**Supp. file 2.** An annotated list of morphological characters scored for six ingroup taxa (species of *Brachymelecta* author+ year) and four outgroup taxa (species of other melectine genera) from which the matrix presented in Table 1 was constructed. https://doi.org/10.5852/ejt.2021.754.1393.4423

0. Mandible: 0 bidentate, with inner preapical tooth as well as usual apical tooth (rutellum) (Fig. 14A); 1 tridentate, with inner basal tooth as well as inner preapical tooth and usual apical tooth (rutellum) (Fig. 14B).

1. Maxillary palpus with: 0 one to three palpomeres (Fig. 12B); 1 four to six palpomeres (Fig. 12A).

2. Each flagellomere of male excluding F1: 0 distinctly wider than long (L / W ratio ≤ 0.8) (Hurd & Linsley 1951: pl. 11b); 1 at most as wide as long (L / W ratio = 0.9–1.0) (Lieftinck 1980: fig. 1).

3. Tegula (color): 0 amber (Figs 3B, 5B, 7A, 8, 10B, 11, 16B; Supp. file 3: fig. S2); 1 dark brown to black (Figs 13B, 15B; Supp. file 3: fig. S3).

4. Mesoscutum: 0 with a pair of central spots of pale hairs lighter than the surrounding dark brown/gray or black hairs (Figs 3B, 10B, 11, 16B); 1 with a pair of anterior spots or bands of hairs darker than the surrounding off-white or yellow-orange hairs (Figs 5B, 13B); 2 covered in dense, uniform off-white, golden-yellow, or yellow-orange hairs (Fig. 15; Supp. file 3: fig. S3). Note that in *Zacosmia maculata* both a pair of central spots of off-white hairs and a pair of anterior bands of fuscous hairs are present (Supp. file 3: fig. S2), so the species was coded as polymorphic.

5. Mesoscutum with hairs: 0 appressed (Supp. file 3: fig. S2); 1 erect/suberect (Fig. 15; Supp. file 3: fig. S3); 2 appressed in some areas, erect/suberect in others (Figs 3, 5, 7A, C–D, 8, 10, 11, 13, 16).

6. Mesoscutum with hair density: 0 greatest in anterior half (Figs 5, 7A, C–D, 8, 13, 15; Supp. file 3: fig. S2); 1 not greater anteriorly than elsewhere (Figs 3, 10, 11, 16; Supp. file 3: fig. S3).

7. Mesoscutum and mesoscutellum with erect/suberect hairs (if some hairs erect/suberect; otherwise “?”): 0 short (most <2 MOD) (maximum length shown in Figs 5, 7A, C–D, 13, 15); 1 long (most >2 MOD) (Supp. file 3: fig. S3).

8. Mesoscutum and mesoscutellum each with uninterrupted band of pale hairs along entire midline: 0 absent (e.g. Fig. 3B, D); 1 present (Figs 10B, D, 11, 16B, D).

9. Mesoscutum and mesoscutellum with punctures: 0 distinctly larger than those on discs of metasomal terga (e.g. Fig. 5B, D); 1 not much larger than those on discs of metasomal terga (e.g. Fig. 3B, D).

10. Axilla with hairs predominantly: 0 off-white, golden yellow, or yellow orange (Fig. 15D; Supp. file 3: figs S2, S3); 1 black (Figs 3D, 5D, 10D, 13D, 16D).

11. Mesoscutellum, primary color: 0 same reddish-orange color as legs from trochanters to tarsi (Supp. file 3: fig. S2); 1 black (Figs 3D, 5D, 13D, 15D); 2 reddish brown, contrasting with reddish-orange color of legs from trochanters to tarsi (Figs 10B, D, 16B, D).

12. Mesoscutellum with a pair of conical (i.e. not flat) projections: 0 absent (Fig. 15D; Supp. file 3: fig. S2); 1 present (Figs 3D, 5D, 10D, 13D, 16D). Note that these are occasionally present but very small and thus ill-defined in *Brachymelecta larreae*, so the species was coded as polymorphic.

13. Mesoscutellum with a pair of conical projections (if present; otherwise “?”) forming: 0 acute spines (Figs 3D, 10D, 16D); 1 obtuse mammiform tubercles (Figs 5D, 13D).

14. Metanotum, primary color: 0 same reddish-orange color as legs from trochanters to tarsi (Supp. file 3: fig. S2); 1 black (Supp. file 3: fig. S4A); 2 reddish brown, contrasting with reddish-orange color of legs from trochanters to tarsi (Supp. file 3: fig. S4B).

15. Mesopleuron with punctures: 0 clearly separated from one another (most i≤2d), with most interspaces well-defined, shining (Supp. file 3: fig. S5A); 1 contiguous (Supp. file 3: fig. S5B).

16. Lateral surface of propodeum posterior to spiracle with rugose crescent ridge: 0 absent, surface relatively flat and unmodified (Supp. file 3: fig. S6A); 1 present, strongly carinate above and joining anterior lip of spiracle (Supp. file 3: fig. S6B).

17. Fore wing with membrane in most closed cells: 0 subhyaline, contrasting with infuscate region beyond the veins (Figs 3A–C, 5A–C, 7A, C, 8, 10A–C, 16A–C); 1 infuscate, not contrasting with region beyond the veins (Figs 13A–C, 15A–C).

18. Legs, excluding coxae, predominantly: 0 reddish orange, contrasting strongly with brown or black color of mesopleuron (Figs 3A, C, 10A, C, 11, 16A, C); 1 black or brown, not contrasting strongly with color of mesopleuron (Figs 5A, C, 13A, C, 15A, C).

19. Mesotibia with color sexual dimorphism: 0 absent (see Figs 3A, C, 15A, C); 1 present (see Figs 5A, C, 13A, C, 16A, C).

20. Inner ramus of each tarsal claw of the mid- and hind legs: 0 narrow, pointed, and thus resembles the outer ramus (Fig. 2C); 1 broad, lobelike, and thus does not resemble the outer ramus (Fig. 2A–B).

21. Distitarsi of all legs: 0 without arolia (Supp. file 3: fig. S7); 1 with arolia (Hurd & Linsley 1951: pl. 11f).

22. T1 dorsally AND laterally with long, suberect off-white, golden-yellow, or yellow-orange hairs, of similar length and type to those on the dorsum of the mesosoma. Note that in *Brachymelecta* and *Thyreus*, such hairs (when present) are only present laterally: 0 absent (Figs 3A–C, 5A–C, 7A–C, 8, 9, 10A–C, 11, 13A–C, 15A–C, 16A–C); 1 present (Supp. file 3: fig. S3).

23. T2–T4 each with apical fascia comprised of short, appressed branched pale hairs, which may be reduced to a pair of small patches: 0 present, at least in conspecifics (Figs 3A–C, 5A–C, 7A–C, 8, 9, 10A–C, 11, 13A–C, 15B, 16A–C); 1 absent (Supp. file 3: fig. S3).

24. T4 fascia (if present or reduced to a pair of small patches of short, appressed branched pale hairs, at least in conspecifics; otherwise “?”) with two pairs of lobelike anterolateral extensions: 0 absent (Fig. 3A, C); 1 present (Fig. 5A, C).

25. S4 and S5 of male each with distinct apical/subapical fringe of dense long, curved, suberect hairs: 0 absent (Figs 3C, 10C, 16C); 1 present (Figs 5C, 7C, 13C, 15C).

26. Apodemes of S7 of male each with small lateral spine: 0 absent (Fig. 6E); 1 present (Fig. 6A–D).

27. Gonostylus of male with dorsobasal lobe or process: 0 absent (Mitchell 1962: fig. 119); 1 present (Lieftinck 1980: fig. 33).

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