makes the diagnosis of the taxa very difficult (D'Abrera, 1985). The genus includes 10-15 species distributed from the Western Himalaya in India to southern China, and southward to Sundaland, the Philippines and New Guinea (Smith, 1989; Corbet *et al*., 1992; Huang, 1998; Huang and Xue, 2004). Seven currently recognized subspecies, classified among five species, occur in the Himalaya and in the Patkai mountain ranges in northeastern India, some of which are very rare and endemic to these mountain ranges (Kunte, 2010). Kunte (loc.cit.) rediscovered the butterfly *Symbrenthia silana* de Nicéville from the Eastern Himalaya and Garo Hills after 90 years.

Symbrenthia lilaea (Hewitson)

Common name: The Common Jester

(Figure 4)

Hewitson, 1864; Trans. ent. Soc. Lond. (3) 2 (3): 246 (*Laogona*).

Adult (Male): Forewing upper side dark brown, deep yellow streak extends from base to discal region, post discal area deep yellow, margins dark brown, underside bright yellow with rufous brown streaks; hind wing basal colour deep brown, deep yellow coloured discal and post discal bands present, underside similar as fore wing.

Venation: Forewing with discal cell slightly shorter than half length of wing, vein Sc moderately long and terminates at half costa, vein R_1 parallel to Sc and originate well before upper apex of end cell, R_2 from well before end cell, stalk R_3+R_4+R_5 just from upper apex of end cell, vein R_3 originate well before mid of R_5, vein R_3 terminates slightly before apex of wing, M_1 arises from just below upper apex of end cell, vein M_2 closer to M_1 than to M_3 at origin, vein M_3 curved and arises just from lower apex of end cell, Cu_1 arises opposite to M_2, discal cell closed; hind wing with forwardly curved humeral vein, Sc+R_1 parallel to costa and terminates just at apex of wing, stalk Rs+M_1+M_2 and M_3+Cu_1+Cu_2 present, discal cell open, ldc absent.

Adult (Female): Similar to male, but the orange markings are broader and paler on upper side of wings.

Male genitalia: Tegumen narrow and extended backward, oval from dorsal view; uncus well sclerotized, bifid, Y-shaped from dorsal view, dilated from middle portion in later view; gnathos narrow and lightly sclerotized; saccus moderately long, slightly curved upwards, tubular, tip blunt and swollen; vinculum narrow along entire length, quite long than latero-ventral projections of tegumen, convex; juxta prominent, long, U-shaped and slit like; valvae broad, oriented obliquely touching tip of uncus, tip of valvae produced into heavily sclerotized sickle like pointed hook; aedeagus long, slightly stout, tubular, tip blunt; vesica absent; ductus ejaculatorius enters dorsad.

Female genitalia: Sterigma well sclerotized and developed into a small funnel like structure composed with fusion of lamella antevaginalis and lamella postvaginalis; ostium bursae cresent shaped; ductus seminalis tubular, attached on dorsal side at middle of ductus bursae; latter with short proximal portion sclerotized, otherwise membranous, tubular, well demarcation at inception of corpus bursae; corpus bursae much longer than ductus bursae, membranous, egg shaped with apex rounded but curved into an irregular S-shaped; apophyses anteriores absent; apophyses posteriores moderately long, slender, well sclerotized and straight; papilla analis oval, distal portion heavily sclerotized, pilose.

Distribution: India (Eastern Ghats, Himalaya, North-eastern India, W. Bengal, Odisha), Indo-China, SE

Asia (Kunte, 2010).

Material examined: 1♂♀, 29.v.1991, Kasauli, Solan (H.P.); 1♂, 15.vi.1992, Chail wildlife sanctuary, Shimla (H.P.); 2♂, 26.ix.2015, Andretta, Palampur, Kangra (H.P.).

Host plant: Urticaceae (Smetacek, 2012).

Remarks: The present species is distributed from northern India to Indo-China. It is an occasional species in the western Himalaya and inhabits the subtropical evergreen forest between 300 m to 1,700 m (Smetacek, 2012). This species frequently visits stream beds for mud-puddling. In the present study, an interesting specimen in the museum of Department of Zoology and environmental Sciences was observed with very broad fulvous and obsolete black maculation on the upper side of fore and hind wing. The morphology of external male and female genitalia has been described and illustrated in the present work.

Symbrenthia hypselis cotanda Moore

Common name: The Himalayan Spotted Jester

(Figure 5)

Godart, [1824]; Encyclopédie Méthodique 9 (2): 818, no. 5-6 (*Vanessa*).

Type locality: Darjeeling

Adult (Female): Upper side of both wings blackish brown with dark fulvous maculation; underside clouded with creamy yellow colour, a series of sub-marginal metallic green conical spots present and caudal lunular spots quite prominent.

Venation: Forewing with discal cell slightly shorter than half length of wing, vein Sc moderately long and terminates at half costa, vein R_1 originate well before upper apex of end cell, R_2 from well before end cell, stalk R_3+R_4+R_5 just from upper apex of end cell, vein R_3 originate well before mid of R_5, vein R_3 terminates slightly before apex of wing, M_1 arises from just below upper apex of end cell, vein M_2 closer to M_1 than to M_3 at origin, M_3 curved and arises just from lower apex of end cell, Cu_1 arises opposite to M_2, discal cell closed; hind wing with forwardly curved humeral vein, Sc+R_1 parallel to costa and terminates just at apex of wing, stalk Rs+M_1+M_2 and M_3+Cu_1+Cu_2 present, discal cell open, ldc absent.

Male genitalia: Not examined.

Female genitalia: Sterigma reduced, lamella antevaginalis merely as emarginated sclerotization around ostium bursae; ductus seminalis tubular, attached on dorsal side at middle of ductus bursae; latter membranous, tubular, no demarcation at inception of corpus bursae; corpus bursae much longer than ductus bursae, membranous, egg shaped with apex rounded; apophyses anteriores absent; apophyses posteriores not long, slender, well sclerotized and slightly curved; papilla analis oval, with shallow emarginations along proximal and distal margins, distal portion heavily sclerotized, pilose.

Distribution: India (Himalaya, NE India), S. China, Indo-China, SE Asia (Kunte, 2010).

Material examined: 1♀, 30.x.1995, Pitthoragarh (Uttrakhand).

Host Plant: Urticaceae

Remarks: The species under reference mainly inhabits the forested areas between the altitudinal ranges from 300m to 2,400m above mean sea level. D'Abrera (1985) has not mentioned the distribution of this species in North-west Himalaya. However, Bhardwaj *et al*. (2012) recorded the nominate species from Gangotri National Park and referred it as a very rare species. Kehimkar (2016) has also reported the nominate species from North-west Himalaya. Only female genitalia of the nominate species has been described and illustrated for the first time in the present work. The specimens dealt in the present study were procured from the older insect collection lying in the museum of Department of Zoology and Environmental Science, Punjabi University, Patiala.

Symbrenthia niphanda Moore

Common name: Kumaon Blue-Tail Jester

Moore, 1872; Proc. zool. Soc. Lond. 1872 (2): 559.

Type locality: Sikkim, Himalaya

Distribution: W. Himalaya (Kashmir to Kumaon), India, Naga Hills, Bhutan.

Remarks: The subspecies *S.n.hysudra* Moore is found in the western Himalaya. It is indeed a very rare species in western Himalaya. It has been reported from Western Himalaya by Moore (1872), Evans (1932); Arora *et al*. (2005); Kunte (2010); Smetacek (2012); Singh and Sondhi (2016). However, there is a lack of recent records of this sub-species from Himachal Pradesh and Jammu and Kashmir.

No specimen of the nominate species could be collected under the present survey. Genitalia of the species *Symbrenthia niphanda* Moore has been studied by (Huang and Xue, 2004).

Symbrenthia brabira Moore

Common name: The Yellow Jester

Moore, 1872;. zool. Soc. Lond. 1872 (2): 558.

Type locality: N. India.

Distribution: Himalaya, SE Tibet, S. China.

Remarks: *S.b. brabira* Moore is the subspecies distributed in western Himalaya, India. It is also a very rare species. A few records of this subspecies are by: Moore (1872), Hannyngton (1910); Evans (1932); Kunte (2010); Singh (2009); Smetacek (2012); Singh and Sondhi (2016). However, no specimen could be collected under the present study. Its genitalia have also been earlier elucidated by Huang (1998)

Vanessa cardui (Linnaeus)

Common name: The Painted Lady

cardui Linnaeus, *Syst. Nat.*, 10th ed.: 475.1758 (*Papilio*).

Type locality: Sweden.

Distribution: Nearctic, African, Oriental, Australian, Palaearctic Regions.

Host Plants: Urticaceae, Asteraceae (Smetacek, 2012).

Remarks: It is an extremely common species throughout its distributional range. It is one of the most common butterflies in western Himalaya. The male and female external genitalia of the nominate species has been described by Field (1971) and Mattu *et al*. (2017).

Vanessa indica (Herbst)

Common name: The Indian red admiral

indica Herbst, Nat. Schmett., 7: 171; 1794 (*Papilio*).

Type locality: India

Distribution: India to S.E. Asia.

Host Plants: Urticaceae; Tiliaceae; Ulmaceae (Smetacek, 2012).

Remarks: It is also an extremely common species throughout its distributional range. It is a multivoltine species having several overlapping generations. The external genitalia of male and female of the nominate species has been described by Field (1971) and Mattu *et al*. (2017).

Aglais cashmirensis (Kollar)

Common name: The Indian Tortoiseshell

Kollar, [1844]; in Hügel, Kaschmir und das Reich der Siek 4: 442 (*Vanessa*).

Type locality: Kashmir, India.

Distribution: India to S.E. Asia.

Host Plants: Urticacae

Remarks: In India, the species *A. caschmirensis* (Kollar) is represented by two subspecies; *A.c. caschmirensis* (Kollar) which is a western subspecies known from the Kashmir Valley (Jammu and Kashmir) to Kulu (Himachal Pradesh) (Varshney and Smetacek, 2015), and *A.c. aesis* (Fruhstorfer) distributed through Uttarakhand to Arunachal Pradesh and Nagaland (Greeshma, 2010; Naro, 2012; Varshney and Smetacek, 2015; Irungbam, 2017). Irungbam (2017) recorded the range extension of *A.c. aesis* (Fruhstorfer, 1912) into different parts of the Manipur State. More recent records of this species from the western Himalaya are as follows: Uniyal (2007); Singh (2009); Smetacek (2012); Bhardwaj et al. (2012);

Sidhu *et al*. (2012); Qureshi *et al*. (2014); Singh and Sondhi (2016); Sondhi *et al*. (2017).

The male and female genitalia along with the life history stages was described and illustrated by Rose (2005).

Aglais ladakensis (Moore)

Common name: The Ladakh Tortoiseshell

Moore, 1878; Ann. Mag. nat. Hist. (5) 1 (3): 227 (*Vanessa*).

Type locality: Gogra, Changchenmo (15000ft), Ladak; Karatagh lake, on snow (16890ft), Yarkund

Distribution: Jammu and Kashmir to Sikkim

Host Plants: Urticacae

Remarks: It is indeed a very rare species. Smith *et al.* (2007) reported this species from Muchuwar valley, Pakistan. It has been reported by Doherty (1886); Moore (1899-1900); Hannyngton (1910); Evans (1932); Vis and Coene (1987); Varshney and Smetacek (2015); Sondhi *et al*. (2017).

Discussion:

A review of the western Himalayan butterflies under the tribe Nymphalini has been presented. Based on the external genitalic survey the following conclusions can be drawn:

Tegumen is very robust (except in genus *Symbrenthia* Hübner, in which it is relatively small) and projecting backwardly (in lateral view) in all the species under consideration. Uncus is also well developed and sclerotized (dorso-ventrally flattened in *K. canace* (Linnaeus); straight and tapering into blunt tip in *N. xanthomelas* (Esper) and *P.c-album* (Linnaeus); somewhat swollen near base, long and divided in *S. lilaea* (Hewitson); simple and long in *S. hypselis* (Godart); simple with broad base and tapering in *S. niphanda* Moore; simple, long with Y-shaped apex in *S. brabira* Moore; beak like, stout with a bifid apex in *V. indica* (Herbst); stout, beak like with a blunt tip in *V. cardui* (Linnaeus); undivided, straight, dorsoventrally compressed in *A. cashmirensis* (Kollar) and *ladakensis* (Moore)). Vinculum is well developed. Saccus is generally small and upturned obliquely (*N. xanthomelas* (Esper), *P.c-album* (Linnaeus), *K. canace* (Linnaeus), *V. indica* (Herbst), *V. cardui (Linnaeus))*. The genus *Symbrenthia* Hübner is an exception, as in *S. lilaea* (Hewitson) the saccus is long, tubular and slightly curved upwards towards the tip, where as in *S. hypselis* (Godart), *S. niphanda* Moore and *S. brabira* Moore (as well in *A. cashmirensis* (Kollar) and *ladakensis* (Moore)) it is long and straight. Gnathos is prominently developed (especially in *P. c-album* (Linnaeus)). Juxta is sclerotized, and valva is very broad and heavily sclerotized in in all the species under consideration. However, latter's shape vary in every species. Aedeagus is long, heavily sclerotized, robust, abruptly and obliquely bent beyond the half-length, and tapers into a sharp tip (*N. xanthomelas* (Esper), *P. c-album* (Linnaeus), *K. canace* (Linnaeus), *V. indica* (Herbst)), whereas it is broad and almost straight in *S. lilaea* (Hewitson); long, narrow and slightly curved in *S. hypselis* (Godart), *S. niphanda* Moore and *S. brabira* Moore*;* long, narrow and wavy in *A. cashmirensis* (Kollar) and *ladakensis* (Moore).

The data for female genitalia is however incomplete. In general, the genital plate is weakly developed with pod-like ostium bursae. Ductus bursae is long, narrow and partly sclerotized at the proximal end and otherwise membranous (*S.lilea* (Hewitson), *S. hypselis* (Godart), *V.indica* (Herbst), *A.cashmerensis* (Kollar), K. canace (Linnaeus)). Corpus bursae is oval, elongated or balloon like, membranous with a pair of diffused signum. Ductus seminalis enters at the junction of sclerotized and membranous portion of ductus bursae. Anterior apophysis are absent and posterior apophysis are short and weakly sclerotized. Papila analis moderately sclerotized.

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