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Description of the pupa and redescription of the third instar of *Phileurus valgus* (Olivier) (Coleoptera: Scarabaeidae: Dynastinae: Phileurini)

MARIO G. IBARRA-POLESEL[1], NESTOR G. VALLE[1],
JHON C. NEITA-MORENO[2] & MIRYAM P. DAMBORSKY[1]

[1]*Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, Avda. Libertad 5470. (3400) Corrientes, Argentina. E-mail: mario.ibarrapolesel@gmail.com*
[2]*Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Claustro de San Agustín, Ext. 129, Villa de Leyva, Boyacá, Colombia. E-mail: jneita@humboldt.org.co*

Abstract

Phileurus valgus (Olivier) (Coleoptera: Scarabaeidae: Dynastinae: Phileurini) is a common species widely distributed from the southern United States to Argentina and the West Indies. In this work the immature stages are described and illustrated based on specimens from Argentina. A key to the known third-stage larvae of New World Phileurini species is provided and updated. Notes on the life cycle and natural history are also included.

Key words: scarab beetle, morphology, immature stages, Argentina

Resumen

Phileurus valgus (Olivier) (Coleoptera: Scarabaeidae: Dynastinae: Phileurini) es una especie común, ampliamente distribuida del sur de Estados Unidos hasta Argentina e Indias Occidentales. En este trabajo se describen e ilustran sus estadios inmaduros basados en especímenes de Argentina. Se provee una clave para las larvas del tercer estadio de Phileurini del Nuevo Mundo. Se incluyen también notas sobre su ciclo de vida y biología.

Introduction

The genus *Phileurus* Latreille (Coleoptera: Scarabaeidae: Dynastinae: Phileurini) currently contains 31 species distributed from the central United States to southern South America and the West Indies (Ratcliffe 2011; Grossi & Saltin 2014). *Phileurus* adults are characterized by a sharply acuminate clypeus; outer side of the mandibles lacking teeth; presence of horns or tubercles on the head located near the lateral margins; pronotum with a longitudinal furrow, apical tubercle, and either a subapical fovea or declivous area; and the apical margin of the metatibia with one or two large teeth (Ratcliffe & Cave 2006).

Phileurus valgus (Olivier) is a common species known from the southern United States to Argentina and West Indies (Endrodi 1985; Ratcliffe 2011). Endrodi (1985) recognized three subspecies of *P. valgus*: *P. valgus valgus* (Oliver) that occurs from the southern United States to Colombia and Venezuela; *P. valgus meridionalis* Kolbe that occurs from Colombia to Argentina, and *P. valgus antillarum* Bates that occurs from the Antilles. However, Ratcliffe and Cave (2015) states that Endrödi's separation of "northern", "southern", and "Caribbean" populations into three different subspecies seem arbitrary and without justification, because there are no morphological differences to distinguish among them.

Larva of *P. valgus* were previously described by Ritcher (1966) under the name *P. castaneus* (Haldeman). However, the original description is too brief and was based only on cast skin of one third instar, therefore intraspecific variation is unknown. Immature stages for two other species, *Phileurus didymus* (Linnaeus) and *Phileurus affinis* (Burmeister), have also been described (by Ritcher 1966; Morelli 1990, respectively).

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The natural history of *Phileurus* species is largely unknown. Both adults and larvae have been collected inside rotting logs and stumps, where they feed on decaying wood, fungi, or are predators on other insects (Ratcliffe 2011). Velázquez *et al.* (2006) observed the predatory habitus of *P. valgus* and cites this species as a natural enemy of the agave weevil (*Scyphophorus acupunctatus* Gyllenhal, Coleoptera: Curculionidae). Adults of *Phileurus* have also been found in ant nests (Deloya 1988; Alves-Oliveira *et al.* 2016). Most of the species are typically encountered in lowland forests, but they have also been recorded from forests as high as 1,850 m in elevation (Ratcliffe & Cave 2006; Ratcliffe & Skelley 2011). Adults are readily attracted to lights at night.

The aims of this study were to: 1) describe larval and pupal stages of *P. valgus*, 2) contribute to the knowledge of the natural history and life cycle of this species, and 3) provide a key to the known third instar of New World Phileurini species.

Materials and methods

Specimens were collected in a *Copernicia alba* Morong (Arecaceae) palm grove (27°26'31.2"S, 58°53'13.61"W) located in Puerto Antequera, Primero de Mayo Department, Chaco Province, Argentina. The study area is located within the Ramsar Site Wetlands Chaco, and the landscape is comprised of complex freshwater environments, palm groves, grasslands, and gallery forests. The climate of the region is subtropical. During the collection period, the absolute maximum temperatures were recorded on 17 October 2014 (44.4 ºC) and 11 January 2015 (38.4 ºC), while the absolute minimum was on 25 July 2015 (-0.6 ºC). During the study period, the amount of rainfall was 1157 mm. Historical data (1968–2015) of average temperature and rainfall records were provided by the weather station of Instituto Nacional de Tecnología Agropecuaria (2016).

Palm trunks were sampled, and those with *P. valgus* specimens were marked and monitored monthly from September 2014 to August 2015. Some larvae and adults were collected from each trunk and taken to the laboratory. The adults were also caught with light traps. In the laboratory, some larvae were fixed and others were individually kept in 1-L plastic containers with decaying wood, where they were measured and reared until emergence of adults. Collected adult couples were transferred into terraria (25 x 15 x 18 cm) with a 5-cm-deep soil layer and decaying palm wood and were fed with balanced dry cat food. The specimens kept in the laboratory at room temperature, 60% humidity and a natural photoperiod (13 light, 11 dark hours).

The description is based on one first instar, three second instars, eleven third instars, two pre-pupae, and five pupae. Identification of the immature specimens was determined by association with adults. Terms and characters used in the larval and pupal description are those of Ritcher (1966), Morón (1987), and Morón & Ratcliffe (1990). Specimens were deposited in the collection of the Biology Department, Northeast National University (Corrientes, Corrientes, Argentina).

The key of third instars of New World Phileurini species is based and modified from previous studies (Ritcher 1966; Vanin *et al.* 1983; Morelli 1990; Ocampo & Morón 2004; Neita & Ratcliffe 2010, 2011; Ratcliffe & Skelley 2011). The larva of *Platyphileurus felscheanus* Ohaus is not included in the key, since Albertoni *et al.* (2014) transfered *Platyphileurus* Ohaus from the tribe Phileurini to Oryctini.

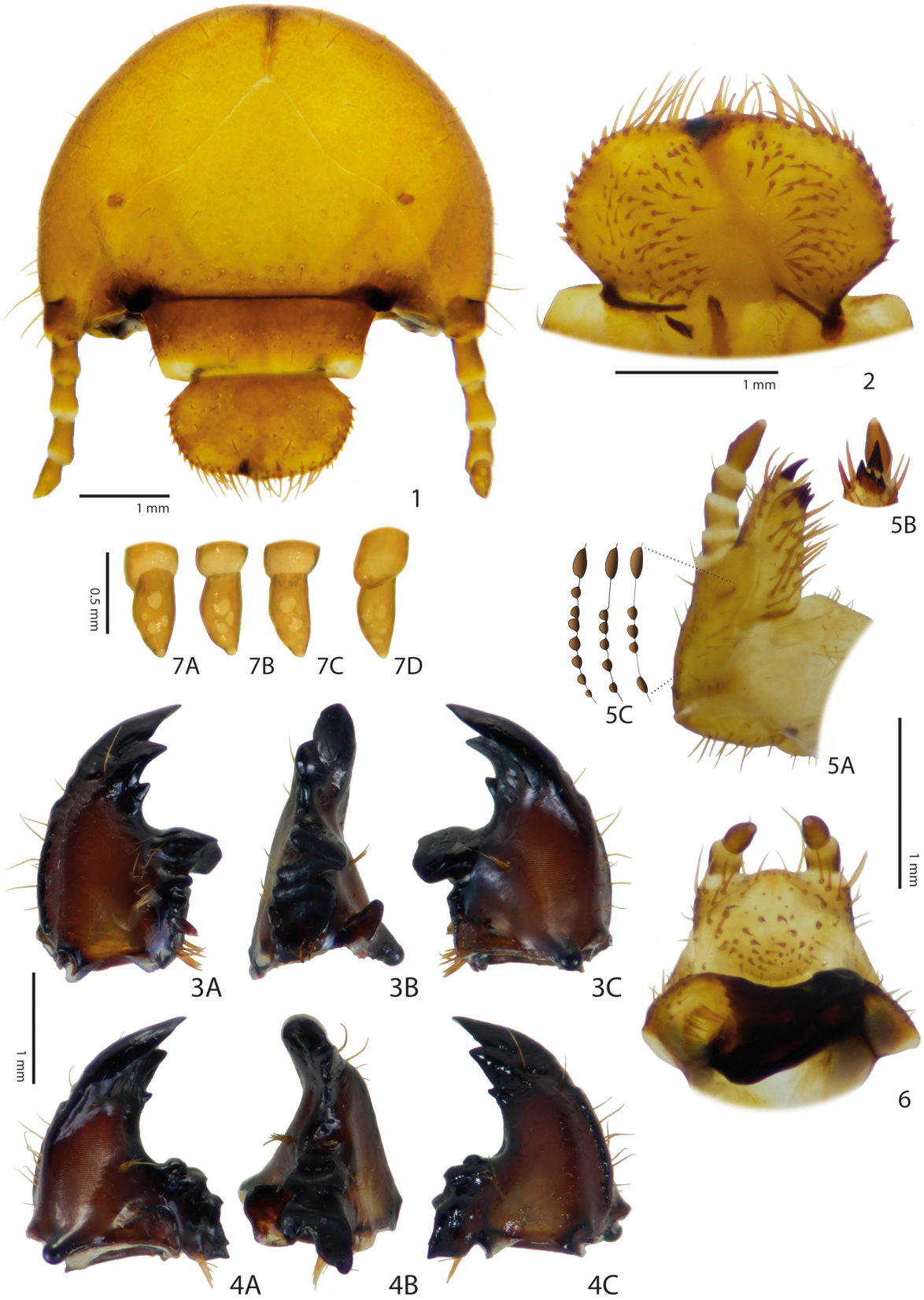
Phileurus valgus (Olivier, 1789)

(Figs. 1–14)

Third instar. Dorsal body length 74.9 mm, width 10.7 mm, weight 2.9 g. **Cranium** (Fig. 1): Width of head capsule 4.6–5.1 mm. Color yellowish brown/orange brown. Surface with wrinkles and a fine chagrin. Frons with small, shallow pits sparsely and irregularly over the anterior third. Epicraneal, frontal, and clypeofrontal suture distinct. **Frons** (Fig. 1): Surface with 4 anterior frontal setae and 1–2 exterior frontal setae; each anterior angle with 1–2 setae and 4–6 posterior frontal setae. Remaining cranial surface with 4–6 dorsoepicranial setae on each side, 24–30 epicranial setae distributed irregularly or in row, and 3 paraocellar setae on each side. Ocellus absent. **Clypeus** (Fig. 1): Form trapezoidal. Surface of postclypeus yellowish brown, well sclerotized, with punctures smaller than those on frons; with 2 central setae and 2 lateral setae on each side. Surface of preclypeus light brown and without punctures. **Labrum** (Fig. 1): Slightly asymmetrical, with some discal punctures similar to those of postclypeus,

with 12 posterolateral labral setae, 1 lateral seta on each side and 2 central setae. **Epipharynx** (Fig. 2): Form transversely suboval, asymmetrical, left and right lateral margins angulate. Haptomeral process prominent and entire. Right chaetoparia with 59 setae; left chaetoparia with 51 setae; with some sensillae between the setae. Acroparia with 22 straight, long, thick setae; corypha with 8 slender, long setae; right and left acanthoparia with 6–9 short, curved, spine-like setae. Pedium longer than wide, without setae. Dexiotorma narrow, elongate; laeotorma slightly shorter than dexiotorma. Epitorma curved on to disc of pedium, pternotorma rounded. Dexiophoba and laeophoba absents; haptolachus with 5–8 small, slender setae. Sclerotized plate of right nesium slender, acute at apex. Sense cone on left nesium represented by longitudinal, well-sclerotized plate and with some lateral sensillae. Crepis poorly defined. **Left mandible** (Fig. 3A–C): Form falcate. Scissorial region with 4 teeth, apical tooth (S_1 + S_2 fused), separated from S_3 by scissorial notch, S_4 below notch. Scrobis with 6–9 slender, long setae. Acia well-developed, sharp, with 3 basolateral setae. Dorsal surface with 1 stout, long setae at level to S3–S4 notch; dorsomolar area with row of 3–4 stout, slender, moderately long setae. Preartis distinct, concave. Ventral surface with elongate-oval stridulatory area formed by 54 narrowly separated, subparallel ridges. Ventral process well developed, rounded, with many asperites. Brustia with 7–10 stout, long setae. Molar area with 3 lobes, first molar lobe (M1) large. Postartis large, rounded. **Right mandible** (Fig. 4A–C): Form falcate. Scissorial area with blade-like, apical tooth (S_1 + S_2 fused), separated from S_3 by scissorial notch, S_4 below notch. Scrobis with 5–8 slender, long setae. Dorsal surface with 2 stout, long setae at level to S3 and S4; dorsomolar area with row of 3–6 setae. Preartis distinct, concave. Ventral surface with elongate-oval stridulatory area formed by 52 narrowly separated, subparallel ridges. Molar area with a tuft of 8–11 ventral molar setae. Ventral process well developed, broadly rounded, with many asperites. Brustia with 8–12 stout, long setae. Calx large, molar crown with 3 large lobes. Postartis large, rounded. **Maxilla** (Fig. 5A): Galea and lacinia fused, forming mala. Galea with 6–9 stout setae and 1 well developed uncus at apex, about 0.6 times as long as last segment of maxillary palp. Lacinia with many stout setae and 3 unci fused at their bases (Fig. 5B). Maxillary palpus with 4 palpomeres, palpomere 4 twice as long as palpomere 3. Stridulatory area formed by 4–7 blunt, truncate teeth and a wide, truncate anterior process (Fig. 5C). Cardo subrectangular. **Labium** (Fig. 6): Hypopharyngeal sclerome asymmetrical, concave medially; right side with well-developed, apical, truncate process; left side with well-developed posterior process. Glossa with 26–30 long and 28–30 short setae. Left lateral lobe with 14–16 slender, moderately long setae; right lateral lobe with 8–12 slender, moderately long setae. Left margin with row of 22–28 stout, moderately long setae directed toward center of sclerome and 8 setae near base of sclerome. **Antennae:** With 4 antennomeres, antennomeres 1–2 and 3–4 subequal in length, antennomere 3 extended into an obtuse process at distal end; terminal antennomere about 0.85 times as long as antennomere 2. Terminal antennomere on dorsal surface with 2–4 sensory spots (Fig. 7A–C), ventral surface with 3–5 sensory spots (Fig. 7D). **Thorax**: Pronotum wide, irregularly and weakly sclerotized, with 22 slender, long setae and 9 short, spine-like setae (Table 1). Prothoracic spiracle 0.55 mm long, 0.38 mm wide (Fig. 8A), slightly larger than abdominal spiracle I (Fig. 8B); respiratory plate yellowish brown, regularly shaped as a closed "C", spiracular bulla rounded, slightly prominent; lobes of respiratory plate slightly separated; plate with 30–35 holes across diameter at middle, holes with regular edges (Fig. 8B). Mesonotum and metanotum with variable number of setae (Table 1). **Legs:** Tarsal claws with enlarged apical process, 1 basoexternal seta, and 1 internal, preapical seta (Fig. 9A–C). All tarsal claws similar in size (Fig. 9D–F). Coxa, trochanter, femur, and tibiotarsus of all legs with many long, stout setae. **Abdomen** (Fig. 10): Abdominal spiracle I 0.54 mm long and 0.34 mm wide (Fig. 8B), shorter than spiracles II–VII. Spiracles on segments II and IV subequal in size (0.58 mm long and 0.40 mm wide), slightly longer and less wide than spiracles on segments V–VII (0.55 mm long and 0.42 mm wide). Spiracle VIII shorter than spiracle on segments II–VII (0.51 mm long and 0.39 mm wide). Abdominal segments I–VII each with 7–31 setae on prescutum; 2–5 setae on subscutum; 24–37 setae on scutum; 14–32 setae on scutellum; 4–8 setae on spiracular area, and 8–12 setae on pleural lobe (Table I). Abdominal segments VIII–X with sparse, minute setae. **Raster** (Fig. 11)**:** Surface without palidia; campus with 2–4 slender, long setae; teges with 24–26 short setae that project toward superior anal lobe; barbula with 22 long, slender setae. Anal slit transverse.

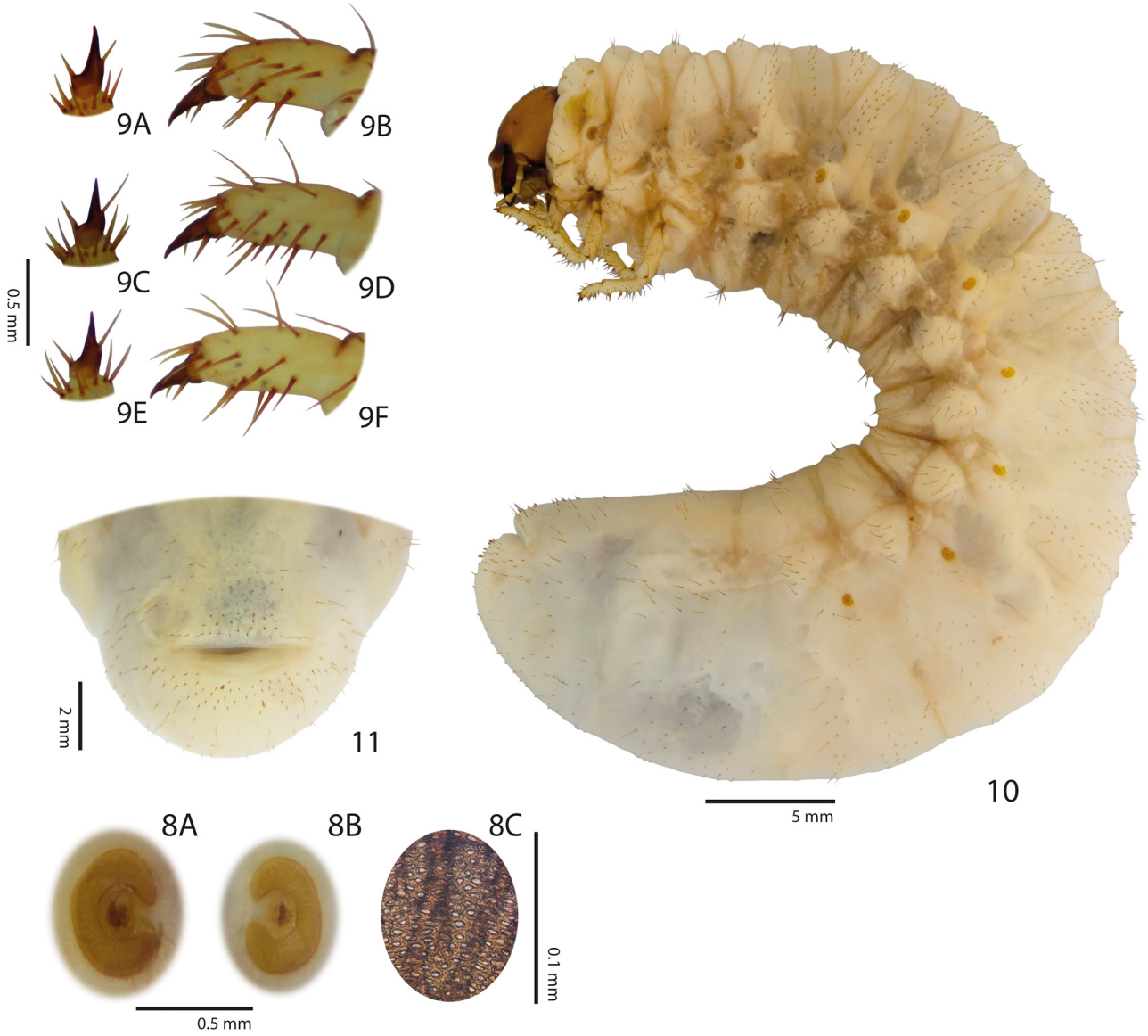
Second instar. Head capsule 2.6–2.9 mm, chaetotaxy similar as larvae of third instar, anterior frontal setae present. Terminal antennomere with 6–9 sensory spots. Prothoracic spiracles 0.25 mm long, 0.14 mm wide. Abdominal spiracles progressively more rounded (0.23–0.18 mm long, 0.14–0.18 mm wide). Approximate dorsal body length 36.4 mm.



FIGURES 1–7. *Phileurus valgus*, third instar. **1,** Cranium, frontal view; **2,** epipharynx; **3,** left mandible, dorsal view (A), lateral view (B), and ventral view (C); **4,** right mandible, ventral view (A), lateral view (B), and dorsal view (C); **5,** left maxilla, dorsal view (A), apex of mala showing unci (B), and stridulatory teeth of maxilla (C); **6,** dorsal view of labium; **7,** terminal segment of antenna in dorsal view, with four (A), three (B), and two (C) sensory spots and ventral view of terminal segment (D).

TABLE 1. Chaetotaxy on thoracic and abdominal segments of third instar *Phileurus valgus*.

Segment	Tergum	Long, slender setae	Short, spine-like setae
Pronotum		22	9
Mesonotum	Prescutum	3	2
	Scutum	17	6
	Scutellum	0	0
Metanotum	Prescutum	4	2
	Scutum	18	6
	Scutellum	0	0
Abdominal segment I	Prescutum	1	6
	Scutum	20	4
	Subscutum	1	1
	Scutellum	0	14
	Spiracular area	5	0
	Pleural lobe	8	0
Abdominal segment II	Prescutum	0	22
	Scutum	7	25
	Subscutum	1	1
	Scutellum	0	24
	Spiracular area	5	0
	Pleural lobe	11	0
Abdominal segment III	Prescutum	0	18
	Scutum	6	26
	Subscutum	2	2
	Scutellum	0	21
	Spiracular area	2	4
	Pleural lobe	10	2
Abdominal segment IV	Prescutum	0	19
	Scutum	6	23
	Subscutum	1	3
	Scutellum	0	24
	Spiracular area	1	3
	Pleural lobe	0	9
Abdominal segment V	Prescutum	0	24
	Scutum	6	31
	Subscutum	1	4
	Scutellum	0	32
	Spiracular area	4	2
	Pleural lobe	10	0
Abdominal segment VI	Prescutum	0	31
	Scutum	7	22
	Subscutum	2	1
	Scutellum	3	16
	Spiracular area	6	2
	Pleural lobe	10	0
Abdominal segment VII	(Two row)	5	30
	Spiracular area	7	0
	Pleural lobe	8	0
Abdominal segment VIII	(Two row)	6	31
	Spiracular area	7	0
	Pleural lobe	8	0
Abdominal segment IX		22	37
Abdominal segment X		13	42

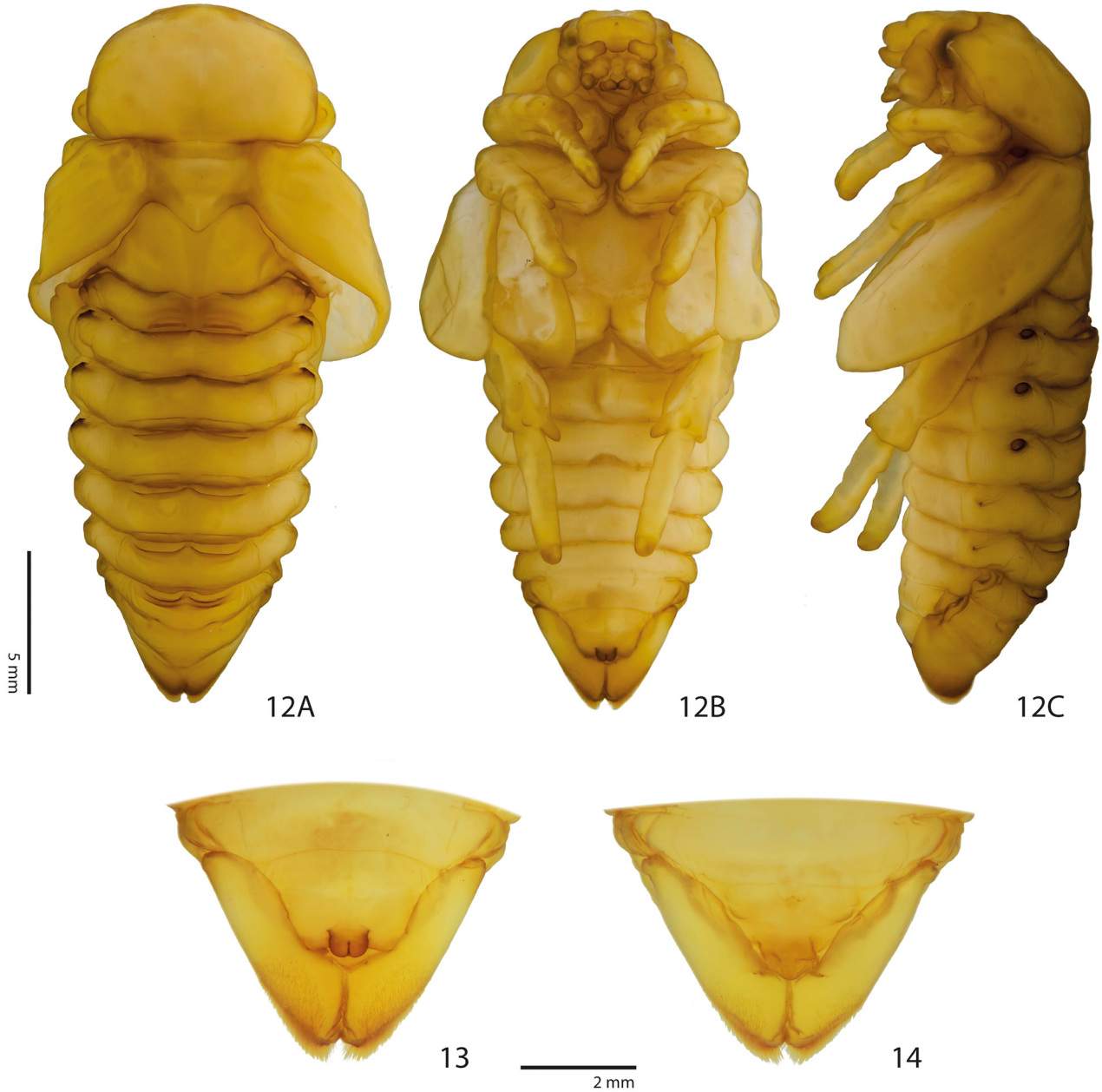


FIGURES 8–11. *Phileurus valgus*, third instar. **8,** Spiracles, prothoracic (A), first abdominal (B), and spiracular holes (C); **9,** prothoracic (A), mesothoracic (C), and metathoracic (E) claws in dorsal view, and lateral view of protarsus (B), mesotarsus (D), and metatarsus (F); **10,** third instar, entire body in lateral view; **11,** terminal abdominal segment, ventral view.

First instar. Similar to second and third instars. Head capsule 1.8 mm, dorsal body length 15.4 mm. Terminal antennomere shorter than antennomeres 1–2, and subequal to antennomere 3. Eclosion spine on each side of metanotum conical, with acute apex, small (0.08 mm). Thoracic and abdominal spiracles kidney shaped, similar in size: 0.11–0.09 long, 0.08–0.07 mm wide, without definite bulla.

Male pupa (Figs. 12A–C). Length 23.8–22.6 mm; greatest width 11.2–9.7 mm. Adecticous, exarate, body elongate, oval, stout. Color yellowish brown. **Head:** Surface glabrous, mouthparts directed ventrally; antenna, labrum, mandibles, maxillae and palps discernible; antennal tecae expanded, stout, with apices rounded. Compound eyes sunken, partially covered by the anterior edges the pronotum, with 2 tubercles between eyes. **Thorax**: Pronotal surface glabrous. Form transverse, with wide, anteromedial, round apex. A narrow, median and longitudinal sulcus extending from apex to base. Mesonotum and Mesonotum well differentiated. Elytral and posterior wing tecae appressed, curved ventrally around body; elytral tecae extending to middle of abdominal segment II–III; posterior wing tecae extending to the end of abdominal segment III–IV. **Legs:** Protibia with 3 distinct teeth on external edge and with tubercle-like apical spurs. Mesotibiae and metatibiae with inner and external spines well developed at apices. Mesotibiae and metatibiae each with inner well developed; apex of metatibia with 2 visible teeth. Metafemur and metatibia covered by elytra and wings. Tarsomeres and pretarsus not

distinct. **Abdomen:** Segments III–X (ventral view) well defined, sternite III and IV are the widest, intersegment VII–VIII, VIII–IX, and IX–X poorly defined. Segment X with genital ampulla (male). In dorsal view, segments I–IX well defined, dioneiform organs between segments I–II, II–III, III–IV, IV–V, V–VI, and VI–VII, the first strongly sclerotized. Pleural lobes rounded. Spiracle I elongate, with fine peritreme, partially covered by wing tecae; spiracles II–IV ovate, prominent, each with strongly sclerotized peritreme; spiracles V–VIII closed. Abdominal apex rounded, with fine, short setae. Genital ampulla sub-trapezoidal, at basal area a sclerotized structure in "U" shape, with basal notch (Fig. 13).



FIGURES 12–14. *Phileurus valgus*, pupa. **12,** Male pupa in dorsal view (A), ventral view (B), and lateral view (C); **13,** male pupa, ventral view of apex with genital ampulla; **14,** female pupa, ventral view of apex with genital ampulla.

Female pupa. Length 25.2–19.7 mm; greatest width 12.1–10.3 mm. Same characteristics as in male, but apical area of tergite 9 slightly shorter than in male. Sternite IX anteriorly convex in males, in females with sub-trapezoidal shape and 2 small lateral lobes in basal area. Genital pore a "W" shape. Genital ampulla with base slightly sclerotized (Fig. 14).

Life cycle and natural history. Our results based on field and laboratory work showed that *P. valgus* on the Argentina northeast has a bivoltine life cycle (Fig. 15A). That seems to be associated with precipitation and the

increase in temperature (Fig. 15B). Under laboratory conditions, the duration of third instars was 38–42 days (n = 21), pre-pupa 6–9 days (n = 13), pupa 11–13 days (n = 8), and the adults lived three months (n = 7). Our results were similar to those reported by Garcia *et al.* (2013) from Brazil. In the *C. alba* palm grove, however, was observed a faster development of immatures, which could be attributed to higher average temperature in field.

In the laboratory, most larvae began pupation when they reached a weight of approximately 3 g. Before pupation, larva builds a cocoon with sawdust and its own excrement, and remains within it. The larval exuvia is pushed to the rear of the pupal chamber. In the field during March, several pre-pupae and pupae were found dead in their camera, days after intense rainfall, perhaps because of the high humidity in the rotting wood.

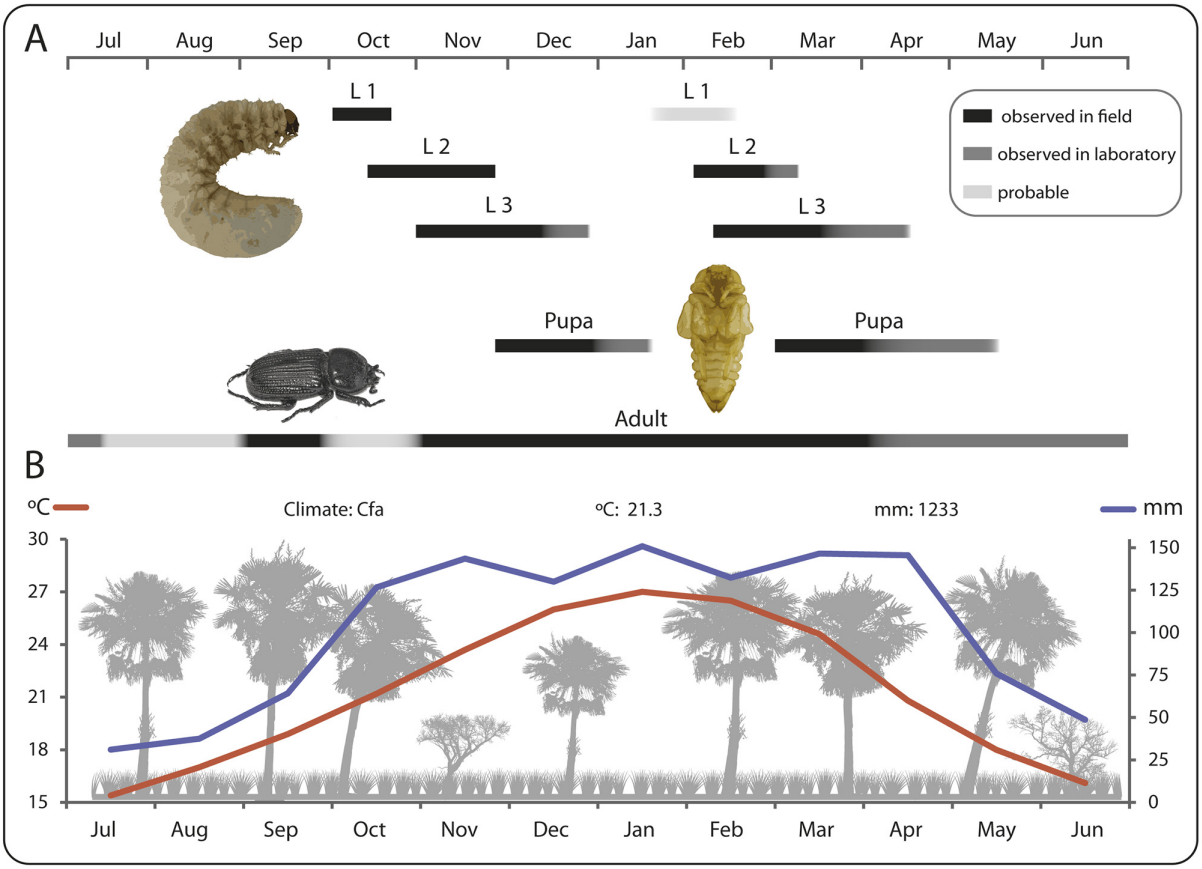


FIGURE 15. A, *Phileurus valgus* development seasonality of larval stadium (L1 = first instar, L2 = second instar and L3 = third instar), pupal, and adult stages under laboratory conditions and in the natural environment (a *Copernicia alba* Morong (Arecaceae) palm grove) between September 2014 to August 2015 in Chaco, Argentina. **B,** Historical data (1968–2015) of average temperature and rainfall records of the study area.

The adults were captured with a light trap in September, January, February, and March; immatures and imagoes were observed together in November and December (Fig. 15). Laboratory specimens that emerged in April lived to July. We believe that in the field, however, the adults could have a longer life span, because a wider range of microhabitats and food resources are available. The adults collected in September showed a great wear on their cuticle, which suggest that these are specimens with a considerable lifespan. Therefore, adults could be present all year long, although their activity is limited to the warmer months. Ratcliffe (2011) mentions that adults have been captured every month of the year, and Morelli (1990) collected adults of *P. affinis* from October to late March.

In the laboratory, adults were observed preying on larvae of *Leucothyreus costatus chaconus* Ohaus (Coleoptera: Scarabaeidae: Ruteliane), and adults of *Stenocrates holomelanus* (Germar) (Coleoptera: Scarabaeidae: Dynastinae). For that reason, we offered balanced dry cat food (protein) to the adults, which they accepted and consumed throughout the adult stage. The predatory habitus of *P. valgus* were documented by Velázquez *et al.* (2006), who observed adults consume 1–3 *Scyphophorus acupunctatus* larvae per day. Other studies also cited predatory behavior in other Phileurini species (Ratcliffe & Morón 1997; McCleve 2007; Neita & Ratcliffe 2009, 2010).

Discussion

In this work we found discrepancies with the original description by Ritcher (1966), including 1) the presence of the four anterior frontal setae, 2) left and right lateral margins of labrum angulate. We also expanded the range of variability of the following characters: 3) maxilla with a row of 4–7 truncate stridulatory teeth, 4) terminal antennomere with 2–4 dorsal sensory spots.

According to our results, the larvae of genus *Phileurus* based in three known species (*P. affinis*, *P. didymus*, and *P. valgus*) share the following two principal characters: 1) presence of the anterior frontal setae, and 2) protarsal claw similar in size to mesotarsal and metatarsal claws. Larvae of more species of *Phileurus* need to be studied, however, before we can propose a precise diagnostic. Given the wide distribution of *P. valgus*, it would also be interesting to have an updated description of northern specimens.

Key to the third instars of New World Phileurini

Modified from Neita & Ratcliffe (2011), Ratcliffe & Skelley (2011).

1 Anterior frontal setae absent . . . 2
- Anterior frontal setae present . . . 7
2 Lateral margins of labrum broadly rounded, not angulate (Argentina, Brazil, Paraguay, Uruguay) . . . *Trioplus cylindricus* (Mannerheim)
- At least one lateral margin of labrum angulate . . . 3
3 Left and right lateral margins of labrum angulate, maxilla with a row of 6 conical, stridulatory teeth (Uruguay, Brazil). . . . *Archophileurus fimbriatus* (Burmeister)
- Left lateral margin of labrum angulate . . . 4
4 Abdominal spiracle I shorter than spiracles II–VII. Terminal antennomere with 5 dorsal sensory spots (Colombia) . . . *Hemiphileurus elbitae* Neita & Ratcliffe
- Abdominal spiracles similar to size. Terminal antennomere with less than 5 dorsal sensory spots . . . 5
5 Terminal antennomere with 2 dorsal sensory spots. Inner margin of left mandible, distad of molar area, with a short, rounded tooth (Hispaniola) . . . *Hemiphileurus dispar* Kolbe
- Terminal antennomere with 3–4 dorsal sensory spots. Inner margin of left mandible, distad of molar area, with a prominent, triangular tooth (United States of America, Mexico) . . . *Hemiphileurus illatus* LeConte
7 Protarsal claw longer than mesotarsal and metatarsal claws. . . . 8
- Protarsal claw similar in size to mesotarsal and metatarsal claws . . . 11
8 Surface of head coarsely pitted, with dense covering of setae. Stridulatory area of mandible formed by approximately 30 separated ridges (Brazil). . . . *Actinobolus trilobus* Lüderwaldt
- Surface of head moderately punctate and sparsely setae. Stridulatory area of mandible formed by 40 or more separated ridges . . . 9
9 Left lateral margin of labrum angulate . . . 10
- Lateral margins of labrum broadly rounded, not angulate (northeastern South America) . . . *Homophileurus luederwaldti* (Ohaus)
10 Anterior clypeal setae absent (Brazil, Paraguay) . . . *Homophileurus integer* (Burmeister)
- Anterior clypeal setae present (Mexico to Brazil) . . . *Homophileurus tricuspis* Prell
11 Ocelli absent . . . 12
- Ocelli present. . . . 13
12 Right lateral margin of labrum rounded, raster and lower anal lobe with short setae alternates with numerous long setae (South America) . . . *Archophileurus vervex* Burmeister
- Right lateral margin of labrum angulate, raster and lower anal lobe with short and thin setae (United States of America to Argentina) . . . *Phileurus valgus* (Olivier)
13 Lateral margins of labrum broadly rounded, not angulate. Maxilla with a row of 7 stridulatory teeth (Mexico to Paraguay) . . . *Phileurus didymus* (Linnaeus)
- Left and right lateral margins of labrum angulate. Maxilla with a row of 9 stridulatory teeth (French Guiana, Brazil, Uruguay) . . . *Phileurus affinis* Burmeister

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