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falvarez@ib.unam.mx

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## Taxonomy and systematics

# The passalid beetles (Coleoptera: Passalidae) from Costa Rica, with the description of two new species of *Passalus*

## *Los pasálidos (Coleoptera: Passalidae) de Costa Rica, con la descripción de dos especies nuevas de Passalus*

Larry Jiménez-Ferbans<sup>a,\*</sup>, Pedro Reyes-Castillo<sup>b</sup>, Jack C. Schuster<sup>c</sup>, Cristian Beza-Beza<sup>d</sup>

<sup>a</sup> Grupo de Investigación en Evolución, Sistemática y Ecología Molecular, Universidad del Magdalena, Carrera 32 No 22-08, Apartado postal 2-1-21630, Santa Marta, Colombia

<sup>b</sup> Red de Biodiversidad y Sistemática, Instituto de Ecología, A.C., Carretera antigua a Coatepec 351, El Haya, 91070 Xalapa, Veracruz, Mexico

<sup>c</sup> Universidad del Valle de Guatemala, Apartado postal 82, 01901 Guatemala, Guatemala

<sup>d</sup> Department of Biological Sciences, The University of Memphis, 3700 Walker Av., Memphis, TN 38152, USA

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### Abstract

Two new endemic, brachypterous species of *Passalus* (*Pertinax*) from mid and high montane habitats of the Sierra de Talamanca, Costa Rica, are described and illustrated. Additionally, a checklist for the bess beetle species of Costa Rica is provided.

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**Keywords:** Bess beetles; Diversity; Taxonomy; Brachypterous

### Resumen

Se describen e ilustran 2 especies nuevas endémicas de *Passalus* (*Pertinax*) con alas reducidas de mediana y alta montaña de la Sierra de Talamanca, Costa Rica. Adicionalmente, se provee un listado de las especies de pasálidos de Costa Rica.

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**Palabras clave:** Pasálidos; Diversidad; Taxonomía; Braquipterismo

### Introduction

Passalidae are a pantropical group of Coleoptera. In the Western Hemisphere, the family is represented by the tribes Proculini and Passalini. *Passalus* is the most speciose genus of Passalini. Within Passalidae, *Passalus* is the genus with the widest geographic distribution, being found from the United States to Argentina (Jiménez-Ferbans, Reyes-Castillo, Schuster,

& Salazar, 2013; Schuster, 1983). *Veturius* is the most speciose genus of Proculini. These 2 genera are rich in South and Central America, but *Passalus* (*Passalus*) is richer in the Amazon lowlands and many Proculini genera are richer in the mountains of South and Central America.

In their Passalidae catalog, Hincks and Dibb (1935, 1958) cite 48 species of Passalidae for Costa Rica, the majority being *Passalus*. However, no recent monograph accurately lists the number of bess beetle species in this country. As a contribution to the documentation of the biodiversity of Costa Rica, we present a checklist of Passalidae from Costa Rica (Table 1) and describe 2 new species of *Passalus* from the montane areas of the Sierra de Talamanca.

\* Corresponding author.

E-mail address: [larryjimenezferbans@gmail.com](mailto:larryjimenezferbans@gmail.com) (L. Jiménez-Ferbans).

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Table 1

List of species of Passalidae from Costa Rica.

Passalini (18 species)

*Passalus* Fabricius, 1792Subgenus *Passalus* s. str.Section “*Neleus*”*Passalus interstitialis* Eschscholtz, 1829;*Passalus barbatus* Lepeletier & Serville, 1825 (non Fabricius, 1801);*Passalus acuminatus* Eschscholtz, 1829;*Passalus compar* Erichson, 1847;*Neleus interstitialis* Kaup, 1869 (non Eschscholtz, 1829);*Ninus interstitialis* Kaup, 1869;*Ninus amazonicus* Kuwert, 1891;*Ninus hondurae* Kuwert, 1891;*Ninus assimilatus* Kuwert, 1898;*Ninus bergi* Kuwert, 1898;*Ninus cayennensis* Kuwert, 1898;*Ninus columbicus* Kuwert, 1898;*Ninus consimilis* Kuwert, 1898;*Ninus infallibilis* Kuwert, 1898;*Ninus mazatlanicus* Kuwert, 1898;*Ninus signisternus* Kuwert, 1898;*Ninus subsimilatus* Kuwert, 1898;*Ninus nobilii* Pangella, 1905;*Ninus rosminae* Pangella, 1905;<sup>a</sup>*Passalus nevermanni* Luederwaldt, 1941;*Passalus punctiger* Lepeletier et Serville, 1825;*Lucanus interruptus* Olivier, 1789 (non Linnaeus, 1764);*Passalus tlascala* Percheron, 1835;*Neleus chilensis* Kuwert, 1891;*Neleus guatemalae* Kuwert, 1891;*Neleus distinguendus* Kuwert, 1891;*Neleus laevicypeatus* Kuwert, 1891;*Neleus nicaraguae* Kuwert, 1891;*Neleus sanio* Kuwert, 1891;*Neleus scelus* Kuwert, 1891;*Neleus scepticus* Kuwert, 1891;*Neleus scurra* Kuwert, 1891;*Neleus suturalis* Kuwert, 1891 (non Burmeister, 1847);*Neleus transvaalensis* Kuwert, 1891;*Neleus vagans* Kuwert, 1891;*Neleus acarinatus* Kuwert, 1898;*Neleus aequatoris* Kuwert, 1898;*Neleus altidens* Kuwert, 1898;*Neleus approximadentatus* Kuwert, 1898;*Neleus arcuatotaeniatus* Kuwert, 1898;*Neleus argentinus* Kuwert, 1898;*Neleus arrogans* Kuwert, 1898;*Neleus boliviensis* Kuwert, 1898;*Neleus coarctatus* Kuwert, 1898 (non Percheron, 1835);*Neleus difformis* Kuwert, 1898;*Neleus dilatidentatus* Kuwert, 1898;*Neleus dilatipunctatus* Kuwert, 1898;*Neleus dilatus* Kuwert, 1898;*Neleus disjunctus* Kuwert, 1898;*Neleus dislocandus* Kuwert, 1898;*Neleus dispar* Kuwert, 1898;*Neleus dispositus* Kuwert, 1898;*Neleus distinctus* Kuwert, 1898;*Neleus durangi* Kuwert, 1898;*Neleus intermissus* Kuwert, 1898;*Neleus obtusecornutus* Kuwert, 1898;*Neleus scurroides* Kuwert, 1898;*Neleus scutellosulcatus* Kuwert, 1898;*Neleus subcarinaefrons* Kuwert, 1898;*Neleus subcarinatus* Kuwert, 1898;*Neleus sulcicornis* Kuwert, 1898;

Table 1 (Continued)

*Neleus taeniolatus* Kuwert, 1898;*Neleus festae* Rosmini, 1902;*Neleus cognettii* Pangella, 1905;*Neleus unicornis* Moreira, 1922 (non Lepeletier et Serville, 1825);*Passalus microcollis* Luederwaldt, 1931;*Passalus riograndensis* Luederwaldt, 1931.Section “*Phoroneus*”*Passalus jansonii* (Bates, 1886);*Phoroneus jansonii* Bates, 1886;*Phanocles nudus* Kuwert, 1898;<sup>a</sup>*Passalus labroexcisus* (Kuwert, 1898);*Neleus labroexcisus* Kuwert, 1898;Subgenus *Pertinax* Kaup, 1869;*Passalus alfaroi* (Pangella, 1905);*Paxillosomus alfaroi* Pangella, 1905;*Paxillus rufiventris* Luederwaldt, 1934;*Tetraracus centralis* Arrow, 1907;*Passalus caelatus* Erichson, 1847;*Rhodocanthopus caelatus*: Kaup, 1871 (non Erichson, 1847);*Rhodocanthopus nanus* Kuwert, 1891;*Rhodocanthopus perversus* Kuwert, 1891;*Rhodocanthopus solidus* Kuwert, 1891;*Rhodocanthopus sulcatus* Kuwert, 1891;*Passalus clypeoneleus* (Kuwert, 1891);*Rhodocanthopus clypeoneleus* Kuwert, 1891;*Rhodocanthopus formosiceps* Kuwert, 1891, n. syn.;*Passalus halfiterorum* n. sp.;*Passalus rzedowskiorum* n. sp.;*Passalus maillei* Percheron, 1841;*Epiphanus molestus* Kuwert, 1891;*Passalus perparvulus* (Kuwert, 1898);*Rhodocanthopus perparvulus* Kuwert, 1898;*Passalus punctatostratus* Percheron, 1835;*Passalus contractus* Percheron, 1841;*Rhodocanthopus hoffmanni* Kuwert, 1891;*Rhodocanthopus ignavus* Kuwert, 1891;*Rhodocanthopus laticollis* Kuwert, 1891;*Rhodocanthopus mundus* Kuwert, 1891;*Rhodocanthopus curtus* Bates, 1886;*Rhodocanthopus maillei* Bates, 1886 (non Percheron, 1841);*Aponelides nescio* Kuwert, 1898;*Aponelides parabolicus* Kuwert, 1898;*Aponelides praestans* Kuwert, 1898;*Aponelides sincerus* Kuwert, 1898;*Aponelides singularis* Kuwert, 1898;*Aponelides superfluous* Kuwert, 1898;*Passalus spiniger* (Bates, 1886);*Rhodocanthopus spiniger* Bates, 1886;*Passalus spinipes* Gravely, 1918;*Passalus spinosus* (Kuwert, 1898);*Rhodocanthopus spinosus* Kuwert, 1898;*Rhodocanthopus biolleyi* Pangella, 1905;*Rhodocanthopus spineus* Kuwert, 1898, n. syn.;*Paxillus Macleay*, 1819;*Paxillus leachi* Macleay, 1819;*Passalus depressus* Drapiez, 1819;*Passalus brasiliensis* Lepeletier et Serville, 1825;*Rhodocanthopus anguliferoides* Kuwert, 1891;*Paxillus minor* Kuwert, 1891;*Paxillus parvus* Casey, 1897;*Paxillus consobrinus* Kuwert, 1898;*Paxillus denticulatus* Kuwert, 1898;*Paxillus latisternus* Kuwert, 1898;*Paxilloides schmidti* Kuwert, 1898;*Paxillus brasiliensis* Luederwaldt, 1931 (non Lepeletier et Serville, 1825)

Table 1 (Continued)

*Paxillus nitidior* Bechyné, 1943;  
*Ptichopus* Kaup, 1869;  
*Ptichopus angulatus* (Percheron, 1835);  
*Passalus angulatus* Percheron, 1835;  
*Passalus nodus* Apetz, 1837;  
*Passalus thoracicus* Smith, 1852;  
*Ptichopus aberrator* Kuwert, 1891;  
*Ptichopus borellii* Rosmini, 1902;  
*Ptichopus inca* Kuwert, 1891;  
*Ptichopus inflatus* Kuwert, 1898;  
*Ptichopus montezuma* Kuwert, 1891;  
*Ptichopus nitidus* Kuwert, 1891;  
*Ptichopus melzeri* Boucher, 2006 (non Luederwaldt, 1927).  
*Proculini* (35 species):  
*Arrox* Zang, 1905;  
*Arrox agassizi* (Kaup, 1871);  
*Sertorius agassizi* Kaup, 1871;  
*Sertorius assmanni* Kuwert, 1897;  
*Heliscus* Zang, 1905;  
*Heliscus eclipticus* (Truqui, 1857);  
*Passalus eclipticus* Truqui, 1857;  
*Popilius guatemalae* Gravely, 1918;  
*Popilius felschei* Kuwert, 1891;  
*Popilius varius* Kuwert, 1891;  
*Popilius frantzi* Kuwert, 1897;  
*Heliscus wagneri* (Kaup, 1868);  
*Passalus wagneri* Kaup;  
*Odontotaenius* Kuwert, 1896;  
<sup>a</sup>*Odontotaenius decipiens* (Kuwert, 1897);  
*Petrejoides decipiens* Kuwert, 1897;  
*Odontotaenius striatopunctatus* (Percheron, 1835);  
*Passalus striatopunctatus* Percheron, 1835;  
*Popilius mancus* Luederwaldt, 1931;  
*Popilius pedunculatus* Luederwaldt, 1931;  
*Oileus* Kaup, 1869;  
*Oileus sargi* (Kaup, 1871);  
*Rimor sargi* Kaup, 1871;  
*Rimor honestus* Kuwert, 1897;  
*Petrejoides* Kuwert, 1896;  
<sup>a</sup>*Petrejoides abnormalis* (Luederwaldt, 1941);  
*Popilius abnormalis* Luederwaldt, 1941;  
<sup>a</sup>*Petrejoides hirsutus* (Luederwaldt, 1941);  
*Popilius hirsutus* Luederwaldt, 1941;  
<sup>a</sup>*Petrejoides lenzi* (Kuwert, 1897);  
*Popilius lenzi* Kuwert, 1897;  
*Petrejoides subrecticornis* (Kuwert, 1897);  
*Soranus subrecticornis* Kuwert, 1897;  
*Popilius scutellopunctatus* Kuwert, 1897;  
*Petrejoides wagneri* Boucher, 2006 (non Kaup, 1868);  
*Petrejoides tau* (Kaup, 1869);  
*Pertinax tau* Kaup, 1869;  
*Passalus klingelhofferi* Kaup, 1869;  
*Soranus intergenus* Bates, 1886;  
*Popilius punctatissimus* Luederwaldt, 1941;  
*Petrejoides tenuis* Kuwert, 1897;  
*Popilius* Kaup, 1869;  
*Popilius erotylus* Reyes-Castillo & Castillo, 1992;  
<sup>a</sup>*Popilius rectangulatus* Luederwaldt, 1941;  
<sup>a</sup>*Popilius rotundicornis* Luederwaldt, 1941;  
*Pseudoarrox* Reyes-Castillo, 1970;  
<sup>a</sup>*Pseudoarrox karreni* Reyes-Castillo, 1970;  
*Spurius* Kaup, 1871;  
*Spurius bicornis* (Truqui, 1857);  
*Passalus bicornis* Truqui, 1857;  
*Verres* Kaup, 1871 [synonyms of *Neoverres costaricensis* Hincks, 1934,  
*Verres costaricensis* Luederwaldt, 1941 and *Verres luederwaldti*  
Reyes-Castillo, 1970 taken from Marshall, (2000)];

Table 1 (Continued)

*Verres cavicollis* Bates, 1886;  
*Verres camerani* Pangella, 1905;  
*Verres cavilabris* Casey, 1896;  
*Verres corticicola* (Truqui, 1857);  
*Passalus corticicola* Truqui, 1857;  
*Verres corticola* Kaup, 1871;  
*Verres angustatus* Kuwert, 1891, n. syn.;  
*Verres deficiens* Kuwert, 1891;  
*Verres deflexicornis* Kuwert, 1998, n. syn.;  
*Verres hageni* Kaup, 1871;  
*Verres hagenii* Kaup, 1871;  
*Verres cavifrons* Kuwert, 1891;  
*Verres sternipunctatus* Kuwert, 1891;  
*Verres vernicatus* Casey, 1897, n. syn.;  
*Verres cavicollis* Kuwert, 1898 (non Bates, 1886);  
*Verres muzoensis* Hincks, 1950;  
<sup>a</sup>*Verres longicornis* (Luederwaldt, 1934);  
*Platyverres longicornis* Luederwaldt, 1934;  
*Neoverres costaricensis* Hincks, 1934, n. syn.  
*Verres sternbergianus* Zang, 1905;  
*Verres costaricensis* Luederwaldt, 1941, n. syn.;  
*Verres luederwaldti* Reyes-Castillo, 1970, n. syn.;  
*Veturius* Kaup, 1871.  
Subgenus *Publius*  
*Veturius solisi* Boucher, 2006;  
*Veturius talamacaensis* Boucher, 2006;  
Subgenus *Ouayana*  
*Veturius cirratus* Bates, 1886;  
*Veturius criniceps* Kuwert, 1891;  
<sup>a</sup>*Veturius laevior* (Kaup, 1868);  
*Proculejus laevior* Kaup, 1868;  
*Veturius lineatosulcatus* Luederwaldt, 1941;  
*Veturius ptichopoides* Boucher, 2006;  
<sup>a</sup>*Veturius ultimus* Boucher, 2006;  
Subgenus *Veturius*  
*Veturius aquilonalis* Boucher, 2006;  
*Veturius aspina* Kuwert, 1898;  
*Veturius sinuatocollis* Kuwert, 1890;  
*Veturius sinuatosulcatus* Gravely, 1918;  
*Veturius aculeatus* Luederwaldt, 1941;  
*Veturius schusteri* Boucher, 2006;  
<sup>a</sup>*Veturius sinuatomarginatus* Luederwaldt, 1941;  
*Veturius tuberculifrons* Kuwert, 1891;  
*Veturius isthmicus* Arrow, 1907;  
*Veturius latisulcatus* Luederwaldt, 1941.

<sup>a</sup> Endemic species.

## Materials and methods

For the list of species, we follow the classification of Boucher (2006); for the descriptions, we use the terminology of Boucher (2006) for the cephalic region (except when indicated) and Reyes-Castillo (1970) for the rest of the body. We used a caliper for metric measurements; illustrations were made using a camera lucida. The specimens are deposited in the following entomological collections: Colección Entomológica del Instituto de Ecología, A. C., México (IEXA); Colección Nacional de Insectos del Instituto de Biología, Universidad Nacional Autónoma de México (CNI-UNAM); Colección Entomológica, Universidad del Magdalena, Colombia (CBUMAG-ENT); Colección de Artrópodos de la Universidad del Valle de Guatemala (UVGC); Michigan State University Collection

(MSUC); The Field Museum of Chicago (FMNH); and the personal collection of Dr. Alan Gillogly in Caldwell, USA (ARGC).

To elaborate the checklist (Table 1), we surveyed literature to gather information about the Passalidae from Costa Rica and reviewed material deposited in the collections cited above, and also we reviewed material from the American Museum of Natural History, New York (AMNH); United States National Museum of Natural History, Washington (USNM); California Academy of Sciences, San Francisco (CAS); Carnegie Museum of Natural History, Pittsburg (CMNH); Philadelphia Academy of Natural Sciences, Philadelphia (PANS); Museo de Historia Natural de Costa Rica, San José (MHNCR); Museo de Entomología de la Facultad de Agronomía de la Universidad Nacional Autónoma de Costa Rica, San José (MEUNCR); Centro Agronómico Tropical de Investigación y Enseñanza, San José (CATIEC), Museu de Zoologia da Universidade de Sao Paulo, Sao Paulo (MZSP); Institut Royal des Sciences Naturelles, Brussels (IRSN); Muséum National d’Histoire Naturelle, Paris (MNHN); and Museo di Zoologia della Università di Torino, Torino (MZUT).

## Descriptions

*Passalus (Pertinax) halffterorum* n. sp. (Fig. 1)

**Description:** Habitus: midsize, total length 24.0–28.9 mm, brachypterous, body convex shiny black. Head: labrum with anterior border straight or slightly concave, covered with scarce setae, setae are less dense in medial labrum. Clypeus hidden under the frons, with anterior angles strongly developed under the mediofrontal tubercles and of similar size as mediofrontal tubercles. Frons wide, anterior frontal edge with small middle indentation, without secondary mediofrontal tubercles. Mediofrontal tubercles projected forward, smaller than inner tubercles. Inner tubercles conical, with free apex, joined to mediofrontal tubercles by a weak ridge, placed mid distance between the mediofrontal tubercles and the central tubercle apex. Posterofrontal ridges “V” shaped. Area between the frontal ridges heavily punctuated on the anterior half. Cephalic mamelon (*sensu* Jiménez-Ferbans & Reyes-Castillo, 2014) present and whole. Mesofrontal structure of the “marginatus” type (Reyes-Castillo, 1970), with central tubercle wide at the base, with or without a sulcus in the posterior part, apex not free. Lateroposterior tubercles marked. Lateropostfrontal areas glabrous, shiny, and impunctate. Eyes reduced, with canthus covering  $\frac{1}{2}$  of the eye in lateral view. Canthus glabrous or with 3 setae at the margin of the eye. Postfrontal groove semicircular and complete. Hypostomal process slightly separated from mentum, glabrous and reaching the superior part of the middle zone of the mentum. Medial basal mentum protruding ventrally, with fine line of setae at the posterior margin and reduced punctures (4) on its anterior border. Mentum with large lateral fossae, deep, glabrous and opaque. Antennal club trilamellate, with lamellae short (h longer than w, Fig. 1A). Internal tooth of the left mandible bidentate, simple on the right mandible. Dorsal tooth straight in dorsal view and slightly concave in lateral view. Dorsal mandibular pubescence covering the base

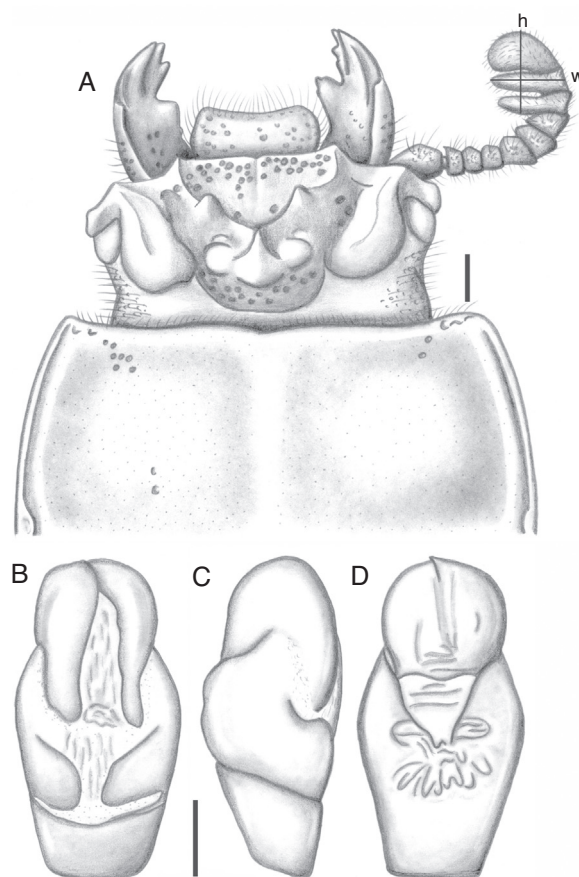


Figure 1. *Passalus (Pertinax) halffterorum* n. sp.; A, head and anterior part of pronotum; B, ventral view of aedeagus; C, lateral (left) view of aedeagus; D, dorsal view of aedeagus. Scale bars: 1 mm.

of the mobile tooth and reaching the base of the internal tooth. Mandibular fossae short, reaching only half of the base of the mobile tooth. Maxilla with lacinia bidentate at the apex. Ligula tridentate, with middle tooth longer than lateral teeth. Middle palpomere of the labial palp 1.2 times wider and with the same length as the distal palpomere.

**Thorax:** pronotum with anterior angles sharp and posterior angles rounded, wider than elytra, with punctuations restricted to the lateral fossae areas. Marginal groove wide, occupying  $\frac{3}{4}$  of the anterior margin of the pronotum, impunctate on the posterior half. Longitudinal sulcus well marked. Lateral fossae slightly marked, with 2 punctures on the right side and smooth on the left side. Punctures of the pronotum restricted to the marginal groove and fossae. Prosternellum rhomboidal, shiny. Pre-epimeron (*sensu* Reyes-Castillo, 1970) shiny and glabrous. Mesosternum without mesosternal scar, indicated only by an opaque anterior area, impunctate and glabrous; lateral area opaque. Posterior corner of the mesepisternum and mesepimere glabrous. Anterolateral part of metasternum smooth and glabrous, but with moderate punctures with 1–2 minute setae on the sides of mesocoxae. Metasternal disc short, strongly convex posteriorly, with dense strong punctures, rarely with 1 or 2 punctures; delimited by numerous strong punctures medially and posteriorly. Posterior metasternal

lateral fossa of the same width as epipleura and narrower than mesotibia.

*Elytra*: shiny, anterior border rounded and glabrous. Humeri with scarce minute setae. Epipleura with reduced group of short setae basally. Striae with rounded punctures, marked on both lateral and dorsal striae.

*Legs*: femur I with ventral anterior marginal sulcus wide and incomplete, not reaching the apical pubescence. Tibia I with dorsal sulcus complete or incomplete. Tibia II with 2 strong spines and 1 weak spine. Tibia III with moderately strong spine.

*Abdomen*: last sternite with marginal groove incomplete.

*Aedeagus*: basal piece partially fused with parameres in ventral view (Fig. 1B). Median lobe almost entirely sclerotized on ventral surface, length is 1.1 times the length of the basal piece and parameres, measured at the median ventral line. Lateral projections of the parameres large and apex truncated in lateral view (Fig. 1C).

*Variation*: the medial part of the mentum completely glabrous or with a line of setae on its posterior margin, rarely completely pubescent. Some specimens without left pronotal fossa, others with up to 3 punctures in each fossa. Some with small mesosternal scars. Mesotibia in MSU specimen with 3 weak spines on left, 1 strong and 1 weak on right.

#### Taxonomic summary

*Holotype male*. Costa Rica: Villa Mills, Cerro de la Muerte, “53”, 18.II.1975/*Passalus (Pertinax)* sp. nov. Reyes-Castillo det. 1987 (IEXA).

*Paratypes* (2♀♀, 1♂ and 44 sex unknown). Costa Rica: Villa Mills, Cerro de la Muerte [with numbers 48, 49, 50, 53, 54 in each specimen], 18.II.1975/*Passalus (Pertinax)* sp. nov. Reyes-Castillo det. 1987 (5 specimens, sex unknown, IEXA). 2♀♀, Costa Rica: San José, C. de la Muerte, Auxiliadora, 2,700 m snm, 1.IX.2000, I. Chacon y J. Monzón. (UVGC). Costa Rica: Prov. San José. San Isidro del General Cerro de la Muerte. 23.IX.1969. P. Reyes y G. Halffter, cols./Bosque de Encinos. alt. 2,750 m. En tronco de encino (8 specimens, sex unknown, 7 IEXA, 1 FMNH). Costa Rica: Prov. San José. Villa Mills. 23.IX.1969 P. Reyes y G. Halffter, cols./Bosque de Encinos. alt. 2,750 m. En tronco podrido (13 specimens, sex unknown, 10 IEXA, 3 CBUMAG-ENT); same data as previous 19.IX.1969/Bosque de encino. alt. 2,680 m. En tronco podrido (3 specimens, sex unknown, IEXA); same data as previous 20.IX.1969 (4 specimens, sex unknown, IEXA). Costa Rica: San José. Villa Mills. Elv. 3,075 m. 14.VIII.1967 [R. Pope, leg.] (10 specimens, sex unknown, 5 IEXA, 5 CBUMAG-ENT). Costa Rica, Cerro de la Muerte 25.VIII.1970 Pat Rich (1 specimen, sex unknown, MSUC). Costa Rica, 31 mi.[km?] SSE Cartago, Tres de Junio Mountain, 7.II.1971, under log, R. Foster (1♂, 4 specimens, sex unknown, ARGC).

*Etymology*: this species is named in honor of Gonzalo Halffter and Violeta Halffter, distinguished coleopterists, founders of the Instituto de Ecología, A.C., Xalapa, with whom the second author (PRC) had the privilege of collecting passalids in Costa Rica with the support of the OTS.

#### Remarks

*Passalus halffterorum* n. sp. has the middle tibiae armed and reduced eyes, similar to *Passalus spinosus* and *Passalus spiniger*; however, in these latter species the posterior tibiae are strongly armed and the frontal ridges have secondary internal teeth, different from *P. halffterorum* n. sp. Likewise, a distinct characteristic of *P. halffterorum* n. sp. is the evident hind wing reduction (brachypterous), with the pronotum wider than the base of the elytra.

*Passalus (Pertinax) rzedowskiorum* n. sp. (Fig. 2)

*Description*: habitus: midsize, total length 26.0–35.8 mm, hemibrachypterous, body convex shiny black. Head: labrum with anterior border slightly concave, covered with scarce setae that are less dense anteromedially. Clypeus hidden under the frons, with anterior angles reduced, placed under the mediofrontal tubercles, smaller than mediofrontal tubercles. Frons wide, anterior frontal edge with light or strong medial indentation (notched), without secondary mediofrontal tubercles. Mediofrontal tubercles projected forward, larger than inner tubercles. Inner tubercles conical, projected upwards, joined to mediofrontal tubercles by a weak ridge, placed at mid distance between the mediofrontal tubercles and the central tubercle apex. Posterofrontal ridges “V” shaped. Area between frontal ridges heavily punctate on the anterior half. Cephalic mamelon (*sensu* Jiménez-Ferbans & Reyes-Castillo, 2014) present and whole. Mesofrontal structure of the “marginatus” type (Reyes-Castillo, 1970), with central tubercle wide at the base, without a sulcus posteriorly, apex not free. Lateroposterior tubercles marked. Lateropostfrontal areas glabrous, shiny, and mostly impunctate, but with conspicuous striae. Eyes reduced, with canthus covering 2/3 of the eye in lateral view. Canthus glabrous. Postfrontal groove complete with an inverted “V” at the mid-part. Hypostomal process slightly separated from mentum, glabrous and reaching the upper part of the mid zone of the mentum. Medial-basal mentum protruding ventrally, pubescent on the posterior half. Mentum with big lateral fossae, deep and glabrous. Antennal club trilamellate, with short lamellae. Mandibles tridentate on the apex, with teeth of similar size. Internal tooth of the left mandible bidentate, simple on the right mandible. Dorsal tooth straight in dorsal view and slightly concave in lateral view. Dorsal mandibular pubescence covering the base of the mobile tooth and reaching the base of the internal tooth. Mandibular fossae covering entirely the base of the mobile tooth. Maxilla with lacinia bidentate at the apex. Ligula tridentate, with middle tooth longer and lateral teeth reduced. Middle palpomere of the labial palp 1.5 times wider and with almost the same length as the distal palpomere.

*Thorax*: pronotum square, with anterior angles sharp and posterior angles rounded, slightly wider than elytra, with punctuations restricted to the lateral fossae area (1 or 2 punctures) and marginal groove. Marginal groove wide, occupying 1/2 of the anterior margin of the pronotum. Longitudinal sulcus well marked. Lateral fossae slightly marked, with or without punctures. Prosternellum rhomboidal. Pre-epimeron (*sensu* Reyes-Castillo, 1970) shiny and glabrous. Mesosternum with

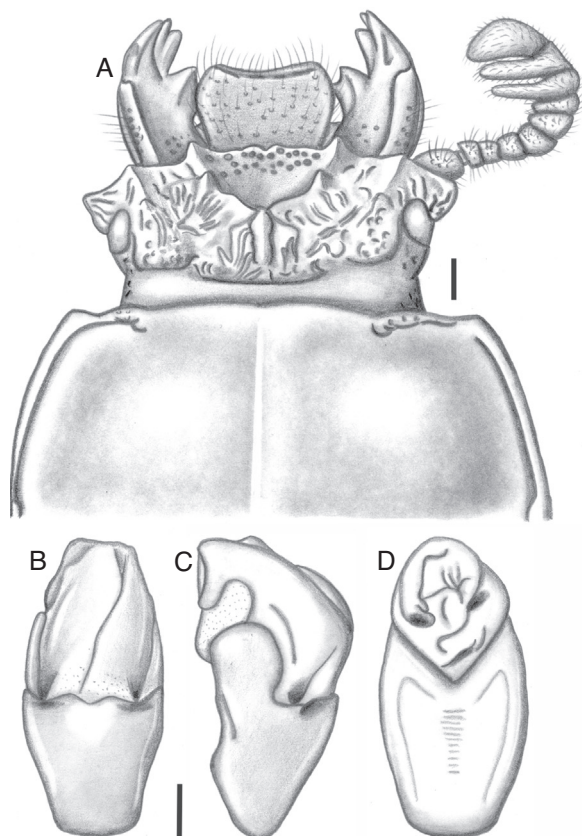


Figure 2. *Passalus (Pertinax) rzedowskiorum* n. sp.; A, head and anterior part of pronotum; B, ventral view of aedeagus; C, lateral (left) view of aedeagus; D, dorsal view of aedeagus. Scale bars: 1 mm.

mesosternal scar slightly marked, oval shaped, impunctate and glabrous; lateral area opaque. Posterior corner of the mesepisternum and mesepimere glabrous. Anterolateral part of metasternum smooth and glabrous. Metasternal disc short, slightly convex posteriorly, without or with scarce punctures (4); delimited by numerous punctures medially and posteriorly. Posterior metasternal lateral fossa narrower than epipleura.

**Elytra:** shiny, anterior border rectangular and glabrous. Humeri and epipleura glabrous. Striae with rectangular punctures, marked on both lateral and dorsal striae.

**Legs:** femur I with ventral anterior marginal sulcus wide and complete, reaching the apical pubescence. Tibia I with dorsal sulcus complete or incomplete. Tibia II with 1 strong spine and 1 weak spine. Tibia III with moderately strong spine.

**Abdomen:** last sternite with marginal groove incomplete.

**Aedeagus:** basal piece fused with parameres in ventral view (Fig. 2B). Median lobe almost entirely sclerotized on ventral surface, length is 1.1 times the length of the basal piece and parameres, measured at the medial ventral line. Lateral projections of the parameres large and apex rounded in lateral view (Fig. 2C).

**Variation:** the notch in frons can be well marked (deep) or weak. The metasternal disc can be smooth or with scarce punctures (4 punctures).

#### Taxonomic summary

**Holotype male.** Costa Rica: Prov. San José. San Isidro del General 21.IX.1969. P. Reyes y G. Halffter, cols./Selva tropical de montaña, alt. 1480 m. en tronco podrido (IEXA).

**Paratypes** (3♀♀ and 8 sex unknown). 1♀ and 2 sex unknown, Costa Rica: Prov. San José, San Isidro del General. 21-IX-1969. P. Reyes y G. Halffter, cols./Selva tropical de montaña, alt. 1,480 m. en tronco podrido (IEXA). 2♀♀ and 2 sex unknown, Costa Rica: Prov. San José, San Isidro del General, 22.IX.1969. P. Reyes y G. Halffter, cols./Selva tropical de montaña, alt. 1,480 m. en tronco podrido, (3 IEXA, 1 CBUMAG-ENT). 2 sex unknown, Costa Rica: Prov. San José, Rd. to San Isidro el General, ~2700 m, 6.II.1979. N. Rizzo (UVGC). 1 sex unknown, Costa Rica: Prov. San José, PanAmerican Hwy, km 70. Mirador del Quetzal. 9°38'37" N, 83 51'2" W. 2,690 m. 20.VII.2000. J. Asche, R. Brooks, Z. Falin CR1 ABFOO 198 ex. under logs//SMO 204354 KUNHM-ENT (UVGC). 1 sex unknown, Costa Rica: P.N. Tapanti, La Esperanza 2680 m Monzón y Camposeco/*Passalus (Pertinax)* sp. nov. det.: Jiménez-Ferbans (UVG).

**Etymology:** this species is named in honor of Jerzy Rzedowski and Graciela Calderón de Rzedowski, emeritus researchers of the Instituto de Ecología A.C., for their contributions and studies on taxonomy and biogeography of the Mexican flora.

**Taxonomic remarks:** the meso- and metatibiae with moderate strong spine relates *P. rzedowskiorum* with the *Rhodocanthopus* species group (*sensu* Jiménez-Ferbans, Reyes-Castillo, & González, 2016), especially with species with strong elytral striae. However, the shape of anterior part of elytra (humeri very acute) and the body size easily distinguish *P. rzedowskiorum*. Another characteristic trait of *P. rzedowskiorum* is its lateropostfrontal areas (frontal fossae *sensu* Reyes-Castillo, 1970) with conspicuous striae.

#### Nomenclatural comments of the checklist

*Passalus (Pertinax) clypeoneleus* (Kuwert, 1891): Hincks and Dibb (1935) considered *Rhodocanthopus spineus* Kuwert, 1898 as a synonym of *P. clypeoneleus*. However, here we synonymized *R. spineus* Kuwert with *Passalus spinosus* (Kuwert). As established in this work, *Rhodocanthopus formosiceps* Kuwert, 1891, which is considered a synonym of *Passalus caelatus* Erichson, is actually a synonym of *Passalus clypeoneleus* (Kuwert). These proposals are based on examination of the type material of these 4 species, deposited in the Museum National d'Histoire Naturelle in Paris.

*Verres corticicola* (Truqui, 1857): Hincks and Dibb (1935) considered *Verres angustatus* Kuwert, 1891 as a valid species. Examination of the type material of *V. angustatus*, deposited in the Museum National d'Histoire Naturelle in Paris, allows us to propose this species as a synonym of *Verres corticicola* (Truqui).

*Verres deficiens* Kuwert, 1991: in the catalogue of Hincks and Dibb (1935), *V. deficiens* Kuwert is considered as a synonym of *V. furcibrabis* (Eschscholtz). We have examined the type material of *V. deficiens* and consider it as a valid species. Likewise, we have examined the type material of *Verres deflexicornis* Kuwert,

1998 and this species must be considered as synonym of *Verres deficiens* Kuwert. The types of Kuwert's species are deposited in the Museum National d'Histoire Naturelle in Paris.

*Verres hageni* Kaup, 1871: *V. vernicatus* Casey, 1897 was revalidated by Hincks (1950) in his key to the species of *Verres*. After examining the type material, deposited in the United States National Museum, Smithsonian Institution in Washington, D.C., we propose *V. vernicatus* Casey, as a synonym of *Verres hageni* Kaup.

#### *Species with erroneous or dubious literature records*

*Passalus (Pertinax) perparvulus* (Kuwert): cited from Costa Rica by Pangella (1905). We have examined the specimen studied by Pangella (1905) (deposited in MZUT) and it is very similar to small specimens of *P. caelatus* Erichson, with which it could be a synonym.

*Passalus (Pertinax) spinipes* Gravely: originally described from Nicaragua, Hincks (1934) cited it from Costa Rica; we have not studied specimens from Costa Rica.

*Passalus (Passalus) interruptus* (Linnaeus): a species from South America, its distributional northern boundary is the Panama Canal (Reyes-Castillo & Castillo, 1992). The Costa Rican specimens cited as *P. interruptus* may correspond to *P. (Passalus) punctiger* Lepeletier & Serville. Following the criterion of Reyes-Castillo and Castillo (1992), we have excluded this species from the list.

*Passalus (Passalus) labroexcisus* (Kuwert): described by Kuwert (1898) based on 1 specimen without locality, was considered a synonym of *P. punctiger* Lepeletier & Serville in the catalogue of Hincks and Dibb (1935). However, *P. labroexcisus* was treated as a valid species by Luederwaldt (1934a), who studied a specimen of the A. Alfaro collection from "Costa Rica, Tempisque, I-1932". Finally, Hincks and Dibb (1958) followed the criterion of Luederwaldt (1934a) and assigned it to the "Phoroneus" section of *Passalus*.

*Passalus (Passalus) nevermanni* Luederwaldt, 1941: described from Costa Rica in a posthumous publication, this species would correspond to a synonym of *P. (Passalus) punctiger* Lepeletier & Serville. In the description, Luederwaldt (1941) only cited a specimen from "Costa Rica, I-1933" in the collection of F. Nevermann.

*Yumtaax recticornis* (Burmeister): cited from "La Palma", Costa Rica by Alfaro (1935), is a montane species endemic to Mexico (Castillo & Reyes-Castillo, 1984). We have excluded this species from the list.

*Heliscus wagneri* (Kaup): although the original description by Kaup (1868) cites a specimen from Guatemala, a later work (Kaup, 1871: 108–109) only mentions 2 specimens from Nicaragua; it is cited from Costa Rica by Biolley (1901); Reyes-Castillo (1970) confused it with *Petrejoides subrecticornis* (Kuwert). We have not seen specimens or the type.

*Proculus mniszehi* Kaup: this species was cited from the humid mountains of Carrillo (Braulio Carrillo, National Park) in Costa Rica by Alfaro (1935). However, it is endemic to Guatemala and Honduras (Schuster, Cano, & Reyes-Castillo, 2003) and we know of no specimens from Costa Rica. We have excluded this species from the list.

*Veturius (Publius) crassus* (Smith): is described from Colombia; Luederwaldt (1934b) cited it from Costa Rica as did Alfaro (1935) from Volcán Irazú (3,400 m). However, Reyes-Castillo and Castillo (1992) rejected that citation, indicating that *V. crassus* is endemic to Colombia; the same was said by Boucher (2006). We have excluded this species from the list.

## Discussion

We have listed 53 species of Passalidae of Costa Rica (18 Passalini and 35 Proculini). This is a relative high level of richness, considering that Costa Rica has an area of 51,100 km<sup>2</sup>, compared with the number of species in larger countries like Guatemala (90 species), Mexico (83 described species and 22 not described, Reyes-Castillo, Rojas-Gómez, & Vázquez, 2006) and Colombia (87, Amat-García, Blanco-Vargas, & Reyes-Castillo, 2004).

Proculini dominate the composition of Passalidae in Costa Rica, similar to what occurs in Guatemala and Mexico, but different from what occurs in South America. However, a high percentage of Costa Rican Proculini (35 species) belong to *Veturius* (12 species), which is a highly diversified genus in South America. The other speciose genera in Costa Rica are *Petrejoides* and *Verres* (6 species each), which have an important level of diversification in the southern part of Central America. On the other hand, Passalini are dominated by *Passalus (Pertinax)* having 11 of the 18 species of the tribe; of these 11 species, 6 belong to the *Rhodocanthopus* species group (*sensu* Jiménez-Ferbans, Reyes-Castillo, & González, 2016), which has a clear Mesoamerican lowland distribution (Jiménez-Ferbans et al., 2016).

There are 13 endemic species of Passalidae in Costa Rica, most of them distributed in mountainous areas. The genus with more endemic species is *Petrejoides*, in which 3 of the 6 species are exclusive for Costa Rica. Likewise, the genus *Veturius* shows a high level of endemism in the region of the Sierra de Talamanca (between Costa Rica and Panama). This pattern of endemism in the high mountain area is common in Passalidae from Mexico to northern South America (Gutiérrez-Velázquez, Rojas-Soto, Reyes-Castillo, & Halffter, 2013; Schuster, 1978), and normally is dominated by species of Proculini and species of *Passalus (Pertinax)*.

Concluding, the Costa Rican passalid fauna is relatively well known compared to nearby countries. However, more exploration is required in habitats with the highest levels of endemism (i.e. montane cloud forests), in order to complete the list of the Passalidae of this country.

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