

## New species of *Zenoria* Mulsant (Coleoptera: Coccinellidae) from Brazil and Peru

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### Abstract

Four new species of *Zenoria* Mulsant, 1850 are described: *Zenoria limitrophi* sp. nov. from Brazil; and *Z. westerduijni* sp. nov., *Z. carbo* sp. nov., and *Z. miroi* sp. nov. from Peru. Diagnostic characters are illustrated and relationships with previously described species are discussed.

**Key words:** taxonomy, Ortaliini, Neotropical, South America

### Resumen

Se describen cuatro nuevas especies del género *Zenoria* Mulsant, 1850: *Zenoria limitrophi* n. sp. de Brasil, y *Z. westerduijni* n. sp., *Z. carbo* n. sp., y *Z. miroi* n. sp., todas de Perú. Se ilustran los caracteres diagnósticos y se discuten las relaciones con las especies previamente descritas.

**Palabras clave:** taxonomía, Ortaliini, Neotropical, América del Sur

### Introduction

*Zenoria* Mulsant, 1850 is a Neotropical genus of predaceous ladybird beetles. The genus was described in 1850 by Mulsant, who assigned it to Ortaliini (as Ortaliaires), a classification followed by all subsequent authors. In his revision, Gordon (1971) redescribed eight previously known species, described 15 new ones (one of which was later synonymized), and provided an identification key. Subsequently, Gordon (1972) described five additional species. Almeida (1995) described *Zenoria roberti* and included this species in the prior key proposed in Gordon (1971). González & Honour (2012) described three new species from Peru and Brazil possessing genitalia of an unusual form, atypical for the genus.

Members of *Zenoria* are medium sized (2–5 mm) Coccinellidae, with a characteristic appearance due to their dorsal pubescence and long slender legs that protrude beyond the outer margin of the elytral epipleuron. Their coloration is mainly black or dark metallic green, sometimes with yellow edges; a few species are predominantly yellow or red. Unlike members of other genera, *Zenoria* species rarely have spots or defined areas with other colors, except concentric ovals covering the elytra and pronotum. The eyes are large, finely faceted, with inner orbits emarginate; antennae of 11 antennomeres; elytron with unequal punctuation, with coarse punctures interspersed with fine ones, irregularly distributed, more apparent and less widely spaced near lateral margin than on elytral disc; elytral epipleuron with carina running along inner margin, diverging obliquely toward outer margin near elytral base; abdomen with ventrite VI in males emarginate; abdominal postcoxal line recurved, angulate and incomplete; protarsus cryptotetramerous; male with pro- and mesotarsal claws bifid (Gordon 1971). In most species the penis guide is mamilliform or triangular and has, at least apically, granular areas with small round

tubercles (Gordon 1971, 1972); in a few species the penis guide may be hexagonal or fanlike (González & Honour 2012).

Knowledge of Ortaliini genera that occur in the Neotropical region is still scattered and fragmented, with few groups of species treated, increasing the difficulties for understanding the biodiversity of the region and for obtaining consistent classifications. Few specimens of *Zenoria* are found in collections, and in several cases only one sex is known. Also, the sexual dimorphism makes it difficult to establish relationships between males and females. The genus has not been included in any of the molecular-phylogenetic studies published to date. This study aims to increase knowledge of the species *Zenoria* occurring in the Amazon forest of Brazil and Peru with the description of four new species.

## Material and methods

The terminology used here, especially for the genitalia, follows Ślipiński (2007). All genital structures included in this study have been preserved in microvials with glycerin, along with the respective specimen. The genitalia were extracted by immersing the entire abdomen in a solution of 10% KOH, which was heated by thermal convection in a test tube immersed in boiling water. The abdomen was then washed in distilled water and the genital structures were separated under a stereomicroscope, with the help of microdissection tools.

The material studied belongs to the following collections:

CPGG	Guillermo González Private Collection, Santiago, Chile.
DZUP	Coleção Entomológica Pe. J. S. Moure, Department of Zoology, Universidade Federal do Paraná, Curitiba, Paraná, Brazil.
KUNHM	Snow Entomological Collection, University of Kansas, Lawrence, KS, USA.
MEUT	Museo de Entomología de la Universidad Nacional de Tumbes, Tumbes, Peru.
UNMSM	Colección Entomológica de la Universidad Nacional Mayor de San Marcos, Lima, Peru.

The general or type material from other institutions which was examined and used in comparisons belongs to the following collections: Natural History Museum, London (BMNH); Fundação Instituto Oswaldo Cruz, Rio de Janeiro, Brazil (FIOC); Museu de Ciências Naturais da Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Brazil (MCNZ); Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA); Musée de Confluences, Lyon, France (MHNL); Museum für Naturkunde der Humboldt–Universität, Berlin, Germany (ZMHB); Muséum National d'Histoire Naturelle, Paris, France (MNHN); Museu Nacional, Universidade Federal do Rio Janeiro, Rio de Janeiro, Brazil (MNRJ); Museum of Zoology, Lund University, Lund, Sweden (MZLU); Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZSP); Pontificia Universidad Católica del Ecuador, Quito, Ecuador (PUCE); Universidad Nacional Mayor de San Marcos, Lima, Peru (UNMSM); United States National Collection, Smithsonian Institution, Washington, DC, USA (USNM); Universidad Nacional Agraria La Molina, Lima, Peru (UNALM).

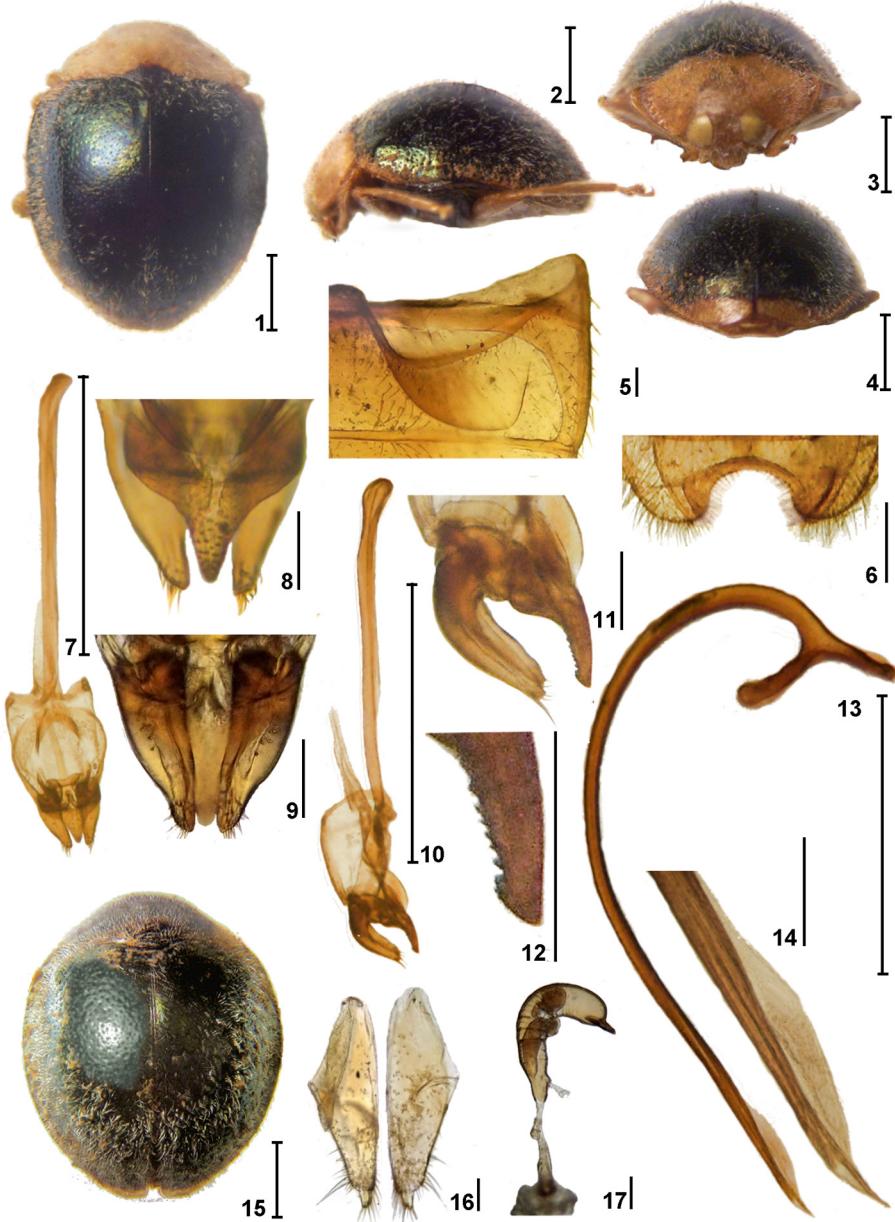
Label data of type specimens is arranged in sequence from top to bottom. Information taken from a single label is placed within double quotes (""), a slash (/) separates the rows, and the collection of deposition is indicated in brackets.

## Taxonomic part

### *Zenoria limitrophi* González & Santos, sp. nov.

Figs. 1–13

**Diagnosis.** *Zenoria limitrophi* sp. nov. has distinctive male genitalia. The structure differs from all other species in that the penis guide is as wide as long, while in other species it is much longer than wide, except *Z. lativerpa* González & Honour (2012), which is as wide as long, but with its maximum width at the apex and not at the base.



**FIGURES 1–17.** *Zenoria limitrophi* sp. nov. 1–14: Holotype male; 15–17: female. 1–4: Habitus (dorsal, lateral, frontal and posterior views); 5: abdominal postcoxal line; 6: ventrite VI (detail); 7–8: penis guide (ventral view); 9: parameres (ventral view); 10: tegmen (ventral view); 11: penis guide and parameres (lateral view); 12: penis guide apex (lateral view); 13: penis (lateral view); 14: penis apex (lateral view); 15: habitus (dorsal view); 16: spermatheca; 17: coxites. Scale: "I" 0.1 mm, "I" 1 mm.

**Description of holotype, male.** Length 3.9 mm; width 3.0 mm. Body oval, elongate, maximum width at basal third of elytra (Fig. 1). Head, antennae, mouthparts, prothorax, legs and abdomen pale yellow; median basal mark on pronotum black, anteriorly rounded. Head with sparse yellowish-white pubescence. Scutellar shield black. Elytra dark metallic green with narrow humeral and apical pale-yellow margin, widened at apex; yellowish-white pubescence, sparse, except discal area with sparse brown pubescence (Figs. 1–4). Margin of elytron broadly explanate, inner carina extending about  $\frac{1}{3}$  distance to outer margin near elytral base. Meso- and metaventrite black. Abdominal postcoxal line curved posterolaterally, closely paralleling posterior margin of ventrite for short distance, then abruptly redirected anteriorly toward base of ventrite in lateral third (Fig. 5). Posterior margin of ventrite V smoothly arched, convex. Posterior margin of ventrite VI with wide and deep semicircular emargination (Fig. 6). Phallobase more than half length of tegminal strut, nearly two times longer than wide (Fig. 7). Penis guide mamilliform, as wide as long at base, first third almost parallel-sided, sharply narrowed at midlength, subtriangular

with rounded apex, with tubercles in apical third (Fig. 8); curved in lateral view, basal half with keel on inner side, measuring 2/5 of its length, narrower (Figs. 11–12). Parameres projecting beyond penis guide subtriangular in ventral view, curved inward and narrower in distal third, with short setae at apex (Fig. 9), curved in lateral view in basal half and nearly straight in distal half; apex pointed (Figs. 10–11). Penis normal wide, no more than 40 times longer than wide, semicircular in basal half; apical half straight (Fig. 13); apex bifurcate with outer side short and blunt, inner side long, sharp and slightly curved downward (Fig. 14); penis capsule with inner branch curved slightly inward and ending in a club, outer branch narrowing only near end, with outer membranous projection (Fig. 13).

**Female.** Length 3.6 mm; width 3.0 mm. Similar to male except pronotum dark with narrow yellowish anterior and lateral margins, elytra lacking yellow humeral spot, apical spot shorter and narrower than in male (Fig. 15). Ventricle VI with shallow emargination on posterior margin. Spermatheca J-shaped, cornu thickened toward distal end, with lamellar projection and barely visible basal ramus; nodulus extending in same direction as cornu, conical; accessory gland present; sperm duct long; infundibulum absent; apex of bursa copulatrix not modified (Fig. 16). Coxites four times longer than wide, triangular; styli well developed (Fig. 17).

**Variation.** Length 3.6–4.1 mm; width 3.0–3.2 mm.

**Etymology.** From the Latin “*limitophorus*”, indicating their location near on the border between Brazil, Colombia and Peru.

**Type material. Holotype.** “Brasil, Amazonas, / Tabatinga, 50 m / 01-IX-2006, leg. R. / Westerduijn, understory / of open altered forest” “Male 964” “*Zenoria* sp. nov. 2 / Santos P.B. 2013” [DZUP].

**Paratypes** (3): (1) “Brasil, Amazonas, / Tabatinga, 26-VIII al / 6-IX-2006, Leg. R. / Westerduijn. Understory / mature altered forest” “Female 357” “*Zenoria* / sp. 8 / Det.: G. González 2011” “*Zenoria* sp. nov. 2 / Santos P.B. 2013” [DZUP]. (2) “Brasil, Amazonas, / Tabatinga, 50 m / 01-IX-2006, leg. R. / Westerduijn, understory / of open altered forest” “Male” “*Zenoria* / sp. 10 / Det.: G. González 2011” “*Zenoria* sp. nov. 2 / Santos P.B. 2013” [DZUP].

**Distribution.** Brazil, Amazonas.

### *Zenoria westerduijni* González & Santos, sp. nov.

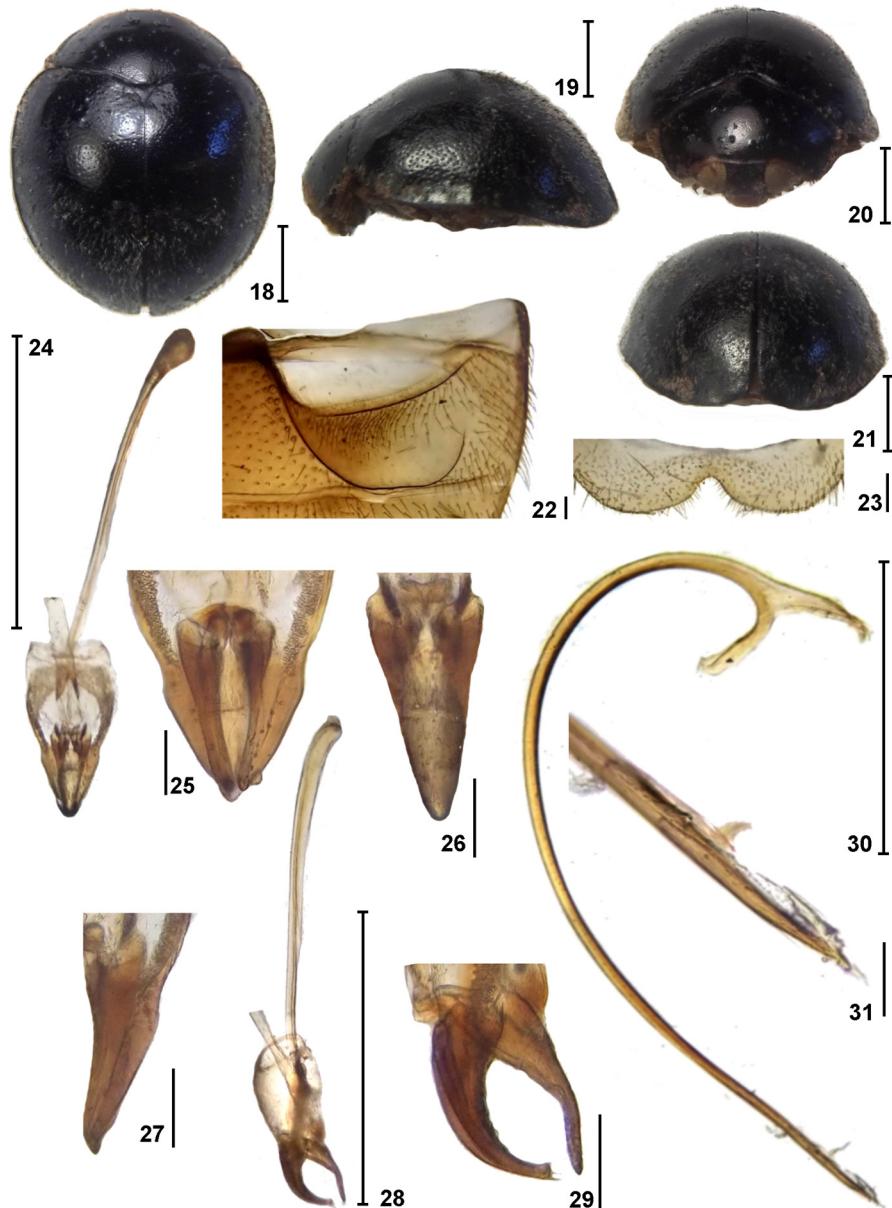
Figs. 18–30

**Diagnosis.** *Z. westerduijni* sp. nov. is distinguishable from all other species of the genus by the almost entirely black body. It also differs from other species by the slightly angulate postcoxal line and the extremely narrow penis, about 50 times longer than wide, typically 35–40 times in other species of the genus.

**Description of holotype, male.** Length 4.0 mm; width 3.4 mm. Body oval, rounded, convex (Figs. 18–19). Head and pronotum black, latter with narrow yellow stripe on anterior border; antennae and mouthparts brown, apex sometimes darker; pubescence grayish white, short, irregularly distributed (Fig. 20). Prothorax black; pubescence light brown, short. Scutellar shield black. Elytra entirely black, shiny; pubescence light brown except for central area, with inconspicuous dark-brown pubescence; this pubescence lacking in some areas, probably due to rubbing (Figs. 18–21). Epipleuron black, inner carina extending more than half distance to outer margin. Meso- and metaventrite brown. Legs brown. Abdominal postcoxal line curved posterolaterally, reaching posterior margin of ventrite for short distance, then redirected anteriorly toward base of ventrite in lateral third (Fig. 22). Posterior margin of ventrite V with smooth notch. Posterior margin of ventrite VI with deep triangular emargination (Fig. 23). Phallobase short, half length of tegminal strut, two times longer than wide (Fig. 24). Penis guide triangular in dorsal view, two times longer than wide, with rounded apex (Figs. 25–27); in lateral view, triangular in basal 3/5, parallel-sided and narrow in distal 2/5 (Figs. 28–29). Penis guide projecting beyond parameres (Fig. 25), parallel-sided in ventral view, slightly projected apically (Fig. 27); regularly curved in lateral view and tapering from base to apex, the latter with small truncated widening (Figs. 28–29). Sparse, very short setae at end of paramere (Fig. 29). Penis narrow, more than 50 times longer than wide, semicircular in basal third, gently curved in middle third, and straight in apical third (Fig. 30), ending in pointed apex, membranous areas in distal 1/20 of apex, on lower side (Fig. 31); inner branch of penis capsule slightly curved inward and truncated, outer branch subtriangular, tapered with hook, inconspicuous membranous projection on outer margin (Fig. 30).

**Female.** Unknown.

**Variation.** Not observed.



**FIGURES 18–31.** *Zenoria westerdujni* sp. nov. 18–21: Holotype male. 18–21: Habitus (dorsal, lateral, frontal and posterior views); 22: abdominal postcoxal line; 23: ventrite VI (detail); 24: tegmen (ventral view); 25: penis guide and parameres (ventral view); 26: penis guide (ventral view); 27: paramere (ventral view); 28: tegmen (lateral view); 29: penis guide and parameres (lateral view); 30: penis (lateral view); 31: penis apex (lateral view). Scale: "I" 0.1 mm, "I" 1 mm.

**Etymology.** This species is named after the biologist and entomologist Rob Westerduijn, who collected this specimen and several others described in this contribution.

**Type material. Holotype.** “Perú, Loreto / Picuroyacu, Pongo / 150 m, 18-XI-2008 Leg. / R. Westerduijn, / Understory of altered / mature forest” “Male 1612” [UNMSM].

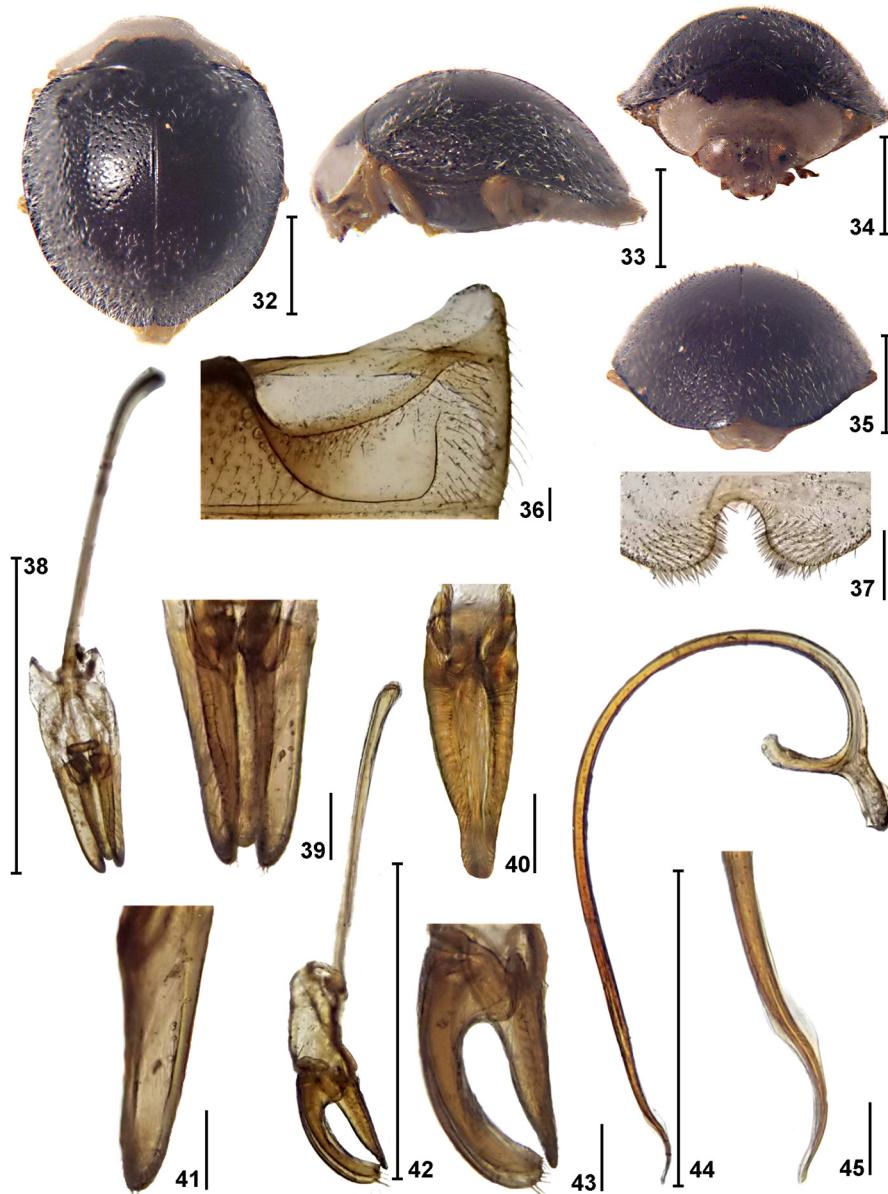
**Distribution.** Peru, Loreto.

#### *Zenoria carbo* González & Santos, sp. nov.

Figs. 32–45

**Diagnosis.** *Z. carbo* sp. nov. resembles a group of species with a long subtriangular penis guide, about 3 times longer than wide, and parameres with setae only at the apex. Other species that have these features are *Z.*

*circumcincta* Gordon, 1971; *Z. emarginata* Gordon, 1971; *Z. linteolata* Mulsant, 1850 and *Z. purpurea* Gordon, 1972. The new species differs from *Z. circumcincta* in the more elongated phallobase (3 times longer than wide) and the parameres parallel sided with a straight outer margin in ventral view. It is distinguished from the other species by having a penis guide with a sinuous inner margin in lateral view. Apart from this, all other species are predominantly lighter in color (with or without dark spots on the elytral disc), except *Z. linteolata* and *Z. purpurea*, which have a dark metallic-green and dark metallic-purple elytra respectively.



**FIGURES 32–45.** *Zenoria carbo* sp. nov. 32–45: Holotype male. 32–35: Habitus (dorsal, lateral, frontal and posterior views); 36: abdominal postcoxal line; 37: ventrite VI (detail); 38: tegmen (ventral view); 39: penis guide and parameres (ventral view); 40: penis guide (ventral view); 41: paramere (ventral view); 42: tegmen (lateral view); 43: penis guide and parameres (lateral view); 44: penis (lateral view); 45: penis apex (lateral view). Scale: "I" 0.1 mm, "I" 1 mm.

**Description of holotype, male.** Length 3.2 mm; width 2.6 mm. Body oval, convex (Figs. 32–33). Head and prothorax pale yellow; antennae and mouthparts brown; pubescence yellowish white (Fig. 34). Pronotum with basal black spot occupying central  $\frac{3}{4}$  of base and extending to middle; pubescence yellowish white, about half scutellar shield length (Figs. 32–34). Elytra black, shiny with yellowish-white pubescence, except central medial area with inconspicuous dark-brown pubescence (Figs. 32–35). Scutellar shield black (Fig. 32). Epipleuron black, inner carina extending half distance to outer margin. Meso- and metaventrite black. Legs pale yellow. Abdominal

postcoxal line curved posterolaterally, closely paralleling posterior margin of ventrite for short distance, then abruptly redirected anteriorly toward base of ventrite in lateral third (Fig. 36). Posterior margin of ventrite V with smooth emargination. Posterior margin of ventrite VI with wide emargination, accentuated medially, deep (Fig. 37). Phallobase long,  $\frac{2}{3}$  length of tegminal strut, three times longer than wide (Fig. 37). Penis guide triangular in dorsal view, nearly three times longer than wide, sides almost parallel, slightly narrower in apical fourth; apex rounded (Figs. 39–40); in lateral view triangular, inner margin slightly sinuous (Figs. 42–43). Parameres projecting slightly beyond penis guide (Fig. 39), in ventral view subtriangular with straight lateral margins, directed slightly inward in distal 1/5 (Fig. 41), regularly curved in lateral view and parallel sided. Sparse short setae at end of paramere (Figs. 42–43). Penis normal, wide, no more than 40 times longer than wide, semicircular in basal 3/5, straight in apical 2/5, except apex recurved upward relative to penis capsule, with membranous areas on outer side, fewer on inner side (Figs. 44–45); penis capsule with inner branch slightly longer than outer branch, curved inward, narrow at base and widening to 2/3 of length with membranous areas, outer branch with almost parallel sides, truncated, with outer membranous area (Fig. 44).

**Female.** Unknown.

**Variation.** Length 3.1–3.2 mm; width 2.5–2.6 mm. The pale yellow coloration of the pronotal anterior margins may be reduced to  $\frac{2}{3}$  or  $\frac{1}{3}$  of the size.

**Etymology.** From Latin "carbo" meaning coal, referring to the intense black color of the elytra; proposed as a noun in apposition.

**Type material. Holotype.** "Perú, Madre de Dios / Tahuamanu, Iberia / 292 mnsm, 10-I-2010 / Leg. J. Miró, Cítricos" "Male 1617" [MEUT].

**Paratypes** (2): (1) "Perú, Madre de Dios / Tahuamanu, Iberia / 292 mnsm, 10-I-2010 / Leg. J. Miró, Cítricos" "Male 612" [MEUT]. (1) "Perú Madre de Dios dept. / CICRA FldStn, trail 6 research / plot, 12.55207°S 70.10962°W / 295m, 11-13.VI.2011, Chaboo / team, canopy Malaise, bottom / sample, PER-11-CMB-002" "[bar code] / SEM C0986969 / KUNHM-ENT" "Male 1571" [UNMSM].

**Distribution.** Peru, Madre de Dios.

### ***Zenoria miroi* González & Santos, sp. nov.**

Figs. 46–59

**Diagnosis.** *Zenoria miroi* sp. nov. is easily distinguishable from other species with the same color pattern, *Z. crotchi* Gordon, 1971; *Z. delicatula* Weise, 1910; *Z. discoidalis* (Kirsch, 1876); *Z. lativerpa* González & Honour, 2012; *Z. luciae* González & Honour, 2012; and *Z. sylvatica* González & Honour, 2012 by the subtriangular black basal spot on the pronotum. The male genitalia with short, inflated parameres, curved in lateral view with sensory setae limited to the apex are distinctly different from other described species. Although the male genitalia resemble *Z. annularis* Gordon, 1971 this species has broad triangular parameres, angulate at the base and straight on the outer margin in ventral view.

**Description of holotype, male.** Length 3.2 mm; width 2.5 mm. Body oval, slightly convex (Figs. 46–47). Head pale yellow with yellowish-white pubescence, longer and more abundant toward clypeus; antennae and mouthparts brown (Fig. 48). Pronotum dark yellow with subrectangular basal black spot; pubescence yellowish white (Figs. 46–48). Elytra pale yellow with large black common spot on disc, covering part of humeral callus; pubescence yellowish-white, except elytral disc with dark-brown pubescence (Figs. 46–49). Scutellar shield black (Fig. 46). Epipleuron yellow, inner carina extending less than half distance to outer margin. Meso- and metaventrite black. Legs pale yellow. Abdominal postcoxal line curved posterolaterally, closely paralleling posterior margin of ventrite for short distance, then abruptly redirected anteriorly toward base of ventrite in lateral third (Fig. 50). Posterior margin of ventrite V arcuate. Posterior margin of ventrite VI with broad and deep semicircular emargination (Fig. 51). Phallobase short, less than half length of tegminal strut, two times longer than wide (Fig. 52). Penis guide mamilliform, basal third broad with convex sides, apex rounded (Figs. 53–55); in lateral view broad at base, outer margin straight, inner margin curved and not sinuous, with tubercles (Figs. 56–57). Parameres projecting beyond penis guide in ventral view; outer margin wide and curved, inner margin parallel-sided (Figs. 53–54); curved in lateral view, apex truncate; short sensory setae at apex (Figs. 56–57). Penis normal, wide, no more than 40 times longer than wide, basal third semicircular, middle third curved, straight in apical third except

apex curved downward and tapering upward relative to penis capsule in short, very narrow projection (Fig. 58); apical membranous projections on both sides (Fig. 59); penis capsule with inner branch curved inward, ending in enlargement, and triangular outer branch (Fig. 58).

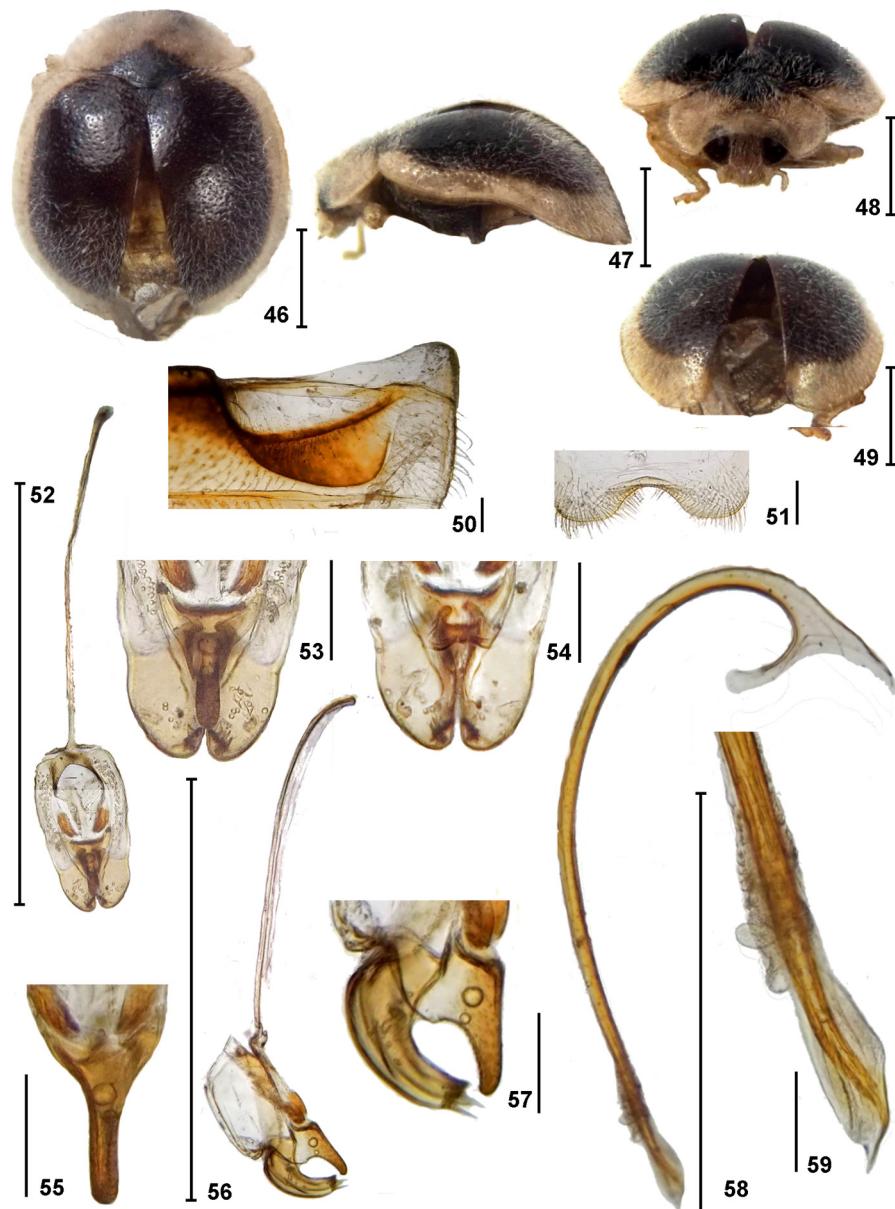
**Female.** Unknown.

**Variation.** Not observed.

**Etymology.** This species is named after the agronomist Jimmy Miro, collector of this species and many other species of Coccinellidae in Tumbes and Madre de Dios departments, Peru.

**Holotype.** "Perú, Madre de Dios / Tambopata, Las / Piedras, Alegría, 5-VIII / 2012, leg. Jimmy Miró" "N: 8660120 E: 486620 / Cítricos: Naranjo" "Male 1100" [MEUT].

**Distribution.** Peru, Madre de Dios.



**FIGURES 46–59.** *Zenoria miroi* sp. nov. 46–59: Holotype male. 46–49: Habitus (dorsal, lateral, frontal and posterior views); 50: abdominal postcoxal line; 51: ventrite VI (detail); 52: tegmen (ventral view); 53: penis guide and parameres (ventral view); 54: parameres (ventral view); 55: penis guide (ventral view); 56: tegmen (lateral view); 57: penis guide and parameres (lateral view); 58: penis (lateral view); 59: penis apex (lateral view). Scale: "I" 0.1 mm, "I" 1 mm.

## Conclusion

*Zenoria* is an endemic genus of the Neotropical fauna, currently with 38 described species, the genus with the second highest number of species allocated to the Ortaliini. Nevertheless, it is not well known, biological data are scarce and its activity patterns are understudied. The description of four new species widens the taxonomic knowledge of the group. Remaining species of *Zenoria*, their evolutionary relationships, a review of all described species, descriptions of new species, new records, identification key and biological data, fundamental to improving the knowledge of the region's biodiversity, will be treated in future publications.

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