

A revision of genus *Alcis* Curtis from Kashmir valley

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ABSTRACT

Genus *Alcis* Curtis is reported for the first time from Kashmir valley, India. Four species *Alcis jubata* Thunberg, *A. perspicuata* (Moore), *A. repandata* Linnaeus and *A. variegata* Moore belonging to the genus are described morphologically in detail. Their DNA was sequenced and subjected to blast analysis to compliment the morphological identification.

Key words: DNA, genitalia, moth, wing.

The moth family Geometridae (Inchworms or loppers), with approximately 23, 000 described species, is the second most diverse family of the Lepidoptera, occurring worldwide except in the Polar Regions (Scoble, 1999; Scoble and Hausmann, 2007). Genus *Alcis* Curtis belongs to tribe Boarmiini of the subfamily Ennominae of family Geometridae. Genus *Alcis* is described by John Curtis in 1826. Total of 264 have been reported worldwide (Myers *et al.*, 2021), out of which only 29 are found so far in India (Gunathilagaraj, 2016).

Taxonomy.

Alcis repandata Linnaeus, 1758 (Fig. 1)



Fig. 1: *Alcis repandata* (A) Adult (B) Male genitalia (C) Aedeagus (D) Female genitalia

MATERIALS AND METHODS

Distribution: Europe, Asia Minor and parts of Western Asia.

Type: Ompora, 31°14'N, 83°06'E, 1,601 mts a.s.l. 16 May 2018-1; Verinag, 33°55'N 75°25'E 1,851 mts a.s.l. 19 Oct 2018-1♂; 4 May 19-2♂, 2♀; 20 May 2018-1♂, 1♀; Drangbal, 34°42'N, 74°54'E, 2,730 mts a.s.l. 7 April 2018-3♂; 15 Oct 3♀.

Diagnostic characters: Wing span is 32 mm, wings are creamy white irrorated with brown, Fore wings with blackish bands at base and margins, anterior and post medial bands end in midway of wing obversely; Male antennae bipectinate, female antennae filiform; Male genitalia with valva rounded, costa broader towards apex, harpe with two pointed projections on inner edge of costa, upper swollen at the base, heavily spined, furca curved, pointed, united at base, uncus blunt, gnathos hooked, rounded and squamous, cornuti curved sharp spine

like, Saccus rounded; Female genitalia with corpus bursae long, narrow, signum irregular, two strips on the posterior end of bursa, ductus bursae short and narrow, striated, posterior apophyses longer than anterior apophyses, papilla analis long, flat, sparsely setosed with fine setae.

Alcis variegata Moore, 1888 (Fig. 2)

Distribution: Sikkim, Khasis.

Type: India, Jammu and Kashmir Dodhpathri, 34°42'N, 74°54'E, 2,730 mts a.s.l, 27 April 2018-1♂; 19 Oct 2018-2♂; Verinag, 33°55'N 75°25'E 1,851 mts. a.s.l, 13 May 2018-1♂; 9 Sep17-2♂; 12 Oct 2018-1♂.

Diagnostic characters: Wing span 37mm, wing are dirty white speckled with brown, slightly wavy wing margins; Antennae bipectinate; Male genitalia with uncus beaklike, socci absent, gnathos with central process broad, rectangular, tegumen broad; vinculum as length of tegument, saccus V-shaped, valvae long and narrow, costa and sacculus highly sclerotized, juxta oval, plate-like, transtilla membranous, aedeagus long, vesica small, membranous, with spine-like cornuti at base and a band of sclerotisation at middle, ductus ejaculatorius entering sub-terminally.

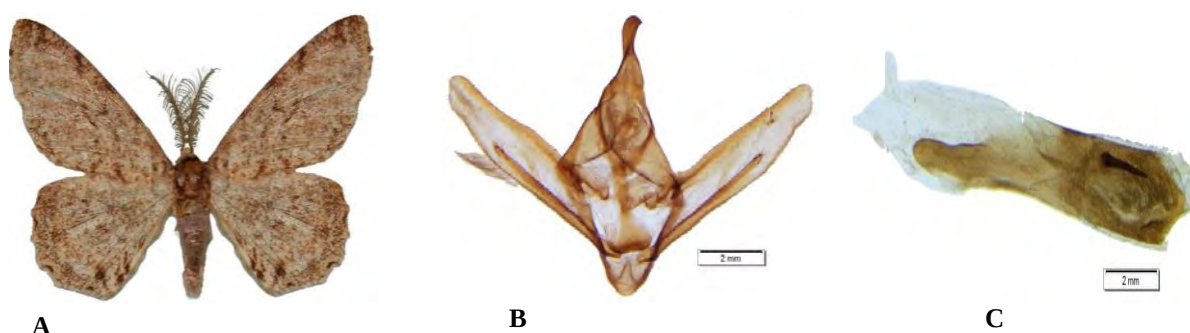


Fig. 2: *Alcis variegata* (A) Adult (B) Male genitalia (C) Aedeagus

Alcis jubata Thunberg, 1788 (Fig. 3)

Distribution: Central Europe, Scandinavia, northern Italy and India.

Type: India, Jammu and Kashmir Dodhpathri, 34°42'N, 74°54'E, 2,730 mts a.s.l 5 May 2018 -1♂,2♂; Ompora, 31°14'N, 83°06'E, 1,601 mts a.s.l. 29 October 2018-1; Drangbal, 34°12'N, 74°19'E, 1593 mts a.s.l. 21 April 17-1♂; 1 May 17-2♂.

Description: Wing span 31 mm, Wings are dirty white in color having wavy interior and exterior crosslines with intermittent broader, Wing margins are wavy with visible marginal lines; Antennae bipectinate in males; Male genitalia with valva simple, broad, costa thickened, spined, projecting at apex, harpe angular finger-like projection, furca bifurcate, uncus blunt, ridged, gnathos pointed, squamous, Saccus rounded, aedoeagus short fusiform, cornutus curved spine like, vesica embranous, weakly sclerotized towards apex.

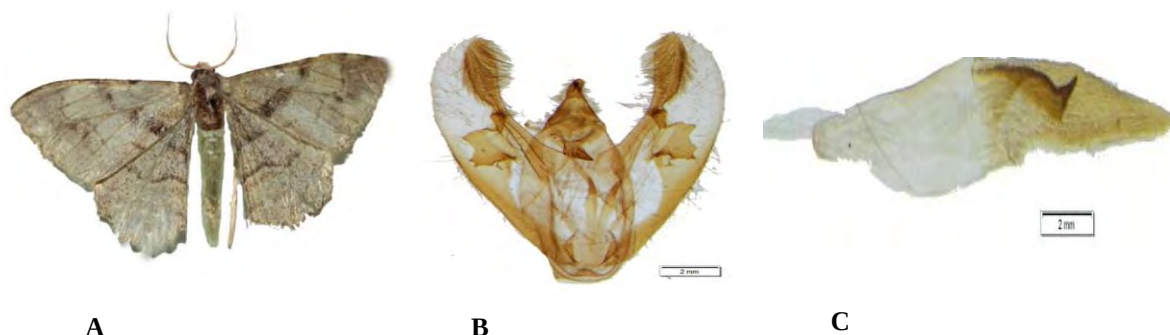


Fig. 3. *Alcis jubata* (A) Adult (B) Male genitalia (C) Aedeagus

Alcis perspicuata (Moore, 1868) (Fig. 4)

Distribution: Central Europe, Italy, India.

Type: India, Jammu and Kashmir Dodhpathri, 34°42'N, 74°54'E, 2,730 mts a.s.l, 25 April 2018-2♂; 11 October 2018-1♂; Verinag, 33°55'N 75°25'E 1,851 mts a.s.l, 25 April 2018-2♂; 13 May 2018-1♂.

Description: Wings are brownish with wavy borders, Both fore and hind wings have dark crosslines, post medial line is dentate with dark suffusion beyond it; Antennae is filiform; Male genitalia with uncus short, blunt, gnathos well developed with medial part developed into tongue like sclerotized process, valvae developed, differentiated into parts, costal margin narrow, weakly sclerotized, setosed with fine setae; sacculus broad, bearing a digitate flap in centre, many robust spines present towards coastal margin, densely setosed with setae, juxta with hooked pair of projections much longer and broader, a single cornutus much longer, over one-half length of aedeagus, pointed at apex.



Fig. 4: *Alcis perspicuata* (A)Adult (B)Male genitalia (C)Aedeagus

RESULTS AND DISCUSSION

DNA sequencing: DNA was extracted from respective moth specimens using DN easy tissue kit following the procedure for animal tissue instructed on the kit, later subjected to polymerase chain reaction (PCR) using the universal primers LCO1490 and HCO2198. The PCR products/amplicons were subjected to Sanger's sequencing. The finished contigs/Sequences were analysed using BLAST (Basic Logical Alignment Search Tool) programme and compared with the nearest watch sequences retrieved from GenBank. Based on similarity of identity the species status was assigned. The DNA sequences were submitted to NCBI and are now available to all (Table-1).

Table 1. Molecular identification on BLAST similarity bases

Sampled	Description	Identification %	Accession No.	Species Identification	New Accession No. Alloted By NCBI
G-29	<i>Alcis repandata</i> voucher BC ZSM Lep 09526 cytochrome oxidase subunit 1 (COI) gene, partial cds; mitochondrial	99.73%	KX071762.1	<i>Alcis repandata</i>	MN689335
G-66	<i>Alcis variegata</i> voucher BC ZSM Lep 21361 cytochrome oxidase subunit 1 (COI) gene, partial cds; mitochondrial	95.76%	KX072097.1	<i>Alcis variegata</i>	MN689347
G-17	<i>Alcis jubata</i> voucher E. Ounap 1321 cytochrome oxidase subunit 1 (COI) gene, partial cds; mitochondrial	100%	MH522795.1	<i>Alcis jubata</i>	MN689352
G-56	<i>Alcis perspicuata</i> voucher E. Ounap 1321 cytochrome oxidase subunit 1 (COI) gene, partial cds; mitochondrial	96.03%	MH522795.1	<i>Alcis perspicuata</i>	MN689360

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