

Revision of the Neotropical genus *Pseudodira* (Coleoptera: Coccinellidae: Epilachnini)

Karol SZAWARYN

Raabego 13, 02-793, Warsaw, Poland; e-mail: k.szawaryn@gmail.com

Abstract. The South American genus *Pseudodira* Gordon, 1975 is revised; its species are described, diagnosed and illustrated, and an identification key and comments are provided. *Rodolia carmelitana* Mulsant, 1853 is removed from synonymy with *Mada fraterna* (Mulsant, 1850), provided with lectotype designation, and transferred to *Pseudodira*. *Pseudodira amazona* sp. nov. is described from Peru.

Key words. Coleoptera, Cucujoidea, Coccinellidae, Epilachnini, ladybirds, entomology, taxonomy, revision, new species, South America

Introduction

The genus *Pseudodira* Gordon, 1975 is one of nine genera of Epilachnini present in the New World and was proposed for a single species, *Pseudodira clypealis* Gordon, 1975, based on four females from the city of Rio de Janeiro, Brazil. GORDON (1975) described *Pseudodira* as having produced, strongly emarginated clypeus and V-shaped abdominal postcoxal lines. Later, GORDON & ALMEIDA (1986) illustrated the male genitalia from additional specimens of *P. clypealis* collected on Mt. Corcovado in center of Rio de Janeiro city.

Pseudodira was placed in Madaini Gordon, 1975 along with the South American genera *Damatula* Gordon, 1975, *Lorma* Gordon, 1975, *Mada* Mulsant, 1850, and *Malata* Gordon, 1975. According to GORDON (1975) Madaini is composed of rather small, rounded species, rather uniform in appearance with foveate epipleura for receiving femoral apices. Recent phylogenetic study on herbivorous ladybirds (SZAWARYN et al. 2015) showed that Madaini do not form a monophyletic taxon, and each genus is placed in a different position on the phylogenetic tree.

During examination of the type specimens of *P. clypealis* I found some new characters that support *Pseudodira* as a distinct genus but redefine its diagnosis. *Pseudodira* has the anterior margin of the metaventrite emarginated and distinctly bordered, the border with distinct incisions in the anterior angles between the midcoxae; moreover, *Pseudodira* possesses a transverse carina near the apices on the mid and hind tibiae (shared with *Damatula* and *Lorma*), and a sinuate row of large denticles on the dorsal surface of the mandibles.

CROTCH (1874) synonymized *Rodolia carmelitana* Mulsant, 1853 with *Mada fraterna* (Mulsant, 1850). GORDON (1975) in his revision of the Epilachnini of the Western Hemisphere mentioned that *R. carmelitana* type was not examined, so even though this species could be valid it must remain a synonym. I was able to examine the type of *R. carmelitana* deposited in the Museum National d'Histoire Naturelle, Paris and found that the species belongs to the genus *Pseudodira*. Among unidentified specimens I found another specimen from Peru which also belongs to *Pseudodira* and is here described as a new species – *P. amazona* sp. nov.

Both *P. carmelitana* and *P. amazona* sp. nov. share the same generic characters as the type species but they differ in the shape of the abdominal postcoxal lines that are not V-shaped but parallel to the posterior margin of the ventrite I and have visible styli on coxites. Since males of these two species are not known they are provisionally placed in the genus *Pseudodira* which now consists of three species.

Material and methods

Mouth parts and genitalia were dissected, cleared in 10% solution of KOH and rinsed with distilled water then transferred to glycerol and examined on slides. Illustrations were made from slide preparations using a camera lucida attached to Leica or Carl Zeiss Jenamed microscopes. After examination the genitalia were transferred to microvials and pinned under the specimen. Measurements were made using an ocular micrometer attached to an Olympus (SZH 10) dissecting microscope. Scanning electron micrograph images were made using a HITACHI S-3400N machine. The morphological terms follow LAWRENCE et al. (2011) and ŚLIPIŃSKI (2007). Individual labels are separated by a double slash ('//'), while data on different rows by a single slash ('/'). Additional information regarding the labels is given in square brackets. The following terms are used in descriptions: TL – total length, from apical margin of clypeus to apex of elytra; PL – pronotal length, from the middle of anterior margin to margin of basal foramen; PW – pronotal width in widest part; EL – elytral length across sutural line including scutellum; EW – elytral width across both elytra in widest part.

Studied specimens are deposited in following museums:

MNHN Museum National d'Histoire Naturelle, Paris, France;
USNM United States National Museum of Natural History, Washington, USA.

Taxonomy

Pseudodira Gordon, 1975

Pseudodira Gordon, 1975: 207. Type species: *Pseudodira clypealis* Gordon, 1975, by monotypy.

Diagnosis. *Pseudodira* can be characterized by: i) the incisor edge of the mandibles with large denticles continuing as a sinuate line to the apex of the mandible on the dorsal surface (Fig. 13); ii) the anterior margin of the metaventrite emarginated and distinctly bordered, the border with distinct incisions in the anterior angles between the midcoxae (Fig. 8); iii) the presence of a carina on the apices of the mid and hind tibiae (Fig. 5). The last character is shared with the South American genera *Damatula* Gordon, 1975 and *Lorma* Gordon, 1975.

Redescription. Size: length 5.8–7.5 mm, width 5.0–6.4 mm. Body oval, strongly convex. Dorsum covered with dense pubescence.

Head retracted in prothorax (Fig. 11). Eyes finely faceted; interocular distance 0.63–0.70 times as wide as head across eyes. Gular sutures deep, separated, reaching half length of gula (Fig. 12). Antenna short, less than width of the head; 10- (*P. clypealis*) or 11-segmented (other two species); scape large, swollen, along external surface regularly convex; pedicel distinctly narrower than scape; antennal club 3-segmented, asymmetrical; penultimate antennomere distinctly shorter than terminal one; terminal segment subquadrate (Fig. 17). Antennal grooves absent. Clypeus with anterior margin emarginate. Labrum slightly emarginate apically (Fig. 16). Mandible mesal and apical surfaces strongly serrated, apical third with strong prominent teeth; molar part absent; prostheca well developed, setose (Fig. 13). Maxilla with cardo subquadrate; mediastipes and basistipes distinctly separated (Fig. 15), lacinia simple, broad, and short with its apical surface covered with long setae and its mesal surface covered with irregularly arranged short pubescence. Galea round-oval; apex densely pubescent. Terminal maxillary palpomere large and securiform. Mentum (Fig. 14) transverse; sides rounded; anterior margin weakly arcuate posteriorly. Prementum oval, ligula reduced. Labial palps narrowly separated, originated subapically on prementum; apical palpomere shorter and narrower than penultimate one; basal palpomere transverse, about two times shorter than penultimate.

Prothorax. Anterior angles weakly produced anteriorly. Lateral margin not upturned. Prothoracic hypomeron smooth, setose. Prosternal process complete and less than 0.5 width of mesoventral process; surface smooth (Figs 1, 4) or with small tubercle (Fig. 8), sparsely setose, margined laterally. Prosternum in front of coxa shorter than coxal longitudinal diameter at the same position, with anterior margin slightly produced. Procoxal cavity with anterior border marginated.

Meso- and metathorax. Mesoventrite with raised anterior border. Mesoventral process flat (Figs 1, 4) or with small tubercle (Figs 8). Meso-metaventral junction with suture visible, angulate posteriorly. Scutellum triangular. Lateral margins of elytra not or slightly explanate; often visible from above; surface with double size punctation. Elytral epipleuron almost complete, reduced only at apex; with distinct foveae to receive tips of mid and hind femora; inner margin with border area throughout narrow and border line fading before base of elytron. Metaventral postcoxal lines contiguous, antero-lateral angles (between midcoxae) deeply incised (Figs 1, 4, 8); laterally complete, slightly arcuate.

Legs. Trochanters angulately produced posteriorly. Femora with distinct, complete grooves to receive tibiae. Fore tibiae with complete groove on outer edge. Mid and hind tibiae with oblique carina on outer edge near apex (Figs 3, 5, 9). Protibia with single apical spur; mid and hind tibia with two spurs. Tarsus 4-segmented, pseudotrimerous; claws double, base weakly swollen (Fig. 7).

Abdomen. Abdominal postcoxal lines separated medially, V-shaped (Fig. 18) or parallel to posterior margin of ventrite 1 (Figs 23, 28), well developed but incomplete; without additional oblique line. Females with 5 ventrites, ventrite 5 broadly rounded; abdominal sternite VIII not divided longitudinally in middle. Female tergite 8 rounded (Figs 21, 26, 31).

Male genitalia. Known only for *P. clypealis* but not examined in the present study; see figures in GORDON & ALMEIDA (1986).

Female genitalia. Coxites more or less oval in outline; ventral surface of coxite smooth. Bursa copulatrix simple, ending with common oviduct; infundibulum, sperm duct and spermatheca absent.

Distribution. Brazil, French Guiana, and Peru (Fig. 36).

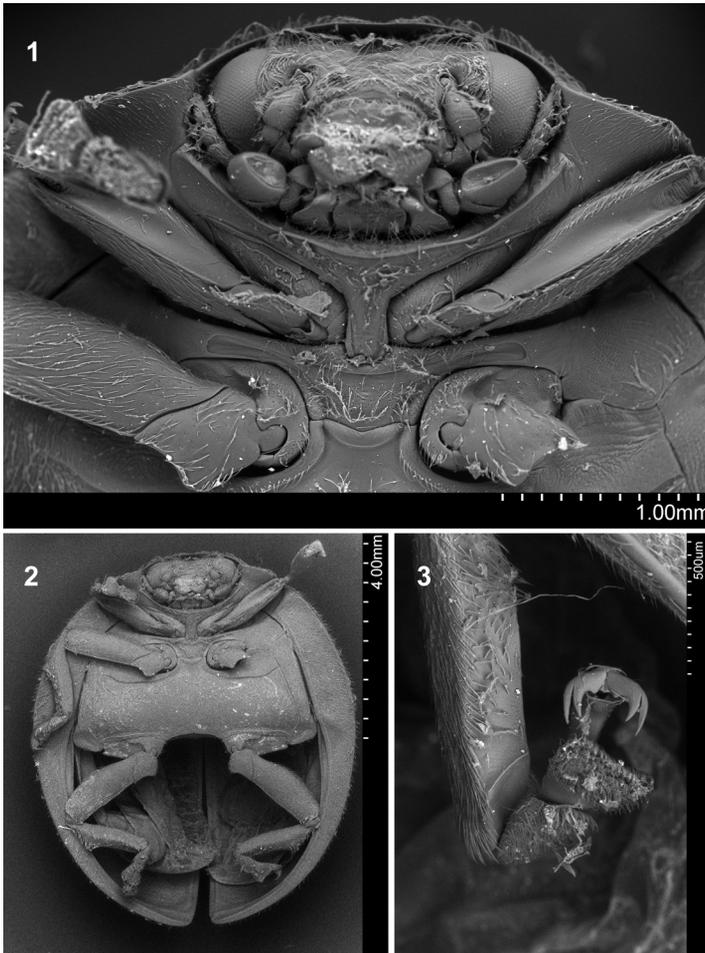
***Pseudodira amazona* sp. nov.**

(Figs 1–3, 28–32, 33)

Type locality. Peru, San Martín Region, Tarapoto.

Type material. HOLOTYPE: ♀, 'Amazones, Tarapote, M. de Mathan [collector], 4e Trimestre 1885' (MNHN).

Description. Length 7.5 mm; TL/EW = 1.18; PL/PW = 0.44; EL/EW = 1.06; EW/PW = 1.76. Body oval (Figs 2, 33). Pronotum chestnut brown with anterior angles piceous. Elytra chestnut brown with suture black. Pubescence short, dense, yellow. Punctuation dual, shallow, with smaller punctures very fine, dense, larger punctures sparsely distributed.



Figs 1–3. *Pseudodira amazona* sp. nov. 1 – head, prothorax and mesothorax, ventral view, 2 – body, ventral view, 3 – tibia, tarsus and tarsal claw.

Head covered with long, dense pubescence. Antennae with 11 antennomeres; scape about 2.3 times as long as pedicel; pedicel about 1.3 times as long as wide; as long as antennomere III. Antennomere III 2.1 times longer than wide, about 2.0 times as long as IV; antennomeres IV and VI subquadrate, antennomere V longer than wide, longer than antennomere IV, antennomeres IV–VI subquadrate; antennomeres VII and VIII transverse. Clypeus not produced.

Prosternal process (Fig. 1) 0.32 times as wide as mesoventral process, elongate, about 1.66 times as long as wide; mesoventral process flat, at median length of coxa 0.86 times as broad as corresponding coxal diameter.

Elytral epipleuron 2.5 times as wide as corresponding metanepisternum (Fig. 2).

Abdominal postcoxal lines incomplete laterally, parallel to posterior margin of ventrite 1 (Fig. 28). Female ventrite 5 weakly arcuate; abdominal sternite VIII weakly emarginate apically (Fig. 29).

Female genitalia (Figs 30, 32) with proctiger (TX) truncate at apex, transverse, about 2.4 times as wide as long; coxites suboval, about 1.9 times as wide as long; styli visible. Bursa copulatrix not divided, simple, spermatheca not observed.

Male unknown.

Differential diagnosis. *Pseudodira amazona* sp. nov. can be separated from *P. clypealis* by having antennae with 11 antennomeres, clypeus not produced, and abdominal postcoxal lines not recurved. This species shares with *P. carmelitana* the abdominal postcoxal lines shape and the presence of styli, but its body size is larger (*P. amazona* – 7.5 mm, *P. carmelitana* – 6.0 mm), oval, with piceous anterior angles of pronotum, black elytral suture, and antennomere V as long as antennomere IV.

Etymology. The name of the new species is an adjective referring to the Amazonian part of the Peru where the holotype was collected.

Distribution. Peru (Fig. 36).

Pseudodira carmelitana (Mulsant, 1853) stat. restit. & comb. nov.

(Figs 4–7, 23–27, 34)

Rodolia carmelitana Mulsant, 1853: 258; CROTCH (1874): 67 (synonymy with *Epilachna fraterna* (Mulsant, 1850)). *Mada fraterna* (partim): KORSCHESKY (1931): 68 (catalogue); BLACKWELDER (1945): 442 (catalogue); JADWISZCZAK & WĘGRZYNOWICZ (2003): 201 (catalogue).

Type locality. French Guiana, Cayenne.

Type material examined. LECTOTYPE (designated here): ♀, ‘*Rodolia carmelitana* / mihi / muls / cayenne // type’ (MNHN).

Redescription. Length 6.0 mm; TL/EW = 1.07; PL/PW = 0.43; EL/EW = 0.90; EW/PW = 1.91. Body sub-circular (Figs 6, 34). Elytra chestnut brown; hypomerion, mouthparts and legs piceous, ventral side brown. Pubescence short, dense, yellow. Punctuation almost equal in diameter but still distinctly dual, shallow, with smaller punctures fine, larger punctures sparsely distributed.

Head covered with moderately long, scarce pubescence. Antennae with 11 antennomeres; scape about 2.3 times as long as pedicel; pedicel about 1.3 times as long as wide; as long as antennomere III. Antennomere III 2.1 times longer than wide; about 2.0 times as long as IV; antennomeres IV and VI subquadrate, antennomere V longer than antennomere IV, longer

than wide; antennomeres VII and VIII transverse. Clypeus not produced anteriorly.

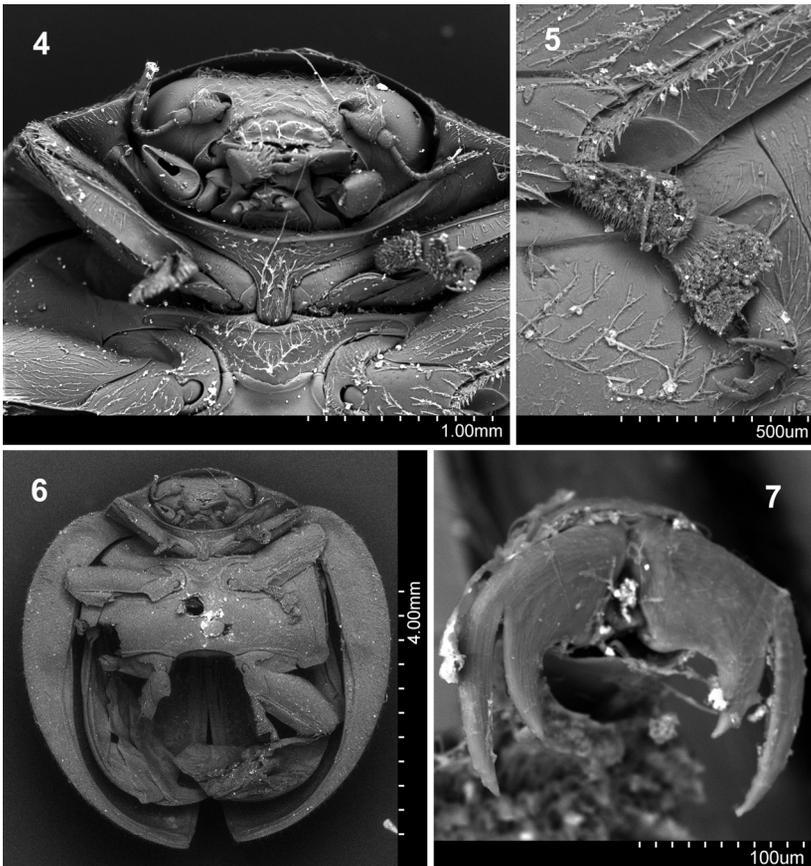
Prosternal process (Fig. 4) 0.30 times as wide as mesoventral process, elongate, about 1.51 times as long as wide; mesoventral process flat, at median length of coxa 0.94 times as broad as corresponding coxal diameter.

Elytral epipleuron 2.6 times as wide as corresponding metaepisternum (Fig. 6).

Abdominal postcoxal lines incomplete laterally, parallel to posterior margin of ventrite 1 (Fig. 23). Female ventrite 5 weakly arcuate; abdominal sternite VIII weakly emarginate apically (Fig. 24).

Female genitalia (Figs 25, 27) with proctiger (TX) truncate at apex, transverse, about 2.8 times as wide as long; coxites suboval, about 1.9 times as wide as long; styli visible. Bursa copulatrix not divided, simple, spermatheca not observed.

Male unknown.



Figs 4–7. *Pseudodira carmelitana* (Mulsant, 1853). 4 – head, prosternum and mesoventrite; 5 – apex of tibia and tarsus; 6 – body, ventral view; 7 – tarsal claw.

Differential diagnosis. *Pseudodira carmelitana* can be separated from *P. clypealis* by having antennae with 11 antennomeres, clypeus not produced, and abdominal postcoxal lines not recurved. This species shares with *P. amazona* sp. nov. the shape of the abdominal postcoxal lines and the presence of styli, but it is smaller (*P. carmelitana* – 6.0 mm, *P. amazona* – 7.5 mm), sub-circular, uniformly brown, and antennomere V longer than antennomere IV.

Distribution. French Guiana (Fig. 36).

Comments. *Rodolia carmelitana* was described by MULSANT (1853) from Cayenne in French Guiana, and its type was not examined by following authors. CROTCH (1874) synonymized this species with *Epilachna fraterna* (Mulsant, 1850). GORDON (1975) redescribed *Mada fraterna* and mentioned that *R. carmelitana* may be valid based on the description but the type cannot be located thus retained the species in synonymy. I have located and examined the type of *R. carmelitana* in MNHN and found that it is not conspecific with *M. fraterna*. Moreover it has the same generic characters as *Pseudodira clypealis*. Therefore here I remove *R. carmelitana* from the synonymy with *M. fraterna* and transfer it to *Pseudodira*.

MULSANT (1853) did not mention how many specimens he had at his disposal for description of *R. carmelitana*. Therefore, the only presently known specimen found in MNHN is here designated as a lectotype to stabilize the taxonomic identity of this species.

Pseudodira clypealis Gordon, 1975

(Figs 8–22, 35)

Pseudodira clypealis Gordon, 1975: 207 (description); GORDON & ALMEIDA (1986): 373 (male genitalia); JADWISZCZAK & WĘGRZYŃCZYK (2003): 207 (catalogue).

Type locality. Brazil, Rio de Janeiro, Rio de Janeiro city.

Type material examined. HOLOTYPE: ♀, 'Brazil / Guanabara / Rio de Janeiro / XI 1963 // M. Alvarenga coll. // HOLOTYPE / *Pseudodira clypealis* Gordon' (USNM). PARATYPE: ♀, 'Rio de Janeiro, Brazil / Acc. No. 2966 // PARATYPE / *Pseudodira clypealis* Gordon' (USNM).

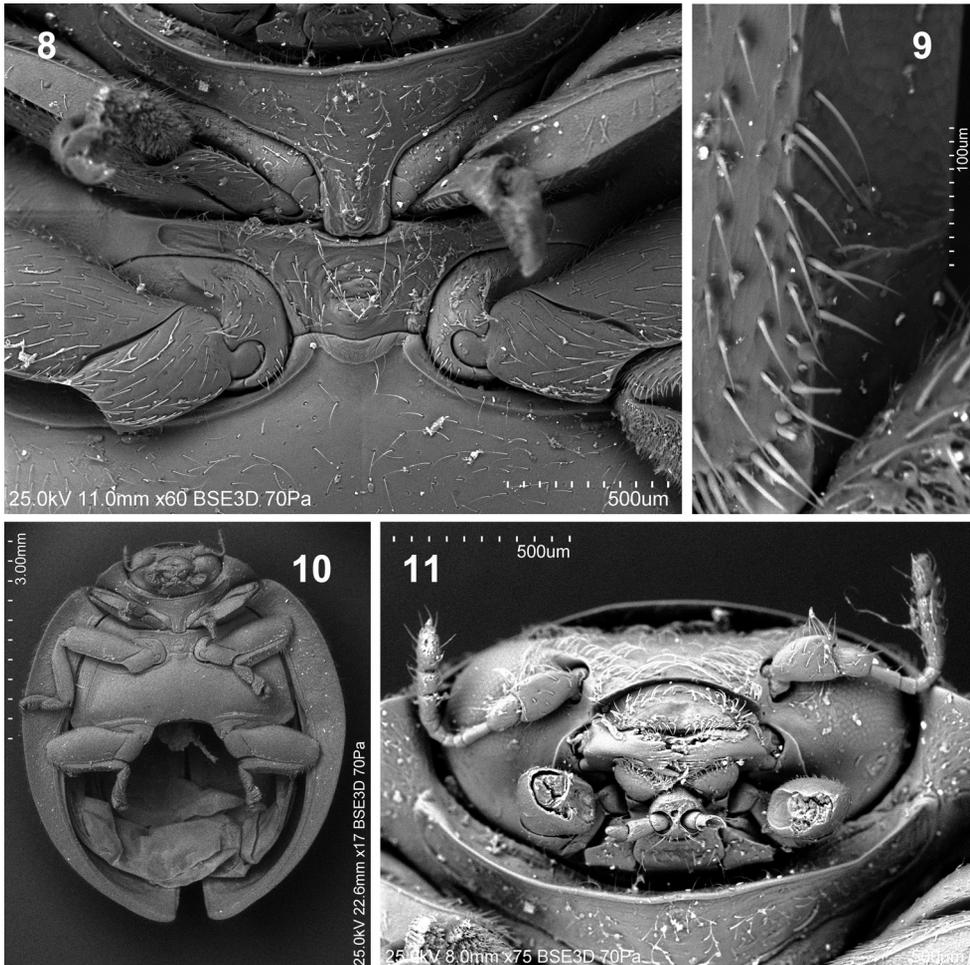
Redescription. Length 5.8 mm; TL/EW = 1.16; PL/PW = 0.46; EL/EW = 0.98; EW/PW = 2.01. Body oval (Figs 10, 35). Elytra black with greenish sheen; mouthparts piceous, antennae with first antennomere black and the rest yellow; ventral side brown to black; abdomen brown. Pubescence long, moderately dense, yellowish white. Punctuation dual, almost equal in diameter, dense, shallow.

Head covered with moderately long, rather dense pubescence. Antennae with 10 antennomeres (Figs 17); scape about 2.5 times as long as pedicel; pedicel 1.3 times as long as wide; scarcely shorter than antennomere III. Antennomere III 1.6 times longer than wide; antennomeres IV–VI subquadrate; antennomere VII transverse. Clypeus produced anteriorly.

Prosternal process (Fig. 8) 0.47 times as wide as mesoventral process, subquadrate, about 1.10 as long as wide; mesoventral process with tubercle in posterior part (Figs 8), at median length of coxa 0.80 times as broad as corresponding coxal diameter.

Elytral epipleuron 3.1 times as wide as corresponding metaepisternum (Fig. 10).

Abdominal postcoxal lines incomplete, recurved, V-shaped (Fig. 18). Female ventrite 5 rounded; abdominal sternite VIII weakly emarginate apically with anterior part membranous (Fig. 19).



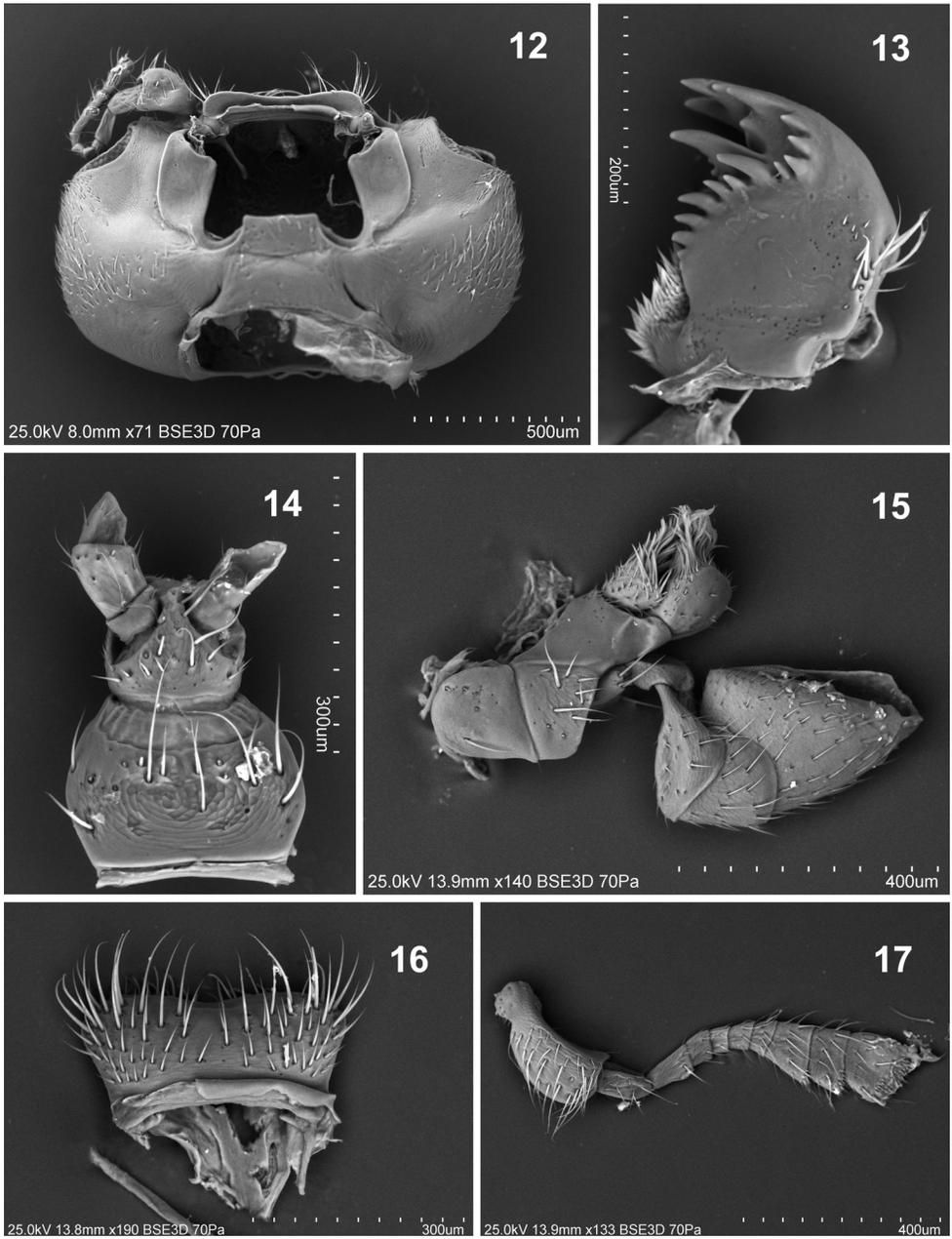
Figs 8–11. *Pseudodira clypealis* Gordon, 1975. 8 – prosternum and mesoventrite; 9 – tibia; 10 – body, ventral view; 11 – head, ventral view.

Female genitalia (Figs 20, 22) with proctiger (TX) truncate at apex, subtrapezoidal with basal part membranous; coxites oblique, suboval; styli absent. Bursa copulatrix not divided, simple, spermatheca not observed.

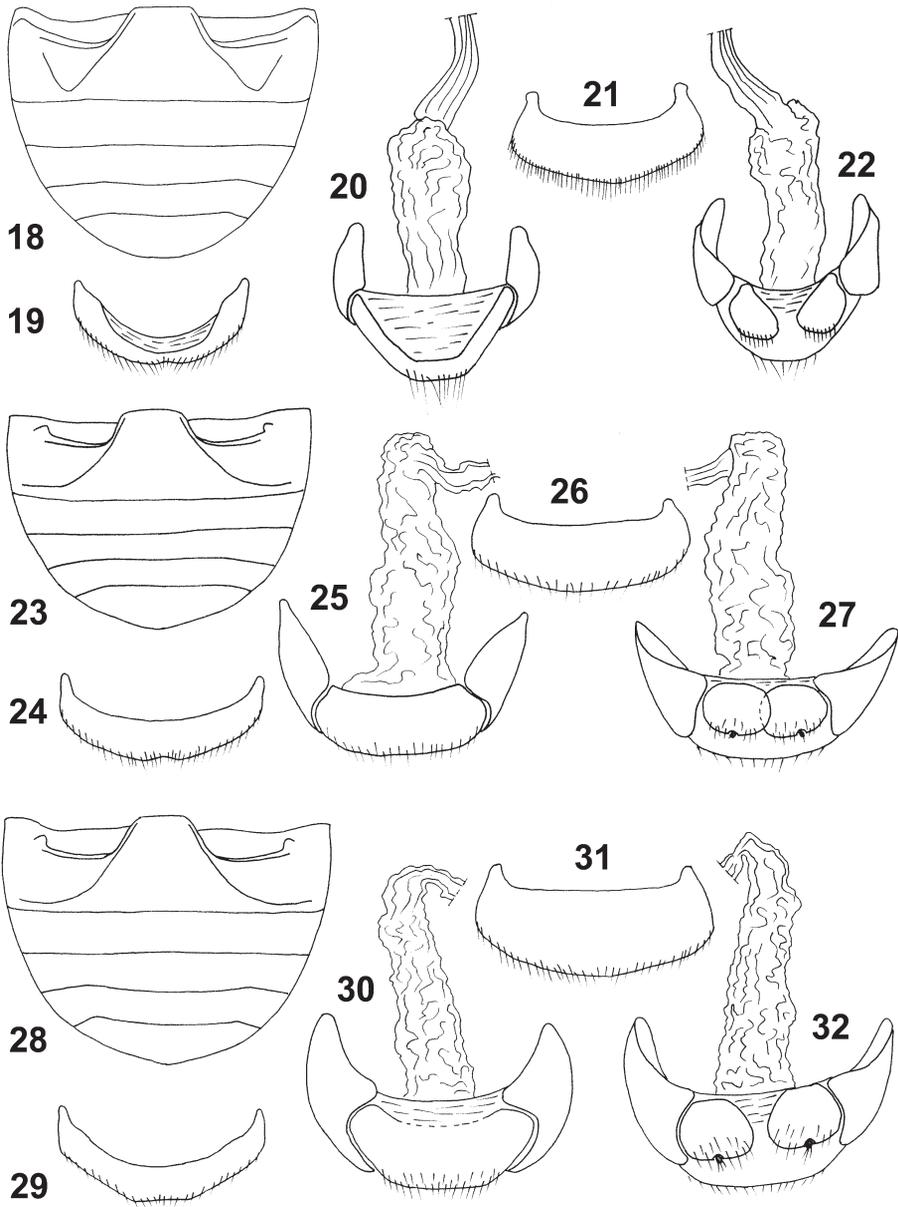
Male not examined. Male terminalia as in GORDON & ALMEIDA (1986).

Differential diagnosis. *Pseudodira clypealis* can be separated from the two other species by having the body black with greenish sheen (Fig. 35), the V-shaped abdominal postcoxal lines and the antennae with 10 antennomeres. Moreover it has long, moderately dense pubescence on elytra, produced clypeus, the mesoventral process with a tubercle, the proctiger (TX) membranous at base, and the styli on coxites absent.

Distribution. Brazil (Fig. 36).



Figs 12–17. *Pseudodira clypealis* Gordon, 1975. 12 – head, ventral side; 13 – mandible, dorsal side; 14 – labium; 15 – maxilla, ventral side; 16 – labrum, dorsal side; 17 – antenna.



Figs 18–32. 18–22 – *Pseudodira clypealis* Gordon, 1975: 18 – abdomen, female; 19 – abdominal sternite VIII; 20 – female genitalia, dorsal; 21 – abdominal tergite VIII, female; 22 – female genitalia, ventral. 23–27 – *P. carmelitana* (Mulsant, 1853): 23 – abdomen, female; 24 – abdominal sternite VIII; 25 – female genitalia, dorsal; 26 – abdominal tergite VIII, female; 27 – female genitalia, ventral. 28–32 – *P. amazona* sp. nov.: 28 – abdomen, female; 29 – abdominal sternite VIII; 30 – female genitalia, dorsal; 31 – abdominal tergite VIII, female; 32 – female genitalia, ventral.



Figs 33–35. Habitus, dorsal: 33 – *Pseudodira amazona* sp. nov., holotype; 34 – *P. carmelitana* (Mulsant, 1853), lectotype; 35 – *P. clypealis* Gordon, 1975, holotype.

Key to the species of *Pseudodira*

- 1 Antennae with 10 antennomeres; body black; abdominal postcoxal lines V-shaped (Fig. 18), clypeus produced; Brazil. *P. clypealis* Gordon, 1975
- Antennae with 11 antennomeres; body brown; abdominal postcoxal lines parallel to posterior margin of ventrite 1 (Figs 23, 28), clypeus not produced. 2
- 2 Pronotum and elytra uniformly brown; body sub-circular; length below 6 mm (Fig. 34); French Guiana. *P. carmelitana* (Mulsant, 1853)
- Pronotum with anterior angles piceous; elytra brown with suture black; body oval; length more than 7 mm (Fig. 33); Peru. *P. amazona* sp. nov.



Fig. 36. Map showing distribution of the three *Pseudodira* species.

Acknowledgments

I thank Natalia Vandenberg (USNM) and Antoine Mantilleri (MNHN) for loan of specimens used in this study. Natalia Vandenberg and Lisa Roberts (USDA-Systematic Entomology Laboratory) are acknowledged for examination and pictures of the holotype of *P. clypealis* and label data. Wioletta Tomaszewska read an early draft of this manuscript and provided helpful suggestions. Many thanks to Adam Ślipiński (Commonwealth Scientific and Industrial Research Organisation - CSIRO) and Hermes Escalona (CSIRO) for improving this manuscript. Małgorzata Bużantowicz (Museum and Institute of Zoology PAS) is acknowledged for help with SEM images.

References

- BLACKWELDER R. E. 1945: Checklist of the coleopterous insects of Mexico, Central America, the West Indies, and South America. Part 3. *Bulletin of the United States National Museum* **185**(3): i-iv + 343-550.
- CROTCH G.R. 1874: *A revision of the coleopterous family Coccinellidae*. Janson, London, 311 pp.
- GORDON R. D. 1975: A revision of the Epilachninae of the western Hemisphere (Coleoptera: Coccinellidae). *Technical Bulletin of the United States Department of Agriculture* **1493**: 1-409.
- GORDON R. D. & ALMEIDA L. M. 1986: New species and comments on *Mada* Mulsant, 1850, *Pseudodira* Gordon, 1976 and other Epilachninae (Coleoptera, Coccinellidae) in the collection of the 'Universidade Federal do Parana', Curitiba, Brazil. *Revista Brasileira de Entomologia* **30**(2): 365-373.

- JADWISZCZAK A. & WĘGRZYNOWICZ P. 2003: *World Catalogue of Coccinellidae. Part I – Epilachninae*. Mantis, Olsztyn, 264 pp.
- KORSCHESKY R. 1931: Coccinellidae I. In: SCHENKLING S. (ed.): *Coleopterorum Catalogus. Part 118*. W. Junk, Berlin, 224 pp.
- LAWRENCE J. F., ŚLIPIŃSKI S. A., SEAGO A. E., THAYER M. K., NEWTON A. F. & MARVALDI A. E. 2011: Phylogeny of the Coleoptera based on morphological characters of adults and larvae. *Annales Zoologici* (Warszawa) **61(1)**: 1–217.
- MULSANT E. 1850: Species des Coléoptères Trimères Sécouripalpes. *Annales des Sciences Physiques et Naturelles, d'Agriculture et d'Industrie, Lyon, Deuxième Série* **2**: 1–1104.
- MULSANT E. 1853: Supplément a la Monographie des Coléoptères Trimères Sécouripalpes. *Annales de la Société Linnéenne de Lyon, Nouvelle Série* **1**: 129–333.
- SZAWARYN K., BOCAK L., ŚLIPIŃSKI A., ESCALONA H. E. & TOMASZEWSKA W. 2015: Phylogeny and evolution of phytophagous ladybird beetles (Coleoptera: Coccinellidae: Epilachnini), with recognition of new genera. *Systematic Entomology* DOI: 10.1111/syen.12121.
- ŚLIPIŃSKI S. A. 2007: *Australian ladybird beetles (Coleoptera: Coccinellidae). Their biology and classification*. Australian Biological Resources Study, Canberra, 304 pp.

