



Taxonomic account of four species of genus *Ilema* Moore, 1860 (Lepidoptera: Erebiidae: Lymantriinae) with range extensions and new records from Indian Himalayas

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Abstract

An updated taxonomic account of four species of genus *Ilema* Moore, 1860 namely *chloroptera* (Hampson, 1892), *bhana* (Moore, 1865), *acerosa* (Chao, 1986) and *caperata* (Moore, 1986) have been described from Western Himalayas. Two species i.e., *acerosa* (Chao, 1986) and *caperata* (Moore, 1986) have been reported for the first time from India. The detailed diagnostic characters along with the global distribution and range extension of these species have also been updated.

Keywords: extension; genitalia; global distribution; *ilema*; projection; significant

1. Introduction

Moore (1860) established the genus *Ilema* with *costalis* Walker as its type species from Java as a replacement name for *Melia* Walker. Swinhoe (1923)^[13] shifted its species under genus *Orygia* Ochsenheimer. Collenette (1934)^[3] discussed its type species *costalis* Walker and *bhana* Moore under genus *Dasychira* Hübner. Holloway (1982)^[5] revived its status for proper placement of its species which were misplaced under genus *Dasychira* Stephens. Kishida (1996) further included the species of genus *Neocifuna* Inoue in this genus. Holloway (1999)^[6] and Chao (2003) followed the same nomenclature and discussed ten species from Borneo and twenty four species from China respectively under *Ilema* Moore.

In the present studies, the external morphological features including the wing venation and genitalic features of four species namely *Ilema chloroptera* (Hampson, 1892), *Ilema bhana* (Moore, 1865), *Ilema acerosa* (Chao, 1986) and *Ilema caperata* (Moore, 1986) have been studied in detail and their taxonomic account has been updated. The occurrence of *Ilema acerosa* (Chao) and *Ilema caperata* (Moore) from Himachal Pradesh is their first record from Indian Himalayas. The range extension of other two species has also been provided.

2. Materials and Methods

Adult moths were collected from different localities of Arunachal Pradesh (28.218°N, 94.727°E), Himachal Pradesh (32.084°N, 77.571°E) and Meghalaya (25.467°N, 91.366°E) using light traps equipped with a 160 w mercury bulb and vertical white sheet. To study of wing venation, the methodology proposed by Zimmermann (1978) was followed. The male and female moths were dissected out to examine the external genitalic features (Robinson, 1976) and the terminology for naming various genitalic parts given by Klots (1970) was followed. After detailed study, the specimens were catalogued and preserved in the Lepidoptera Lab, Department of Zoology & Environmental Sciences, Punjabi University Patiala.

2 a. Abbreviations: 1A: First anal vein; 2A: Second anal vein; AED: Aedeagus; ANT.APO: Anterior apophyses;

CO.P: Costal process; CRN: Cornuti; CRP.BU: Corpus bursae; CU₁: First cubital vein; CU₂: Second cubital vein; DU.EJ: Ductus ejaculatorius; JX: Juxta; M₁: First median vein; M₃: Third median vein; PAP.A: Papilla analis; PO.APO: Posterior apophyses; R₁: First radial vein; R₂: Second radial vein; R₃: Third radial vein; R₄: Fourth radial vein; R₅: Fifth radial vein; SA: Saccus; Sc: Subcosta; Sc+R₁: Subcosta+First radial vein; SIG: Signum; SL.P: Saccular projection; TG: Tegumen; VIN: Vinculum; VLV: Valva.

3. Results

Genus *ILEMA* Moore, 1860

Moore, 1860, *Cat. Lepid. Insects Mus. Nat. Hist.*, 2: 341; Swinhoe, 1923^[13], *Ann. Mag. Nat. Hist.*, (9) 11 (63): 295; Holloway, 1999^[5], *Moths Borneo*, 5: 40; Chao, 2003, *Fauna Sinica*, 30: 106.

Melia Walker, 1855, *List Spec. Lepid. Insects Colln Brit. Mus.*, 4: 808.

Cadrosia Moore, 1879, *Descr. Indian Lepid. Atkinson*. (1): 54.

Melachitis (Liparinae), Swinhoe, 1923^[13], *Ann. Mag. Nat. Hist.* (9) 11 (64): 415.

Neocifuna Inoue, 1982, in Inoue, Sugi, Kuroko, Moriuti and Kawabe, *Moths Japan*, 1: 630.

Type species: *Melia costalis* Walker, 1855.

Distribution: India; China; Japan; Sundaland (Holloway 1999; Chao 2003)^[5]

Diagnosis: Large to medium sized moths, usually dark in colouration. Labial palpi porrect. Antennae bipectinate in both sexes, pectinations reduced at distal end. Forewing acute at apex, ground colour usually black with distinct markings; discal cell more than half the length of wing, closed; 1A+2A from base of wing, 3A absent; Cu₂, Cu₁, M₃ and M₂ from near angle of cell; M₁ from upper angle of cell; radial veins forming a distinct areole; Sc from base of wing, not reaching apex. Hindwing globular, paler irrorated with dark scales; discal cell half the length of wing, closed; 1A and 2A from base of wing; 3A absent; Cu₁ and M₃ from

near angle of cell; M_2 from well above lower angle of cell; M_1 and R_s from upper angle of cell; $Sc+R_1$ from base of wing, anastomosing with discal cell near its middle. Legs dressed with scales; fore-tibia with an epiphysis; mid-tibia with one pair of tibial spurs; hind-tibia with two pairs of tibial spurs; tibial spurs of unequal length. Abdomen hairy. Male genitalia with uncus of moderate size; gnathos absent; saccus usually absent; juxta well developed, rod-like; valva usually bifid apically, finger-like dorsal part overlapping a broader, less sclerotized ventral part; sacculus usually with saccular projection; aedeagus slender, stick-like, strongly curved.

Keys to the studied species of genus *Ilema* (Moore)

1. Labial palpi fringed with black scales; forewing brownish in colouration; hindwing paler with veins Cu_1 and M_3 from lower angle of cell, not stalked.....2
 - Labial palpi fringed with orange scales, third segment with green scales; forewing light green in colouration; hindwing fuscous with veins Cu_1 and M_3 minutely stalked from lower angle of cell.....*chloroptera* (Hampson)
2. Forewing with ground colour dark brown. Male genitalia with uncus of moderate size, valvae symmetrical.....3
 - Forewing with ground colour light brown; male genitalia with uncus short, valvae asymmetrical.....*bhana* (Moore)
3. Hindwing with veins M_1 and R_s minutely stalked from upper angle of cell. Male genitalia with valva short, squarish; sacculus having a well sclerotized, short wedge-shaped setosed projection with blunt apex.....*acerosa* (Chao)
4. Hindwing with veins M_1 and R_s stalked from upper angle of cell, not stalked. Male genitalia with valva broad; sacculus setosed having a well sclerotized, prominent, setosed saccular projection with irregular serrations.....*caperata* (Moore)

Ilema chloroptera (Hampson)

(Figs. 1-9)

Dasychira chloroptera Hampson, 1892, *Moths India*, 1: 450.

Ilema chloroptera Hampson: Holloway, 1982, In Barlow, *Intro. Moths South East Asia*, 1982: 226; Chao, 2003, *Fauna Sinica*, 30: 122-123.

Orgyia chloroptera Hampson: Swinhoe, 1923^[13], *Ann. Mag. Nat. Hist.*, (9) 11 (63): 304.

Type Locality: India (Khasi hills)

Diagnosis: Head with vertex and frons clothed with greenish scales. Labial palpi with first segment fringed with orange scales, second and third segments with green scales. Antennae with scape and flagellum studded with green scales. Thorax, collar and tegula dressed with blackish-green scales; underside bright orange. Legs dressed with long black scales. Abdomen furnished with brown scales, a median band of

dark scales; distal segment fringed with orange scales; underside paler.

Wing maculation: Forewing with ground colour light green, irrorated with black and green scales; irregular, waved medial, postmedial and submarginal lines; fringe black; underside paler. Hindwing with ground colour black in males, marginal area with orange scales; fringe orange; underside paler with a distinct discal black spot. In females, hindwing with ground colour orange; a black spot at the end of cell; a wavy black submarginal band, reduced between veins Cu_2 to M_2 ; fringe orange; underside paler, with same markings as on upper side.

Wing venation: Forewing with vein Cu_2 from three-fourth of cell; Cu_1 from well before lower angle of cell; M_3 from lower angle of cell; M_2 from just above lower angle of cell; M_1 from upper angle of cell; R_5-R_3 well stalked from upper angle of cell, R_2 well before upper angle of cell sending a bar beyond middle of common stalk of R_5-R_3 to form a rectangular areole; R_1 from two-third of cell. Hindwing with Cu_2 from well before lower angle of cell; Cu_1 and M_3 minutely stalked from lower angle of cell; M_2 from above lower angle of cell; M_1 and R_s stalked from upper angle of cell; $Sc+R_1$ from base of wing anastomosing with cell well before its middle.

Wing Expanse: Male: 48mm; Female: 70mm.

Body Length: Male: 17mm; Female: 23mm.

Male genitalia: Uncus of moderate size, moderately sclerotized, dorsally setosed, distal end notched giving bifid appearance; a rectangular, setosed projection on dorsal side of uncus covering its basal half, also notched; tegumen long, U-shaped, moderately sclerotized having finger-like projections extending on both lateral sides of uncus; vinculum narrow, moderately sclerotized, shorter than tegumen ending into well-sclerotized, rounded saccus; juxta well sclerotized, narrow, tubular, backwardly directed on dorsal side, distal end bifurcated making a 'V' mark. Valva broad, sacculus and costa well differentiated; sacculus having a well-sclerotized, thumb-like projection with rounded apex; a small knob-like projection on saccular margin; costal margin with a highly sclerotized, curved, prominent beaked projection extending above distal end of valva; dorsal margin of distal end well sclerotized, distal one-third portion broad, round, weakly sclerotized or nearly membranous. Aedeagus long, narrow, well sclerotized, rod-like; curved, more strongly curved towards proximal half, proximal end rounded; ductus ejaculatorius entering near proximal end; distal end flap-like; vesica armed with few denticles representing cornuti.

Female genitalia: Corpus bursae large, globular, membranous, entering directly into highly sclerotized, tubular antrum; a pair of distinct crescent-like signa present; ductus seminalis originating near junction of corpus bursae and antrum; apophysis of moderate length, semi-sclerotized, slightly dilated at distal end; posterior apophysis narrow, basal two-third portion well sclerotized, distal one-third weakly sclerotized, 2x length of anterior ones; papilla analis nearly rectangular, moderately setosed with long and short setae.

Material Examined: India: Arunachal Pradesh, PUP-LYM-32i, 06.v.2013, 1 male, Rupa (27.203°N & 92.398°E); Meghalaya, PUP-LYM-32ii, 10.ix.2014, 1 male, Pynursla (25.310°N & 91.902°E); Collected by: Gagan Bali.

Distribution: India: Arunachal Pradesh, Meghalaya; China (Hampson 1892; Chao 2003; present studies).

Remarks: Hampson (1892) originally described this species under genus *Dasychira* Stephens from Khasi hills, Meghalaya. Swinhoe (1923)^[13] described it under genus *Orgyia* Ochseneheimer. Holloway (1982) placed it to genus *Ilema* Moore and this placement has been followed by Chao (2003) and in the present studies.

***Ilema bhana* (Moore)**

(Figs. 10-15)

Dasychira bhana Moore, 1865, *Proc. Zool. Soc. London*, 1865: 804.

Ilema bhana Moore: Schintlmeister, 1994, *Heterocera Sumatrana*, 7: 118; Chao, 2003, *Fauna Sinica*, 30: 129.

Orgyia bhana Moore: Swinhoe, 1923^[13], *Ann. Mag. Nat. Hist.*, 11 (9): 304.

Type Locality: India (Darjeeling)

Diagnosis: Head with vertex and frons clothed with black scales. Labial palpi fringed with black scales. Antennae bipectinate, reduced at distal end; scape covered with fawn scales, flagellum black. Thorax, collar and tegula dressed with brownish-black scales, underside blackish. Legs dressed with grey scales, interspersed by brown scales. Abdomen furnished with brown scales; distal segment fringed with fawn long scales.

Wing maculation: Forewing with ground colour light brown, irrorated with black scales; a creamish orbicular spot; a wavy black medial line; a distinct spot at the end of cell; a wavy black postmedial line, followed by an irregular, wavy submarginal line; fringe black; underside paler. Hindwing paler; an indistinct creamish marginal line; fringe with fawn scales; underside paler with a distinct discal black spot, two distinct antemedial lines.

Wing Venation: Forewing with Cu₂ from beyond two-third of cell; Cu₁ from well before lower angle of cell; M₃ from lower angle of cell; M₂ from above lower angle of cell; M₁ from upper angle of cell; R₅-R₃ well stalked from well before upper angle of cell, R₂ from beyond three-fourth of cell, sending a bar to common stalk of R₅-R₃ to form a long areole; R₁ from two-third of cell. Hindwing with Cu₂ from well beyond middle of cell; Cu₁ from before lower angle of cell; M₃ from lower angle of cell, M₂ from well above upper angle of cell; M₁ and R_s stalked from upper angle of cell; Sc+R₁ from base of wing anastomosing with cell before its middle.

Wing Expanses: Male: 38mm-44mm, Female: Not examined.

Body Length: Male: 14mm-19mm, Female: Not examined.

Male genitalia: Uncus short, tongue-like, dorsally setosed, setae long at its base; tegumen semi-sclerotized, U-shaped; vinculum shorter than tegumen, V-shaped; saccus slightly

produced; juxta well-sclerotized, tubular, backwardly directed on dorsal side. Valvae asymmetrical, left valva smaller in size; sacculus well differentiated, having a oblong, well sclerotized, setosed projection, walls slightly serrated towards distal end; saccular margin with knob-like projection beyond middle of valva; costal margin having a curved hood-like projection with narrow, rounded apex; distal end of valva broad, weakly sclerotized, setosed. Aedeagus long, narrow, well sclerotized, rod-like, curved, C-shaped; distal end dilated, rounded, narrowing towards distal end; ductus ejaculatorius entering directly from proximal end; vesica without any cornuti.

Material Examined: India: Himachal Pradesh, PUP-LYM-33i, 10.vii.2015, 1 male, Basantpur (31.208°N & 77.174°E); PUP-LYM-33ii, 19.v.2015, 1 male, Draman (31.988°N & 76.712°E); Uttarakhand, PUP-LYM-33iii, 17.vi.2015, 1 male, Sheetlakhet (29.594°N & 79.543°E); Jammu and Kashmir, PUP-LYM-33iv, 11.ix.2013, 1 male, Lamberi (33.077°N & 74.324°E); Collected by: Gagan Bali.

Distribution: India: Himachal Pradesh, Jammu and Kashmir, Uttarakhand, West Bengal; China (Moore 1865; Chao 2003; present studies).

Remarks: Moore (1865) described this species under genus *Dasychira* Stephens from Darjeeling, India. Schintlmeister (1994) transferred it to the present genus based on its diagnostic long and highly curved aedeagus. Chao (2003) followed the same nomenclature. The collection of this species from different localities of Himachal Pradesh, Jammu and Kashmir and Uttarakhand is its first record from North-West India.

***Ilema acerosa* (Chao)**

(Figs. 16-22)

Dasychira acerosa Chao, 1986, *Acta. Ento. Sinica*, 4: 160.

Ilema acerosa Chao, 2003, *Fauna Sinica*, 30: 111.

Type Locality: China (Nyalam)

Diagnosis: Head with vertex and frons clothed with black scales. Labial palpi fringed with greyish-black scales. Antennae with scape covered with black scales, flagellum black. Thorax, collar and tegula clothed with blackish-brown scales. Legs dressed with black scales. Abdomen furnished with blackish-brown scales.

Wing maculation: Forewing with ground colour dark brown, sprinkled with black scales; a patch of black scales at the end of cell; a distinct crenulate postmedial line; marginal area diffused with black and purple scales; fringe black; underside paler. Hindwing paler, without any distinct markings; fringe black; underside paler, having a discal spot.

Wing Venation: Forewing with Cu₂ from two-third of cell; Cu₁ from well before lower angle of cell; M₃ from lower angle of cell, M₂ from above lower angle of cell; M₁ from upper angle of cell; R₅-R₃ stalked from upper angle of cell, R₂ from well before upper angle of cell sending a bar to common stalk of R₅-R₃ just at separation of R₅ (R₄-R₃) to form an areole; R₁ from well before two-third of cell. Hindwing with Cu₂ from well beyond middle of cell; Cu₁

from well before lower angle of cell; M_3 from lower angle of cell; M_2 from above lower angle of cell; M_1 and R_s minutely stalked from upper angle of cell; $Sc+R_1$ from base of wing anastomosing with discal cell well before its middle.

Wing Expanse: Male: 44mm; Female: Not Examined.

Body Length: Male: 16mm-18mm; Female: Not Examined.

Male genitalia: Uncus narrow, moderately sclerotized, long, curved dorsally having few setae near middle, apex rounded; tegumen U-shaped, moderately sclerotized, gradually narrowing towards vinculum; vinculum narrow, semi-sclerotized; saccus absent; juxta long, well sclerotized, flap-like, backwardly directed on dorsal side. Valva short, nearly squarish; sacculus and costa well differentiated; sacculus having a well sclerotized, short wedge-shaped setosed projection with blunt apex; costal margin with rounded, well sclerotized, setosed, ridge-like extension extending above distal end of valva; distal end broad, setosed with long setae. Aedeagus long, moderately sclerotized, medially curved, proximal one-third portion broad, sclerotized; proximal end having flap-like extension; distal end narrow, spine-like; ductus ejaculatorius entering directly from proximal end; vesica without any distinct cornuti.

Material Examined: India: Himachal Pradesh, PUP-LYM-34i, 07.ix.2013, 1 male, Chamunda Devi (32.051°N & 76.643°E); PUP-LYM-34ii-iii, 06.v.2013, 2 males, Ropa (31.795°N & 78.421°E), Collected by: Gagan Bali.

Distribution: India: Himachal Pradesh; China (Chao 1986, 2003; present studies).

Remarks: Though, Chao (1986) described this species under genus *Dasychira* Stephens from Nyalam, China, but transferred it to the present genus in 2003. The reporting of this species from Himachal Pradesh is its first record from Indian Himalayas.

***Ilema caperata* (Chao)
(Figs. 23-30)**

Dasychira caperata Chao, 1986, *Acta. Ento. Sinica*, 4: 163.
Ilema caperata Chao, 2003, *Fauna Sinica*, 30: 118.

Type Locality: China (Kunming)

Diagnosis: Head with vertex and frons suffused with black scales.

Labial palpi fringed with black scales. Antennae with scape and flagellum covered with black scales. Thorax, collar and tegula dressed with black scales. Legs dressed with black scales.

Abdomen furnished with blackish-brown scales; distal segment fringed with long black scales.

Wing maculation: Forewing with ground colour dark brown, irrorated with black scales; a distinct black discal spot; a lunulate antemedial line; fringe black; underside paler. Hindwing paler, sprinkled with black scales; fringe black; underside with distinct discal spot and a postmedial line.

Wing Venation: Forewing with Cu_2 from two-third of cell; Cu_1 before lower angle of cell; M_3 from lower angle of cell; M_2 from above lower angle of cell; M_1 from upper angle of cell; R_5 from before upper angle of cell, R_4-R_2 well stalked from well before upper angle of cell sending a bar near separation of (R_4-R_3), R_2 to R_5 to form a distinct areole; R_1 from beyond two-third of cell.

Hindwing with Cu_2 from two-third of cell, Cu_1 from before lower angle of cell; M_3 from lower angle of cell; M_2 from well above lower angle of cell, M_1 and R_s stalked from upper angle of cell; $Sc+R_1$ from base of wing anastomosing with discal cell well before its middle.

Wing Expanse: Male: 44mm-48mm; Female: Not Examined.

Body Length: Male: 19mm; Female: Not Examined.

Male genitalia: Uncus of moderate size, moderately sclerotized, bent ventrally, dorsally setosed, setae near base long, almost 2X length of remaining ones, apex broad and blunt; tegumen U-shaped, medially notched, gradually narrowing towards vinculum; vinculum semi-sclerotized, narrow with ventral expansion; saccus absent; juxta long with basal one-third portion pitcher-like, remaining tubular, backwardly directed on dorsal side. Valva broad, sacculus and costa well differentiated; sacculus setosed having a well sclerotized, prominent, setosed sacculus projection with irregular serrations; costal margin with a narrow, curved projection with rounded apex not reaching the distal end of valva; distal end of valva round, setosed. Aedeagus long, well sclerotized, medially curved; proximal end with narrow, produced into flap-like projection; ductus ejaculatorius entering under this projection; distal half more sclerotized, ending into narrow flap-like projection; vesica without any distinct cornuti.

Material Examined: India: Himachal Pradesh, PUP-LYM-35i, 07.x.2013, 1 male, Andretta (40.938°N & 15.325°E); PUP-LYM-35ii, 15.ix.2014, 1 male, Majhwar (31.463°N & 76.775°E); Collected by: Gagan Bali.

Distribution: India: Himachal Pradesh; China (Chao 1986, 2003; present studies).

Remarks: Chao (1986) described this species under genus *Dasychira* Stephens from Kunming, China. Later, he placed it under genus *Ilema* (Chao, 2003). Its collection from Andretta and Majhwar from Himachal Pradesh is its first report from Indian Himalayas.

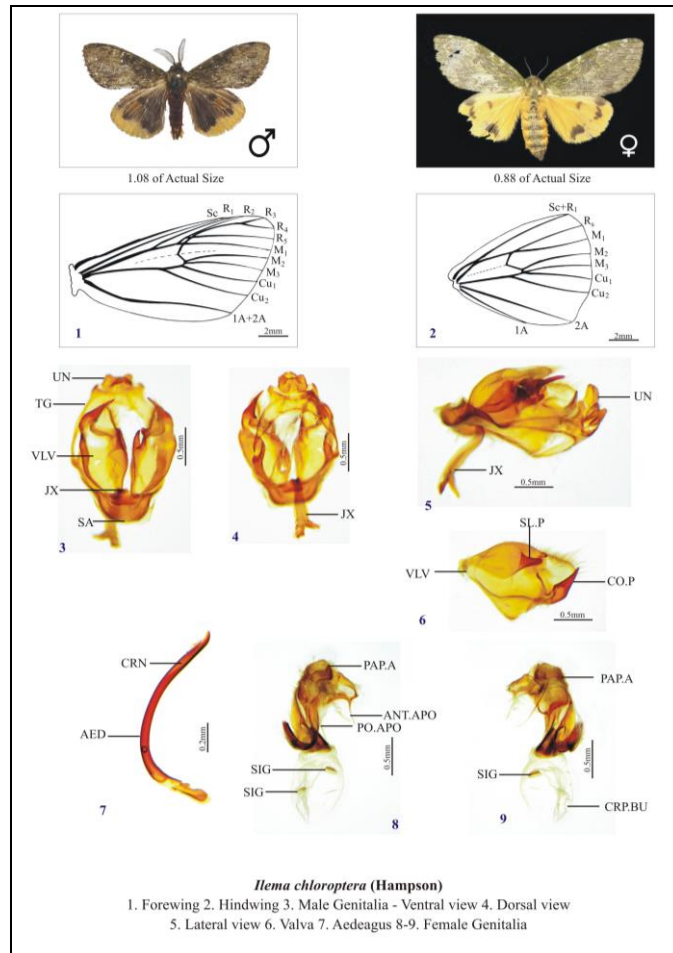


Plate 1

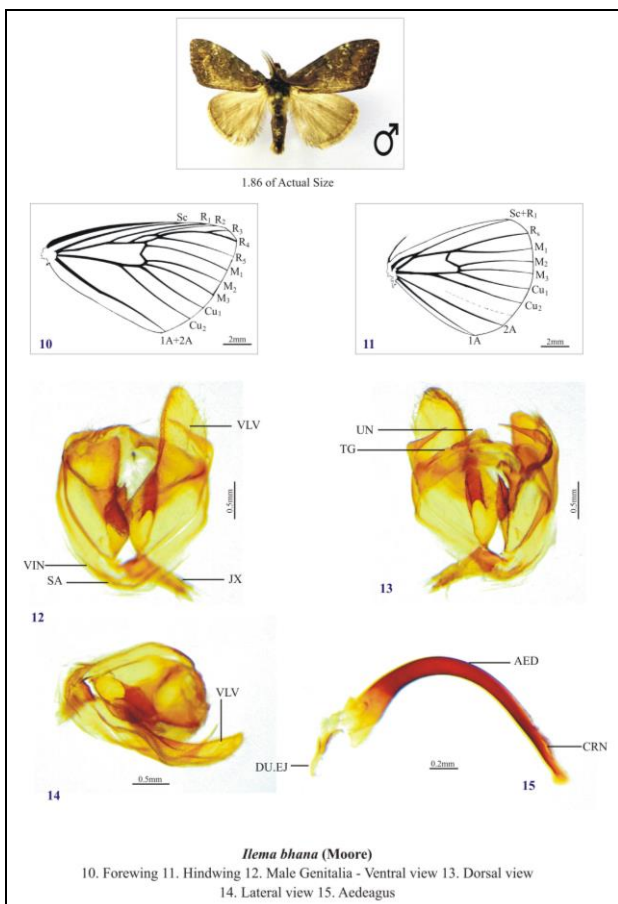


Plate 2

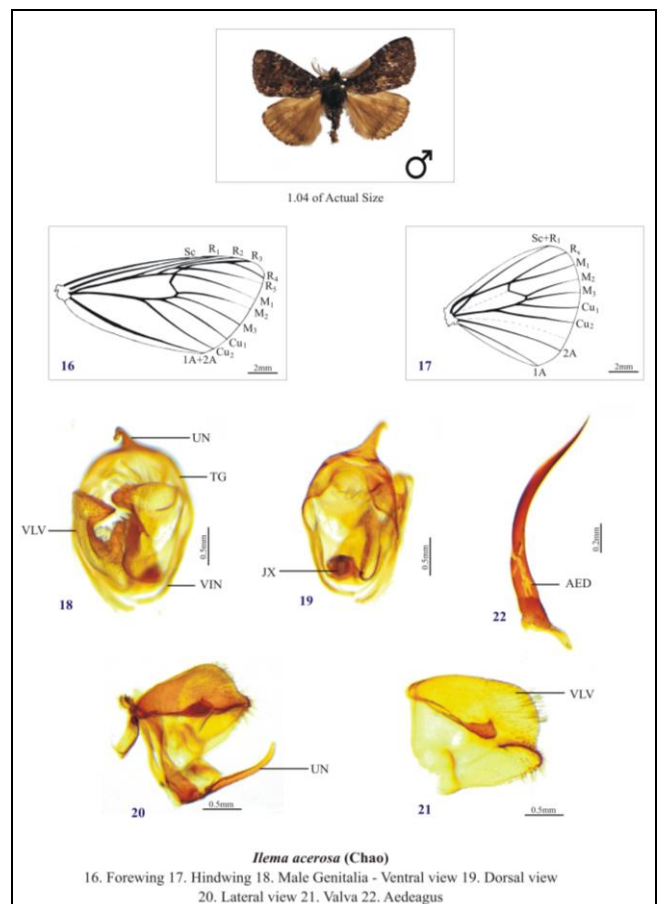


Plate 3

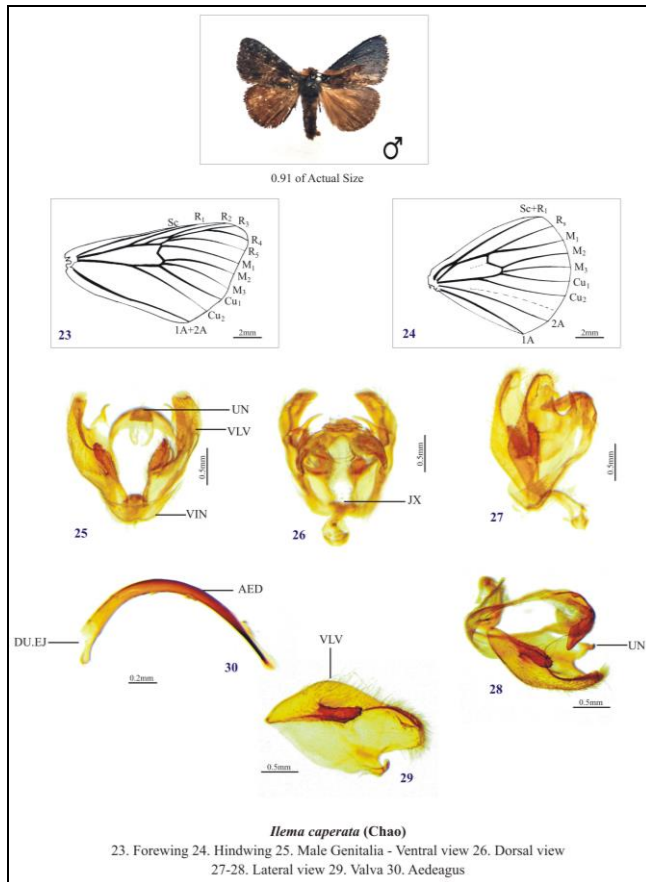


Plate 4

4. Discussion

Chao (1986) described two species i.e., *acerosa* and *caperata* under genus *Dasychira* Stephens on the basis of male specimens collected from Nyalam and Kunming in China. In 2003, he discussed both these species under genus *Ilima* Moore along with twenty three species from China and the same placement has been followed in the present studies. The collection of *Ilima acerosa* Chao and *Ilima caperata* Chao from different localities of Himachal Pradesh accounts for their first record from Indian Himalayas. Similarly, range extension and distribution updates of the other two studied species have been recorded. Hampson (1892) reported *Ilima chloroptera* from Khasi hills, Meghalaya. It has been collected from Meghalaya and Arunachal Pradesh in the present studies and its collection from Arunachal Pradesh is its additional distribution range in North Eastern Himalayas. Moore (1865) recorded *Ilima bhana* form Darjeeling, West Bengal. Its collection from different localities of Himachal Pradesh, Jammu and Kashmir and Uttarakhand in the present studies is its first record from North-West Himalayas and accounts for its range extension. The external morphological characters including wing maculation, venation and genitalic features of all the four species have been studied and illustrated to update their taxonomic account. These features completely conform with the characterization of the genus and justified their placement in the present genus.

5. Acknowledgment

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