



Taxonomic Studies on the Tribe- Archipini (Lepidoptera: Tortricidae) from Kashmir Himalaya, India

Mushtaq Ganai^{1*} and Zakir Khan¹

¹*Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar- 190 025, India.*

Authors' contributions

This work was carried out collectively by both authors. Author MG collected the specimens, performed the laboratory work and wrote the first draft of the manuscript. Author ZK selected the topic, performed the photography of specimens and helped in finalization of the draft of manuscript. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/ARRB/2018/41606

Editor(s):

(1) Dr. George Perry, Dean and Professor of Biology, University of Texas at San Antonio, USA.

Reviewers:

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Complete Peer review History: <http://www.sciedomain.org/review-history/25264>

Original Research Article

Received 5th April 2018

Accepted 16th June 2018

Published 25th June 2018

ABSTRACT

Aims: Taxonomy refers to assignment of name to an organism which provides the only key to all the information available about that species and its relatives. Careful and accurate identification and classification of organisms are of vital importance so that the extents of their harmful and beneficial properties are established. Since some of the members of tribe Archipini are pests of various crops, so this study was conducted with the aim to identify, describe, name and classify these species and also prepare illustrated diagnostic keys for their quick and authentic identification and efficient management.

Study Design: Taxonomy of tribe Archipini.

Place and Duration of Study: The collection of these tortricid moth specimens was done in districts Anantnag, Ganderbal, Kupwara, Kargil and Leh of J&K State during 2010-2012, while as

*Corresponding author: E-mail: Ganaimushtaq12@gmail.com;

their processing was performed during 2014 in Biosystematics Laboratory, Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar-190 025.

Methodology: For this study, intensive and extensive collection-cum-survey tours were conducted to capture tortricid moth species from far-flung localities of different areas of Kashmir and Ladakh from March 2010 to November 2012. Since these moths being nocturnal in behaviour, their collection was done during night with the help of portable bucket type light traps fitted with 125 W mercury vapour lamp and mercury vapour lamp hung along a white cloth sheet secured to a wall or directly over a plain white wall to protect wings and scales from damage due to overcrowding during trapping in bucket of light trap. These specimens after collection from field were processed in laboratory. For preparation of permanent slides for wing venation, method proposed by Common (1970) and advocated by Zimmerman (1978) was followed, while as for studying male and female genitalia, the method suggested by Robinson (1976) was followed with slight modification.

Results: Twelve Tortricid moth species belonging to six genera viz., *Choristoneura* Lederer, *Archips* Hubner, *Pandemis* Hubner, *Clepsis* Guenee, *Neocalyptis* Diakonoff and *Homona* Walker of tribe Archipini and sub-family Tortricinae were collected from Kashmir Himalaya and dealt with taxonomically. Overall, two species viz., *Choristoneura pseudofumiferana* and *Clepsis kupwari* are being reported as new to science. Besides, giving an illustrated account of new species, the taxonomic account of already known species has also been added to improve their diagnosis. Further, key to the presently examined species of all genera has been prepared on the basis of characters such as labial palpi, antennae, costal fold, anal fold, wing venation and male and female genitalic characteristics.

Conclusion: In the Kashmir and Ladakh Himalayan region (North-west) of J & K state of India twelve species belonging to six genera viz., *Choristoneura* Lederer, *Archips* Hubner, *Pandemis* Hubner, *Clepsis* Guenee, *Neocalyptis* Diakonoff and *Homona* Walker of tribe Archipini have been collected during present investigation, out of which two species viz., *Choristoneura pseudofumiferana* and *Clepsis kupwari* are being reported as new to science. Further the reporting of two new species increased the number of species under genus *Choristoneura* Lederer from four to five and genus *Clepsis* Guenee from two to three in Kashmir zone of Jammu & Kashmir.

Keywords: *Choristoneura*; *Clepsis*; fauna; leaf roller; *Neocalyptis*; *Pandemis*; Tortricid moth.

1. INTRODUCTION

Archipini were initially recognized by Pierce and Metcalfe [1] based on the presence of an elongated signum and a bulbous capitulum in the female genitalia, however, several of the taxa placed in the tribe by them lacked this character and the circumscription of the group was based solely on the British fauna. Common [2] subsequently had difficulty applying Pierce and Metcalfe tribal arrangement to the Australian tortricids, which led him to broaden Archipini to include several additional taxa lacking the signum and/or capitulum. Horak [3,4] postulated that Common's concept of Archipini was polyphyletic and divided the tribe into three groups typified by *Archips*, *Clepsis*, and *Planotortrix*. Razowski [5] briefly expanded the tribe to include the tribe Euliini but then removed the latter, as well as transferring taxa with a well sclerotized costa of the valve of the male genitalia into a new tribe, Ramapesiini [6]. Jinbo [7] conducted the only phylogenetic analysis of

Archipini to date, based on morphology of the Japanese species, and found Ramapesiini to be paraphyletic to a monophyletic Archipini. According to Brown [8] Archipini is the largest tribe within the Tortricinae, with more than 1,600 described species in 150 genera. Its members are present in all regions but are uncommon in the neotropics. Most are polyphagous leafrollers, and this tribe contains many pests, such as the light brown apple moth (*Epiphyas postvittana* Walker). A synapomorphy for the group is the dagger-shaped signum in the female corpus bursae. Following this characterisation, the material collected from Kashmir Himalaya have been found to belong Twelve species of six genera viz., *Choristoneura* Lederer, *Archips* Hubner, *Pandemis* Hubner, *Clepsis* Guenee, *Neocalyptis* Diakonoff and *Homona* Walker belonging to tribe Archipini and sub-family Tortricinae. Further the authors acknowledge that they mistakenly mentioned the new reported species in their earlier diversity related published manuscript (Ganai & Khan [9]) first, but they now

want to clarify that they wish to establish that the current work contains the formal description of these new species.

2. METHODOLOGY

For this study, intensive and extensive collection-cum-survey tours were conducted to capture different tortricid moth species in five districts viz. Anantnag, Ganderbal, Kupwara, Kargil and Leh based on their accessibility, differing elevation, and habitat type from March 2010 to November 2012. Since Tortricid moths being nocturnal in behaviour, their collection was done during night with the help of portable bucket type light traps fitted with 125 W mercury vapour lamp and mercury vapour lamp hung along a white cloth sheet secured to a wall or directly over a plain white wall to protect wings and scales from damage due to overcrowding during trapping in bucket of light trap. In this method specimen tubes with a piece of cotton soaked in benzene and a piece of blotting paper placed over it, were used for trapping and killing the moths. Also chargeable electric lamp was also used for collection purpose in some areas where electricity supply was not available. The surveyed areas included both plains and hilly places and elevation extremes examined for the study ranged from 1700 meters to 3000 meters. The collected individuals were killed with benzene or ethyl acetate vapours in the killing bottles, transferred into butter paper envelops and were brought to the laboratory, where these were properly stretched in the small adjustable wooden stretching boards or thermocol sheets after pinning through the mid of mesothorax. Before stretching, the specimens were relaxed on blotting paper placed over water soaked cotton sterilized with phenol in an airtight Petri dish and left for 4-6 hours. The stretched specimens were then oven dried for 72 hours at 60°C and preserved in the insect storage boxes, fumigated with naphthalene balls. Before the specimens were preserved in the boxes, each was furnished with data such as name of the locality, locality altitude, date of collection, and name of the collector etc. For preparation of permanent slides, method proposed by Common [10] and advocated by Zimmerman [11] for wing venation was followed, while as for studying male and female genitalia, the method suggested by Robinson [12] was followed with slight modification. All the specimens after sorting were identified with the help of relevant literature especially the Tort fauna of Korea, Guide to tortricid moths of America at the first instance. To

achieve this important objective, an exhaustive search of Biological Abstracts, Entomological Abstracts, Zoological Records, and Net surfing led to the collection of large number of references and procurement of research papers. A communication channel was also established with the eminent taxonomists currently working on family Tortricidae around the globe. The identification was confirmed by sending adult, wing and genitalia photographs to these tortricid experts for examination and validation of species. The photography of adult moths, fore and hind wings, external male and female genitalic structures was done at the same scale of magnification with the help of digital camera attached to Stereo zoom Olympus microscope and specimens are deposited in the insect collection of the museum of bio-systematic laboratory in the Division of Entomology, SKUAST-K, Shalimar campus, Srinagar.

3. RESULTS AND DISCUSSION

The members of tribe Archipini have forewing with costal fold in males, chorda rarely present. Male genitalia always with coremata on eighth sternite; uncus with hair brush below apex; valve with pulvinus; sacculus sclerotized along ventral edge and dorsal margin membranous. Female genitalia with dagger shaped signum.

3.1 Genus *Archips* Hubner

Hubner, 1822, *Syst.-alphab. Verz.* 58.

Type species: *Phalaena (Tortrix) piceana* Linnaeus, 1758

Distribution: Palaearctic, Nearctic and Oriental regions

Diagnosis: The members of this genus are characterised by broad forewings due to concave shaped termen or costa or both beyond the apex. More often the ground colour is yellowish to brownish with pinkish or reddish admixture. The markings are reduced in females while as in males the basal patch is often expressed dorsally. Sexual dimorphism exists in size and colour and females are larger than males. The fore wing of male is more expanded terminally while as in females the termen is more strongly concave beyond apex. Male genitalia usually with slender uncus, gnathus arm slender, socius small or rudimentary, tegumen large with ventral sclerites, valve ovate, pulvinus distinct and juxta simple. Aedeagus is simple with numerous

cornuti. Female genitalia with more or less elongated sterigma which is anteriorly cup shaped, ductus bursae long, ductus seminalis extending from antrum and capitulum of signum and basal plates distinct.

3.1.1 Archips cantinus Razowski, 2006

Cantinus Razowski, 2006 (*Archips*), *Acta Zool. Cracov.* 49B: 122.

Description: Adult (Fig. 1a): Head and thorax creamy brown. Forewing costa distinctly convex in basal third, slightly concaving post-medially; termen oblique, not concave beneath apex; posterior side of forewing not expanding. Ground colour pale, sprinkled with rust; veins suffused with same colour. Hindwing pale brownish, creamy towards base.

Male genitalia (Fig. 2a): Uncus moderately broad, pointed apically; socii rudimentary; tegumen long and thin; vinculum U shaped; membranous part of valve straight dorsally and terminal process of sacculus thick, upcurved and short; aedeagus slender, distinctly extending ventro-terminally; coecum penis long, perpendicular to the latter; cornuti two in vesica.

Female genitalia (Fig. 3a): Papilla analis wide and short, anterior apophyses slightly longer than posterior apophyses; sterigma cup shaped, distal edge of postostial sterigma strongly projecting medially, submedian part expanding laterally, proximal portion short; ductus bursae somewhat short; cestum short, hardly reaching middle of the latter; signum slender, long, with large sized capitulum.

Wing span: Male 23 mm, Female 24 mm.

Material examined: Salia, 02.v.10-1♂; 02.ix.12-1♂; Gutlibag, 06.v.10-3♂; 11.ix.10-2♂; 09.ix.11-2♂, 1♀; Kundalgam, 10.v.10-1♂; 01.viii.12-6♂, 2♀; Kargil, 18.v.10-1♂; Khalsi, 27.vi.10-1♂, 1♀; 31.vii.10-2♂; 13.v.11-1♂; 28.vi.11-1♂; 01.vii.11-2♂, 1♀; 25.ix.11-1♂; 21.vii.12-3♂, 1♀.

Distribution: Kashmir (India).

Remarks: Razowski [13] named a new species *cantinus* under the genus *Archips* Hubner from female specimen collected from Kashmir Himalaya and published this in his paper. He also found that this species resembles with *Archips asiaticus* (Walsingham, 1900) as the shapes of the female genitalia show; but argued that it differs from that species in much shorter

ductus bursae and proximal portion of cup-shaped part of sterigma. The present collection comprised of thirty one specimens which have been found conspecific on the basis of female genitalia and has been identified as *Archips cantinus* Razowski. Further, the male genitalia which was reported first time, was found similar with *Archips naltarica* Razowski, 2006 from the same region but differentiates from that in shape of valvae and sacculus.

3.1.2 Archips naltarica Razowski, 2006

Naltarica Razowski, 2006 (*Archips*), *Acta Zool. Cracov.* 49B: 122.

Description: Adult (Fig. 1b): Head and thorax light to dark orange rust. Forewing brownish basally with indistinct pinkish, distinct refractive along edges of markings; markings orange, basal blotch broad, rather diffuse; median fascia slender, pale at costa, very broad, darkening towards dorsum; subapical blotch long, orange rust, fusing with subterminal diffuse marking; concolorous spot at apex. Cilia cream tinged greyish ochreous. Hindwing creamy orange and at base; cilia cream white, cream at apex. Male with costal fold ill-defined and a long upcurved wing edge.

Male genitalia (Fig. 2b): Uncus slender, elongated, pointed apically; socius rudimentary; tegumen long and thin; vinculum oval shaped; terminal process of sacculus small; aedeagus slender, distinctly extending ventro-terminally, with some ventral microthorns beyond zone; coecum penis long, perpendicular to the latter; two cornuti in vesica.

Female genitalia (Fig. 3b): Papilla analis thin and short, anterior apophyses longer than posterior apophyses; sterigma U shaped somewhat small, ostium bursae moderate; ductus bursae medium; cestum to two third of the ductus bursae, broad in basal half; signum slender with elongate basal plate and small capitulum.

Wing span: Male 20 mm, Female 23 mm.

Material examined: Hiller, 03.v.10-1♂; Handwara, 09.v.10-1♂; 21.viii.10-2♂, 1♀; 19.vi.11-2♂; 30.vii.12-3♂, 2♀; Khalsi, 19.v.10-1♂; 31.vii.10-3♂, 1♀; 11.v.11-2♂.

Distribution: Kashmir (India).

Remarks: Razowski [13] on the basis of some individuals named a new species *naltarica*

Razowski under genus *Archips* Hubner and published this in his paper. Further he found male genitalia of this species similar with *Archips dierli* Diakonoff, 1976 from Nepal but differentiated it from that by large coecum penis perpendicular to median part of aedeagus, long ventral termination of aedeagus and light prominences of basal part of sterigma situated away from one another which was also observed in present study. The present collection comprised of nineteen individuals which have been found conspecific on the basis of genital structures and has been identified as *Archips cantinus* Razowski.

3.2 Genus *Choristoneura* Lederer

Lederer, 1859, *Wien. ent. Monatschr.* 3: 426.

Type species: *Tortrix diversana* Hübner, [1814-1817].

Distribution: Palaearctic and Nearctic regions.

Diagnosis: Fore wings are usually large with yellowish to brownish ground colour and with basal blotch, median fascia and sub apical spot markings. Males often are smaller than females and markings also more developed in males. Male genitalia with often club shaped uncus, gnathus arm simple, socius variable, valve with better differentiated dorso-proximal portion due to presence of long scent scales, sacculus simple with 1 or 2 thorns, juxta simple, aedeagus is with caulis short or strongly elongated and cornuti numerous long spines. Female genitalia with anterior portion of sterigma short, rarely cup shaped and long ductus bursae with long cestum.

Remarks: Genus *Choristoneura* was proposed by Lederer [14], with *Tortrix diversana* Hübner as its type species. Razowski [15] revised *Choristoneura* dealing with the Palaearctic and Nearctic species and Brown [16] included 38 species in the genus, with 20 described from the Palearctic Region, 17 from the Nearctic Region, and one from the Afrotropical Region. In the present study, out of five species already reported from the region under genus *Choristoneura* Lederer, only one could be collected from different localities of Kashmir which was identified as *Choristoneura colyma* Razowski. In addition to this one more species identified as *Choristoneura pseudofumiferana* sp.nov. was reported as new to science. Both the species are studied in detail in the present manuscript.

3.2.1 *Choristoneura colyma* Razowski, 2006

Colyma Razowski, 2006 (*Coristoneura*), *Acta Zool. Cracov.* 49B: 123.

Description: Adult (Fig. 1c): Head and thorax creamy tinged ferruginous; labial palpus brownish. Forewing terminally not expanding, costa convex upto middle, apically somewhat short, termen concave beneath apex; ground colour creamy yellow; markings ill-defined, pale rust consisting of dorsal remnants of basal blotch, three spots representing median fascia accompanied by weak spot at end of median cell and spot at tornus; cilia whiter than ground colour. Hindwing creamy white in colour with whitish cilia.

Male genitalia (Fig. 2c): Uncus spatulate, narrow basally rounded apically; socius small; tegumen broad but short; sacculus long with small thorn at middle and rather broad terminal fourth armed with apical thorn; fairly long process beyond middle of sacculus; vinculum U shaped; aedeagus short, terminating in small ventral thorn; coecum penis and caulis long with two long, slender cornuti in vesica.

Female genitalia (Fig. 3c): Large papilla analis long and convex, heavily covered with micro and macro setae; corpus bursae spherical, encircled by long ductus bursae and slightly sclerotized towards ductus bursae; signum three armed thorn like; ductus bursae thick and well developed; cestum long extending from corpus bursae to ostium bursae; posterior apophyses shorter than anterior apophyses, well sclerotized and anterior apophyses weakly sclerotized.

Wing span: Male 20 mm, Female 21 mm.

Material examined: Akingam, 06.vi.10-1♂; Lolab, 14.vi.10-1♂, Sonamarg, 11. vii. 10-1♂; 05. viii. 10-1♂, 1♀; 20. viii. 11-2♂; 16. viii. 12-3♂, 2♀; Gawran, 14. vii. 10-1♂, 1♀; Kupwara, 20. vii. 10-2♂, 1♀; 27.viii. 12-2♂, 1♀; Aru, 11. viii. 10-1♂.

Distribution: Kashmir (India).

Remarks: Razowski [13] named a new species *colyma* Razowski under genus *Choristoneura* Lederer on the basis of few male individuals collected from Kashmir region and published it in his paper. He further reported that its male genitalia resembling with *Choristoneura propensa* Razowski, 1992 from which it differs in

sacculus thorn length, and with *Choristoneura griseicoma* (Meyrick, 1924), *Choristoneura neurophaea* (Meyrick, 1932) and *Choristoneura ferrugininotata* Obraztsov, 1968 also with different thorn of sacculus, aedeagus and colouration, which was also observed during the present investigation. The present collection comprised of twenty one specimens which have been found conspecific on the basis of male genitalia and has been identified as *Choristoneura colyma* Razowski. Further, the female genitalia of this species were described first time, during the present study.

3.2.2 *Choristoneura pseudofumiferana* sp. nov.

Description: Adult (Fig. 1d): Head creamy with frons brown; eyes brown with black spots; labial palpus two, short, porrect and brownish. Forewing pointed at coastal side terminally, costa convex at middle, termen concave beneath apex; ground colour cream yellowish, veins in whole of wing appear as dark lines; markings ill-defined except some whitish spots appear on the posterior part of wing; cilia whiter than ground colour; costal fold absent in males. Hindwing with ground colour same as in forewing; cilia whitish.

Male genitalia (Fig. 2d): Slender, short uncus slightly expanding terminally; tegumen broad and short; sacculus with small thorn at middle and terminally pointed and upcurved; saccus narrow, simple; valvae well developed, differentiated into dorsal and ventral arms, dorsal arm weakly sclerotized almost of uniform thickness, beset with setae, terminally round and covered with long hairs, ventral arm very well sclerotized; socius small; aedeagus medium sized; coecum penis and caulis long; two long, slender cornuti in vesica.

Female genitalia (Fig. 3d): Papilla analis broad, heavily setosed with micro and macro setae; posterior apophyses longer than anterior apophyses, well sclerotized, apically spatulate; anterior apophyses weakly sclerotized, apically spatulate; corpus bursae small, slightly sclerotized towards ductus bursae, provided with shoe screw shaped signum; ductus bursae long, thin and well developed; cestum thin, long extending from corpus bursae to ostium bursae.

Wing span: Male 18 mm, Female 19 mm.

Material examined: Holotype: ♂ India, Jammu & Kashmir: District Anantnag; Ranipora, 1610 m,

33.71 N, 75.21 E, 05.vi.10, Mushtaq A. Ganai (Genitalia Slide BSL 114) (SKUAST-Kashmir).

Allotype: ♀ India, J & K: District Kupwara; Lolab, 1571 m, 34.45 N, 74.08 E, 27.viii.12, Mushtaq A. Ganai (Genitalia Slide BSL 115) (SKUAST-Kashmir).

Remarks: The individuals representing the genus *Choristoneura* could neither be identified through literature nor by tortricid moth experts and is presently named as new species *Choristoneura pseudofumiferana* sp. nov. This new species is closely similar with *Choristoneura fumiferana* (Clemens, 1865) in general maculation and in generalized structure of the external genitalia. However, the external male genitalia differs from that of *fumiferana* (Clemens, 1865) in presence of thorn on sacculus, valvae shape terminally, uncus which is short and thick and also in female genitalia in which ductus bursae is short, corpus bursae small and signum small, with *Choristoneura colyma* Razowski 2006 from which it differs in presence of small thorn on sacculus and shape of uncus, also with *Choristoneura neurophaea* (Meyrick, 1932) and *Choristoneura ferrugininotata* Obraztsov, 1968 from which it differ in shape of thorn on sacculus, shorter aedeagus and different colouration. During the present study, male and female adult representatives of this species were collected from different localities of Kashmir. The detailed description of morphology along with the genitalia, material examined and photograph of external genitalia are given for the sake of information.

Etymology: The species name *pseudofumiferana* refers to its resemblance with *fumiferana* (Clemens, 1865) of genus *Choristoneura* Lederer.

3.3 Genus *Clepsis* Guenee

Guenee, 1845, Annls Soc. ent. Fr (2)3: 149.

Type species: *Tortrix rusticana* Hubner [1796-1799] sensu Treitschke, 1830 [= *Tortrix senencionana* Hubner, [1818-1819].

Distribution: Palaearctic, Nearctic, Neotropical and Oriental regions.

Diagnosis: *Clepsis* genus is characterised by fore wing with curved costa basally, males with short rounded apex while in some females it is

pointed. Ground colour is ochreous to brownish with refractive scales in some species. Male genitalia with slender to very broad uncus and flattened dorsoventrally, tegumen very broad, gnathos arms simple often armed with numerous spines, valva with terminal portion often well differentiated, sacculus usually tapering terminally and aedeagus simple with spiniform cornuti. Female genitalia with sterigma provided with slender lateral plates and well developed dorsal cavity, membranous or with distinct internal sclerites antrum, inception of ductus seminalis anterior to antrum or from its dorsal surface and capitate type of signum.

Remarks: *Clepsis* Guenée, 1845 is a large genus of tribe Archipini of subfamily Tortricinae. In the present study, both the two species already reported from the region under genus *Clepsis* Guenée, were collected from different localities of Kashmir and Ladakh which were identified as *Clepsis rurinana* Linnaeus and *Clepsis translucida* Meyrick. In addition to this one more species named as *Clepsis kupwari* sp.nov. was reported as new to science. All these species are studied in detail in the present manuscript.

3.3.1 Clepsis rurinana (Linnaeus, 1758)

Rurinana Linnaeus, 1758 (*Phalaena (Tortrix)*), *Systema Naturae* (10th ed.): 823.
Phalaena Tortrix modeeriana Linnaeus, 1761: 347.
Phalaena Tortrix moderiana: Linne, 1767: 880
Phalaena Tortrix angulana Villers, 1789: 417, 612
Pyralis avellana Panzer, 1804 (nee Linne): 124
Tortrix consimilana Treitschke, 1830 (nee Hiibner): 75
Cacoecia idana Kennel, 1919: 51, pl. 2, fig. 1.
Tortrix semialhana Guenée, 1845: 139
Tortrix obscura Dufrane, 1957
Phalaena angulosa Fourcroy, 1785
Tortrix croceana Curtis, 1850 (nee Haworth): 110
Clepsis (Siclobola) rurinana: Diakonoff, 1955: 45
Clepsis (Siclobola) semialhana: Obraztsov, 1954—1957: 52, 193, 213, 315.
Tortrix liotoma Meyrick, 1936: 60.

Description: Adult (Fig. 1e): Head with frons dark; vertex with rough scales, yellowish brown; thorax yellowish brown. Forewing with ground colour pale brown; basal blotch, median fascia and subapical blotch dark brown; basal portion of costal edge yellow-brown; costal fold broad, reaching median fascia; apex blunt; termen

oblique. Hindwing pale gray, termen somewhat yellow. Legs whitish, outer side of tarsi of foreleg, midleg and outer spur of midleg dark brown.

Male genitalia (Fig. 2e): Tegumen broad; uncus strong, distinctly broadened at middle, tapering terminally, rounded apically; socius small; arm of gnathos strong, rounded apically; valva oblong, terminal portion with lobe; sacculus narrow, slightly convex near base; median part of labis broad and spined, terminal portion slender; aedeagus thin, apically rounded, with three large cornuti in vesica.

Female genitalia (Fig. 3e): Papilla analis short, lightly setosed with micro and macro setae; posterior apophyses slightly longer than anterior apophyses; corpus bursae medium, spherical, dilated, slightly sclerotized towards ductus bursae, signum elongated with small capitulum; ductus bursae long, thin and well developed; cestum thin, long extending from corpus bursae to ostium bursae.

Wing span: Male 19 mm, Female 20 mm.

Material examined: Salia, 02.v.10-1♂, 22.v.12-1♂, 02.ix.12-3♂, 1♀; Gutlibag, 06.v.10-2♂; 08.vii.11-5♂, 3♀; 04.v.12-2♂, 1♀; Khalsi, 27.vi.10-1♂; 31.vii.10-2♂, 1♀.

Distribution: China, Mongolia, Korea, Japan, India, Nepal, Afghanistan, Siberia and Europe.

Remarks: Diakonoff [17] gave the photographs of external genitalic structures of the species *rurinana* Linnaeus and also described it in detail. This species has been also treated by Razowski [18] and transferred to *Clepsis*. This is similar to *Clepsis melissa* (Meyrick, 1908), but differs from the latter in forewing ground colour, uncus, sacculus and aedeagus. This species is also closely allied to *Clepsis laetornata* Wang, but can be distinguished from it by basal blotch on the surface of the forewing very small and indistinct; uncus longer and less strong than that of the latter species; aedeagus less slender, laterally with subterminal denticle which was also observed by Zinpu et al. [19].

3.3.2 Clepsis kupwari sp. nov.

Description: Adult (Fig. 1f): Head with frons light brown; vertex pale yellow with rough scales; antennae with scape and pedicel light yellow; eyes dark brown; labial palpus, short, porrect and brownish furnished with pale brown scales;

thorax chocolate colour. Forewing with ground colour light brown; basal blotch, median fascia and subapical blotch dark brown; basal portion of costal edge dark-brown; costal fold broad in male. Hindwing with ground colour same as in forewing; cilia dark-brown. Legs creamy-whitish, outer side of tarsi of foreleg and mid leg dark brown. Dorsal surface of abdomen chocolate, ventral surface light-creamy.

Male genitalia (Fig. 2f): Uncus spatulate shaped, well sclerotized and has a shorter base, connected to tegumen by means of a slender neck; tegumen almost of equal length as uncus, broader at base, narrow towards apex; vinculum longer than tegumen, weakly sclerotized and O-shaped; socii very short, somewhat dilated; gnathos with a large, strong middle process, tapering backward; valvae well developed, inversely trapezoidal, broad, rounded externally, undifferentiated into dorsal and ventral arms; sacculus reaching to about middle of valva length; aedeagus broad proximally, bent in external portion, slightly narrower and sclerotized towards distal end, bearing a laterodorsal thorn before apex; coecum penis elongate, slightly narrowed at middle, rounded cephalically, directed obliquely ventrad from external portion of aedeagus; cornuti 3-5 long, straight, deciduous needles.

Female: Not found.

Wing span: Male 15 mm.

Material examined: Holotype: ♂ India, Jammu & Kashmir: District Kupwara; Kupwara town, 1577 m, 34.43 N, 74.12 E, 20.vii.10, Mushtaq A. Ganai (Genitalia Slide BSL 33 a) (SKUAST-Kashmir).

Paratype: ♂ India, Jammu & Kashmir: District Kupwara; Kundalgam, 1573 m, 34.44 N, 74.09 E, 26.viii.11, Mushtaq A. Ganai (Genitalia Slide BSL 33 b) (SKUAST-Kashmir).

Remarks: The male specimens representing the genus *Clepsis* could neither be identified through literature nor by tortricid moth experts and is presently named as new species *Clepsis Kupwari* sp. nov. The new species is closely similar with *Clepsis persicana* (Fitch) in general maculation and in generalized structure of the external genitalia. However, the external male genitalia differs from that of *persicana* (Fitch) in the shape of uncus which is more round with narrow neck, tegumen which is less broad and also in valvae which are long and thin than

persicana (Fitch). During the present study, three male representatives of this species were collected from different localities of Kashmir and identified as new species. Hence, the detailed description of morphology along with the genitalia, material examined and photograph of external genitalia are given for the sake of information.

Etymology: The species name *Kupwari* refers to its place of collection "Kupwara".

3.3.3 Clepsis translucida (Meyrick, 1908)

Translucida (Meyrick, 1908) (*Cacoecia*), J. Bombay nat. Hist. Soc., 18: 616.

Cacoecia translucida Meyrick, 1908.

Description: Adult (Fig. 1g): Head chocolate; labial palpus two and brownish. Forewing expanding terminally, costa straight to apex; ground colour dark gray; markings ill-defined; cilia creamy colour. Hindwing colour same as forewing.

Female genitalia (Fig. 3f): Papilla analis shoe shaped, long and convex, lightly covered with micro and macro setae; posterior apophyses shorter than anterior apophyses, well sclerotized and anterior apophyses weakly sclerotized; corpus bursae large spherical connected by medium ductus bursae; cestum absent; signum three armed thorn like with a small caputulum. Male not found.

Wing span: Female 19 mm.

Material examined: Kangan, 09.vi.10-1♀; 10.vi.11-1♀; 15.vi.12-1♀; Leh, 01.viii.10-1♀.

Distribution: Kashmir (India).

Remarks: This collection comprised of four specimens which have been found conspecific on the basis of female genitalia and has been identified as *Clepsis translucida* Meyrick. This species was established by Meyrick [20] and described in detail, since then also treated by several other authors. Hence, the detailed description of morphology along with female genitalia is given in this for more improvement in identification.

3.4 Genus Neocalyptis Diakonoff

Diakonoff, 1941, Treubia, vol. 18, p. 407.

Type species: *Neocalyptis telutanda* Diakonoff, 1941.

Distribution: Ethiopian, Nearctic, Oriental and Palaearctic regions.

Diagnosis: The members of this genus are characterised by uniformly broad fore wing with costa straight except for basal third, termen weakly oblique, gently sinuate; ground colour variable; cilia worn; hindwing variable in colour. Male genitalia with uncus slender to broad, broadening basally; socius usually large; arms of gnathos long; valvae oval or spherical and membranous; aedeagus usually bent with tapering terminad, terminal process (broken); cornuti group of large spines. Female genitalia corpus bursae variable, membranous; posterior apophyses slightly shorter than anterior apophyses; ductus bursae medium to long and membranous; papilla analis variable, setosed with setae; sterigma with a cup shaped part but without any sharp part of lateral arms; capitulum of signum visible, blade of signum usually long.

Remarks: In this study, out of three species already reported from the region under genus *Neocalyptis* Diakonoff, only two could be collected from different localities of Kashmir and Ladakh. Both the species were identified as *Neocalyptis ladakhana* Razowski and *Neocalyptis chlansignum* Razowski and are studied in detail in the present manuscript.

3.4.1 *Neocalyptis chlansignum* Razowski, 2006

Chlansignum Razowski, 2006 (*Neocalyptis*), Acta Zool. Cracov. 49B: 125.

Description: Adult moth (Fig. 1h): Brownish head; brown coloured marked with brown before median joint ends laterally; thorax dark-brownish coloured. Forewing narrow at base, broadening at medium but not expanding terminally; termen nearly straight, slightly oblique; ground colour creamy sprinkled with brown; markings dark greyish-brown consisting of dorsal remnant of basal blotch, weakly-defined median fascia dark at costa and large triangular subapical blotch reaching end of termen; cilia pale creamy ochreous. Hindwing brown-grey; cilia very paler.

Male genitalia (Fig. 2g): Slender and long uncus; socius medium; arms of gnathus almost long; valva oval with long dorsal hair brush; sacculus weakly sclerotized, short lines on ventral side of valva; aedeagus medium, bent and tapering

terminally, with broken terminal process and armed with post median, dorso lateral process extending beyond its termination; coecum penis long; cornuti in the form of bunch of long spines.

Female: Not found.

Wing span: Male 12 mm.

Material examined: Khalsi, 31.vii.10-1♂; 01.vii.11-3♂; 25. ix.11-1♂; 22.vi.12-2♂; Shargol, 03.viii.10-2♂.

Distribution: India (J&K).

Remarks: Razowski [13] named a new species *chlansignum* Razowski under genus *Neocalyptis* Diakonoff on the basis of few female individuals collected from Kashmir region and published it in his paper. He further reported that this species resembles externally with *Neocalyptis nexilis* Razowski, 1984 which was also found in present research. Further, female genitalia are differing from that of *Neocalyptis nexilis* in slender, rather long colliculum and larger signum. The present collection comprised of four male specimens which have been found conspecific on the basis of male genitalia and has been identified as *Neocalyptis chlansignum* Razowski. Further, the male genitalia of this species were described first time, during the present study.

3.4.2 *Neocalyptis ladakhana* Razowski, 2006

ladakhana Razowski, 2006 (*Neocalyptis*), Acta Zool. Cracov. 49B: 125.

Description: Adult (Fig. 1i): Head and thorax brownish. Forewing of same width basally and apically but terminally not expanding more; costa nearly straight except at basal part where it turns towards inner; apex very short and rather sharp; termen lightly oblique, rather sinuate below apex; ground colour whitish-brown and finely strigulated with brown; markings dark consisting of dorsal remnant of basal blotch, median fascia expand at tornus and large subapical blotch proceeding to end of termen; cilia of same colour with ground colour, whitish-brown at tornus, with trace of brownish median line. Hindwing grey-brown; cilia seldom paler.

Male genitalia (Fig. 2h): Broad, straight uncus, some what expanding apically; socius medium; arms of gnathus almost long; valva short, complete round; sacculus short, weak within membranous valva; aedeagus medium, bent and tapering terminad, with broken terminal process; cornuti in the form of group of large spines.

Female genitalia (Fig. 3g): Corpus bursae round, membranous; posterior apophyses slightly shorter than anterior apophyses; ductus bursae medium and membranous; papilla analis nearly triangular, setosed with setae; sterigma with a cup shaped part but without any sharp part of lateral arms; capitulum of signum visible, blade of signum long.

Wing span: Male 12 mm, Female 13 mm.

Material examined: Kharbo, 25.vi.10-1♂; 26.vi.11-1♂; 17.vii.12-5♂, 1♀; Khalsi, 27.vi.10-1♂; 31.vii.10-2♂, 1♀.

Distribution: India (J&K).

Remarks: Razowski [13] named a new species *ladakhana* Razowski under genus *Neocalyptis* Diakonoff on the basis of few female individuals collected from Ladakh region of J & K and published it in his paper. He further reported that this species resembles closely with *Neocalyptis nematodes* (Meyrick, 1928) from Philippines but differs from that in longer subapical blotch of forewing, the much longer ductus bursae and the atrophied basal sclerite of signum which was also observed in present investigation. The present collection comprised of seven specimens which have been found conspecific on the basis of female genitalia and has been identified as *Neocalyptis ladakhana* Razowski. Further, the male genitalia of this species were described first time, during the present study.

3.5 Genus *Pandemis* Hubner

Hubner, [1825] 1816, Verz. bekannter Schmett. 388.

Type species: *Pyralis corylana* Fabricius, 1794.

Distribution: Ethiopian, Nearctic, Oriental and Palaearctic regions.

Diagnosis: Members of this genus are characterised by broad forewings with termen or costa or both concave beyond apex, ground colour yellowish to brownish and markings consist of basal patch, median fascia and pre-apical spot. Male genitalia with strong uncus provided with hairy brush, gnathus short and simple, socius large, valvae short and dorsally round, sacculus simple or with minute free termination, aedeagus well developed with slender coecum penis and cornuti broadening post-basally. Female genitalia with variably

developed sterigma provided with cup shaped portion and short lateral plates around dorsal cavity, ductus seminalis posterior or extending dorsally from antrum, anterior part of ductus bursae broad and signum with distinct capitulum and basal plates.

Remarks: In this study, the only species already reported from the region under genus *Pandemis* Hubner, had been collected from different localities of Kashmir and Ladakh. This species was identified as *Pandemis thomasi* Razowski and is studied in detail.

3.5.1 *Pandemis thomasi* Razowski, 2006

Thomasi Razowski, 2006 (*Pandemis*), Acta Zool. Cracov. 49B: 124.

Description: Adult (Fig. 1j): Whitish cream head; labial palpus comparatively long and rather concolorous; antenna weakly dentate-ciliate, with notch near base; thorax brownish. Forewing almost broad; costa of forewing without costal fold, distinctly convex to middle; apex rather short; termen not oblique to middle, slightly concave beneath apex; ground colour brownish, markings weakly defined consisting of dorsal part of basal blotch, median fascia well-defined, widening towards tornus and subapical blotch. Hind wing brownish.

Male genitalia (Fig. 2i): Large uncus, apex rounded, slightly concave medially; socius large, broadest post medially; gnathus simple and well developed, with rather short arms; sacculus rather long, rounded terminally; transtilla strongly constricted medially; aedeagus almost slender provided with few dorsal teeth at middle and terminally small dorsal process; cornuti in the form of group in vesica.

Female genitalia (Fig. 3h): Shoe shaped papillae analis; ductus bursae medium, well developed, simple and narrow towards ostium bursae; anterior apophyses much shorter than posterior apophyses; anterior part of sterigma broad, provided with cup shaped portion and short lateral plates around dorsal cavity, ductus seminalis posterior or extending dorsally from antrum; antrum relatively very short, tapering hardly towards anterior, sclerotized lateral walls of antrum not parallel; ductus bursae without cestum; corpus bursae almost oval with two small sclerotized patches; signum with short basal plate.

Wing span: Male 20 mm, Female 23 mm.

Material examined: Gund, 10.vii.10-2♂, 1♀; Kupwara, 28.v.12-1♂; Mulbek, 20.viii.12-2♂, 1♀; Sonamarg, 5.viii.10-1♂.

Distribution: India (Jammu and Kashmir).

Remarks: Razowski [13] named a new species *thomasi* Razowski under genus *Pandemis* Hubner on the basis of few male individuals collected from Kashmir region of J & K and published it in his paper. He further reported that this species resembles closest to *Pandemis heparana* ([Denis & Schiffermüller], 1775), but reported that it can be distinguished easily from that by slenderer, rounded terminally uncus which was also observed in present investigation. The present collection comprised of eight specimens which have been found conspecific on the basis of male genitalia and has been identified as *Pandemis thomasi* Razowski. Further, the female genitalia of this species were described first time, during the present study.

3.6 Genus *Homona* Walker

Walker, 1863, *List Specimens lepid. Insects Colln. Br. Mus.* 28: 424.

Type species: *Homona fasciculana* Walker, 1863 [= *Tortrix coffearia* Nieter, 1861].

Distribution: Oriental and Eastern Palaearctic regions.

Diagnosis: Forewing semi-ovate and elongated with semicircular costal fold in males. In some species median fascia divided into oblique dorsal fascia and dark costal patch in males and reduced markings in females. Male genitalia with round large uncus provided with clavate top; socii narrow; valva short, broad and triangular; sacculus sclerotized strongly. Female genitalia with variable sterigma; long ductus bursae provided with long cestum and large signum.

Remarks: In this study, all the two species already reported from the region under genus *Homona* Walker, were collected from different localities of Kashmir and Ladakh. These were identified as *Homona coffearia* Nieter and *Homona nakaoi* Yasuda and are studied in detail in the present manuscript.

3.6.1 *Homona coffearia* (Nieter, 1861)

coffearia Nieter, 1861 (*Tortrix*), *Obs. Enem. Coff. Tree Ceylon*: 24.

Homona picrostacta Meyrick, 1921.

Godana simulana Walker, 1866.
Homona fasciculana Walker, 1863.
Tortrix fimbriana Walker, 1869.
Pandemis menciana Walker, 1863.
Godana nubiferana Walker, 1866.
Tortrix coffearia Nieter, 1861.
Homona euryptera Diakonoff, 1941.
Homona socialis Meyrick, 1912.
Homona stenoptera Diakonoff, 1941.

Description: Adult (Fig. 1k): Male with head and thorax ochreous, grey-brown or light reddish brown; Fore wing with huge, semicircular costal fold, reaching just to one-third; ground colour light greyish ochreous, with basal half of wing except costal fold strongly suffused with blackish brown; pattern always variably developed. Hind wing dark brownish grey, usually with reddish tinge on apex. Female with head and thorax ochreous-orange to red-brown tinge coloured. Fore wing with costa curved in basal part, thereafter straight; ground colour light ochreous with orange tinge, Hind wing ochreous orange, with grey in apex and anal area.

Male genitalia (Fig. 2j): Uncus nearly spoon shaped and apically little rounded; socii consisting of some bristles only; tegumen broad and short; vinculum V shaped; sacculus a sclerotized part along ventral side of valva with two strong thorns at the end; aedeagus pistol-shaped, with a large sub dorsal hook on its left side; vesica with three to five cornuti.

Female genitalia (Fig. 3i): Papilla analis shoe shaped; anterior apophyses slightly longer or equal to posterior apophyses; sterigma cup shaped; ostium large and roundish with a narrow rim-shaped lamella ante-vaginalis; antrum weakly sclerotized, short and strongly tapering funnel; ductus bursae somewhat medium and thin; cestum wider than half diameter of ductus bursae, extending from corpus bursae to about four-fifths of ductus; signum a large curved and serrate dagger, invaginated from a dome-shaped plate.

Wing span: Male 20 mm, Female 22 mm.

Material examined: Gund, 10.vii.10-1♂; 15.vii.12-2♂, 1♀; Sonamarg, 5.viii.10-1♂; Aru.11.viii.10-1♂, 1♀.

Distribution: India, China, Sri Lanka, Malaysia, Thailand, Java, Brunei, Sabah and Sarawak.

Remarks: This species was originally described from Sri Lanka by Nieter [21] also described as *Homona spargotis* by Meyrick [22] but

subsequently synonymised with *Homona coffearia* and re-described by Diakonoff [23]. Whittle et al. [24] gave the photographs of external genitalic structures of the species *coffearia* Nietner and also reported that this species resembles with *Homona spargolis*, but argued that *Homona coffearia* is characterised in the male by a semicircular costal fold reaching to one-third costa, greyish, dark hind wings, a band-shaped sacculus with apical thorns, and a long hook on the aedeagus, similarly its females have a faintly sclerotized, short antrum and a long cestum extending from the corpus bursae to about four-fifths of the ductus which differs it from *Homona spargolis* which was also observed in present study. The present collection comprised of seven specimens which have been found conspecific on the basis of male and female genitalia and has been identified as *Homona coffearia* (Nietner, 1861).

3.6.2 *Homona nakaoi* Yasuda, 1969

Nakaoi Yasuda, 1969 (*Homona*), Bull. Univ. Osaka Pref. (B) 21: 168.

Description: Male adult (Fig. 1l): Head brownish coloured; thorax creamy brown. Forewing costa slightly curved at base, then weakly so, termen moderately oblique and convex; costal fold broader, nearly rounded, to before one third. Ground colour brownish and tinged ferruginous grey; suffusions at base of wing and trace of median fascia rust; costal remnant in form of blackish spot; subapical blotch totally reduced. Cilia more creamy in colour than ground colour. Hindwing with brownish cilia paler in colour.

Male genitalia (Fig. 2k): Uncus long finger shaped, round terminally; socius small; gnathos arm slender; tegumen slender and long; vinculum V shaped; sacculus long, slender, concave post-basally, provided with two terminal thorns; aedeagus long, slender, with simple terminal part.

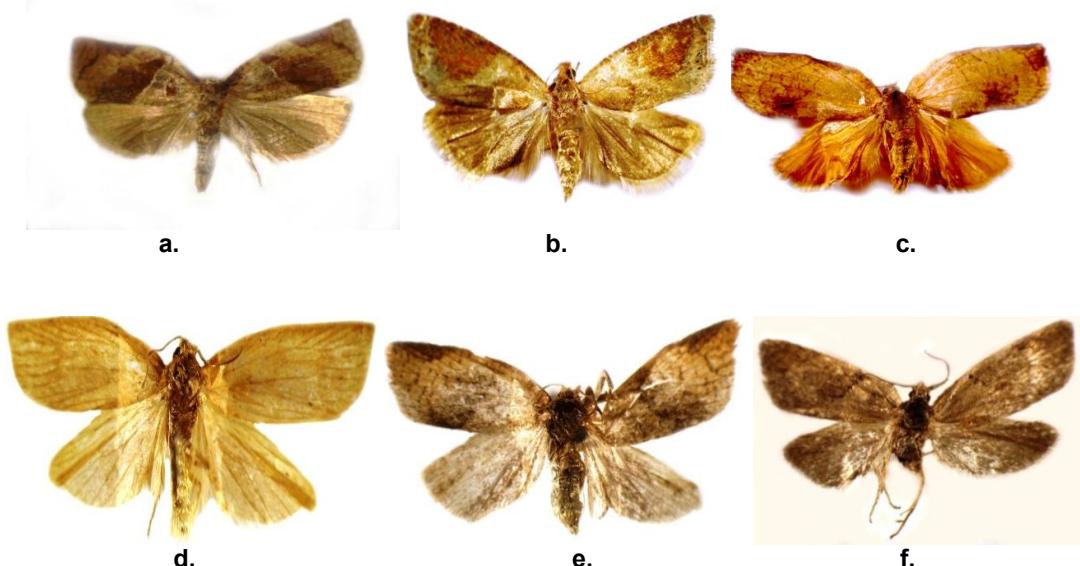
Female not found.

Wing span: Male 17 mm.

Material examined: Sirgufara, 15.viii.10-1♂; Kupwara, 28.vii.12-1♂; Handwara, 23.ix.12-1♂; Brariangan, 14.vi.11-2♂.

Distribution: Kashmir (India), Nepal, China and Vietnam.

Remarks: This species was described from Nepal, re described by Diakonoff [25] on basis of additional material from same country, also by Razowski [26] in detail, in which he reported that this species resembles with *Homona parvanima*, but *H. parvanima* differs with it in gently concave sacculus, single terminal process of sacculus, and small ventro-terminal thorn of aedeagus. This species has also been reported closely related and similar to *Homona baolocana*, but *H. baolocana* from it in rounded uncus, longer sacculus with small post-basal concavity, and slender aedeagus without ventro-terminal thorn. The present collection comprised of four specimens which have been found conspecific on the basis of male and has been identified as *Homona nakaoi* Yasuda 1969.



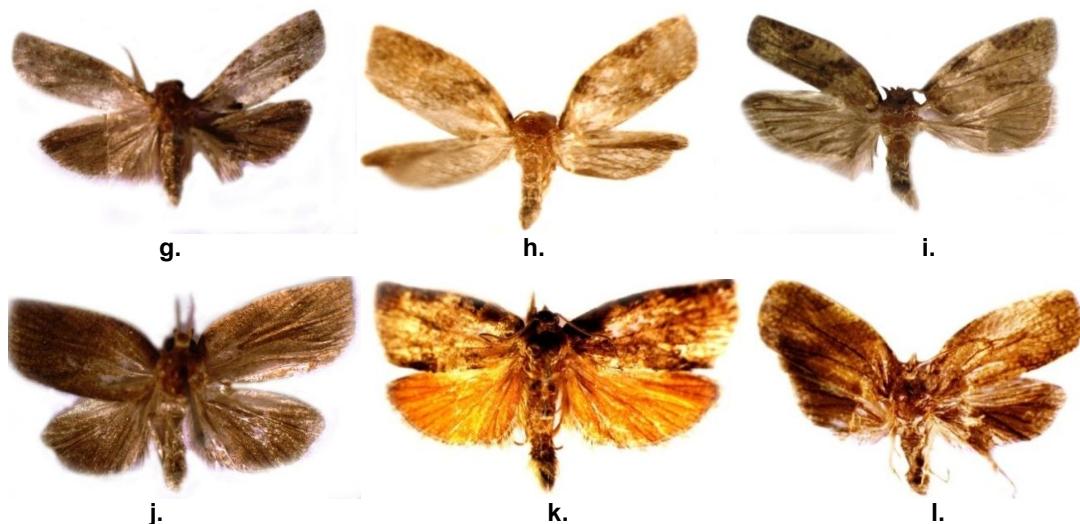
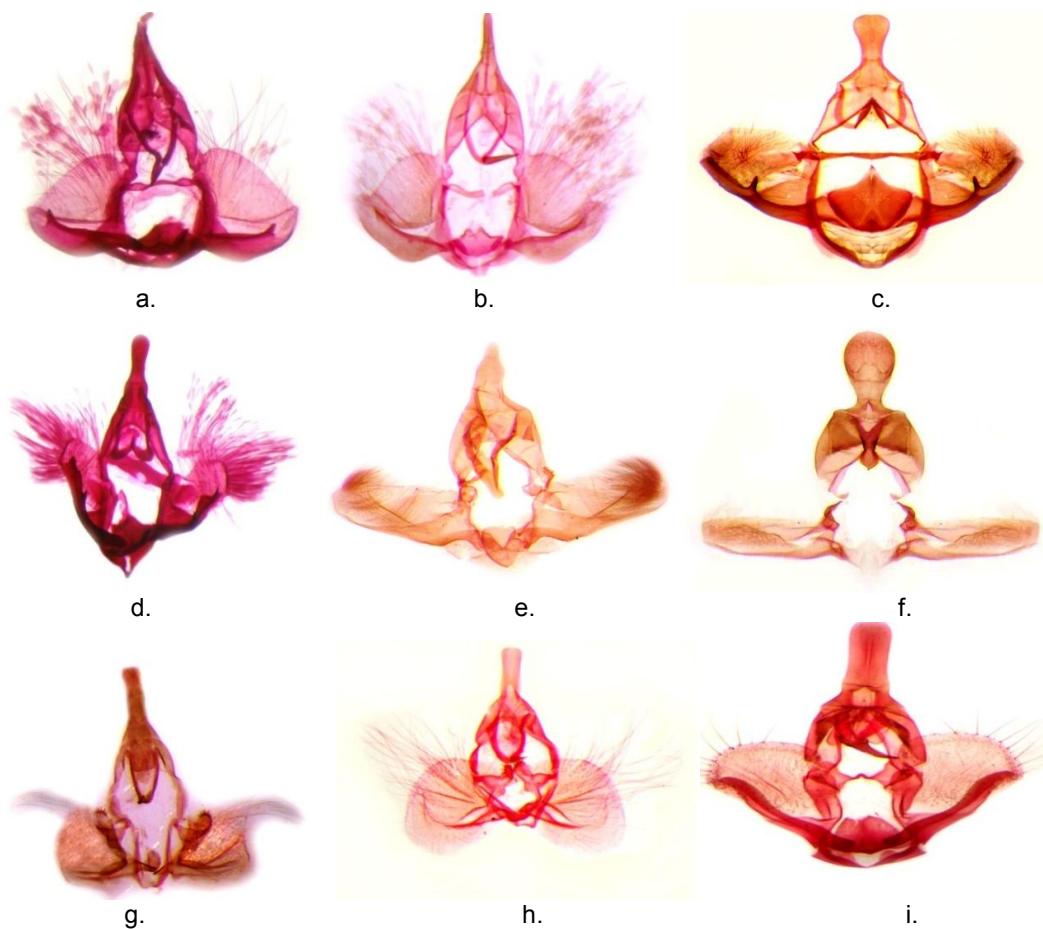


Fig. 1: Adult moths. a. *Archips cantinus* Razowski, 2006, b. *Archips naltarica* Razowski, 2006, c. *Choristoneura colyma* Razowski, 2006, d. *Choristoneura pseudofumiferana* sp. nov., e. *Clepsis rurinana* (Linnaeus, 1758), f. *Clepsis kupwari* sp. nov., g. *Clepsis translucida* (Meyrick, 1908), h. *Neocalyptis chlansignum* Razowski, 2006, i. *Neocalyptis ladakhana* Razowski, 2006, j. *Pandemis thomasi* Razowski, 2006, k. *Homona coffearia* (Nietner, 1861), l. *Homona nakaoi* Yasuda, 1969



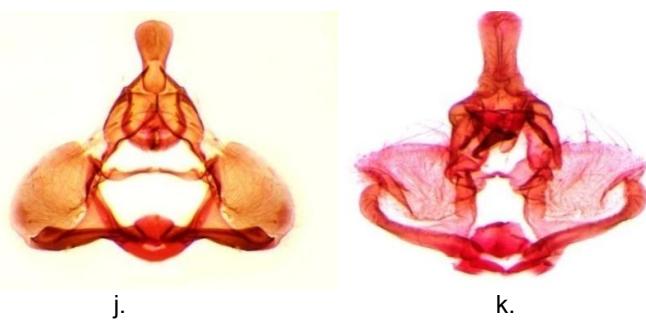


Fig. 2. Male genitalia. a. *Archips cantinus* Razowski, 2006, b. *Archips naltarica* Razowski, 2006, c. *Choristoneura colyma* Razowski, 2006, d. *Choristoneura pseudofumiferana* sp. nov., e. *Clepsis rurinana* (Linnaeus, 1758), f. *Clepsis kupwari* sp. nov., g. *Neocalyptis chlansignum* Razowski, 2006, h. *Neocalyptis ladakhana* Razowski, 2006, i. *Pandemis thomasi* Razowski, 2006, j. *Homona coffearia* (Nietner, 1861), k. *Homona nakaoi* Yasuda, 1969



Fig. 3. Female genitalia. a. *Archips cantinus* Razowski, 2006, b. *Archips naltarica* Razowski, 2006, c. *Choristoneura colyma* Razowski, 2006, d. *Choristoneura pseudofumiferana* sp. nov., e. *Clepsis rurinana* (Linnaeus, 1758), f. *Clepsis translucida* (Meyrick, 1908), g. *Neocalyptis ladakhana* Razowski, 2006, h. *Pandemis thomasi* Razowski, 2006, i. *Homona coffearia* (Nietner, 1861)

4. CONCLUSION

In the Kashmir and Ladakh Himalayan region (North-west) of J & K state of India twelve species belonging to six genera viz., *Choristoneura* Lederer, *Archips* Hubner, *Pandemis* Hubner, *Clepsis* Guenée, *Neocalyptis* Diakonoff and *Homona* Walker of tribe Archipini have been collected during present investigation. In this, the male genitalia of only eleven species could be studied in which it has been observed that coremata is on eighth sternite, uncus with hair brush below apex, valve with pulvinus, sacculus sclerotized along ventral edge and dorsal margin membranous. However, the female genitalia of only nine species viz. *Archips cantinus* Razowski, 2006, *Archips naltarica* Razowski, 2006, *Choristoneura colyma* Razowski, 2006, *Choristoneura pseudofumiferana* sp. nov., *Clepsis rurinana* (Linnaeus, 1758), *Clepsis translucida* (Meyrick, 1908), *Neocalyptis ladakhana* Razowski, 2006, *Pandemis thomasi* Razowski, 2006 and *Homona coffearia* (Nietner, 1861) could be studied only and it has been noticed that dagger shaped elongated signum and a bulbous capitulum female genitalia is present in all species. Further the reporting of two new species increased the number of species under genus *Choristoneura* Lederer from four to five and genus *Clepsis* Guenée from two to three in Kashmir zone of Jammu & Kashmir.

ACKNOWLEDGEMENTS

Authors are thankful to Division of entomology SKUAST-Kashmir for giving necessary permissions and constant support. Authors express their sincere gratitude to overseas tortricid moth experts like Dr. Joseph Razowski, Institute of Systematics and Evolution of Animals, Poland, B. K Byun, T. K. Park (Korea) and Dr. John W. Brown, USDA for their valuable publications, suggestions in certain specific issues and cooperation in identification of the moth species. Thanks are also due to Dr. V. V. Ramamurthy, Principal Scientist, Entomology, ICAR, New Delhi for his encouragement during the course of this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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