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An integrative approach in taxonomic revision of the genus *Merohister* Reitter, 1909 (Coleoptera, Histeridae) from India, with redescriptions of *M. jekeli* (Marseul, 1857) and *M. asoka* (Lewis, 1910)

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Couverture / *Cover*:
Merohister asoka (Lewis, 1910) habitus in dorsal view.

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An integrative approach in taxonomic revision of the genus *Merohister* Reitter, 1909 (Coleoptera, Histeridae) from India, with redescriptions of *M. jekeli* (Marseul, 1857) and *M. asoka* (Lewis, 1910)

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ABSTRACT

The genus *Merohister* Reitter, 1909 comprises seven recognized species, most of which exhibit a broad distribution across multiple biogeographic regions worldwide. Two species have been recorded from India, *M. jekeli* (Marseul, 1857) and *M. asoka* (Lewis, 1910). Both species were re-examined on a large sample of specimens collected from buffalo carcass disposal sites in Punjab, India, and both are redescribed in detail, supported by high-resolution images, highlighting their diagnostic morphological features. For the first time, the male genitalia of *M. asoka* are described and illustrated, enhancing the taxonomic understanding of this species. Multivariate studies of 14 morphometric features (Principal Component Analysis and Canonical Discriminant Function) further support the delimitation of both species, demonstrating the value of an integrative approach in their redescription.

KEY WORDS
Histerini,
carcass,
Asia,
oriental region,
beetle.

RÉSUMÉ

Une approche intégrative pour la révision taxonomique du genre Merohister *Reitter, 1909 (Coleoptera, Histeridae) en Inde, avec la redécription de* M. jekeli *(Marseul, 1857) et* M. asoka *(Lewis, 1910).*

Sept espèces sont reconnues dans le genre *Merohister* Reitter, 1909, dont la plupart présentent une large aire de répartition couvrant plusieurs régions biogéographiques à travers le monde. Deux espèces ont été répertoriées en Inde : *M. jekeli* (Marseul, 1857) et *M. asoka* (Lewis, 1910). Les deux espèces ont été réexaminées à partir d'un large échantillon de spécimens collectés sur des sites d'élimination de carcasses de buffles au Punjab, en Inde ; toutes deux font l'objet d'une redescription détaillée, à l'aide d'images haute résolution mettant en évidence leurs caractéristiques morphologiques diagnostiques. Pour la première fois, les genitalia mâles de *M. asoka* sont décrits et illustrés, ce qui permet d'approfondir la connaissance taxonomique de cette espèce. Des analyses multivariées portant sur 14 caractéristiques morphométriques (Analyse en composantes principales et fonction discriminante canonique) viennent étayer davantage la délimitation des deux espèces, illustrant ainsi l'utilité d'une approche intégrative dans leur redéfinition.

MOTS CLÉS
Histerini,
carcasse,
Asie,
région orientale,
coléoptère.

INTRODUCTION

The family Histeridae Gyllenhal,1808, comprising 4843 described species, represents a remarkably diverse group of predatory beetles largely distributed throughout tropical regions (Mazur 2011; Catalogue of Life [COL] 2024). Within this assemblage, the establishment of 426 genera (COL 2024) underscores both the evolutionary breadth and the variability in body size – from as diminutive as 0.5 mm to as robust as 20 mm.

The genus *Merohister* Reitter, 1909 is classified under the tribe Histerini Gyllenhal, 1808 by synapomorphies including a marginate prosternal keel, complete inner elytral striae, and a sinuate mesosternal margin. These traits clearly group *Merohister* with other histerine genera such as *Hister* Linnaeus, 1758, *Spilodiscus* Lewis, 1906, and *Margarinotus* Marseul, 1854 (Ôhara 1992, 1999a, b; Caterino *et al.* 2002). Further, *Merohister* can be distinguished from related genera by its contiguous lateral elytral stria, rugulose discal sculpturing, and a unique genital structure. Within *Merohister*, seven species have been delineated: *M. aino* (Lewis, 1884) inhabits Hokkaido and Honshu, Japan; *M. arboricavi* Wenzel, 1991 is recorded from Iowa, USA; *M. ariasi* (Marseul, 1864) ranges across Spain, southern France, Italy, Slovenia, Turkey, Syria and Israel; *M. asoka* (Lewis, 1910) is endemic to India; *M. jekeli* (Marseul, 1857) occurs in Shanghai (China), Northeast China, the Russian Far East, Kuril Islands, Japan, Korea, the Philippines and India; *M. osculatus* (Blatchley, 1910) is found in Indiana, Virginia, Tennessee, Arkansas, Oklahoma and South Carolina, USA; and *M. uenoi* Ôhara, 1992 has been documented from Japan (Mazur 2011).

Merohister species are primarily associated with arboreal microhabitats such as tree holes, habitats in which they may interact with cavity-nesting birds (Gaudin *et al.* 1999; Kovarik & Caterino 2016). Our recent study recovered specimens of both *M. jekeli* and *M. asoka* exclusively from buffalo carcasses. This finding is particularly intriguing given previous observations that Histeridae are liquid-feeding predators, requiring notably specific conditions for oviposition (Lindner 1967; Kovarik 1995, 2005). These data suggest a potential dietary shift, whereby these beetles exploit leached nutrients available in the crevices of carrion.

The original descriptions of *M. jekeli* and *M. asoka* were based on selected external morphological character (Ôhara 1992). However, the examination of multiple specimens collected from diverse localities in Punjab, India, revealed that many of these characters exhibit huge intraspecific variation. This is the case for example of the cephalic punctation, the intensity of pronotal sculpturing, and the configuration of the lateral marginal elytral stria that were long employed as the primary criteria for species identification (Ôhara 1992). In contrast the degree of punctation on the lateral pronotal area, variation in sculpting of antescutellar region and configuration of the frontal stria have never been discussed before.

Such intraspecific variation in external morphology strongly reinforces the necessity of incorporating robust, less environmentally influenced characters in species delimitation – chiefly, the morphology of the genitalia. Genitalic structures consistently exhibit a characteristic degree of sclerotisation and an ornamented, pigmented surface marked by punctation. Therefore, the present study focuses on a comprehensive documentation of both the external and genitalic structures of the two Indian species of *Merohister*. Notably, for *M. asoka*, this represents the first in-depth characterisation of the male genitalia, an essential step in resolving the complex intraspecific variation encountered and refining our understanding of species boundaries within the genus.

MATERIAL AND METHODS

Samples were collected from buffalo carcasses at the Hadda-Roddi carcass disposal site in the districts of Amritsar and Mullanpur Garibdas (Punjab State, India). Beetles were preserved in 90% ethanol using 50 ml vials immediately after collection. Specimens, both males and females, were stored in a refrigerated environment for long-term preservation, while others were prepared as dry-mounted specimens. Dry-mounted specimens were rehydrated in warm water prior to morphological observation and imaging.

Specimens were examined using a Leica S9i stereo microscope (Leica Microsystems, Germany) equipped with a 10-megapixel camera and stereo zoom functionality. Macrophotography was conducted at the Department of Zoology, Panjab University, Chandigarh, India, using a Canon EOS 80D Digital SLR camera paired with a Canon EF 100mm F2.8L Macro IS USM lens. Soft, diffused lighting was achieved with studio lights connected to five LED bulbs. Image stacking was performed using Zerene Stacker software (version T2023-06-11-1120), and final edits were applied using Adobe Photoshop CC.

Twenty-six adult male specimens representing *M. jekeli* (n = 22) and *M. asoka* (n = 4) were examined for species-level morphometric and genitalia differentiation. Genitalic structures were dissected and cleared by immersion in 10% potassium hydroxide (KOH) for 24 hours, followed by rinsing in 80% ethanol and permanent mounting on glass slides using Canada balsam. Morphometric measurements were obtained using a Leica stereomicroscope with integrated scale bars, and annotations were generated with Leica Application Suite V4 software. Each specimen was characterized by 14 continuous morphometric traits spanning cephalic, pronotal, elytral, and appendicular regions. Data were structured in Microsoft Office LTSC Professional Plus 2024, with each row representing an individual specimen. Principal Component Analysis (PCA) was performed in OriginPro 2024 using correlation-based eigen decomposition. Where required, variables were log-transformed to improve symmetry and standardized to unit variance. Components with eigenvalues greater than 1.0 were retained in accordance with the Kaiser criterion, and loading values were used to identify traits contributing most to interspecific variation.

Canonical Discriminant Analysis (CDA) was conducted in XLSTAT version 2019.2.2 (build 59614) under the assumption of equal within-group covariance matrices, validated via Box's M test ($p < 0.0001$). All 14 variables were treated as quantitative inputs, with species identity designated as the grouping factor. Trait importance was assessed using standardized canonical coefficients and Wilks' Lambda statistics. Classification performance was evaluated via posterior probabilities and Mahalanobis distances, with additional validation provided by Receiver Operating Characteristic (ROC) analysis (AUC = 1.0).

ABBREVIATIONS

Venation, after Ôhara (1994)

A	anal vein;
C	costa;
Cu	cubitus;
HP	humeral plate;
M	media;
PCu	postcubitus;
R	radius;
SC	subcosta.

Measurements (in mm), after Ôhara (1994)

APW	width between anterior angles of pronotum;
EL	elytron length along sutural line;
EW	maximum width between elytral outer margins;
HW	head width;
MSTL	mesotibial length;
MTTL	metatibial length;
PEL	length from anterior angles of pronotum to elytral apices;
PL	pronotal midline length;
PPL	length from anterior angles of pronotum to pygidial apex;
PPW	width between posterior angles of pronotum;
ProL	propygidial length;
ProW	maximum propygidial width;
PTL	protibial length;
Pyl	pygidial length.

Institutions

MNHN	Muséum national d'Histoire naturelle, Paris;
NHMUK	Natural History Museum, London;
PUZEC	Panjab University Zoology Entomology Collection, Chandigarh.

SYSTEMATICS

Family HISTERIDAE Gyllenhal, 1808
Subfamily HISTERINAE Gyllenhal, 1808
Tribe Histerini Gyllenhal, 1808

Genus *Merohister* Reitter, 1909

Merohister Reitter, 1909: 282. — Bickhardt 1917: 159 (catalogued). — Müller 1937: 124. — Kryzhanovskij & Reichardt 1976: 363 (redescription). — Mazur 1984: 280 (catalogued). — Zhou *et al.* 2022: 348.

TYPE SPECIES. — *Hister ariasi* Marseul, 1864, by monotypy.

DIAGNOSIS. — Body oblong, moderately convex, with matte black integument. Dorsum combining coriaceous-reticulate ground sculpture and variable punctation (fine to coarse). Pronotum and elytra tightly articulated; ventral sclerites bearing deeply impressed, often crenate striae. Head: frontal stria complete (rarely medially interrupted); clypeus with widely crenate margins and straight apical edge; labrum finely punctate, anterolateral setal fringes dense; mandibles robust, inwardly curved, with straight subapical teeth and a setose prostheca; eyes large, convex, dorsolaterally bordered by erect setae. Pronotum moderately convex, reticulate-punctate, lateral stria deeply impressed, curved, weakly crenate; marginal stria complete laterally, broadly interrupted posteriorly. Elytra shiny, striae distinct: external subhumeral stria arcuate, internal reduced; striae 1-3 complete, 4 variable (shorter than 3), 5 apically restricted; sutural stria variably developed. Hindwing with unbranched costa, CuA and M veins basally divergent. Propygidium and pygidium with reticulate-punctate mix. Ventral sculpturing: prosternal lobe broadly rounded, sparsely punctate medially; mesoventrite finely sculptured, meso-metaventral sutural stria straight; metaventrite with diagnostic T-shaped suture, lateral striae extending toward metepisterna. Legs: protibia with 4-6 denticles and a robust spur; meso- and metatibiae with distally enlarged denticles; mesofemur bearing dual longitudinal setal rows. Tergite X from irregular to with microscopic dentition. Aedeagus slender, parameres apically expanded; spiculum gastrale variable (Y-shaped to slingshot).

Merohister jekeli (Marseul, 1857)
(Figs 1-3; 10)

Hister jekeli Marseul, 1857: 417; 1862: 709; 1873: 220 (Japan: Kyu-shu, common in dung/manure).

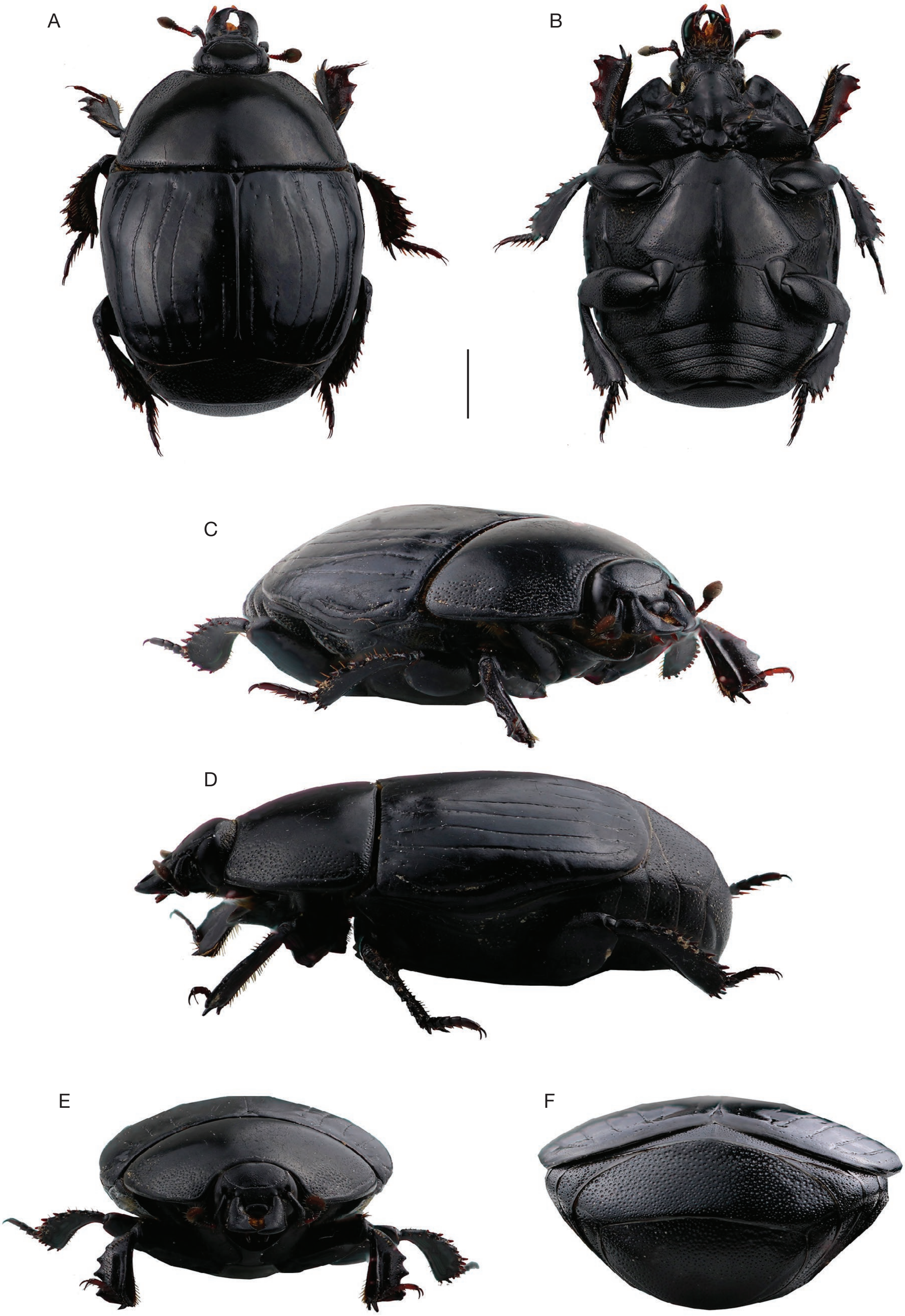


FIG. 1. — *Merohister jekeli* (Marseul, 1857) habitus: **A** dorsal view; **B**, ventral view; **C**,fronto-lateral view; **D**, lateral view; **E**, frontal view; **F**, caudal view. Scale bar: 1 mm.

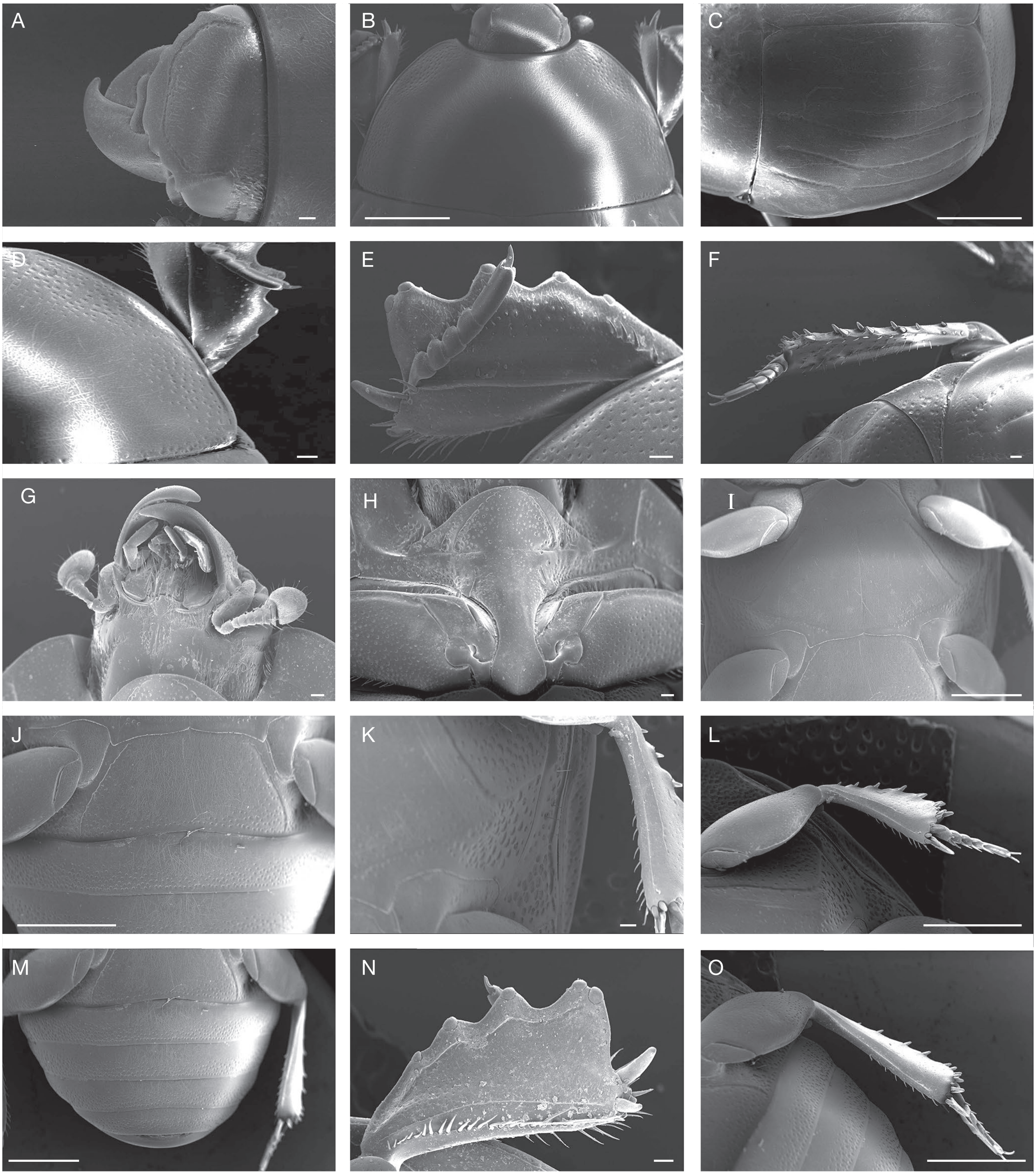


Fig. 2. — *Merohister jekeli* (Marseul, 1857): **A**, head with stria; **B**, pronotum; **C**, elytra with striations; **D**, pronotum, lateral view; **E**, protibia, dorsal view; **F**, mesotibia, dorsal view; **G**, head, ventral view; **H**, prosternum; **I**, mesoventrite; **J**, intercoxal disk of first visible abdominal ventrite; **K**, lateral disc and metepisternum; **L**, mesotibia, ventral view; **M**, sternites, ventral view; **N**, protibia, ventral view; **O**, metatibia, ventral view. Scale bars: A, D, E, F, G, H, K, N, 100 µm; B, C, I, J, L, M, O, 1 mm.

Pactolinus jamatus Motschulsky, 1866: 169, synonymy in Harold (1877: 345).

Hister (*Hister*) *jekeli* – Bickhardt 1910: 44 (China, Japan). — Desbordes 1918: 385 (Japan; Korea; China: Yunnan).

Hister (*Merohister*) *jekeli* – Bickhardt 1913: 171 (Taiwan: Taihorin); 1917: 188 (China, Japan); 1918: 230 (note). — Miwa 1931: 57 (Taiwan: Horisha): Kamiya & Takagi 1938: 31(list). — Ôsawa & Nakane 1951: 4 (note).

TABLE 1. — Measurements (in mm) of body part of *Merohister jekeli* (Marseul, 1857) males. Abbreviations: see Material and methods.

Characters	HW	APW	PPW	PEL	PPL	PL	EL	EW	ProW	ProL	PyL	PTL	MSTL	MTTL
Min	1.2	2.1	4.5	5.9	7.2	1.9	3.9	5.6	3.6	0.9	0.5	1.2	1.6	1.8
Max	2	2.8	5.9	8.1	10.2	2.6	5.3	7.6	4.6	1.5	1.5	1.8	1.9	2.6
Average (n=22)	1.4	2.4	5.3	7.2	8.8	2.3	4.5	6.3	4.1	1.2	0.8	1.5	1.7	2.2

Merohister jekeli – Lewis 1915: 55 (Taiwan: Horisha). — Kryzhanovskij & Reichardt 1976: 304. — Mazur 1984: 201; 2011: 97 (catalogue). — Hisamatsu 1985: 226, pl. 41, f. 4 (note; photo). — Ôhara 1992: 378; 1994: 136. — Kapler 1993: 30. — Kim *et al.* 1994: 137 (Korea). — Ôhara & Paik 1998: 21. — Lackner *et al.* 2015: 102 (catalogue). — Zhou *et al.* 2022: 349 (redescription, figures). — Ôhara 2023: 73 (catalogue).

TYPE LOCALITY. — China, Shanghai.

TYPE MATERIAL. — **Syntype. China** • Shanghai; MNHN-EC-EC60885 (examined by Prof. Masahiro O'Hara).

MATERIAL EXAMINED. — **India. Punjab** • 15 ♂, 3 ♀; Amritsar; 31°36'2.05"N, 74°52'31.70"E; 8.IV.2022; J. Kumar col.; JASENT2022001-015, JASENT2022016 – 018; PUZEC • 5 ♂; Nawanshahr; 31°6'39.24"N, 76°9'36.42"E; 20.VI.2023;J. Kumar col.; JASENT2023001-005; PUZEC • 2 ♂, 20 ♀; Mullanpur Garibdas; 30°79'42.247"N, 76°74'90.211"E; 11.III.2023; J. Kumar col.; JASENT2023006- 007; JASENT2023008-027; PUZEC.

DISTRIBUTION. — India, Kuril Isls., Japan, Siberia, Far East Russia, Sakhalin, Korean Peninsula, Jeju Is., China, Taiwan, Philippines (Ôhara 1992; Mazur 2011).

DIAGNOSIS. — The labrum bears fine, dense anterolateral setal fringes. Mandibles are robust, inwardly curved, and terminate in a blunt apical tip; their surface is finely punctate, overlain by an alutaceous-reticulate ground sculpture that coarsens laterally. A straight subapical tooth lies anterior to a dense cluster of large, golden prosthecal setae. The protibia bears 3-6 denticles, while mesotibiae and metatibiae exhibit dual rows of denticles differing in size.
Male genitalia (Fig. 4D, E): The aedeagus (tegmen) is slender, laterally sclerotized, with inwardly curved median parameres and bulbous apical parameres. The basal piece forms a sclerotized ring encircling the posterior margin, connecting to the parameral basal margins. The tergite X displays denticulate lateral edges, with remaining areas brownish and heavily sclerotized.

REDESCRIPTION

Body (Fig. 1A-E)
Oblong, moderately convex; matte black with faint metallic luster; surface uniformly clothed in coriaceous-reticulate microsculpture. Prothoracic setae golden, short, recumbent; elytra dark, shiny. Measurements provided in Table 1.

Head (Figs 1A, C, E; 2A)
Surface covered with minute punctures (Fig. 2A). Frontal stria complete, anterior contour rounded to straight, margins crenate, narrowly interrupted at midpoint in some specimens; frontal disc glossy, microsculpture coriaceous-reticulate (Figs 1A, C, E; 2A). Clypeus laterally expanded, margins broadly crenate; apex straight. Labrum finely punctate, anterolateral margins bearing dense fringes. Mandibles robust, inwardly curved, apically blunt; lateral surface coarsely punctate, prostheca depressed anterior to subapical tooth; prosthecal setae dense, elongate. Eyes large, convex, dorsolateral margin with row of erect setae (Fig. 1E). Postoccipital suture encircled by dense cluster of short setae (Figs 1B; 2A).

Pronotum (Figs 1A, C-E; 2B, D)
Pronotal disc clothed with reticulate ground sculpture intermixed with microscopic punctures (Figs 1A; 2B). Lateral portions bearing dense mixture of microscopic and larger punctures, extending narrowly toward anterior angles (Figs 1C; 2D); punctation denser anteriorly and posteriorly, sparser medially. Antescutellar region with short longitudinal punctures (Fig. 1A); marginal punctures sparse anteriorly, denser approaching pronotal lateral stria (Figs 1A; 2D). Marginal pronotal stria complete laterally, broadly interrupted behind head (Fig. 1C). Lateral pronotal stria deeply impressed, arcuate, weakly crenulate (Fig. 1A, C-E).

Elytra (Figs 1A; 2C)
Surface dark, shiny, densely punctate; marginal stria complete, finely crenulate (Figs 1A; 2C). Epipleural fossette with large, deep punctures forming longitudinal groove along lateral margin; epipleural stria marginal along apical half (Fig. 1C). External subhumeral stria arcuate; internal subhumeral stria reduced, obsolete. Dorsal striae 1-3 complete, finely impressed, none contacting basal margin (Figs 1A; 2C); interstitial punctures minute, aligned to contact anterior margins. Fourth stria variable in length, consistently shorter than third; striae 1-4 weakly arcuate laterally (Fig. 1A). Fifth stria abbreviated, confined to apical fourth, rarely extending beyond midlength. Sutural stria incomplete, extending from base to apical third. Striae margins externally crenulate throughout.

Hind Wings
C unbranched, extending to anterior wing margin; Sc unbranched, originating from first axillary sclerite; A connecting third axillary sclerite; shorter branch terminating medially before wing center; PCu contacting posterior wing margin, not extending to wing base; Cu and M diverging basally; Cu curving anterad toward anal vein; M extending posteriad toward Sc, connecting median plate (Fig. 5).

Propygidium and Pygidium (Fig. 1F)
Propygidium with reticulate ground sculpture intermixed with coarse, shallow, rounded punctures, diminishing in size posteriorly; pygidium clothed with punctures transitioning finer as density increases. Both regions bearing combined fine and coarse punctation.

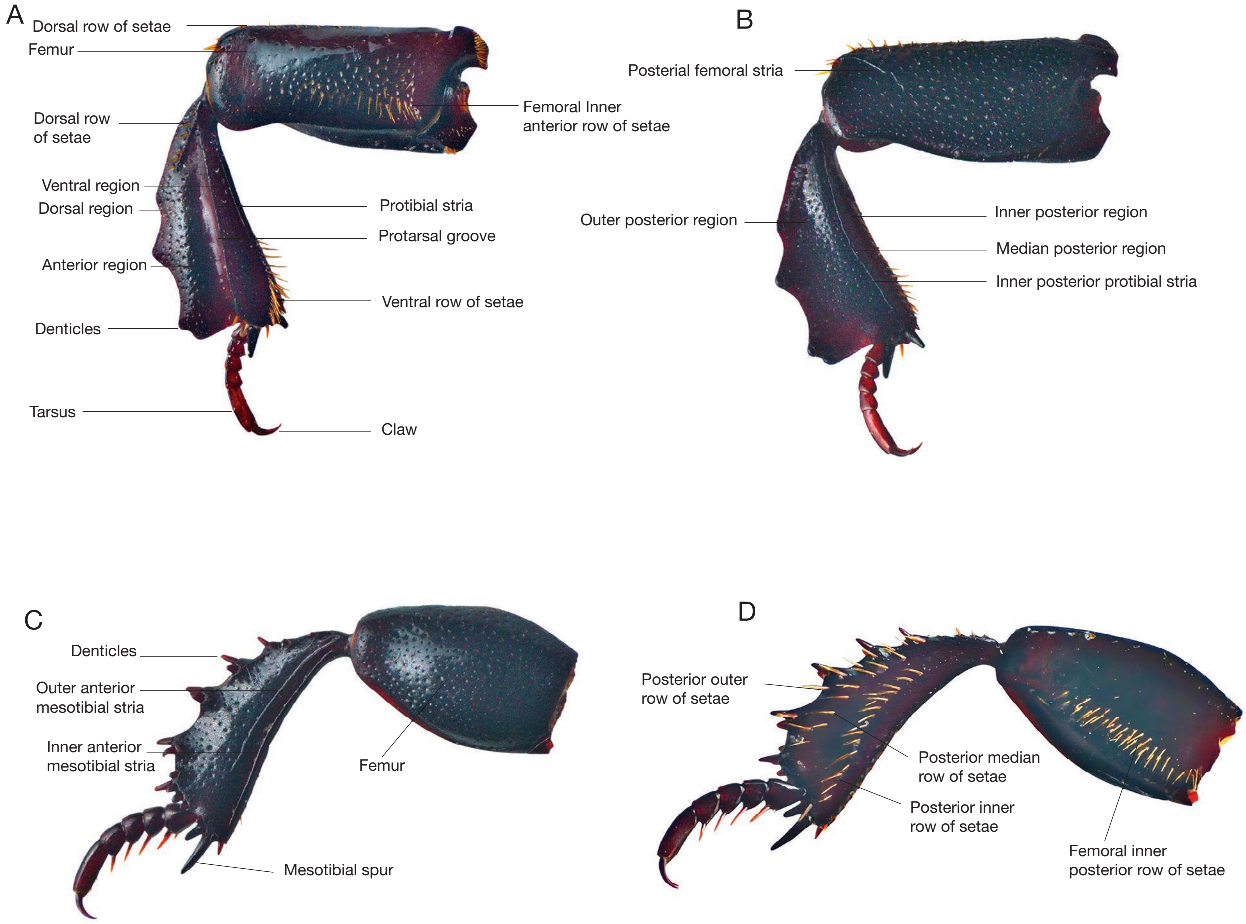


Fig. 3. — *Merohister jekeli* (Marseul, 1857). Legs: **A**, **B**, proleg, dorsal (**A**), ventral (**B**); **C**, **D**, mesoleg, ventral (**C**), dorsal (**D**).

Prosternum (Figs 1B; 2H)
Prosternal lobe apex rounded; disc sparsely punctate at center, punctures coarser laterally. Marginal stria crenulate, fading medially, connecting to lateral margins of lobe, occasionally encircling apex entirely. Parallel crenulate striae originating near basal margin, extending to posterior half. Prosternal keel broad; lateral stria nearly contacting prosternal suture.

Mesoventrite (Figs 1B; 2I, K)
Discal marginal stria crenulate, sinuate, bluntly angulate medially, shortened anteriorly, not attaining lateral metaventral suture. Disc with microscopic reticulate microsculpture. Meso-metaventral sutural stria straight, shortened anteriorly, failing to meet discal marginal stria but both intersecting post-mesocoxal stria.

Metaventrite (Figs 1B; 2I, K)
Lateral disc with coarse punctures and sparse setae. Lateral metaventral stria crenulate, irregular, uniting anteriorly with meso-metaventral sutural stria, extending posteriorly to intersect metepisternal stria. Longitudinal metaventral suture forming T-shaped junction with meso-metaventral sutural stria (Figs 1B; 2I).

Anepisternum (Fig. 2K)
Surface bearing light brown setae and coarse punctures.

Abdomen (Fig. 2I, J, M)
First abdominal ventrite trapezoidal (Fig. 2J); disc clothed with intermixed small and large punctures, occasionally arranged in striae-like rows anteriorly. Lateral stria of ventrite 1 deeply impressed, crenulate. Intercoxal disc bearing anterior row of coarse punctures, with sparse punctures extending toward longitudinal metaventral suture (Fig. 2I). Apparent abdominal ventrites 1-5, progressively narrower posteriorly (Fig. 2J, M).

Legs
Protibia (Figs 2E, N; 3A). Densely punctate, dark brown; dorsal margin with 4-6 denticles (Fig. 2E), surface reticulate, setae occasionally reduced. Protibial spur prominent at anterior angle (Fig. 3A); tibial groove margin bearing row of setae, sometimes reduced. Outer margin with row of robust setae near first denticle (Fig. 2E). Protarsus length *c.* 0.2 mm, base slender, glabrous. Claw ultimate segment cylindrical, length *c.* 0.3 mm. Anterior protibial stria flanked by 4-6-minute denticles (Fig. 2N); ventral strial region occasionally with diminished denticles or glabrous patches. Posterior protibial

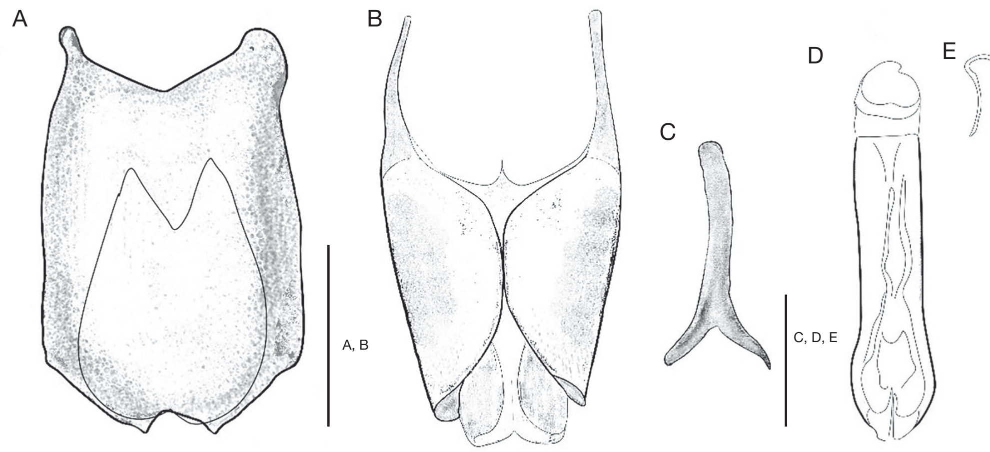


Fig. 4. — Male genital segments of *Merohister jekeli* (Marseul, 1857): **A**, tergite VIII and sternum VIII; **B**, tergites IX and X; **C**, spiculum gastral; **D**, **E**, aedeagus, dorsal (**D**) and lateral (**E**) views. Scale bars: 1 mm.

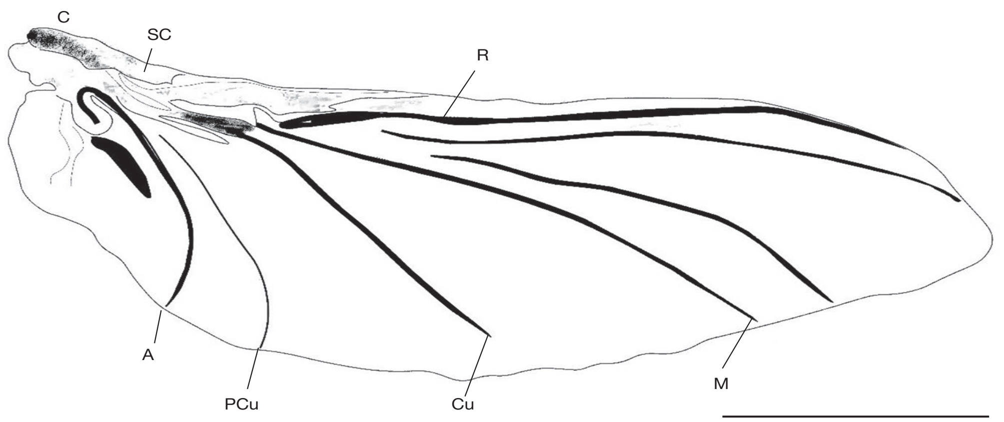


Fig. 5. — Hindwing venation pattern of *Merohister jekeli* (Marseul, 1857). Abbreviations: see Material and methods. Scale bar: 1 mm.

spur and ventral first denticle bearing 4 diminutive denticles (Fig. 2N); inner setal row present basad of stria.

Profemur (Fig. 3A). Coriaceous-reticulate microsculpture, punctate, subrectangular; dorsal setae arranged in scalene triangle; ventral surface with longitudinal groove, reticulate microsculpture basad. Distal end weakly swollen, stria originating dorsally, not attaining tibial base. Dorsal cluster of bristle-like setae near tibial articulation.

Mesotibia (Figs 2F; 3D). Dark brown; dorsal margin with two denticulate rows, denticle size increasing apicad. Outer surface with three setal rows (Fig. 2F): inner row ventrally positioned, irregularly spaced; outer row sclerotized, adjacent to dorsal denticles; middle row extending near mesotibial spur. Four apical spurs; tarsomere 1 with two pairs of spines, remaining tarsomeres each with single pair.

Mesofemur (Fig. 3C). Dark brown; posterior surface with dual setal rows; ventral setae restricted to basal half; dorsal setae sparsely distributed. Anterior surface punctate, glabrous.

Metatibia (Fig. 2F). Similar to mesotibia but elongate; dorsal denticles and setal rows proportionally extended.

Male genitalia

Tergite VIII (Fig. 4A). Posterior margin medially arcuate, semicircular; anterior margin with deep, angulate median emargination.

Sternum VIII (Fig. 4A). Broadly ovate (1:1.2 L/W), glossy, glabrous. Margins ornamented by sclerotized, amber-tinted patches; anterior convex, sparsely setose; posterior emarginate with symmetrical, rounded lobes. Translucent golden-amber center grading to smoky margins; paired anterolateral fuscous blotches.

Spiculum gastral (Fig. 4C). More slingshot shape; bifurcate, moderately sclerotized; stem broad, slightly flattened, divid-

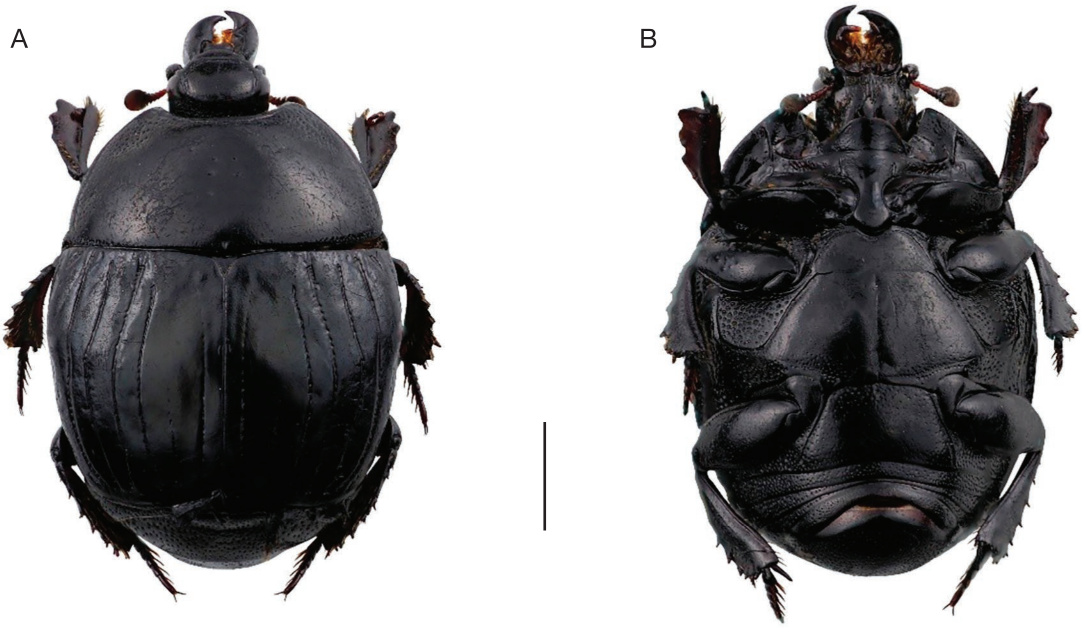


Fig. 6. — *Merohister asoka* (Lewis, 1910) habitus male: **A**, dorsal view; **B**, ventral view. Scale bar: 1 mm.

ing into two slender, symmetrically divergent arms forming open V-angle; arms narrowing to rounded apices, inner margins smooth.

Tergite IX (Fig. 4B). Bilobed, broadly ovate; lobes symmetrical, weakly convex, apically tapered. Medial margin shallowly emarginate, forming narrow midline gap. Sclerotisation moderate to heavy, pigmentation grading from pale amber basally to golden-brown distally. Surface finely granulate, densely punctate medially and sublaterally; punctures small, shallow, uniform, interspersed with circular sclerites. Margins smooth, arcuate laterally and posteriorly; anterior margin broadly rounded, anterolateral angles weakly elevated.

Tergite X. Elongate, narrowly lobed; lobes spatulate to sub rectangular, apically tapered. Sclerotisation heavy, posterior margins amber; surface sparsely punctate laterally and apically, medially glabrous. Apical margins rounded to subacute, occasionally minutely emarginate; apex and lateral margins bearing sparse, sclerotized patches. Moderately membranous, margins finely denticulate.

Aedeagus (Fig. 4D). Slender, elongate (*c.* 5.6× longer than wide); lateral margins smooth, sclerotized, tapering apically. Basal piece forming complete sclerotized ring, posterior margin continuous with parameral bases; short, robust, suboval, heavily pigmented. Tegmen elongate, tubular, moderately sclerotized; surface smooth, glabrous. Median lobe strongly sclerotized, sculptured with complex armature, visible through tegmen as darker internal shaft, gradually tapering posteriorly. Parameres distinctly separated, apically lobate, bulbously expanded (*c.* 0.72× wider than median region); bilobed, symmetrical, lightly sclerotized; apices rounded, glabrous.

Merohister asoka (Lewis, 1910)
(Figs 6-10)

Hister asoka Lewis, 1910: 55.

Merohister asoka – Kryzhanovskij & Reichardt 1976: 303. — Mazur 1984: 201 (catalogue); 1997: 120 (catalogue); 2011: 97 (catalogue: India).

Type locality. — India: Dehradun, United Provinces.

Type material. — **Presumed holotype. India** • ♂; labelled, Dehradun, United Provinces, India; under bark of spruce; Mr. E. P. Stebbing; NHMUK, formal designation lacking and type status unconfirmed.

Material examined. — **India. Punjab** • 4 ♂; Amritsar, 31°36’2.05”N, 74°52’31.70”E; 8.IV.2022; vouchers JAS.ASKENT2022001-004; J. Kumar col.; PUZEC • 1 ♀; same data as preceding males; voucher JAS.ASKENT2022005; J. Kumar col.; PUZEC.

Distribution. — India: Dehradun (Mazur 2011).

Diagnosis. — Five elytral dorsal striae visible, the striae 1-4 fully formed, fifth stria short, second and fourth striae not connected to the base. Protibial outer margin slightly curved and having three denticles. Spiculum gastrale smaller and Y-shaped Tergite X shallowly emarginate, margin angulate and irregular apical margin.

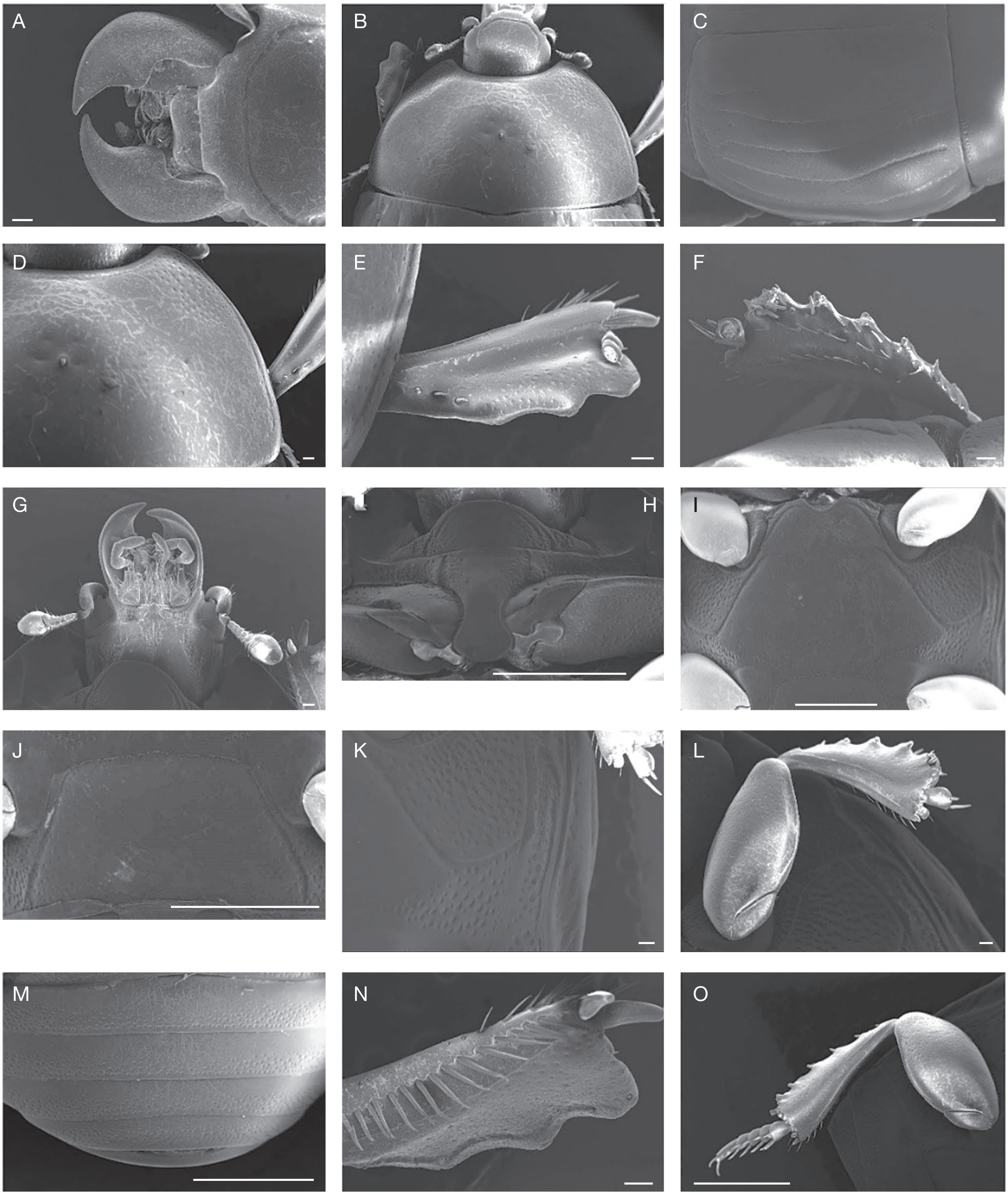


FIG. 7. — *Merohister asoka* (Lewis, 1910): **A**, head with stria, mandibles; **B**, pronotum; **C**, elytra with striations; **D**, lateral side of pronotum, **E**, protibia, dorsal view; **F**, mesotibia; **G**, head, ventral view; **H**, prosternum; **I**, mesoventrite and metaventrite; **J**, intercoxal disk of first visible abdominal ventrite; **K**, lateral disc and metepisternum; **L**, mesotibia, ventral view; **M**, pygidium; **N**, protibia; **O**, metatibia. Scale bars: 1 mm.

REDESCRIPTION

Head (Fig. 7A).

Surface irregularly punctate; cranial stria complete, supraorbital stria arcuate, frontal stria nearly straight, positioned slightly ventral to clypeus. Eyes convex dorsally, bordered posteriorly by cluster of light brown setae. Antennal scape punctate, dis-

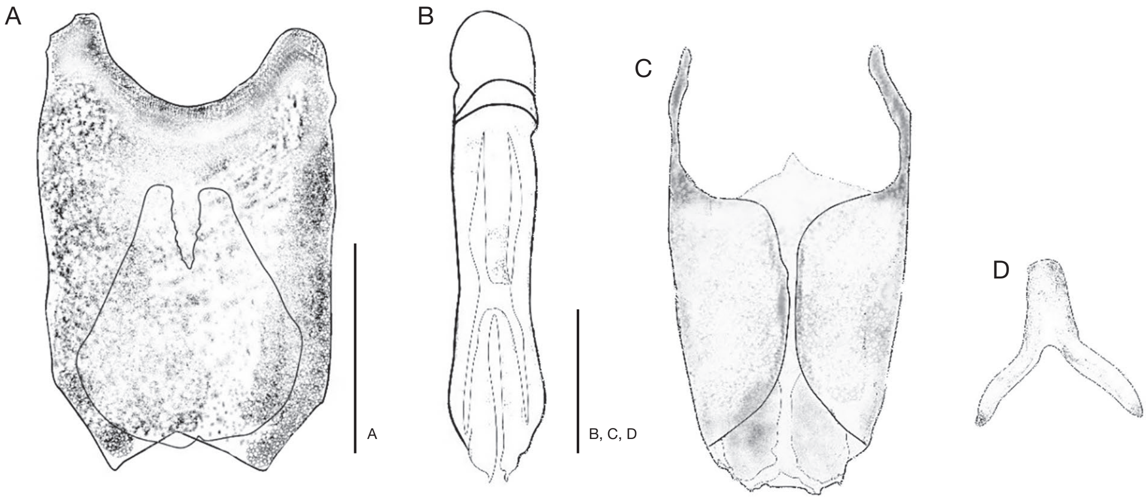


FIG. 8. — *Merohister asoka* (Lewis, 1910), male genitalia: **A**, tergite VIII and sternum VIII; **B**, aedeagus; **C**, tergites IX and X; **D**, spiculum gastral. Scale bar: 1 mm.

tally bearing cluster of pale brown setae near pedicel; pedicel laterally concave on one margin, convex on opposite margin; flagellum sparsely setose throughout. Labrum transverse (width: length *c.* 3:1), finely punctate, anterolateral margins densely fringed. Mandibles robust, inwardly curved, apically blunt; lateral surface coarsely punctate, broader basally; ventral surface with straight subapical tooth; prostheca depressed proximally, prosthecal setae dense, golden; mandibular surface entirely punctate-reticulate.

Pronotum (Figs 6A; 7B)
Anterior margin concave, posterior margin straight (anterior margin length *c.* 0.5× posterior margin); disc convex, microsculpture reticulate, interspersed with minute punctures. Lateral disc densely punctate anterolaterally and posterolaterally; marginal stria complete laterally, broadly interrupted behind head. Lateral stria prominent, not attaining posterior pronotal margin. Antescutellar region nearly smooth, bearing single longitudinal puncture.

Elytra (Figs 6A; 7C)
Width *c.* 1.4× length; surface clothed in microscopic punctures and reticulate ground sculpture. Epipleural marginal stria moderately impressed along median third. Elytral striae strongly carinate throughout. Inner subhumeral stria abbreviated; oblique humeral stria connecting to first dorsal stria. Dorsal striae 1-3 complete, weakly arcuate laterally, reaching basal margin. Fifth stria variable in length, sutural stria carinate, abbreviated, extending slightly beyond midlength.

Hind wing venation (Fig. 9)
C unbranched, attaining anterior wing margin; first axillary sclerite bearing anterodistal projection at wing base. Sc unbranched, originating from first axillary sclerite. M and Cu connected to median plate. PCu arising near A, not attaining wing plate; anal vein bearing short lateral branch basally. Anal lobe bilobed; third axillary sclerite anatomically linked to anal vein.

Propygidium and Pygidium
Propygidium with reticulate ground sculpture intermixed with coarse, rounded, shallow punctures, diminishing in size posteriorly; pygidium clothed with serial punctures.

Prosternum (Figs 6B; 7H)
Prosternal lobe anterior margin rounded, punctate; medio-apical marginal stria deeply impressed, crenate, ascending medio-apically. Basolateral margin with abbreviated striae, two oblique punctures intersecting basolateral stria medially. Interpunctural spaces finely punctate; prosternal process sparsely punctate. Presternal suture deeply incised. Prosternal keel lateral stria nearly straight, crenulate-punctate; keel surface finely punctate, base subglobose.

Mesoventrite (Figs 6B; 7I)
Discal marginal stria carinate, interrupted behind prosternal keel base, forming deep crescentic impression; disc sparsely punctate. Meso-metaventral sutural stria nearly linear, weakly crenulate.

Metaventrite (Figs 6B; 7I)
Lateral stria deeply impressed, carinate, extending obliquely posteriorly, converging posteriorly with recurrent stria. Post-mesocoxal stria deeply impressed, strongly arcuate along mesocoxal posterior margin. Metepimeron with coarse, rounded punctures. Longitudinal metaventral suture weakly impressed, anteriorly forming T-shaped junction with meso-metaventral suture; posteriorly, two fine sutures angling obliquely from suture base toward recurrent stria. Intercoxal disc with punctures denser near lateral stria, sparser medially.

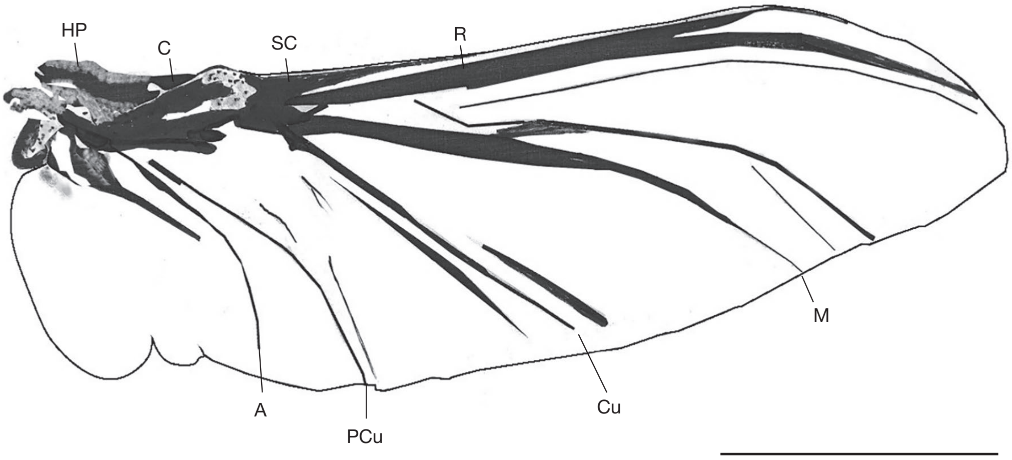


FIG. 9. — Hindwing venation pattern of *Merohister asoka* (Lewis, 1910). Abbreviations: see Material and methods.

Metepisternum
Surface bearing coarse punctures and sparse setae; metepisternal stria anteriorly uniting with oblique stria, extending laterally to mesocoxal margin, joining anepisternum.

Abdomen (Figs 6B; 7J)
Ventrite I. Trapezoidal; lateral stria deeply impressed, crenulate; intercoxal disc with reticulate ground sculpture overlain by sparse microscopic punctures.

Legs
Protibia (Fig. 7E). Dark brown, surface punctate-reticulate; denticles variably present, ventromedial miniature denticles often reduced or absent. Outer setal row extending from base to basal denticle, curving irregularly beyond posterior denticle; protibial stria faintly visible. Basal margin with inner row of light brown setae, small setal tuft near tibial spur; mid-row punctures glabrous; posterior surface punctate, microsculpture coriaceous.

Protarsus. Length *c.* 0.2 mm; slender, glabrous; tarsomeres 1-4 each with single apical spine; tarsomere 5 with paired apical spines.

Profemur. Subrectangular; surface coriaceous, punctate; anterodorsal half with setae arranged in scalene triangular cluster; posterior half bearing longitudinal groove-like impressions; distal end with reticulate microsculpture; dorsal setae in single row; anterior edge with sparse, rounded punctures bearing hollow setal bases, not attaining tibial articulation.

Mesotibia. Dark brown; dorsal margin with two denticulate rows, increasing in density toward tibial spur; posterior surface with three setal rows: inner row densely clustered ventrally (adjacent to spur), median and outer rows sparser.

Mesofemur. Posterior inner margin with dense setal row, terminating before tibial base; anterior surface punctate, glabrous.

Mesotarsus. Tarsomeres 1-4 each with single apical spine (contrasting protarsus).

Metatibia. Structurally similar to mesotibia but proportionally elongate; dentition and setal patterns consistent, adjusted for length.

Male genitalia
Tergite VIII (Fig. 8A). Subrectangular, broader than long, transversely oriented, with flat dorsum and straight to weakly convex lateral margins. Anterior margin straight to faintly convex, unmodified, uniformly sclerotized. Lateral margins smooth, tapering posteriad to angular posterolateral corners. Posterior margin bisinuate: lateral concavities flanking paired, sharp posterolateral projections; medial emargination broad, U-shaped (*c.* 120°), base smooth. Surface entirely glabrous, polished, lacking sculpturing; texture matte to faintly lustrous. Sclerotisation moderate to heavy, uniform; pigmentation homogeneous pale brown-amber.

Sternum VIII (Fig. 8A). Body semicircular to subpentagonal, marginally and dorsally ornamented with sclerotized amber-tinted patches; transverse (slightly wider than long), widest at anterior third. Anterior margin strongly arched, dome-like, with sparse marginal setae; posterior margin deeply V-emarginate, forming parallel, elongate lobes. Cuticle polished, glabrous; sclerotisation gradient dense (anterior) to translucent (posterior). Ground color amber, darkest marginally, with anteromedial subtriangular fuscous spot. Sparse, outward-projecting setae on anterior/lateral margins.

Tergite IX (Fig. 8C). Paired, robust, elongate-oval sclerites occupying lateral thirds of dorsum; anteroposteriorly convex, margins smooth, tapering posteriorly to blunt apices. Medial edges separated by narrow, translucent intersegmental membrane, contrasting dense amber sclerotisation of sclerites with paler midline. Surface glabrous, polished, regular. Pos-

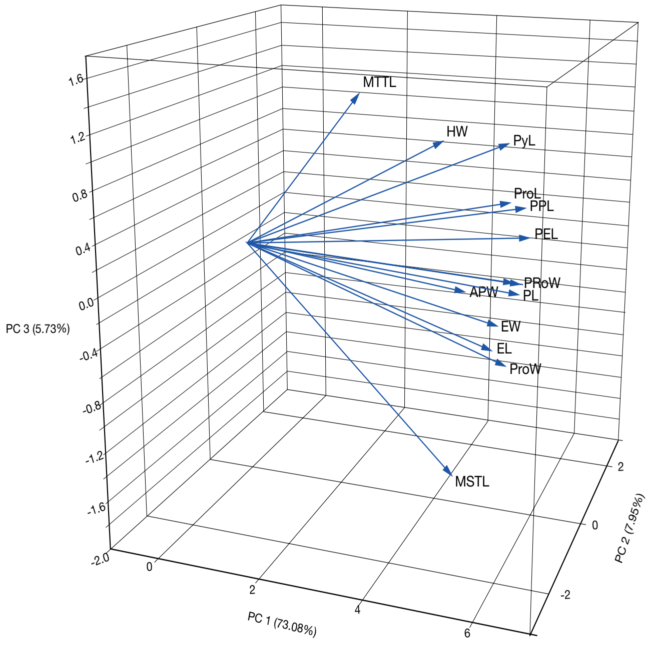
FIG. 10. — Map showing: **A**, the type localities of *Merohister asoka* (Lewis, 1910) in Dehradun, India (**solid star**) and *Merohister jekeli* (Marseul, 1857) in Shanghai, China (**solid red circle**); **B**, sampling locations for *Merohister asoka and M. jekeli* (**empty stars**) in the districts of Punjab (**circles**) and type locality of *Merohister asoka* (Lewis, 1910) in Dehradun, India (**solid star**).

terior margin weakly truncate, medially emarginate, forming a shallow notch framing the anterior edge of tergite X; edge smooth. Coloration medium to dark amber, darkest along anterolateral margins, fading to translucent golden-yellow medially; anteromedial triangular fuscous spot near midline. Latero-apical processes arising dorsolaterally from anteroposterior midpoint of tergite IX: slender, arcuate, strongly sclerotized, reddish-brown; broad base integrated seamlessly with tergite, tapering to acute, outwardly curved apex; surface polished.

Tergite X (Fig. 8C). Narrow, weakly sclerotized, hyaline; posterior margin shallowly emarginate, margin angulate, pointed, irregular; contour smoothly rounded; anterior margin bordered by tergite nine, tapering slightly ventrally; cuticle finely micro-reticulate. Coloration uniform translucent pale amber, grading to slightly darker ochre at anterior edge where overlapping tergite IX; internal musculature or membranous structures faintly visible.

Aedeagus (Fig. 8B). Elongate (5.6× longer than wide); phallobase (basal piece) short (*c.* 1/7 total length); parameres fused apically, forming broadly oval apex; median lobe elongate, encircled strongly sclerotized armature; tapering gradually to narrowly rounded terminus.

Spiculum gastrale (Fig. 8D). Y-shaped; moderately to heavily sclerotized; basal shaft robust, cylindrical, dorsoventrally compressed (flattened laterally); uniform width before tapering toward bifurcation; diverging into two symmetrically arcuate rami forming open V-angle; ramus margins smooth, glabrous, unornamented; inner margins concave, outer margins convex (balanced arcuate profile); apices narrowly rounded; sclerotisation uniform (amber-light brown), marginally darker basally.



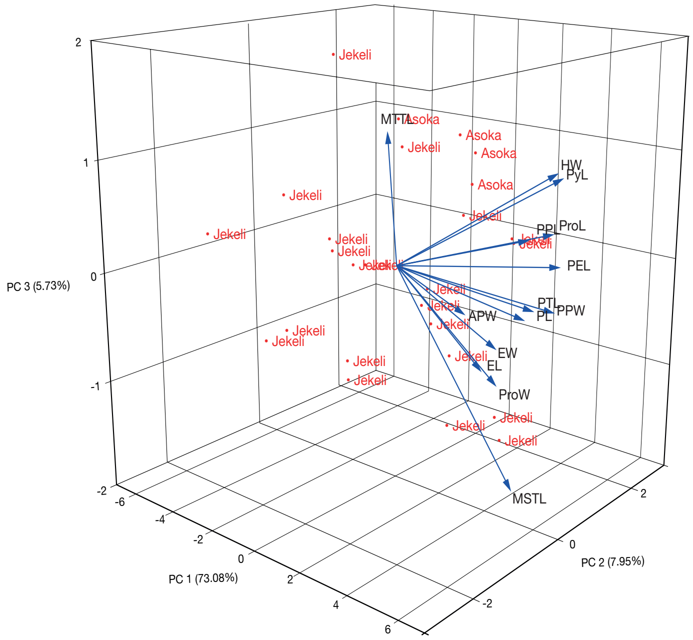


Fig. 11. — PCA loadings of 14 morphometric traits. PC1 captures overall size variation, while PC2 and PC3 reflect head-tarsus contrasts and limb scaling, respectively. HW, MTTL, MSTL, ProW, and PL show the strongest contributions to species differentiation.

Fig. 12. — PCA Biplot (PC1 vs PC2). PC1 reflects body size; PC2 captures head hind appendage length contrasts separating *M. asoka* and *M. jekeli*. Key discriminating traits include HW, MTTL, MSTL, ProW, and PL.

Table 2. — Measurements (in mm) of body part of *Merohister asoka* (Lewis, 1910), males. Abbreviations: see Material and methods.

Characters	HW	APW	PPW	PEL	PPL	PL	EL	EW	ProW	ProL	PyL	PTL	MSTL	MTTL
Min	1.7	2.1	5	6.8	8.6	2	4.2	6	3.7	1.2	1.2	1.3	1.6	2
Max	2	2.2	5.5	7.9	8.7	2.4	4.3	6.3	3.9	1.4	1.5	1.6	1.8	2.1
Average (n=4)	1.9	2.2	5.2	7.2	8.6	2.2	4.2	6.2	3.8	1.3	1.3	1.4	1.7	2.1

Short diagnostic key for differentiation of two Indian *Merohister* Reitter, 1909 species

1. Protibial outer margin bearing three denticles; dorsal elytral striae 1 and 3 reaching basal margin; parameres fused apically into broad lobe; spiculum gastrale small and Y-shaped .... *Merohister asoka* (Lewis, 1910).
— Protibial outer margin bearing four to six denticles; dorsal elytral striae 1-3 all ending short of basal margin; parameres free, apices bulbous; spiculum gastrale slingshot-shaped .... *Merohister jekeli* (Marseul, 1857).

MULTIVARIATE STUDIES OF MORPHOMETRIC MEASURES OF *M. JEKELI* AND *M. ASOKA*

Principal component analysis (Figs 11; 12; Tables 2-5)

Morphometric variation between *Merohister jekeli* and *M. asoka* was assessed using Principal Component Analysis (PCA) (Table 4) on 14 continuous traits measured across 26 adult specimens (Table 3). The first principal component (PC1) explained 73.08% of total variance and was characterized by uniformly positive loadings across all traits (range: 0.167-0.298), indicating a dominant size axis. Traits with the highest contributions to PC1 included pronotal length (PL, 0.298), pronotal posterior length (PPL, 0.298), pronotal width (ProW, 0.297), and elytral length (EL, 0.288), collectively reflecting overall body robustness.

The second component (PC2), accounting for 7.95% of variance, revealed a shape-based contrast between cephalic and appendicular dimensions. Head width (HW) exhibited the strongest positive loading (0.557), while total length (MTTL) loaded negatively (-0.488), indicating that PC2 separates individuals with broader heads and shorter metatarsi from those with narrower heads and elongated hind appendages. This axis effectively distinguished *M. asoka*, which clustered toward high PC2 values, from *M. jekeli*, which occupied lower PC2 space.

TABLE 3. — Measurements of males of *Merohister jekeli* (Marseul, 1857) and *M. asoka* (Lewis, 1910) used for multivariate analyses. Abbreviations: see Material and methods.

Species	HW	APW	PPW	PEL	PPL	PL	EL	EW	ProW	ProL	PyL	PTL	MSTL	MTTL
M. jekeli	1.3	2.2	4.8	6.1	7.5	2	4.1	5.7	3.7	1	0.7	1.3	1.7	1.9
	1.5	2.4	5.2	7	8.4	2.3	4.5	6.3	4.1	1.1	1.2	1.6	1.8	2.4
	1.9	2.7	5.6	8	9.1	2.5	5	7.1	4.4	1.2	0.9	1.5	1.9	2.1
	1.6	2.2	5	6.5	7.3	2.1	4.3	6	3.9	1	1	1.4	1.9	2.2
	1.4	2.5	5.8	7.5	10	2.6	5.3	7.5	4.6	1.5	1.5	1.8	1.8	2.5
	1.8	2.8	5.9	8.1	9.5	2.6	5.3	7.6	4.5	1.3	1.4	1.7	1.9	2
	1.2	2.1	4.6	6	7.4	2	4	5.9	3.6	0.9	0.5	1.2	1.6	2.2
	2	2.8	5.9	8	10.2	2.6	5.3	7.4	4.6	1.5	1.5	1.8	1.9	2.6
	1.7	2.3	5	6.8	8	2.2	4.8	6.9	4	1.2	0.8	1.3	1.7	2.3
	1.9	2.7	5.5	7.9	9.8	2.5	5.2	7.2	4.4	1.4	1.4	1.6	1.8	2.4
	1.3	2.4	5.3	7.2	8.9	2.3	5.1	6.8	4.2	1.3	1	1.5	1.8	2.2
	1.5	2.6	5.7	8.1	9.6	2.5	5	7	4.3	1.4	1.3	1.7	1.7	2.6
	1.6	2.5	5.8	7.6	10.1	2.4	5.3	7.5	4.5	1.5	1.5	1.8	1.9	2
	1.8	2.8	5.2	7	9.4	2.2	4.9	6.7	4.1	1.1	1.2	1.4	1.6	2.5
	1.4	2.3	4.9	6.3	7.6	2	4.2	5.8	3.7	1	0.9	1.3	1.6	2.1
	1.7	2.7	5.1	7.8	9.9	2.6	5.3	7.6	4.4	1.2	1.4	1.8	1.8	2.3
	1.9	2.5	5.6	7.4	8.7	2.3	5	6.6	4.3	1.3	1.1	1.6	1.9	2.2
	1.3	2.1	4.8	6.1	7.3	2.1	4.1	5.7	3.8	1	0.5	1.2	1.7	2
	1.5	2.6	5.4	7.7	9.5	2.5	5.3	7.1	4.5	1.5	1.5	1.8	1.9	2.5
	1.8	2.4	5.2	6.9	8.1	2.2	4.6	6	4	1.1	0.9	1.4	1.8	2.3
	1.6	2.2	5	6.4	7.9	2.1	4.2	6.5	3.9	1	1	1.3	1.7	2.1
	2	2.8	5.9	8.1	10.2	2.6	5.3	7.6	4.6	1.5	1.5	1.8	1.9	2.6
M. asoka	1.72	2.12	5.1	6.9	8.62	2.1	4.25	6.05	3.75	1.25	1.22	1.35	1.62	2.02
	1.89	2.18	5.3	7.5	8.7	2.3	4.28	6.2	3.8	1.35	1.45	1.6	1.75	2.08
	1.85	2.15	5.45	7.8	8.65	2.2	4.22	6.3	3.85	1.3	1.38	1.55	1.78	2.1
	1.92	2.19	5.25	7.2	8.68	2.35	4.3	6.15	3.9	1.4	1.33	1.45	1.69	2.04

PC3 (5.73% variance) further resolved appendicular variation, MSTL showing a strong negative loading (-0.663) and MTTL a positive loading (0.519). These patterns highlight differential scaling of mesotibia and metatibia segments, reinforcing interspecific separation.

A PC1–PC2 biplot revealed minimal overlap between species, with *M. asoka* occupying a distinct morphospace defined by larger body size and broader cephalic proportions. Based on PCA loadings and species-level separation, five traits – HW, MTTL, MSTL, ProW, and PL – were identified as the most reliable traits for distinguishing *M. jekeli* and *M. asoka*, and were subsequently used to construct morphometric diagnostic ratios.

TABLE 4. — Eigenvalues of the Correlation Matrix (Principal Component Analysis).

Principal Component	Eigenvalue	% Variance Explained	Cumulative %
PC1	10.23071	73.08%	73.08%
PC2	1.11311	7.95%	81.03%
PC3	0.80203	5.73%	86.76%

TABLE 5. — Canonical Function Summary (CDA).

Trait	Std. Canonical Coefficient	Direction (positive/ negative)	Contribution
ProW	+4.192	Positive	Strong
APW	+2.869	Positive	Moderate
HW	−0.890	Negative	Moderate
PTL	+2.381	Positive	Moderate
EL	−0.522	Negative	Weak

CANONICAL DISCRIMINANT ANALYSIS (FIGS 13-15)

Canonical Discriminant Analysis (CDA) (Table 5) revealed a robust separation between *M. jekeli* and *M. asoka*, with a single discriminant axis (F1) accounting for 100% of the intergroup variability. The model yielded a canonical correlation of 0.978 and an eigenvalue of 21.837, indicating strong discriminatory power. Multivariate tests including Wilks' Lambda ($\lambda = 0.044$, $F(14\,11) = 17.158$, $p < 0.0001$), Pillai's Trace, Hotelling-Lawley Trace, and Roy's Greatest Root all confirmed significant differences in mean vectors between species. Box's M test rejected the assumption of equal covariance matrices ($p < 0.0001$), validating the use of CDA over LDA.

Classification accuracy was perfect, with 100% of specimens correctly assigned to their respective species. The ROC curve yielded an AUC of 1.0, confirming complete separation in canonical space (Fig. 15). Group centroids on F1 were –10.529 for *M. asoka* and +1.914 for *M. jekeli*, with no overlap in discriminant scores (Fig. 13).

Among the 14 morphometric characters analyzed, ProW emerged as the most influential variable (standardized coefficient = +4.192, $p = 0.038$), followed by APW (+2.869, $p = 0.014$), EL (+0.434, $p = 0.031$), and MTTL (+0.550, $p = 0.066$) (Fig. 14). Although some characters such as PTL and PyL were not individually significant, their high canonical loadings suggest multivariate relevance due to covariance structure. These traits collectively define a diagnostic morphometric profile distinguishing the two taxa.

DISCUSSION

The present study fundamentally revisits the genus *Merohister* in India, by utilizing detailed external morphology and male genitalic features. This approach dismantles earlier, more superficial taxonomic boundaries that relied excessively on variable characters such as elytral striation and cephalic punctation (Ôhara 1994). Instead, our observations reveal that the subtle continuum in external traits is reinforced and clarified by diagnostic features of the internal morphology, particularly the structure of the aedeagus and associated tergites. Such a comprehensive investigation underscores the necessity of examining both external and internal characters when addressing systematics in coleopteran taxa that exhibit modest morphological divergence.

One of the key contributions of this study is the detailed characterisation of the male genitalia in *Merohister asoka*. The genital structure of this species was never documented before, leading to an incomplete understanding of its taxonomic standing. *Merohister asoka* is unique in combining a deeply emarginate tergite 8 and a bifurcate spiculum gastrale whose two slender arms diverge markedly. Its tergite X bears spatulate lobes with denticulate margins – features not seen in *M. jekeli*, *M. aino*, or *M. uenoi*. The aedeagus of *M. asoka* is among the most elongate, with a strongly sculptured median lobe and parameres expanded to nearly three-quarters of shaft width. In contrast, *M. jekeli* and *M. aino* have relatively slender, lightly lobate parameres, and *M. uenoi* has distinctly short, stout parameres. The spiculum gastrale of *M. asoka* is Y-shaped; in *M. jekeli* it is slingshot-shaped; and in *M. uenoi* it is stout and encircled in a ring (Ôhara 1992).

The consistency of these internal structures across multiple specimens suggests that they constitute reliable diagnostic features, largely impervious to intraspecific fluctuations that can confound comparisons based solely on external morphology. This observation supports the view that even minor modifications in the mechanism of copulation may drive speciation in groups where external morphology remains conserved.

Ecologically, our observations support the hypothesis that *Merohister* species are specialists in necrophilous or carcass-associated habitats (Correa *et al.* 2020). Wang *et al.* (2008) documented *Merohister jekeli* among coleopteran assemblages on decomposing pig carcasses in southern China during active decay, indicating its trophic association with late-stage carrion. Similarly, Wang *et al.* (2017) consistently recovered *M. jekeli* in advanced decay and remains phases.

The consistent recovery of specimens from buffalo carcasses at several sites in Punjab reinforces the idea that these beetles are ecologically adapted to environments characterized by decaying organic matter. The correlation between habitat specificity and the evolution of certain morphological features – such as the robustness of the mandibles and slight modifications in tibial dentition – points toward adaptive responses to a necrophilous lifestyle. These adaptations may facilitate effective locomotion on heterogeneous, decomposing substrates and enable efficient exploitation of ephemeral food resources. In this context, the morphological plasticity observed in external characters might reflect adaptive strategies rather than taxonomic distinctiveness, further emphasizing the primacy of genital structure in species delimitation.

Another crucial aspect of this study is its contribution to the broader biogeographical narrative of *Merohister* (Mazur 2011). The genus exhibits a remarkable geographical span being widely distributed in the northern hemisphere, from temperate Est Asia, western Europe and North America to the tropical and subtropical regions of India. The observation of gradual morphological transitions across this distribution suggests that historical processes – such as climatic oscillations, habitat fragmentation, and dispersal events – may have shaped lineage diversification (Zheng & Lackner 2025). In this context, the sharp morphometric bifurcation between *M. jekeli* and *M. asoka* underscores the emergence of species-level boundaries within a geographically dynamic genus.

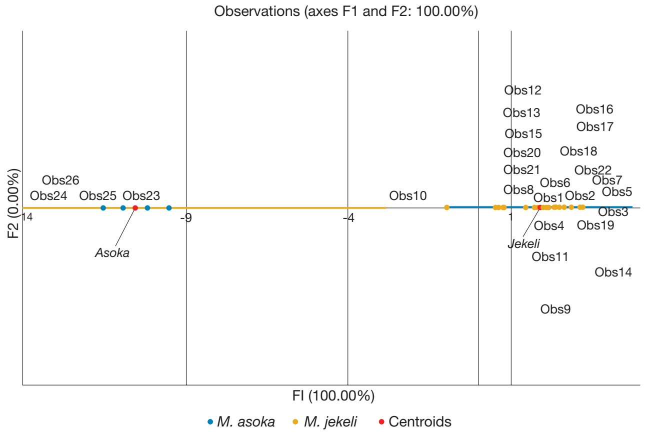


FIG. 13. — Canonical discriminant scores of individual specimens plotted along Function 1 axis (F1=100% of variance explained). Individuals of *M. asoka* (Lewis, 1910) and *M. jekeli* (Marseul, 1857) form distinct, non-overlapping clusters, with centroids at –10.529 and +1.914, respectively. This separation reflects complete species-level discrimination (100% correct classification).

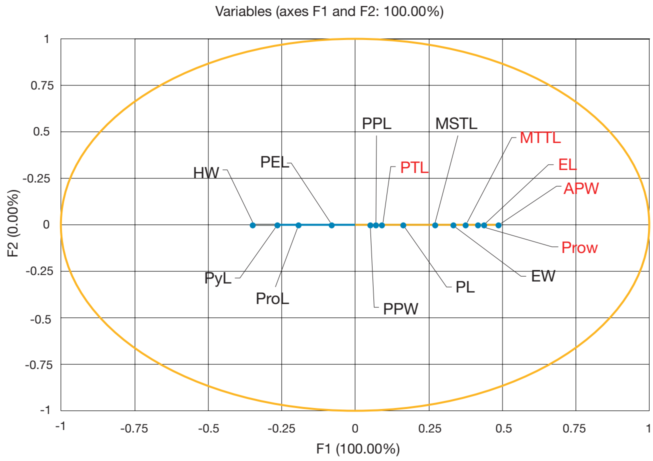


FIG. 14. — Canonical loadings of morphometric variables onto Function 1. Traits with strongest positive contributions include ProW (0.418), APW (0.487), PTL (0.090), EL (0.434), and MTTL (0.375). These traits are key contributors to interspecific separation.

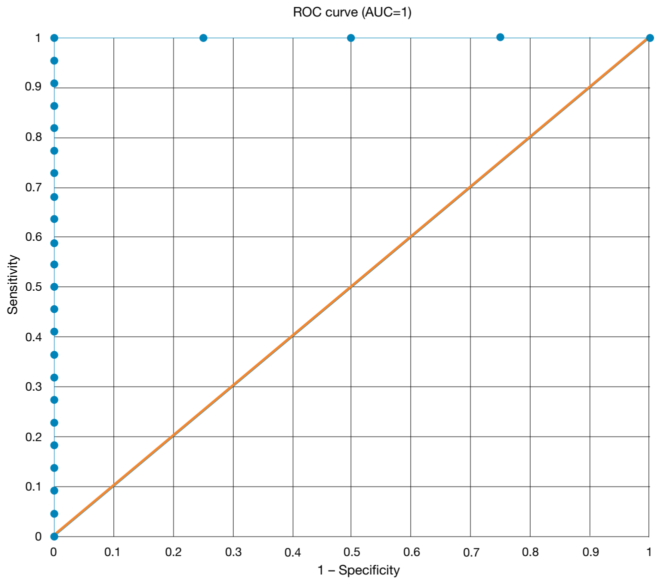


Fig. 15. — Receiver Operating Characteristic (ROC) curve evaluating classification accuracy between *M. asoka* (Lewis, 1910) and *M. jekeli* (Marseul, 1857). The area under the curve (AUC) is 1.0, indicating perfect sensitivity and specificity across all thresholds.

Multivariate analyses revealed a distinctly partitioned morphometric landscape between *M. jekeli* and *M. asoka*. Principal Component Analysis (PCA) showed that PC1 captured 73.08% of total variance, reflecting an overall size gradient, while PC2 isolated shape contrasts between cephalic width and hind appendage length. Notably, *M. asoka* clustered along higher PC2 values, defined by broader heads and reduced metatarsal dimensions. Canonical Discriminant Analysis (CDA) yielded complete classification accuracy (AUC = 1.0), with group centroids fully separated on Function 1.

Among the 14 morphometric characters evaluated, ProW, APW, EL, MTTL, and PTL demonstrated highest canonical loadings and standardized coefficients – reinforcing PCA-based prioritisation and confirming the diagnostic power of these traits. The strong concordance between PCA, CDA, and ROC metrics indicates that species-level discrimination is driven by consistent, quantifiable morphological structure. These findings validate the utility of empirically grounded morphometrics in delimiting species boundaries within *Merohister*.

Future investigations that incorporate molecular phylogenetic approaches in tandem with extensive geographic sampling promise to unravel these complex biogeographical patterns, offering deeper insights into the processes driving diversification in *Merohister*.

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