

ORIGINAL ARTICLE

New taxa of Necrosciinae from Vietnam (Phasmatodea: Diapheromeridae)

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Abstract In this study, one new genus, six new species and two new subspecies from the Necrosciinae of Vietnam are described and illustrated, namely *Asceles hirsutus* **sp. nov.**, *A. maculatus* **sp. nov.**, *Lamachodes brocki* **sp. nov.**, *Marmessoidea alata alata* **sp. nov. & subsp. nov.**, *M. alata elongata* **subsp. nov.**, *M. liuxingyuei* **sp. nov.** and *Neooxyartes zomproi* **gen nov. & sp. nov.**

Key words Stick insects, new genus, new species, new subspecies, Vietnam.

1 Introduction

The phasmid fauna of Vietnam is poorly known. Most taxa were described by Karl Brunner von Wattenwyl and Josef Redtenbacher in their monograph (Brunner von Wattenwyl, 1907; Redtenbacher, 1906, 1908). After these studies, there is no major revisionary work regarding Vietnamese phasmids. Necrosciinae is one of the speciose subfamilies in the Phasmatodea and 20 genera and 39 species are recognised in the Necrosciinae of Vietnam (Brock *et al.*, 2017). In this study, the author examined various Vietnamese phasmid collections and identified nine new taxa, including one new genus, six new species and two new subspecies from the Necrosciinae of Vietnam, described as *Asceles hirsutus* **sp. nov.**, *A. maculatus* **sp. nov.**, *Lamachodes brocki* **sp. nov.**, *Marmessoidea alata alata* **sp. nov. & subsp. nov.**, *M. alata elongata* **subsp. nov.**, *M. liuxingyuei* **sp. nov.** and *Neooxyartes zomproi* **gen nov. & sp. nov.** Keys to the species of studied genera are provided, including *Asceles* Redtenbacher, 1908, *Lamachodes* Redtenbacher, 1908 and *Marmessoidea* Brunner von Wattenwyl, 1893.

2 Materials and methods

The examined materials were dried and pinned. The systematic treatment is according to Otte & Brock (2005), Komoto *et al.* (2011), Bradler *et al.* (2014) and Brock *et al.* (2017). The sequence of genera, species and subspecies is in alphabetical order. Morphological terms follow Bragg (2001), Zompro (2004) and Bradler (2009). Ootaxonomic descriptions refer to Clark (1976, 1988, 1998), Clark-Sellick (1997) and Zompro (2004). All measurements are given in millimetres (mm). The types are deposited in China Agricultural University, Beijing, China (CAU), Hong Kong Entomological Society, Hong Kong, China (HKES), Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, Hanoi, Vietnam (IEBR), Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS) and Manchester Museum, The University of Manchester, U.K. (MMUE).

3 Taxonomy

3.1 *Asceles* Redtenbacher, 1908

Asceles Redtenbacher, 1908: 493. Type species: *Necroschia malaccae* Saussure, 1868: 69 (= *Asceles malaccae*), by subsequent designation of Brock, 1995: 87.

Diagnosis. Medium-sized Necrosciinae. Body granulated, cylindrical, slender and elongate. Head oval. Ocelli absent. Vertex and occiput gently or weakly convex. Antennae filiform and long. Pronotum rectangular. Mesonotum elongate, longer than combined length of metanotum and median segment. Abdomen cylindrical. Female subgenital plate scoop-shaped, distinctly emarginated posteriorly, apex not surpassing posterior margin of anal segment. Male poculum cup-shaped, tapering posteriorly. Cerci long and cylindrical. Legs unarmed, usually with setae. Profemora distinctly incurved basally. Tegmina short. Alae well-developed or rudiment-like. Egg capsule oval with acute posterior pole.

Distribution. China, India, Indonesia, Malaysia, Myanmar, New Caledonia, New Guinea, Philippines, Singapore, Sri Lanka, Thailand and Vietnam.

Remarks. In Vietnam, four species of *Asceles* including *A. brevipennis* Redtenbacher, 1908, *A. diadema* Redtenbacher, 1908, *A. hirsutus* **sp. nov.** and *A. maculatus* **sp. nov.** are currently recognised. A key to the species of the genus is provided.

Key to males of *Asceles* Redtenbacher, 1908.

- | | |
|--|--|
| 1. Ninth abdominal tergum with elongate posterolateral angles..... | <i>A. maculatus</i> sp. nov. |
| Ninth abdominal tergum lacking posterolateral angles | 2 |
| 2. Legs with long hairs | <i>A. hirsutus</i> sp. nov. |
| Legs lacking long hairs | 3 |
| 3. Alae brown with prominent pale white markings | <i>A. diadema</i> Redtenbacher, 1908 |
| Alae brown lacking pale white markings | <i>A. brevipennis</i> Redtenbacher, 1908 |

Key to females of *Asceles* Redtenbacher, 1908.

- | | |
|---|--------------------------------------|
| 1. Pronotum and mesonotum with spines..... | <i>A. maculatus</i> sp. nov. |
| Pronotum and mesonotum lacking spines | 2 |
| 2. Legs lacking long hairs | <i>A. diadema</i> Redtenbacher, 1908 |
| Legs with long hairs..... | <i>A. hirsutus</i> sp. nov. |

Asceles hirsutus **sp. nov.** (Figs 1–4, 24–25, 36–37)

Diagnosis. This new species is related to *A. tanarata* Brock, 1999, but can be separated by large size, medial spine on tegmina and hairy legs in both sexes. This new species is also similar to *A. diadema* Redtenbacher, 1908 and *A. margaritatus* Redtenbacher, 1908, but can be separated by greenish brown colouration, short alae, medial spine on tegmina and long hairs on legs in both sexes.

Description. Female. Body cylindrical, more robust and larger than male. General colour of body greenish brown. Legs greenish brown with darker markings. Head oval, roughly as long as pronotum. Vertex flat, densely covered with minute granules and interspersed with small acute granules. Occiput flat with distinct median and indistinct lateral longitudinal furrows, posterior margin with 6 indistinct small swellings. Compound eyes small and rounded, about 3 times as long as genae. Antennae long and filiform; scapus flattened basally, about 2 times as long as pedicellus, roughly as long as third segment. Pronotum, mesonotum, mesopleurae, metanotum and metapleurae densely covered with minute granules and interspersed with small acute granules, mesosternum and metasternum with inconspicuous granulations. Pronotum rectangular, longer than wide, with longitudinal and transverse sulci crossing before middle area, anterior margin curved inwards, posterior margin rounded. Mesonotum parallel-sided, with indistinct median longitudinal carina. Metanotum shorter than median segment. Abdomen cylindrical, tapering posteriorly, dorsal surface with sparse and inconspicuous minute granules and sparse small granules, ventral surface lacking granulations. Median segment trapezoidal, gently expanded posteriorly. Seventh sternum lacking praeopercular organ. Eighth tergum as long as ninth tergum. Anal segment longer than ninth tergum, with a small emargination on posterior margin. Supra-anal plate small, posterior margin rounded and surpassing posterolateral angles of anal segment. Subgenital plate scoop-shaped, flattened, posterior margin notched and not reaching posterior margin of anal segment. Cerci long, cylindrical, tapering posteriorly, apices obtuse. Legs unarmed, slender and long, very hairy. All femora roughly as long as corresponding tibiae. Profemora incurved basally. Tegmina small, scale-like, with a short spine medially. Alae short, almost reaching middle area of median segment.

Male. Body slender and elongate, distinctly much slender than female. General colour of body and legs greenish brown.

Head densely covered with minute granules and interspersed with small acute granules, oval, roughly as long as pronotum. Vertex and occiput flat, with distinct median longitudinal furrow, posterior margin with 4 small indistinct swellings. Compound eyes small and rounded, about 2.5 times as long as genae. Antennae long and filiform; scapus flattened basally, about 2 times as long as pedicellus, roughly as long as third segment. Thorax densely covered with small granules. Pronotum rectangular, longer than wide, anterior margin curved inwards, posterior margins rounded, longitudinal and transverse sulci crossing before middle area. Mesonotum parallel-sided, with faint median longitudinal line, lateral margins with a few short spine-like tubercles. Mesopleurae also with a few of short spine-like tubercles. Metanotum and median segment covered by wings. Abdomen lacking granulations. Eighth tergum as long as ninth tergum. Anal segment slightly shorter than ninth tergum, with a small emargination on posterior margin. Poculum cup-shaped, flattened, posterior margin rounded and not surpassing posterior margin of ninth tergum. Cerci cylindrical, long, apices obtuse. Legs unarmed, slender and long, very hairy. All femora roughly as long as corresponding tibiae. Profemora incurved basally. Tegmina oval and short, tapering anteriorly, posterior margin truncate, with a short spine medially. Alae short, apices reaching middle area of second abdominal tergum.

Measurements. Length. Body, ♀ 80.0–82.0 mm, ♂ 60.0–67.0 mm; antennae, ♀ 71.0–75.0 mm, ♂ 64.0–77.0 mm; head, ♀ 5.5–6.5 mm, ♂ 4.0–4.5 mm; pronotum, ♀ 5.5 mm, ♂ 3.5–4.0 mm; mesonotum, ♀ 16.0 mm, ♂ 13.0–14.5 mm; metanotum, ♀ 3.0–4.0 mm, ♂ 2.0–2.5 mm; median segment, ♀ 5.0–5.5 mm, ♂ 4.0–5.0 mm; profemora, ♀ 22.0–22.5 mm, ♂ 20.0–23.0 mm; mesofemora, ♀ 14.0–15.0 mm, ♂ 12.0–15.0 mm; metafemora, ♀ 23.0–24.0 mm, ♂ 19.0–23.0 mm; protibiae, ♀ 22.0–23.0 mm, ♂ 20.0–24.0 mm; mesotibiae, ♀ 14.0–14.5 mm, ♂ 12.0–14.0 mm; metatibiae, ♀ 24.0–25.0 mm, ♂ 21.0–25.0 mm; tegmina, ♀ 2.0–2.5 mm, ♂ 2.0–2.5 mm; alae, ♀ 2.5–3.0 mm, ♂ 8.0–9.0 mm.

Egg. Capsule brown, densely granulated, oval, tapering posteriorly, posterior pole acute. Micropylar plate oval. Micropylar cup placed at two-thirds of micropylar plate. Median line about one-half length of micropylar plate. Operculum dark brown, with minute serrations submarginally, also with an elongated and flattened capitulum.

Measurements. Capsule length 4.0 mm, width 2.4 mm, height 2.8 mm.

Material examined. Holotype ♀, Vietnam, Thua Thien Hue, Bachma Mountain, 18–19 September 2016, He Li (HKES). Paratypes. 2♀, 6♂, 11 eggs, same data as holotype (HKES & MMUE).

Distribution. Vietnam.

Etymology. The specific epithet of this new species is derived from the hairy legs in both sexes.

Asceles maculatus sp. nov. (Figs 5–8, 26–27)

Diagnosis. This new species is similar to *A. hirsutus* sp. nov., but can be easily separated by maculated wings and legs, lacking long hairs on legs and long alae in both sexes. The female of this new species is also similar to *A. brevicollis* Redtenbacher, 1908, but can be separated by large size, distinctly tuberculate swellings on posterior margin of head, two pairs of spines on anterior area of mesonotum and maculated wings and legs.

Description. Female. Body cylindrical, more robust and larger than male. General colour of body dark brown. Legs and wings brown with light brown markings. Head oval, flattened, longer than pronotum, with short acute granules and spine-like tubercles. Vertex flat. Occiput flat with distinct median and indistinct lateral longitudinal furrows, posterior margin elevated with 4 tuberculate swellings. Compound eyes small and oval, about 4 times as long as genae. Antennae long and filiform; scapus flattened basally, about 2 times as long as pedicellus, as long as third segment. Pronotum, mesonotum, mesopleurae, and metapleurae with small acute granules and interspersed with short spine-like tubercles, mesosternum and metasternum with inconspicuous granulations. Pronotum rectangular, longer than wide, with longitudinal and transverse sulci crossing before middle area, anterior margin weakly curved inwards, posterior margin rounded, with 2 pairs of spines placed before transverse sulcus. Mesonotum medially constricted posteriorly, with distinct median longitudinal line, with 2 pairs of spines placed at anterior area. Abdomen cylindrical, tapering posteriorly, dorsal surface wrinkled and with inconspicuous granulations, ventral surface lacking granulations. Seventh sternum lacking praeopercular organ. Eighth tergum longer than ninth tergum. Anal segment as long as eighth tergum, with a small emargination on posterior margin. Supra-anal plate small, posterior margin rounded and surpassing posterolateral angles of anal segment. Subgenital plate scoop-shaped, posterior margin with a small U-shaped emargination and reaching middle area of anal segment. Cerci long, cylindrical, apices obtuse. Legs unarmed, slender and long. Profemora and metafemora as long as corresponding tibiae, mesofemora longer than mesotibiae. Profemora incurved basally, anterodorsal and posteroventral carinae raised basally. Tegmina oval, tapering anteriorly, longer than head. Alae long, posterior apices reaching anterior area of sixth abdominal tergum.

Male. Body slender and elongate, distinctly much slender than female. General colour of body brown. Legs and wings brown with dark brown and black markings. Head with sparse and small granules, oval, flattened, slightly longer than

pronotum. Vertex and occiput flat, with distinct median longitudinal furrow, posterior margin elevated with 4 distinct swellings. Compound eyes small and oval, about 2 times as long as genae. Antennae long and filiform; scapus flattened basally, longer than pedicellus, shorter than third segment. Thorax with a few small granules. Pronotum rectangular, longer than wide, anterior margin curved inwards, posterior margins rounded, longitudinal and transverse sulci crossing before middle area. Mesonotum broadly emarginated medially, with distinct median longitudinal line, with a black V-shaped marking on anterior area and post-medial area respectively. Abdomen lacking granulations. Eighth tergum roughly as long as ninth tergum. Ninth tergum with posterolateral angles, apices pointed. Anal segment slightly shorter than ninth tergum, with a small emargination on posterior margin. Poculum cup-shaped, flattened, posterior margin rounded and not surpassing posterior margin of ninth tergum. Cerci cylindrical, long, apices obtuse. Legs unarmed, slender and long. All femora roughly as long as corresponding tibiae. Profemora incurved basally. Tegmina oval, tapering anteriorly, with a spine near middle area. Alae long, apices reaching posterior margin of sixth abdominal tergum.

Measurements. Length. Body, ♀ 85.0 mm, ♂ 60.0 mm; antennae, ♀ 84.0 mm, ♂ 58.0 mm; head, ♀ 7.0 mm, ♂ 3.5 mm; pronotum, ♀ 5.0 mm, ♂ 3.0 mm; mesonotum, ♀ 18.0 mm, ♂ 11.0 mm; metanotum (including median segment), ♀ 12.0 mm, ♂ 8.0 mm; profemora, ♀ 24.0 mm, ♂ 20.0 mm; mesofemora, ♀ 16.0 mm, ♂ 13.0 mm; metafemora, ♀ 16.0 mm, ♂ 19.0 mm; protibiae, ♀ 24.0 mm, ♂ 18.0 mm; mesotibiae, ♀ 14.0 mm, ♂ 11.0 mm; metatibiae, ♀ 24.0 mm, ♂ 20.0 mm; tegmina, ♀ 8.0 mm, ♂ 4.5 mm; alae, ♀ 36.0 mm, ♂ 33.0 mm.

Material examined. Holotype ♀, Vietnam, Gia Lai, c. 40 km N of K' Bang Town, Kon Chu Rang Nature Reserve (14°30'19"N, 108°32'28"E; elev. 1020 m), 24 May–2 June 2016, Abramov A.V., F3476.26 (MMUE). Paratype. 1♂, same data as holotype, F3476.27 (MMUE).

Distribution. Vietnam.

Etymology. The specific epithet of this new species is derived from the maculated wings and legs in both sexes.

3.2 *Lamachodes Redtenbacher, 1908*

Lamachodes Redtenbacher, 1908: 482. Type species: *Lamachodes laevis* Redtenbacher, 1908: 482, by original designation.

Diagnosis. Medium-sized Necrosciinae. Body unarmed, sparsely and inconspicuously granulated; cylindrical, slender and elongate. Head oval. Vertex flat. Occiput gently convex. Antennae filiform and long. Pronotum rectangular. Mesonotum slender and elongate. Metanotum as long as median segment. Abdomen cylindrical. Anal segment emarginated posteriorly in both sexes. Female subgenital plate elongate, scoop-shaped, distinctly notched posteriorly, apex surpassing or not surpassing posterior margin of anal segment. Male poculum cup-shaped, tapering posteriorly, apex pointed. Cerci cylindrical. Legs unarmed. Profemora distinctly incurved basally. Tegmina and alae minute and scale-like. Egg oblong with rounded posterior pole, ventral surface not flattened.

Distribution. Vietnam.

Remarks. *Lamachodes* Redtenbacher, 1908 is similar to *Asceles* Redtenbacher, 1908 and *Marmessoidea* Brunner von Wattenwyl, 1893, but can be separated by scale-like tegmina and alae in both sexes, elongate abdominal subgenital plate in female, broadly emarginated posterior margin of anal abdominal segment and posteriorly elongate poculum in male and oblong egg capsule lacking flattened ventral surface. The discovery of *L. brocki* sp. nov. not only contributes to the knowledge of male and egg structures, but also the geographical distribution pattern for the genus. Based on the current distributions of the genus, which is restricted to southern and central parts of Vietnam, potential distributions can be discovered in northern Vietnam and its neighbouring countries such as Laos, Cambodia and southwestern parts of China. Currently two species are recognised and all of them only occur in Vietnam. The male of *L. laevis* Redtenbacher, 1908 is unknown. A key to the species of genus is only provided for the females.

Key to females of *Lamachodes* Redtenbacher, 1908.

1. Posterior apex of abdominal subgenital plate not reaching posterior margin of anal abdominal segment
..... *L. laevis* Redtenbacher, 1908
Posterior apex of abdominal subgenital plate distinctly surpassing posterior margin of anal abdominal segment..... *L. brocki* sp. nov.

Lamachodes brocki sp. nov. (Figs 9–12, 28–29, 38–39)

Diagnosis. This new species is similar to *L. laevis* Redtenbacher, 1908, but can be easily diagnosed by more robust body and strongly elongate abdominal subgenital plate in female.

Description. Female. Body cylindrical, more robust and larger than male. General colour of body brown. Legs brown with dark brown bands. Head oval, longer than pronotum. Vertex flat, with a few of minute and inconspicuous granules.

Occiput gently convex, with distinct median and lateral longitudinal furrows, posterior margin with 6 small swellings. Compound eyes rounded, about 2 times as long as genae. Antennae long and filiform, projecting over apices of forelegs; scapus more or less flattened, about 2 times as long as pedicellus, roughly as long as third segment. Pronotum with small and inconspicuous granules, rectangular, longer than wide, with longitudinal and transverse sulci crossing before middle area, anterior margin curved inwards, posterior margin rounded. Mesonotum with small and inconspicuous granules, moderately constricted post-medially, anterior margin longer than posterior margin, with indistinct median longitudinal line. Metanotum with small and inconspicuous granules, square, roughly as long as median segment. Abdomen with inconspicuous granulations, cylindrical, tapering posteriorly. Median segment trapezoidal, expanded posteriorly. Seventh sternum lacking praeopercular organ. Eighth tergum as long as combined length of ninth tergum and anal segment. Anal segment longer than ninth tergum, with a broad U-shaped emargination on posterior margin, posterolateral angles pointed. Supra-anal plate small, posterior margin rounded, projecting over posterolateral angles of anal segment. Subgenital plate scoop-shaped, long and elongate, with median longitudinal carina, posterior margin distinctly notched, apex projecting over posterior margin of supra-anal plate. Cerci short, cylindrical, tapering posteriorly, apices reaching posterior margin of supra-anal plate. Legs unarmed, slender and long. All femora roughly as long as corresponding tibiae. Profemora incurved basally. Tegmina and alae minute and scale-like.

Male. Body slender and elongate, much slender than female. General colour of body brown. Forelegs rufous brown, midlegs and hindlegs green. Head lacking granulation, oval, longer than pronotum. Vertex flat, with an obscure and oval depression between compound eyes. Occiput weakly convex, with distinct median longitudinal furrow, posterior margin with 6 small swellings. Compound eyes rounded, about 2 times as long as genae. Antennae long and filiform, longer than body length, covered with dense short bristles; scapus flattened, about 2 times as long as pedicellus; third segment longer than pedicellus. Thorax inconspicuously and sparsely covered with small granules. Pronotum rectangular, longer than wide, anterior margin curved inwards, posterior margins rounded, longitudinal and transverse sulci crossing before middle area. Mesonotum gently constricted post-medially, with faint median longitudinal line. Metanotum as long as median segment. Abdomen sparsely and inconspicuously covered with small granules. Median segment trapezoidal, expanded posteriorly. Eighth tergum as long as ninth tergum. Anal segment shorter than ninth tergum, with a U-shaped emargination on posterior margin, posterolateral angles pointed. Poculum tapering posteriorly, posterior margin pointed. Cerci cylindrical, apices obtuse and curved inwards. Legs unarmed, slender and long. All femora roughly as long as corresponding tibiae. Profemora incurved basally. Tegmina and alae minute and scale-like.

Measurements. Length. Body, ♀ 70.0–77.0 mm, ♂ 62.0–68.0 mm; antennae, ♀ 57.0–72.0 mm, ♂ 75.0–88.0 mm; head, ♀ 5.0–5.5 mm, ♂ 4.0–4.5 mm; pronotum, ♀ 4.5–5.0 mm, ♂ 3.5–4.0 mm; mesonotum, ♀ 14.0–15.0 mm, ♂ 13.0–15.0 mm; metanotum, ♀ 4.0–4.5 mm, ♂ 3.5 mm; median segment, ♀ 4.0–4.5 mm, ♂ 3.5 mm; profemora, ♀ 17.0–20.0 mm, ♂ 18.5–22.0 mm; mesofemora, ♀ 11.5–14.0 mm, ♂ 12.0–13.0 mm; metafemora, ♀ 16.0–19.0 mm, ♂ 17.5–19.0 mm; protibiae, ♀ 15.5–19.0 mm, ♂ 17.0–25.0 mm; mesotibiae, ♀ 11.0–13.0 mm, ♂ 11.5–13.0 mm; metatibiae, ♀ 16.0–20.0 mm, ♂ 18.0–20.5 mm.

Egg. Capsule olive-green, oblong, densely granulated, posterior pole rounded. Micropylar plate pale yellow, oval, elongated anteriorly, anterior apex pointed, posterior apex pointed. Micropylar cup placed at two-thirds of micropylar plate. Median line short, about one-third length of micropylar plate. Operculum olive-green, densely granulated, lacking capitulum.

Measurements. Capsule length 4.0 mm, width 2.0 mm, height 2.0 mm.

Material examined. Holotype ♀, Vietnam, Thua Thien Hue, Bachma Mountain, 18–19 September 2016, He Li (HKES). Paratypes. 4♀, 3♂, 36 eggs, same data as holotype (HKES & IEBR); 1♀, Vietnam, Gia Lai, c. 40 km N of K' Bang Town, Kon Chu Rang Nature Reserve (14°30'19"N, 108°32'28"E; elev. 1020 m), 24 May–2 June 2016, Abramov A.V., F3476.40 (MMUE).

Distribution. Vietnam.

Etymology. This new species is named in honour of Mr. Paul Brock (United Kingdom) for his contributions to the taxonomy of Phasmatodea.

3.3 *Marmessoidea* Brunner von Wattenwyl, 1893

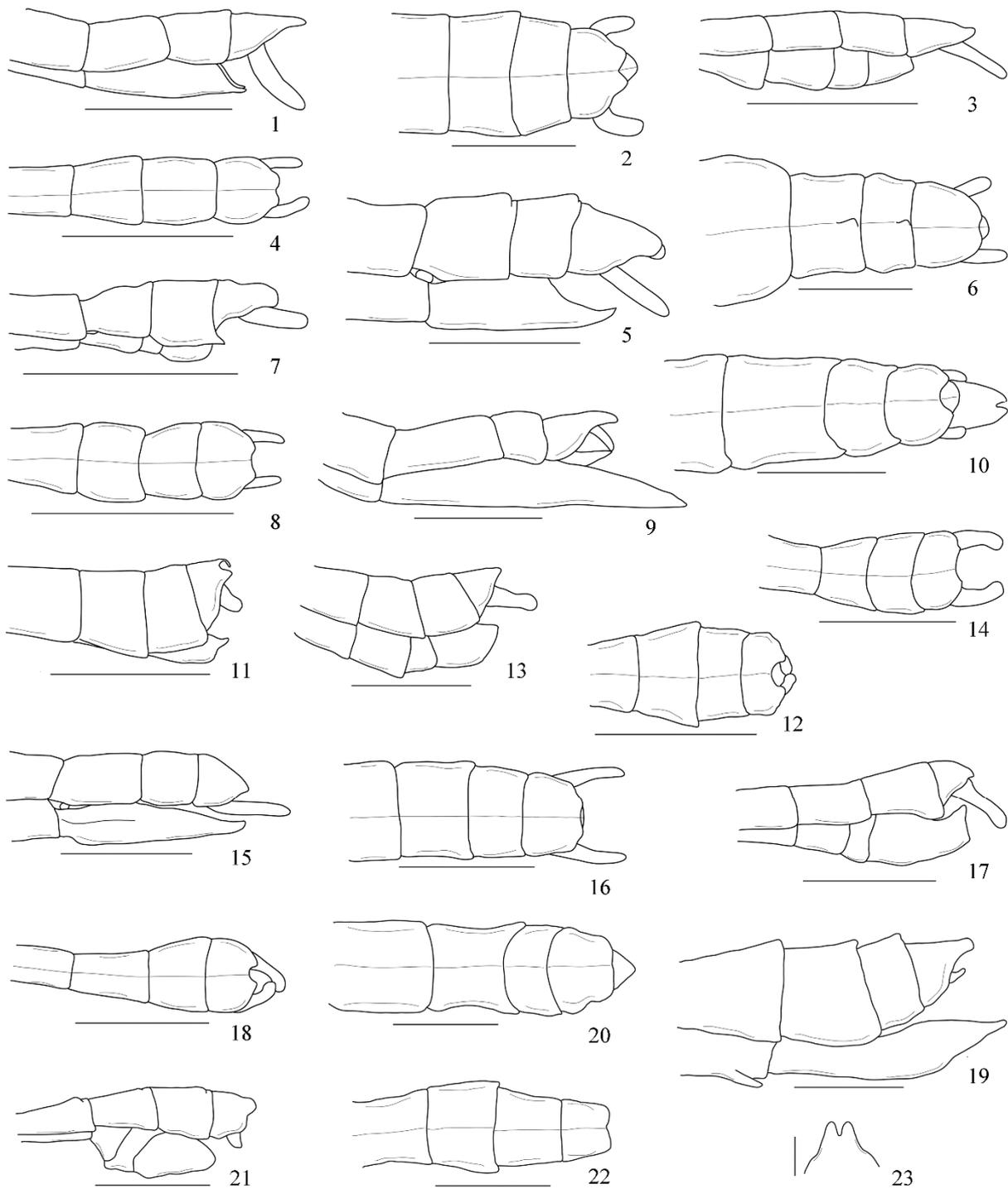
Marmessoidea Brunner von Wattenwyl, 1893: 85 (= *Trigonophasma* Kirby, 1904). Type species: *Necroscia marmessus* Westwood, 1859: 49 (= *Marmessoidea rpsea*), by original designation.

Diagnosis. Medium-sized Necrosciinae. Body unarmed, thorax with granulation, female distinctly larger and more robust than male. Head oval. Vertex and occiput convex. Antennae filiform and very long. Pronotum rectangular. Mesonotum slender and elongate, longer than combined length of metanotum and median segment. Abdomen cylindrical. Anal segment emarginated posteriorly in both sexes. Female subgenital plate short, scoop-shaped, distinctly notched posteriorly. Male

poculum cup-shaped. Cerci long and cylindrical. Legs unarmed, slender and elongate. Profemora distinctly incurved basally. Tegmina and alae fully developed. Egg oval with rounded posterior pole, ventral surface flattened.

Distribution. China, India, Indonesia, Malaysia, Philippines, Singapore and Vietnam.

Remarks. Currently seven species and two subspecies are recognised in Vietnam. A key to the species of genus is provided.



Figures 1–23. Necrosciinae spp. 1–4. *Asceles hirsutus* sp. nov. 5–8. *A. maculatus* sp. nov. 9–12. *Lamachodes brocki* sp. nov. 13–16. *Marmessoidea alata alata* sp. nov. & subsp. nov. 17–18. *M. liuxingyuei* sp. nov. 19–23. *Neoxyartes zomproi* gen. nov. & sp. nov. 1, 5, 9, 15, 19. Female end of abdomen, lateral view. 2, 6, 10, 16, 20. Female end of abdomen, dorsal view. 3, 7, 11, 13, 17, 21. Male end of abdomen, lateral view. 4, 8, 12, 14, 18, 22. Male end of abdomen, dorsal view. 23. Vomer, ventral view. Scale bars: 1–22=5 mm; 23=1 mm.

Key to males of *Marmessoidea* Brunner von Wattenwyl, 1893.

1. Tegmina with a medial spine.....*M. bispina* (Redtenbacher, 1908)
Tegmina lacking medial spine.....2
2. Legs banded.....*M. liuxingyuei* sp. nov.
Legs with or without black apices, other area uniformly coloured.....3
3. Legs green.....4
Legs rufous.....6
4. Mesosternum reddish.....*M. haemorrhoidalis* Redtenbacher, 1908
Mesosternum green.....5
5. Mesonotum not more than 3 times longer than pronotum.....*M. alata alata* sp. nov. & subsp. nov.
Mesonotum more than 3 times longer than pronotum.....*M. alata elongata* subsp. nov.
6. Tegmina with a yellowish marking on posterior area.....*M. biplagiata* Redtenbacher, 1908
Tegmina lacking yellowish marking on posterior area.....7
7. Tibiae with black apices.....*M. usta* Redtenbacher, 1908
Tibiae without black apices.....*M. incensa* Redtenbacher, 1908

Key to females of *Marmessoidea* Brunner von Wattenwyl, 1893.

1. Tegmina with a medial spine.....*M. bispina* (Redtenbacher, 1908)
Tegmina lacking medial spine.....*M. alata alata* sp. nov. & subsp. nov.

***Marmessoidea alata alata* sp. nov. & subsp. nov.** (Figs 13–16, 30–31)

Diagnosis. This new species is related to *M. haemorrhoidalis* Redtenbacher, 1908, but can be diagnosed by green mesosternum and longer alae. The male is also related to *M. liuxingyuei* sp. nov., but can be separated by greenish body and uniformly coloured legs.

Description. Male. Body slender, distinctly smaller than female. General colour of body and legs dull green. Head oval, almost as long as pronotum. Vertex flat, with a few small granules. Occiput convex, with distinct median longitudinal furrow, posterior margin with indistinct swellings. Compound eyes rounded, about 2 times as long as genae. Antennae very long and filiform, longer than body length, covered with dense short bristles; scapus flattened, about 2 times as long as pedicellus; third segment longer than pedicellus, as long as scapus. Pronotum with sparse granulations, rectangular, longer than wide, anterior margin curved inwards, posterior margins rounded, longitudinal and transverse sulci crossing before middle area. Mesonotum with sparse granulations, almost parallel-sided, slightly constricted post-medially, almost as long as combined length of metanotum and median segment, with faint median longitudinal line. Mesopleurae, metapleurae, mesosternum and metasternum lacking granulations. Abdomen lacking granulations. Eighth tergum longer than ninth tergum. Anal segment as long as eighth tergum, with a small emargination on posterior margin. Poculum tapering posteriorly, posterior margin pointed. Cerci cylindrical, apices obtuse and gently curved inwards. Legs unarmed, slender and long, with short bristles. All femora roughly as long as corresponding tibiae. Profemora incurved basally. Tegmina oval, posterior margin subtruncate, with a black and blunt elevated angle near pre-medial area, also with a yellowish green marking near lateromedial area. Alae green, long and well-developed, posterior apices reaching sixth abdominal tergum.

Female. Body cylindrical, distinctly more robust and larger than male. Body and legs brown with light brown markings. Head oval, as long as pronotum. Vertex flat, with a few of minute granules. Occiput convex, with distinct median and lateral longitudinal furrows, posterior margin with indistinct swellings. Compound eyes rounded. Antennae long and filiform; scapus more or less flattened, longer than pedicellus, roughly as long as third segment. Pronotum with small granules, rectangular, longer than wide, with longitudinal and transverse sulci crossing before middle area, anterior margin curved inwards, posterior margin rounded. Mesonotum with small granules, moderately constricted post-medially, with distinct median longitudinal line. Mesopleurae, metapleurae, mesosternum and metasternum with small and inconspicuous granules. Abdomen with inconspicuous granulations, cylindrical, tapering posteriorly. Seventh sternum lacking praeopercular organ. Ninth tergum shorter than eighth tergum. Anal segment as long as eighth tergum, posterior margin with a small emargination. Supra-anal plate small, median longitudinal carina distinct, posterior margin rounded. Subgenital plate scoop-shaped, posterior margin with a deep U-shaped emargination. Cerci long, straight and cylindrical, apices pointed and surpassing posterior margin of anal segment. Legs unarmed, slender and long. Profemora incurved basally. Tegmina oval, longer than head. Alae short, posterior apices reaching anterior area of fifth abdominal tergum, anal region brown.

Measurements. Length. Body, ♀ 66.0–73.0 mm, ♂ 53.0–65.0 mm; antennae, ♀ 60.0–68.0 mm, ♂ 72.0–87.0 mm; head, ♀ 5.0 mm, ♂ 3.0–4.0 mm; pronotum, ♀ 5.0 mm, ♂ 3.0–4.0 mm; mesonotum, ♀ 14.0–15.0 mm, ♂ 10.5–11.5 mm; metanotum (including median segment), ♀ 8.5–9.0 mm, ♂ 7.5–10.0 mm; profemora, ♀ 17.0–19.0 mm, ♂ 18.0–20.0 mm; mesofemora,

♀ 11.0–13.0mm, ♂ 11.0–14.0mm; metafemora, ♀ 17.0mm, ♂ 17.0–21.0mm; protibiae, ♀ 16.0–19.0mm, ♂ 16.0–20.0mm; mesotibiae, ♀ 10.0–13.0mm, ♂ 11.0–15.0mm; metatibiae, ♀ 16.0–18.0mm, ♂ 16.0–22.0mm; tegmina, ♀ 6.0–7.5mm, ♂ 4.0–6.0mm; alae, ♀ 24.0–28.0mm, ♂ 26.0–36.0mm.

Material examined. Holotype ♂, Vietnam, Thua Thien Hue, Phu Loc, Bach Ma (elev. 150 m), 27 September 2011, Liu Xingyue (CAU). Paratypes. 1♂, 1♀(subadult), Vietnam, Thua Thien Hue, Phu Loc, Bach Ma (elev. 150 m), 27 September 2011, Liu Xingyue (CAU & HKES); 1♂, Vietnam, Thua Thien Hue, Bach Ma, 4 May 2012, Liu Xingyue (CAU); 1♂, 2♀, Vietnam, Gia Lai, c. 40km N of K' Bang Town, Kon Chu Rang Nature Reserve (14°30'19"N, 108°32'28"E; elev. 1020 m), 24 May–2 June 2016, Abramov A.V., F3476.23, F3476.28, F3476.39 (MMUE & HKES).

Distribution. Vietnam.

Etymology. The specific epithet of this new species is derived from the well-developed wings.



Figures 24–29. Necrosciinae spp., habitus. 24–25. *Asceles hirsutus* sp. nov. 26–27. *A. maculatus* sp. nov. 28–29. *Lamachodes brocki* sp. nov. 24, 26, 28. Female. 25, 27, 29. Male. Scale bars=5 mm.

***Marmessoidea alata elongata* subsp. nov.** (Fig 32)

Diagnosis. This new subspecies is similar to the nominate *M. alata alata* sp. nov. & subsp. nov., but can be separated by grassy green colouration, much slender and elongate body, weakly convex occiput of head, more elongate mesonotum and shorter wings.

Description. Male. Body slender. General colour of body and legs grassy green. Head lacking granulation, oval, as long as pronotum. Vertex and occiput weakly convex, with distinct median longitudinal furrow, posterior margin with indistinct swellings. Compound eyes big and rounded, about 2 times as long as genae. Antennae very long and filiform, longer than body length, covered with dense short bristles; scapus flattened basally, about 2 times as long as pedicellus, shorter than third segment. Thorax inconspicuously and sparsely covered with small granules. Pronotum rectangular, longer than wide,

anterior margin curved inwards, posterior margins rounded, longitudinal and transverse sulci crossing before middle area. Mesonotum longer than combined length of pronotum, metanotum and median segment, broadly emarginated post-medially, with median longitudinal line. Abdomen smooth. Eighth tergum as long as ninth tergum. Anal segment shorter than ninth tergum, with a small emargination on posterior margin. Poculum tapering posteriorly, posterior margin pointed and reaching posterior margin of anal segment. Cerci cylindrical, apices obtuse and gently curved inwards. Legs unarmed, slender and long, with short bristles. All femora roughly as long as corresponding tibiae. Profemora incurved basally. Tegmina oval, with a yellow spot near lateromedial area. Alae well-developed, posterior apices reaching fifth abdominal tergum.

Female. Unknown.

Measurements. Length. Body, ♂ 70.0 mm; antennae, ♂ 92.0 mm; head, ♂ 4.0 mm; pronotum, ♂ 4.0 mm; mesonotum, ♂ 14.0 mm; metanotum (including median segment), ♂ 9.5 mm; profemora, ♂ 23.5 mm; mesofemora, ♂ 15.5 mm; metafemora, ♂ 21.5 mm; protibiae, ♂ 22.0 mm; mesotibiae, ♂ 15.0 mm; metatibiae, ♂ 23.5 mm; tegmina, ♂ 5.0 mm; alae, ♂ 32.0 mm.

Material examined. Holotype ♂, Vietnam, Thua Thien Hue, Bachma Mountain, 19 September 2016, He Li (HKES).

Distribution. Vietnam.

Remarks. Further material collected from the type locality is necessary to confirm its relationship with the nominate *M. alata alata* **sp. nov. & subsp. nov.**

Etymology. The specific epithet of this new subspecies is derived from the elongate mesonotum while compared to the nominate race.



Figures 30–35. Necrosiinae spp., habitus. 30–31. *Marmessoidea alata alata* **sp. nov. & subsp. nov.** 32. *M. alata elongata* **subsp. nov.** 33. *M. liuxingyuei* **sp. nov.** 34–35. *Neooxyartes zomproi* **gen. nov. & sp. nov.** 30, 32–33, 35. Male. 31, 34. Female. Scale bars = 5 mm.

***Marmessoidea liuxingyuei* sp. nov.** (Figs 17–18, 33)

Diagnosis. This new species is similar to *M. alata* sp. nov., but can be easily diagnosed by much slender body, greenish brown wings and banded legs.

Description. Male. Body slender. General colour of body greenish brown. Legs generally green with black bands. Head lacking granulation, oval, longer than pronotum. Vertex and occiput flat, with distinct median longitudinal furrow, posterior margin with 6 small swellings. Compound eyes rounded, about 2 times as long as genae. Antennae very long and filiform, longer than body length, covered with dense short bristles; scapus more or less flattened, longer than pedicellus; third segment as long as combined length of scapus and pedicellus. Thorax lacking granulation. Pronotum rectangular, longer than wide, anterior margin weakly curved inwards, posterior margins rounded, longitudinal and transverse sulci crossing before middle area. Mesonotum slender and elongate, parallel-sided, with distinct median longitudinal line. Abdomen smooth. Eighth tergum as long as ninth tergum. Anal segment shorter than ninth tergum, with a small emargination on posterior margin. Poculum tapering posteriorly, posterior margin pointed and almost reaching posterior margin of anal segment. Cerci cylindrical, apices obtuse and gently curved inwards. Legs unarmed, very slender and long, with short bristles. All femora as long as corresponding tibiae. Profemora incurved basally. Tegmina greenish brown, oval, posterior margin subtruncate. Alae greenish brown, long and well-developed, posterior apices reaching sixth abdominal tergum.

Female. Unknown.

Measurements. Length. Body, ♂ 60.0 mm; antennae, ♂ 80.0 mm; head, ♂ 3.0 mm; pronotum, ♂ 2.5 mm; mesonotum, ♂ 12.0 mm; metanotum (including median segment), ♂ 8.0 mm; profemora, ♂ 20.0 mm; mesofemora, ♂ 13.0 mm; metafemora, ♂ 19.0 mm; protibiae, ♂ 20.0 mm; mesotibiae, ♂ 13.0 mm; metatibiae, ♂ 19.0 mm; tegmina, ♂ 5.0 mm; alae, ♂ 30.0 mm.

Material examined. Holotype ♂, Vietnam, Dong Nai, Tan Phu, Cat Tien, 21 September 2011, Liu Xingyue (CAU).

Distribution. Vietnam.

Etymology. It is named in honour of Dr. Liu Xingyue (China) for his discovery of this new species.

3.4 *Neoxyartes* gen. nov.

Neoxyartes gen. nov. Type species: *Neoxyartes zomproi* sp. nov., by present designation.

Diagnosis. Medium-sized Necrosciinae. Body slender, unarmed, sparsely granulated. Head oval. Vertex flat. Occiput weakly convex. Antennae filiform and long, surpassing apices of forelegs. Pronotum rectangular. Mesonotum slender and elongate, parallel-sided, longer than combined length of pronotum, metanotum and median segment. Metanotum roughly as long as median segment. Abdomen cylindrical and unarmed. Female with a distinct spine-like praeopercular organ on seventh sternum. Anal segment with an emargination on posterior margin in both sexes. Female subgenital plate scoop-shaped, distinctly notched posteriorly, apex surpassing or not surpassing posterior margin of anal segment. Male poculum cup-shaped, tapering posteriorly, apex pointed. Cerci flattened. Legs slender and unarmed. First tarsi with a cluster of bristles basally. Profemora distinctly incurved basally. Tegmina minute and scale-like. Alae small and rudiment-like. Capsule oval with rounded micropylar plate.

Distribution. Vietnam.



Figures 36–41. Necrosciinae spp., egg. 36–37. *Asceles hirsutus* sp. nov. 38–39. *Lamachodes brocki* sp. nov. 40–41. *Neoxyartes zomproi* gen. nov. & sp. nov. 36, 38, 40. Lateral view. 37, 39, 41. Dorsal view. Scale bars = 1 mm.

Remarks. *Neoxyartes* **gen nov.** is currently known only from Vietnam and is related to *Oxyartes* Stål, 1875, but can be separated by smaller size, unarmed thorax and a cluster of bristles on the base of the first tarsi in both sexes, unarmed abdomen, posteriorly notched subgenital plate and distinct spine-like praeopercular organ on posteromedial area of seventh abdominal sternum in female, unarmed ventral carinae of femora in male and rounded micropylar plate and lacking capitulum on operculum in egg.

Etymology. The specific epithet of this new genus is derived from the Latin words 'Neo' (= new) and 'oxyartes' referring to the relationship with *Oxyartes* Stål, 1875.

Neoxyartes zomproi **sp. nov.** (Figs 19–23, 34–35, 40–41)

Diagnosis. As in the generic diagnosis.

Description. Female. Body slender, more robust and larger than male. General colour of body rufous brown, with a median longitudinal black band running from vertex of head to anal segment. Legs brown with light brown markings. Head with a few small granules, oval, longer than pronotum. Vertex flat. Occiput gently convex, with distinct median and lateral longitudinal furrows, posterior margin with 6 small swellings. Compound eyes rounded, about 2.5 times as long as genae. Antennae annulated, long and filiform, projecting over apices of forelegs; scapus flattened basally, about 2 times as long as pedicellus, shorter than third segment. Pronotum with small and sparse granules, rectangular, longer than wide, with longitudinal and transverse sulci crossing before middle area, anterior margin curved inwards, posterior margin rounded. Mesonotum with small and sparse granules, parallel-sided, with indistinct median longitudinal line. Metanotum with small and sparse granules, roughly as long as median segment. Mesosternum, metasternum and abdomen with inconspicuous granulations. Seventh sternum with spine-like praeopercular organ posteromedially. Eighth tergum longer than ninth tergum. Anal segment almost as long as eighth tergum, posterior margin weakly notched. Supra-anal plate indistinct. Subgenital plate scoop-shaped, tapering posteriorly, with median longitudinal carina after middle area, posterior margin pointed and projecting over posterior margin of anal segment. Cerci short, flattened, apices obtuse and not surpassing posterior margin of anal segment. Legs unarmed. All femora thicker and shorter than corresponding tibiae. Profemora incurved basally. Tegmina minute and scale-like. Alae small and rudiment-like.

Male. Body slender, much slender than female. General colour of body rufous brown, with a median longitudinal black band running from vertex of head to anal segment. Legs brown with light brown markings. Head with a few small granules, oval, longer than pronotum. Vertex flat. Occiput weakly convex, with distinct median longitudinal furrow, posterior margin with 6 small swellings. Compound eyes oval and protruding, about 2 times as long as genae. Antennae long and filiform, annulated, projecting over apices of forelegs, covered with sparse short bristles; scapus flattened basally, about 1.5 times as long as pedicellus; third segment as long as combined length of scapus and pedicellus. Pronotum with sparse and small granules, rectangular, longer than wide, anterior margin curved inwards, posterior margins nearly truncate, longitudinal and transverse sulci crossing before middle area. Mesonotum with sparse and small granules, longer than mesofemora, parallel-sided, with faint median longitudinal line. Metanotum with sparse and small granules, as long as median segment. Mesopleurae and metapleurae sparsely and inconspicuously covered with small granules. Mesosternum, metasternum and abdomen lacking granulations. Eighth tergum expanded posteriorly, as long as ninth tergum. Anal segment shorter than ninth tergum, with a broad V-shaped emargination on posterior margin. Poculum cup-shaped, posterior margin rounded. Cerci short, flattened, apices obtuse. Vomer generally constricted apically, apical part bifurcated, apex distinctly emarginated medially forming two lateral apically blunt bifurcations. Legs unarmed, slender and long. All femora thicker and shorter than corresponding tibiae. Profemora incurved basally. Tegmina minute and scale-like. Alae small and rudiment-like.

Measurements. Length. Body, ♀ 65.0–73.0 mm, ♂ 49.0–59.0 mm; antennae, ♀ 44.0–49.0 mm, ♂ 40.0–51.0 mm; head, ♀ 5.5–6.0 mm, ♂ 3.5–4.0 mm; pronotum, ♀ 4.5–5.0 mm, ♂ 3.0–4.0 mm; mesonotum, ♀ 15.5–17.0 mm, ♂ 11.0–13.0 mm; metanotum, ♀ 4.0 mm, ♂ 3.0–3.5 mm; median segment, ♀ 4.0 mm, ♂ 3.0–3.5 mm; profemora, ♀ 15.5–18.0 mm, ♂ 14.0–17.0 mm; mesofemora, ♀ 12.0–14.0 mm, ♂ 11.0–13.0 mm; metafemora, ♀ 17.5–21.0 mm, ♂ 15.0–19.0 mm; protibiae, ♀ 17.5–20.0 mm, ♂ 16.0–21.0 mm; mesotibiae, ♀ 14.0–16.0 mm, ♂ 12.0–15.0 mm; metatibiae, ♀ 22.5–27.0 mm, ♂ 20.0–24.0 mm.

Egg. Capsule rough, webbed and densely granulated, oval, posteriorly pole rounded. Micropylar plate rounded. Micropylar cup placed at posterior margin of micropylar plate. Median line almost as long as length of micropylar plate. Operculum webbed and densely granulated, gently convex, lacking capitulum.

Measurements. Capsule length 3.0 mm, width 2.0 mm, height 2.4 mm.

Material examined. Holotype ♀, Vietnam, Thua Thien Hue, Bachma Mountain, 18–20 September 2016, He Li (HKES). Paratypes. 3 ♀, 6 ♂, 16 eggs, same data as holotype (HKES, IEBR & MMUE); 2 ♂, Vietnam, Thua Thien Hue, Phu Loc, Bach Ma, 27–28 October 2011, Liu Xingyue & Wang Guoquan (CAU).

Distribution. Vietnam.

Etymology. This new species is named in honour of Dr. Oliver Zompro (Germany) for his contributions to the taxonomy of Phasmatodea.

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