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***Epilandex vignai* sp. nov. from Sulawesi**
(Dermaptera: Anisolabididae)

Abstract: A new species of the genus *Epilandex* Hebard, 1927, *Epilandex vignai* sp. nov., is described based on material from Sulawesi, Indonesia. The habitus and diagnostic characteristics are illustrated, and the taxonomic position is discussed. An identification key for all recognised *Epilandex* species is provided.

Riassunto: *Epilandex vignai* sp. nov. di Sulawesi (Dermaptera: Anisolabididae).

Una nuova specie del genere *Epilandex* Hebard, 1927, *Epilandex vignai* sp. nov., è descritta sulla base di materiale proveniente da Sulawesi, Indonesia. Vengono illustrati l'habitus e i caratteri diagnostici, discussa la posizione tassonomica della nuova specie e fornita una chiave di identificazione delle specie note di *Epilandex*.

Key words: Dermaptera, Anisolabididae, Anisolabidinae, taxonomy, Oriental region.

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INTRODUCTION

The genus *Epilandex* Hebard, 1927, comprises 8 species of Anisolabididae. Anisolabidinae earwigs distributed in Oriental, Australian and Oceanian regions (sensu Holt *et al.*, 2012), from India in the north to the Solomon Islands and Australia in the south (Steinmann, 1989; Srivastava, 1976a, 2003a, 2003b). *Epilandex* includes relatively small species with body lengths of 7-14 mm, reddish brown or dark in colour, shining, generally glabrous, and the genus is well defined by male genitalia with very long and thin parameres, which are characteristically attenuating and asymmetrical male forceps (Steinmann, 1989). Tegmina and wings are fully developed, wings could be concealed, or both tegmina and wings are absent.

A new species, *Epilandex vignai* sp. nov., is described here from Sulawesi, based on holotype male deposited in the National Museum, Praha, Czech Republic.

MATERIALS AND METHODS

Nomenclature and morphological terminology that were used by STEINMANN (1986) follow. The studied specimen of *Epilandex vignai* sp. nov. was dry-mounted, examined, and photographed with an

Olympus SZ61 stereomicroscope equipped with an ocular grid and a CANON D1000 camera. Genitalia were studied and photographed with an Olympus CX41 microscope equipped with a CANON D1000 camera. Microphotographs of 10 to 40 focal layers of the same specimen were combined with Quick Photo Camera 2.3 software and finally processed with Adobe Photoshop CS6 Extended (version 13). The type specimen was mounted on a label, and dissected body parts (penultimate sternite) were mounted with methylcellulose glue on the same board as the specimen. A genital armature was mounted in dimethyl hydantoin formaldehyde resin (DMHF, a water-soluble mounting medium) on the same label as the specimen. Nomenclatural and morphological terminology follows that used by Steinmann (1993); terminology for the terminalia and genitalia follows Kamimura (2014). The type specimen is deposited in the National Museum, Praha, Czech Republic (NMPC).

COMPARATIVE MATERIAL STUDIED. *Epilandex solomonensis* Brindle, 1970: Solomon Is., Guadalcanal, Mt. Austen, Jan. 1966, P. Greenslade (2 males/2 females paratypes, coll. Bernice Pauahi Bishop Museum, Honolulu, Hawaii, USA - BPBM); *Epilandex serrata* Srivastava, 1976: P.I.: Luzon, Camarines Sur, Mt. Isarog, Pili, 600 m, 6.IV.1965; H.M. Torre Villas, Light

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Trap, Bishop (male holotype, coll. BPBM); *Epilandex peterseni* Ramamurthi, 1967: Philippines, Palawan, Mantalingajan, Tagenbung 1150 metres, 19. Sept. 1961, Noona Dan Exp. 61-62, caught by mercury-light 18.30-06.00 (female paratype, coll. Zoological Museum, University of Copenhagen - ZMUC); Philippines, Palawan, Mantalingajan, Pinigisan 600 metre, 10. Sept. 1961, Noona Dan Exp. 61-62, Caught by mercury-light 19.00-06.00 (female paratype, coll. ZMUC); Brunei Darussalam, Ulu Temburong NP, 130 m a.s.l., 4°32'49''S 115°09'25''E, 02.-19.ii.2013, P. Kočárek leg. (2 males coll. P. Kočárek, Ostrava, Czech Republic); *Epilandex handschini* Hincks, 1954: W. Sumba, near Pogobina, 550 m, 12.-15.IX.1949, W.D. Hincks leg. (Holotype, Naturhistorisches Museum Basel); Papua New Guinea, Madang prov., Hapurpi village near Halopa mission, 700 m a.s.l., S 5°05' E 145°41', primary rainforest, April 2001, Aman, Novotný leg. (Malaise trap) (7 males/1 female, coll. P. Kočárek, Ostrava, Czech Republic); *Epilandex burri* (Borelli, 1921): W. Malaysia, Kuala Lumpur, Lake Gardens, 40 m, 3°8'39.1''N, 101°41'3.2''E, 18.9.1999, P. Kočárek leg. (1 male/1 female, coll. P. Kočárek, Ostrava, Czech Republic).

TAXONOMY

***Epilandex vignai* sp. nov. (Figs. 1-5)**

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218FC780-C56B-40B9-A910-3492A6587AD8

TYPE LOCALITY. Indonesia: S Sulawesi, Tana Toraja, Rantepao env., Tilanga village, 930 m, 03°01'27.31'' S, 119°53'29.49''E.

MATERIAL EXAMINED. HOLOTYPE: male, Indonesia: S Sulawesi, Rantepao env., Tilanga, 930 m, 03°01'27.31''S, 119°53'29.49''E, 21.-24.01.2010, Řehoř Fafejt leg. (NMPC). The specimen is provided with an additional printed red label: HOLOTYPE / *Epilandex vignai* sp. nov., det. P. Kočárek 2020'.

DESCRIPTION. General colour blackish brown; head, pronotum and tegmina darker; antennae and legs yellowish brown. Length without forceps 10.1 mm, length of forceps 1.6 mm.

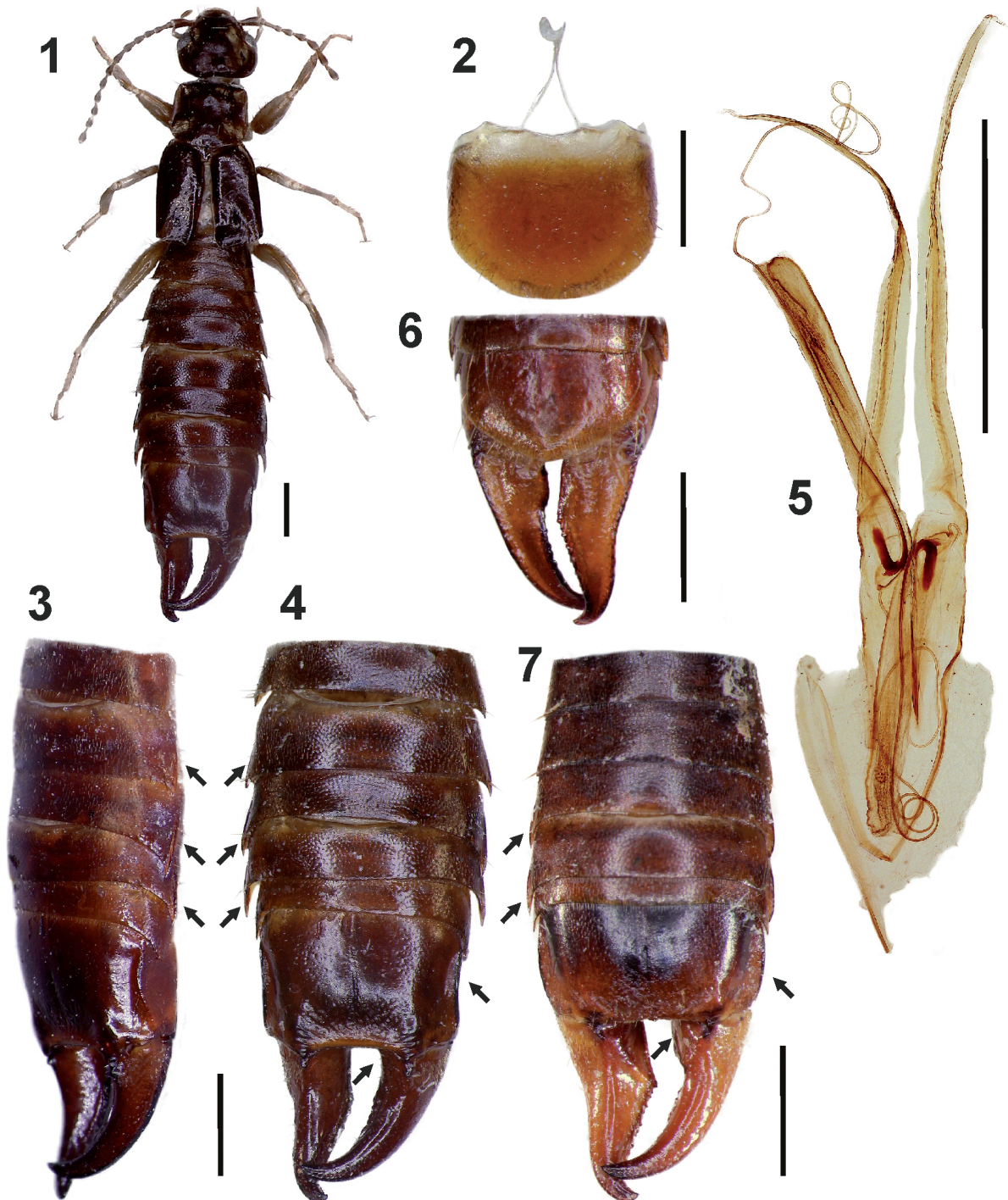
Head (Fig. 1) slightly broader than long; frons moderately convex, smooth, and impunctate; sutures

shallow, but visible. Eyes small, only slightly protruding, shorter than the postocular area, and as long as the basal antenna. Antennae (partly broken) 13-segmented, pyriform; basal segment stout, gently narrowed at base, shorter as the distance between antenna bases; 2nd short, broader than long; 3rd long and slender, shorter than 4th and 5th combined.

Pronotum (Fig. 1) transverse, anteriorly straight, gently diverging posteriorly, hind angles and margin broadly rounded, median sulcus faintly marked; prozona gently raised and metazona depressed. Prosternum longer than broad, slightly narrowed posteriorly; mesosternum approximately as long as broad, hind margin convex and metasternum transverse, projecting as a narrow lobe between hind coxae with hind margin truncate. Tegmina well developed, smooth and glabrous, wings absent. Legs typical for genus, hind tarsi with 1st segment longer than the combined length of 2nd and 3rd segments.

Abdomen (Figs. 1-4) spindle shaped, convex, punctulate, finely pubescent, sides with long sparse pubescence, sides of segment 6th to 8th acute angled with a sharp carina, from above looking incurved (Fig. 2). Penultimate (9th) sternite transverse (Fig. 4), broader than long, smooth, laterally parallel-sided, hind margin broadly rounded, without emargination; manubrium approximately as long as the sternite and gently dilated apically. Ultimate tergite (10th) transverse (Figs. 2-3), broader than long, obscurely punctulate, sloping backwards, sides with a sharp carina, median sulcus faintly marked; the area in middle posteriorly depressed, with fine striations; hind margin trisinate, laterally oblique, above the bases of forceps projecting into minute triangular lobe. Pygidium not visible from above, vertical, narrowed in middle, apically emarginate in middle. Forceps with branches subremote at base, trigonal above in basal one third, then depressed, tapering; left branch almost straight, incurved only in distal fifth; right branch gradually incurved from base and crossing over the left near apices, tip pointed and hooked, internal branches emarginate at base, then finely serrated.

Male genitalia (Fig. 5) with parameres approximately 15 times longer than broad, narrowed apically with tip pointed; penis lobes parallel-sided, obtuse at tip, 3/4 long as parameres and as long as penis base; virga at base incurved, long and thin.



Figs. 1-7. *Epilandex vignai* sp. nov., holotype ♂ 1: habitus from dorsal view; 2: penultimate sternite, ventral view; 3: lateral view on abdomen; 4: dorsal view on abdomen; 5: genital armature. Figs. 6-7. *Epilandex solomonensis* Brindle, 1970, paratype ♂; 6: dorsal view on abdomen; 7: ventral view on penultimate sternite and forceps. Arrows indicate differential characteristics between *E. vignai* sp. nov. and *E. solomonensis* (see differential diagnosis in the main text). Scale bars = 1.0 mm.

DIFFERENTIAL DIAGNOSIS. *Epilandex vignai* sp. nov. differs from other species of *Epilandex* based on its characteristic male genitalia with very long parameres (15 times longer than wide) and long genital lobes reaching 3/4 of the paramere length. *E. vignai* sp. nov. have developed three sharp lateral longitudinal carina on abdominal tergites 6th – 8th. The same arrangement of carina only on *E. acuminata* Srivastava, 2003a from Hong Kong, which is significantly smaller (7.1-8.7 vs. 11.7), has posteriorly subtruncate and usually slightly emarginated penultimate sternite, and all known specimens are fully winged. *E. burri* (Borelli, 1921) has also developed carina on three abdominal tergites, but these are on the 7th to 9th. The remaining species have fewer or more carinate tergites, while *E. wagneri* Srivastava, 1990; *E. handschini* Hincks, 1954; and *E. petterseni* Ramamurthi, 1967, have developed median carina on four distal abdominal tergites (6th to 9th), and two species, *E. serrata* Srivastava, 1976, and *E. solomonensis* Brindle, 1970, have developed median longitudinal carina on only two tergites (on 8th and 9th or 7th and 8th tergites, respectively). *Epilandex gressitti* Srivastava, 1976, has ecarinate abdominal tergites. Newly described species is similar to *E. solomonensis* in general appearance, including size and undeveloped wings in typical form (but winged specimens are also recorded). *E. solomonensis* and *E. vignai* sp. nov. are the only two species with small, not prominent eyes, which are noticeably shorter than the postocular area. Eyes of the remaining species have eyes longer, as long as, or only slightly shorter than the postocular area. In addition to the abovementioned characteristics, the differential characteristics for these two species are different shapes of the penultimate sternite (broadly rounded in *E. vignai* sp. nov. vs. widely triangular posteriorly in *E. solomonensis*), lateral sides of ultimate tergite concave vs. convex, and inner basal part of right cercus continuously rounded vs. widened to sharp ridge (differential characters are marked on Figs. 3, 4 and 7).

ETYMOLOGY. This species is named in honour of deceased Professor Augusto Vigna Taglianti from Rome, who had a significant impact on the knowledge of (not only) European earwigs.

BIONOMY. Unknown.

DISTRIBUTION. Indonesia, Sulawesi, Tana Toraja (Fig. 8).

List of *Epilandex* Hebart, 1927 species and their known distribution

Epilandex acuminata Srivastava, 2003

Distribution: Hong Kong (Srivastava 2003b)

Epilandex burri (Borelli, 1921)

syn. *Epilandex undulata* Ramamurthi, 1963 (synonymized by Srivastava, 1982)

syn. *Epilandex bazyuki* Steinmann, 1979 (synonymized by Srivastava, 2003b)

Distribution: India, Sri Lanka, Thailand, Indonesia: Sumatra, Kalimantan, Philippines: Luzon, Australia (Hebart, 1927, Boseman, 1954, Ramamurthi, 1963, Kapoor, 1968, Brindle, 1970, Srivastava, 1976a,b, 1987, Steinmann, 1979), Malaysia (this study).

Epilandex gressitti Srivastava, 1976

Distribution: Philippines: Mindanao (Srivastava, 1976b)

Epilandex handschini Hincks, 1954

Distribution: Indonesia: West Sumba (Hincks, 1954, Srivastava, 1976a); Papua New Guinea (this study).

Epilandex petterseni Ramamurthi, 1967

Distribution: Philippines: Tawi Tawi, Palawan, Mindanao; Bismarck Islands: New Britain, New Ireland (Ramamurthi, 1967, Srivastava, 1976a, 1978), Brunei (this study).

Epilandex serrata Srivastava, 1976

Distribution: Philippines: Luzon (Srivastava, 1976a)

Epilandex solomonensis Brindle, 1970

Distribution: Solomon Islands (Brindle, 1970)

Epilandex vignai Kočárek, sp. nov.

Distribution: Indonesia: Sulawesi

Epilandex wagneri Srivastava, 1990

Distribution: Indonesia: Moluccas (Srivastava, 1990)

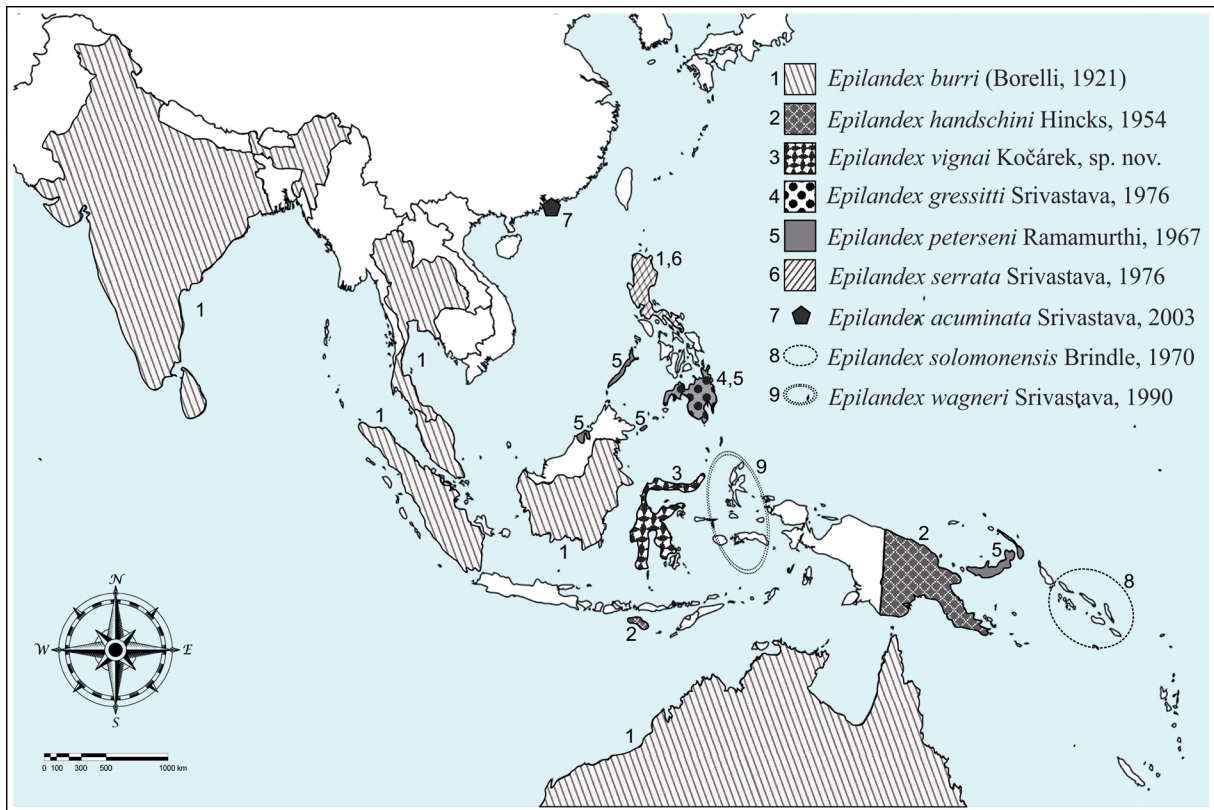


Fig. 8. Map showing known distribution of individual *Epilandex* species based on published records and a new faunistic data presented in this study.

KEY TO *EPILANDEX* SPECIES (BASED ON MALES)

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| <p>1 (6) Penultimate sternite with a short median ridge on the distal part, visible at least as a feeble rudiment of it at the extreme apex.</p> <p>2 (3) Sides of abdominal tergites 7-9 with well visible median longitudinal carina; eyes slightly longer than postocular area.....
.....<i>E. burri</i> (Borelli)</p> <p>3 (2) Sides of abdominal tergites 6-9 with highly visible median longitudinal carina; eyes as long as or slightly shorter than postocular area.</p> <p>4 (5) Left cercus with inner margin entire, not concave; pronotum noticeably widened posteriorly<i>E. peterseni</i> Ramamurthi</p> | <p>5 (4) Left cercus strongly concave from the base to distal third, with a tooth at approximately the middle, finely serrated; pronotum parallel-sided or only slightly widened posteriorly
.....<i>E. handschini</i> Hincks</p> <p>6 (1) Penultimate sternite without any median ridge or rudiment.</p> <p>7 (8) Apterous, tegmina and wings not developed.
.....<i>E. wagneri</i> Srivastava</p> <p>8 (7) Tegmina always fully developed, wings developed or concealed (absent).</p> <p>9 (10) Sides of abdominal tergites without lateral carina; penultimate sternite with a deep emargination in the middle posteriorly
.....<i>E. gressitti</i> Srivastava</p> |
|--|--|

- 10 (9) Sides of certain abdominal tergites carinate; penultimate sternite entire posteriorly.
- 11 (14) Sides of three distal abdominal tergites (6th to 8th) with a sharp median carina.
- 12 (13) Penultimate sternite posteriorly subtruncate in the middle or faintly emarginated in the middle; smaller species <9 mm (incl. forceps)*E. acuminata* Srivastava
- 13 (12) Penultimate sternite wide, broadly rounded posteriorly; larger species >10 mm (incl. forceps).....*E. vignai* sp. nov.
- 14 (13) Sides of only two abdominal tergites with highly visible median longitudinal carina.
- 15 (16) Sides of 8th and 9th abdominal tergites with a median longitudinal carina; penultimate sternite pointed in the middle posteriorly.....*E. serrata* Srivastava
- 16 (15) Sides of 7th and 8th abdominal tergites with highly visible longitudinal carina; penultimate sternite rounded, widely triangular posteriorly*E. solomonensis* Brindle

DISCUSSION

Anisolabididae is subdivided into 13 subfamilies (sensu Srivastava, 1999) and contains approximately 393 species in 31 genera (Srivastava, 1999; Haas, 2018). The subfamily Anisolabidinae, to which *Epilandex* belongs, contains 278 species in 13 genera (Anisyutkin, 1998a,b, 2004, Srivastava, 1990, 1993, 1999, 2003a,b, Nishikawa, 2008, Kočárek, 2011a,b; Matzke & Kočárek, 2015). *Epilandex* is a less numerous genus with only 9 recognised species. With the exclusion of widely distributed *E. burri* (Borelli, 1921) and *E. peterseni* Ramamurthi, 1967 (Steinmann, 1989, Srivastava, 2003a), the remaining species are restricted to one island (or archipelago), and the majority of them seem to be endemic.

Individual species of *Epilandex* are very similar to each other in terms of external morphology, and many characteristics (including those commonly

used for differential diagnoses) are more or less variable. Characteristics used for species delimitations include tegmina and wing development, carination on the lateral sides of abdominal tergites, shape of penultimate sternite and ultimate tergite, shape of male forceps, and structure of male genitals (Steinmann, 1989, Srivastava, 2003a,b). Only one species is apterous (*E. wagneri*), and the remaining species have developed at least the tegmina. However, some species, such as *E. burri* and *E. solomonensis*, show macropterous and brachypterous (or wingless) forms (Ramamurthi, 1963, Steinmann, 1989, Srivastava, 2003b); therefore, the development of wings cannot be generally used as an identification characteristic. A relatively useful characteristic seems to be lateral carination of several abdominal segments, which is stable among species but only in normally developed males. Less developed males (minor form), which resemble females in superficial view (the forceps are less developed, nearly symmetrical), sometimes occur together with fully developed males in the same population (Brindle, 1970), and these males usually have reduced lateral carina (Srivastava, 2003b). Therefore, this characteristic could be applicable only for normally developed males (with strongly asymmetric forceps). Usable indicators occur on terminal abdominal segments (penultimate sternite, ultimate tergite) and forceps, although there is slight variability as well, especially in the less developed minor forms.

Rigorous phylogenetic analysis of the genus supported by molecular evidence is necessary in the future, including clarification of the phylogenetic position and relationships of the genus with other Anisolabidinae genera.

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