

## Two new species and a new subspecies of Easter Egg weevils from the *Pachyrhynchus schoenherii* Heller, 1924 Species Group (Coleoptera, Curculionidae, Entiminae, Pachyrhynchini) from Eastern Mindanao, Philippines

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Two new species and a new subspecies of easter egg weevils from Eastern Mindanao, Philippines are described; *Pachyrhynchus mandaya* Agbas, Obrial, Pajota, & Cabras sp. nov., *Pachyrhynchus mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov., and *Pachyrhynchus jhonnevillegasi* Agbas, Obrial, Medina, Cabras sp. nov. Brief notes of species ecology and variability are also presented.

**Keywords:** biodiversity, novel species, taxonomy, weevils

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## INTRODUCTION

The genus *Pachyrhynchus* Germar, 1842, is a group of flightless weevils under the tribe Pachyrhynchini, known for their highly intricate and distinctive colorful elytral maculation, often forming iridescent patterns. The genus has over 165 described species, of which roughly 94% are endemic to the Philippines. Accordingly, the country serves as the center of its diversity, while the rest of the species are known to occur in Indonesia, Taiwan, and Japan (Schultze, 1923; Rukmane, 2018; Bollino, 2022; Cabras et al., 2022). Members of the genus *Pachyrhynchus*, like other species within the tribe Pachyrhynchini, demonstrate a high degree of endemism, primarily inhabiting a restricted geographic range, particularly in montane ecosystems, making them valuable subjects for biogeographical analysis studies.

At the time of Germar's establishment of the genus *Pachyrhynchus* in 1824, the full extent of its diversity and systematics was not yet recognized. It was not until the early 20th century, through the taxonomic works of Heller (1912; 1921; 1924a; 1924b) and

Schultze (1922a; 1922b; 1923; 1924; 1925; 1934), that the species diversity of the genus began to be more clearly defined, with the description of more novel species and the establishment of species groups. However, for nearly a century, research on this taxon remained dormant. It was not until Yoshitake described *Pachyrhynchus apoensis* in 2012 that the study of the genus *Pachyrhynchus* regained significant taxonomic momentum. Since then, taxonomic research on the genus has continued to progress, with the description of more novel species (Bollino & Sandel, 2015; Rukmane & Barsevkis, 2016; Cabras & Rukmane, 2016; and Bollino et al., 2017). Alongside these taxonomic efforts, studies on the genus *Pachyrhynchus* have expanded to include research into its phylogeny, ecology, and the unique physical properties of its scales, further enriching our understanding of the genus (Tseng et al., 2014; Cabras & Dela Cruz., 2016; Huang et al., 2018; Tseng et al., 2020; Van Dam et al., 2023; Parisotto et al., 2022).

One notable species group within this genus that rapidly gained taxonomical attention in the past decade is the *Pachyrhynchus*

*schoenherii* species complex, which is typified by *Pachyrhynchus schoenherii* Waterhouse, 1841. Members of this species group share a distinct combination of morphological traits, including a dark glowing red integument with minimal green tinges, a subspherical prothorax, a pair of scaly patches on each side in the middle of the pronotum, and each elytron with the following scaly markings: two basal spots, two spots in the median portion, one postmedian spot, and one subapical spot (Bollino et al., 2017). Additionally, all species under the *P. schoenherii* species group are exclusively distributed within the Mindanao Pleistocene Aggregate Island Complex (PAIC), which includes the islands of Samar, Leyte, Bohol, Dinagat, Siargao, Bucas Grande, Basilan, and mainland Mindanao.

One of the remaining strongholds of intact forest ecosystems in the Mindanao PAIC is the Eastern Mindanao Biodiversity Corridor (EMBC) (Critical Ecosystem Partnership Fund, 2001). The EMBC primarily constitutes forest ecosystems with mid to high elevations bordering Mindanao's eastern coast, stretching from Dinagat Island to the north and Mt. Hamiguitan range to the south (PEF, CIP, & DENR, 2008; PEF, CIP, & DENR, 2011). The corridor traverses seven provinces within Region Eleven (XI) and Thirteen (XIII), more commonly known as the regions of Davao and Caraga (PEF, CIP, & DENR, 2008). Within EMBC are nine (9) identified Key Biodiversity Areas (KBAs)- three of which are situated in the Davao Region, particularly in Davao Oriental and Davao de Oro. KBAs are important components of forest biomes as these areas serve as critical habitats for ecologically important and range-specific species (PEF, CIP, & DENR, 2008). Among the three (3) KBAs in Davao region, only Mt. Hamiguitan has been declared as a Protected Area (PA) by the Department of Environment and Natural Resources-

Biodiversity Management Bureau (DENR-BMB) through the National Integrated Protected Areas System (NIPAS) and Expanded National Integrated Protected Areas System (E-NIPAS). The two remaining Key Biodiversity Areas, Mt. Agtuuganon-Pasian and Mt. Kampalili-Puting Bato are currently unregulated but are potential candidates for designation as Protected Areas. The latter also referred to as the Mt. Kampalili-Puting Bato-Mayo complex, is a remarkable mountain range that blankets parts of the municipalities of Banaybanay, Lupon, Mati, Tarragona, Manay, Caraga, Baganga, New Bataan, Maragusan (San Mariano), Maco, Mabini, and Pantukan. Recent biodiversity assessments conducted in this mountain complex have led to the discovery of range-restricted species of weevils, further highlighting its ecological significance (Patano et al., 2022; Agbas et al., 2024; Obrial et al., 2024).

In this paper, three new species of jewel weevils belonging to the *Pachyrhynchus schoenherii* species group from the Mt. Kampalili-Puting Bato mountain complex are described and illustrated. Notes on their ecology, habitat, and geographic distribution are also presented. An updated checklist of the species belonging to the *P. schoenherii* species group is provided as well.

## MATERIALS AND METHODS

The specimens described in this paper were collected by sheet beating and hand picking and then killed in vials with 95% ethyl alcohol. Morphological characters were observed under Luxeo 4D and Nikon SMZ745T stereomicroscopes. The illustrations, as well as the treatment of the genitalia, followed that of Yoshitake (2011). Due to the little or almost no use of the chitinous structures of the female genitalia in identifying and characterizing the species of

Pachyrhynchini (Bollino et al. 2020), these anatomical parts are no longer illustrated. Images of the habitus and genitalia were taken using a Nikon D5300 digital camera with a Sigma 18–250 macro lens. All images were stacked and processed using a licensed version of Helicon Focus 6.7.0 and Photoshop CS6 Portable software. Label data are indicated verbatim.

Abbreviations and symbols mentioned in this paper are abbreviated as follows:

/ different lines;

// different labels;

$\bar{a}$  arithmetic mean;

**LB** length of the body in dorsal view, from the apical margin of the pronotum to the apices of the elytral;

**LE** length of the elytra in dorsal view, from the level of the basal margins to the apices of the elytral;

**LP** length of the pronotum, from the base to apex along the midline;

**LR** length of the rostrum

**WE** maximum width across the elytra;

**WP** maximum width across the pronotum;

**WR** maximum width across the rostrum.

Comparative materials and specimens used in the study are deposited in the following institutional collections:

**BMNH** - British Museum of Natural History, London, United Kingdom

**CAS** - California Academy of Sciences

**CFS** - Private Collection of Francisco

Sandle, Miane, Italy

**CMN** – Canada Museum of Nature, Ottawa, Canada.

**CMU-MZ** - Central Mindanao University, University Museum, Zoological Section, Bukidnon, Philippines

**DGC** - Daven and Graden private collection, City of Mati, Philippines

**DUBC** - Daugavpils University Beetle Collection, Daugavpils, Latvia

**KUM** - The Kyushu University Museum, Fukuoka, Japan

**MBLI** - Private collection of Maurizio Bollino, Lecce, Italy

**MMCP** - Milton Medina Personal Collections, Tagum City Philippines.

**NIAES** - National Institute for Agro-Environmental Sciences, Tsukuba, Japan

**PCKS** - Private Collection of Kaoru Sakai, Tokyo

**PNM** - Philippine National Museum of Natural History under the National Museum of Natural History, Philippines

**SMTD** - Senckenberg Natural History Collections, Dresden, Germany

**TIRLA** - Terrestrial Invertebrate Research Laboratory, City of Mati, Philippines

**UMCRC** - University of Mindanao Coleoptera Research Center, Davao City, Philippines

## TAXONOMY

*Pachyrhynchus mandaya* Agbas, Obrial, Pajota, & Cabras sp. nov. (Fig. 1 A–D)

**Material. Holotype** (Fig. 1A, C), male: Philippines – Mindanao / Davao Oriental / Tarragona / Brgy. Limot / Mt. Mayo Range / iii.2022 / Lg. D. Agbas, Rylle Anubar & G. Obrial/ coll. DGC (typed on white card) // HOLOTYPE ♂ / *Pachyrhynchus mandaya* / Agbas, Obrial, Pajota & Cabras sp. nov. (typed on red card). Presently in TIRL, it will be at PNMNH.

**Paratypes.** 18 ♂♂, 23 ♀♀): same data with holotype. All Paratypes with additional yellow labels. Paratype deposition: 1♂ and 2♀♀ to be deposited in PNM; 1♂ and 2♀♀ to be deposited in CNM; 1♂ and 1♀ deposited in MMCP; 3♂♂ and 4♀♀, deposited in UMCRC; 9♂♂ and 11♀♀, deposited in DGC; 2♂♂ and 2♀♀, to be deposited in SMTD; 1♂ and 1♀, to be deposited in DUBC.

**Diagnosis:** *Pachyrhynchus mandaya* Agbas, Obrial, Pajota, & Cabras sp. nov. belongs to

the *P. schoenherri* species complex and is closely related to *P. esperanza* Bollino, Sandel, and Rukmane, 2017 collected from Esperanza, Agusan del Sur, *P. mandaya maragusanensis* Agbas, Obrial, & Cabras ssp. nov., and *P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras sp. nov.. However, it differs from these congeners having several different morphological characteristics. The eyes of *P. mandaya* Agbas, Obrial, Pajota, & Cabras sp. nov. are more convex and positioned laterally on the head (vs. less convex and situated more dorsally in *P. esperanza*). Dorsally, *P. mandaya* Agbas, Obrial, Pajota, & Cabras sp. nov. has a slenderer elytra with a weakly convex lateral profile and a subacute apex (vs. broader elytra with a subobtusate apex in *P. esperanza*). Laterally, the dorsal profile of *P. mandaya* Agbas, Obrial, Pajota, & Cabras sp. nov. elytra is slimmer with a subacuminate apex (vs. broader dorsal elytral profile and a subacute apex, where the ventral margin of the apical region is slightly arcuate in *P. esperanza*). While both species appear similar, *P. mandaya* Agbas, Obrial, Pajota, & Cabras sp. nov. can be easily distinguished by having a slender body and unique variations of scaly markings as discussed in the taxonomic notes and shown in Fig. 2, A-F, which are absent in the type series of *P. esperanza*, where the only observed variation is the presence of longitudinal scaly markings on the dorsal surface of each elytron. Some variations of *P. mandaya* Agbas, Obrial, Pajota, & Cabras sp. nov. also resembles *P. mandaya maragusanensis* Agbas, Obrial, & Cabras ssp. nov. and *P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras sp. nov. but differ based on the following characteristics: Eyes as viewed dorsally weakly convex, far apart,

weakly pronounced on outer margin of head (vs. very weakly convex, not pronounced on outer margin of head in *P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras sp. nov.). Head, subglabrous with a patch of conspicuous sparse punctures at forehead between eyes (vs. subglabrous, very weakly rugose in *P. mandaya maragusanensis* Agbas, Obrial, & Cabras ssp. nov.). Basal half of rostrum at sides, posteriorly, weakly elevated, gradually declined anteriorly, forming a distinct subtriangular depression (vs. bilobed, fan-shaped depression in *P. mandaya maragusanensis* Agbas, Obrial, & Cabras ssp. nov., and an indistinct subtriangular depression in *P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras sp. nov.), sides of apical third of basal half weakly rugose; apical half, weakly depressed on distal sides of rostrum anteriorly (vs. smooth with no conspicuous projections in *P. mandaya maragusanensis* Agbas, Obrial, & Cabras ssp. nov. and *P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras sp. nov.) (Fig. 6, A). Aedeagus of *P. mandaya* Agbas, Obrial, Pajota, & Cabras sp. nov. as viewed dorsally is lanceolate with a pointed apex (vs. blunt apex of *P. mandaya maragusanensis* Agbas, Obrial, & Cabras ssp. nov., and subacute for *P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras sp. nov.) (Fig. 6, D-F). Furthermore, *P. mandaya* Agbas, Obrial, Pajota & Cabras sp. nov. is easily distinguished from its sub species, *P. mandaya maragusanensis* Agbas, Obrial, & Cabras ssp. nov. by the presence of distinct scaly patches (Fig. 2), which are absent in latter. *P. mandaya* Agbas, Obrial, Pajota & Cabras sp. nov. variations were observed restricted from the type locality (see taxonomic notes below).

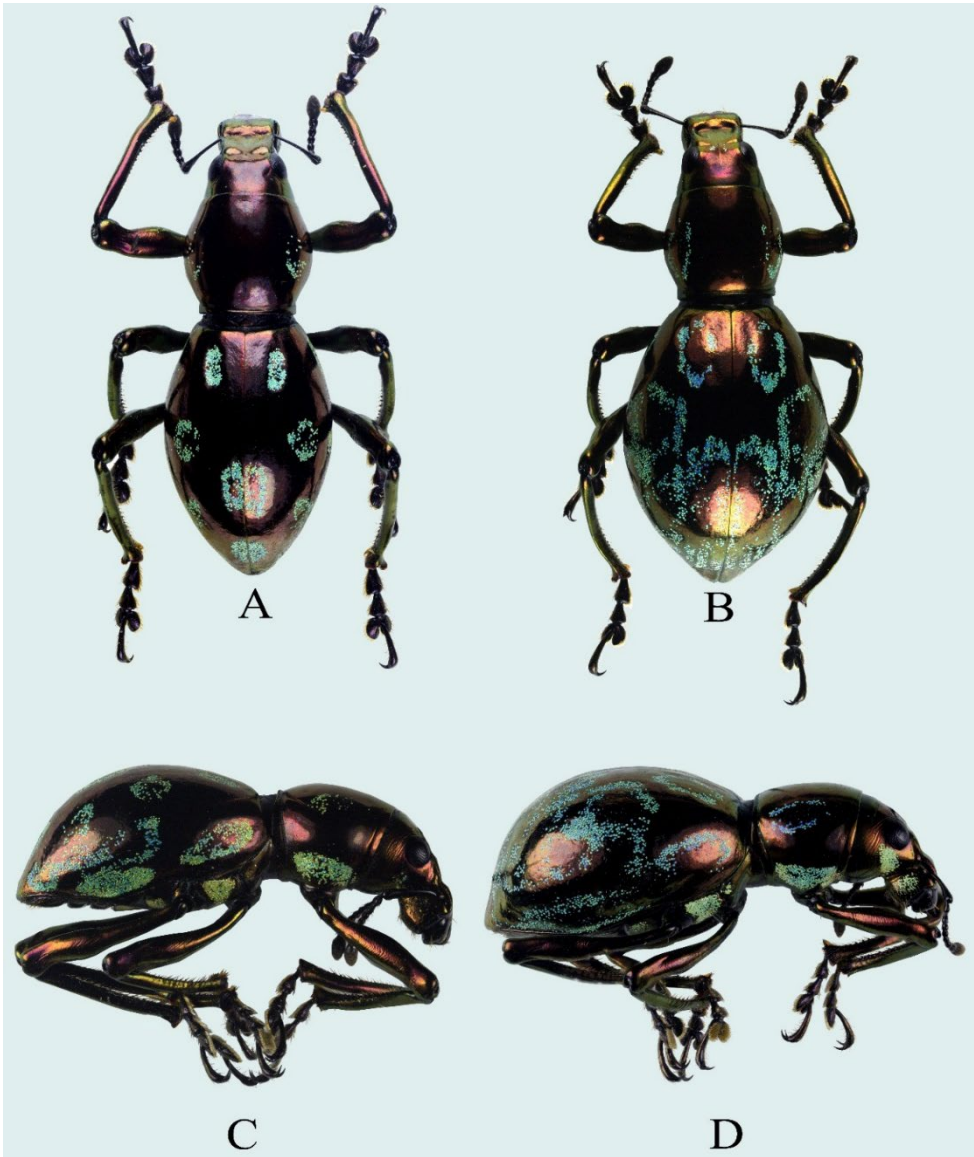


Fig. 1. Habitus of *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov.. A) Male holotype in dorsal view. B) Female habitus in dorsal view. C) Male holotype in lateral view. D) Female paratype in lateral view.

**Description male.** Dimensions: LB: 9.8mm–12.5mm (holotype 12.5mm). LR: 1.4mm–2.2mm (holotype 2.2mm). WR: 1.2mm–1.9mm (holotype 1.8mm). LP: 2.5mm–3.8mm (holotype 3.6mm). WP: 2.8mm–4.2mm (holotype 4.0mm). LE: 6.8mm–8.3mm (holotype 8.3mm). WE: 4.0mm–5.4mm (holotype 5.4mm). N=19.

**Integument** metallic, dark burgundy. Body dorsal surface, rostrum, head, lustrous, ventral surface, moderately lustrous. Body mostly subglabrous with sparse, fine setae and iridescent green, round scales. Head subglabrous, with sparse punctures on dorsum; forehead between eyes flattish with distinct patch of punctures at middle; lateral and lateroventral surfaces before hind margin of eyes rugose. Eyes as viewed dorsally slightly convex, weakly prominent on outer margin of head. Rostrum longer than wide (LR/WR: 2.2mm/1.8mm), raised in both sides at two-thirds of basal half, gradually declining towards apical third of basal half forming a distinct triangular depression with a conspicuous truncate base, extending to lateral margin of rostrum, weakly rugose at sides, abruptly, shortly raised towards basal third of apical half; Apical half bulging, weakly depressed on each side of disc at basal third viewed dorsolaterally. Apical half sparsely punctured; Lateral surface, with a few, iridescent, light-green to yellowish, subappressed scales, interspersed with minute setae and few sparse, short brown setae getting longer towards anterolateral margin (Fig. 1, C). Antenna, scape clavate, shorter than funicle, with sparse, thin and very short subappressed setae, longer at apical half, oriented towards apex. Funicle with longer suberect brown setae. Funicular segment I nearly two times longer than wide; segment II twice longer than wide, as long as segment I; segments III–V nearly as long as wide; Segment VI slightly longer and wider than segment V; segment VII slightly longer than wide; club sub-ovoid, twice longer than

wide. Prothorax subglobular, wider than long (LP/WP: 3.6mm/4.0mm), widest at middle, convex lateral contour in dorsal view, sparsely covered with minute punctures and minute sparse subappressed setae. Prothorax with the following scaly markings of sparse, turquoise with yellowish sheen round scales: a) few scaly patches on each side of disc and b) lateral surface near coxae, with tessellated scaly patch, thick at sides, sparse at middle. Elytra long, narrowly ovate (LE/WE: 8.3mm/5.4mm), wider and more than twice longer than prothorax (WE/WP: 5.4mm/4.0mm, LE/LP: 8.3mm/3.6mm), subglabrous, weakly convex, covered with sparse, minute, fine, subappressed setae. Each elytron with scaly patches of round, iridescent, green-bluish green scales forming the following: a) two scaly patches, one small oblongate, dorsally near base and one larger, ovate scaly patch, laterally, above lateral margin, tessellated at sides, sparse at middle, starting near base up to basal third of elytron, b) two scaly patches on basal third, one annular dorsally, one laterally extended subapically, confluent with c) a tessellated scaly patch along lateral margin of apical two-thirds, d) one, sparse, scaly patch at apicad, just above the extended lateral patch, e) at base of apical declivity, one annular, oblongate scaly patch, and f) one suboblongate scaly patch along suture of apicad. Legs with moderately clavate femora. Femora weakly rugose; inner surface at apical 3<sup>rd</sup>, with sparse, subappressed white setae. Tibiae sparsely covered with punctures, serrate at inner edge with sparse, brown setae. Fore, mid, and hind tibiae mucronate at apex. Tarsomeres covered with sparse, brown, suberect setae. Coxae with sparse minute to long, suberect setae.

**Abdomen:** Mesoventrite moderately rugose. Metaventrite, depressed, coarsely rugose, sparsely covered with subappressed, very short, thin setae; Metathorax with a patch of tessellated, iridescent yellowish green round

scales. Ventrite I coarsely rugose, strongly depressed, sparsely punctured near apex and covered with sparse, subappressed, minute, thin, white setae; at apex of each side, near margin, with tessellated scaly patches of iridescent, yellowish green round scales. Ventrite II weakly rugose, sparsely punctate, sparsely covered with minute thin, subappressed setae; at sides on apex near lateral margin, with tessellated scaly patches of iridescent yellowish green round scales. Ventrites III-IV with sparse minute punctures and thin sparse setae. Apical half of Ventrite V mostly coarsely, weakly, rugopunctate, punctures with short suberect setae, longer at sides. Male genitalia as shown in Figure 5 A–C.

**Female.** Dimensions: LB: 10.2mm–13.7mm. LR: 1.4mm–2.1mm. WR: 1.1mm–1.8mm. LP: 2.5mm–3.8mm. WP: 2.7mm–4.0mm. LE: 7.0mm–9.5mm. WE: 4.5mm–6.6mm. N=23.

Females are generally larger than the males; Prothorax dorsally viewed, with weakly arcuate lateral profile; Elytra wider, exhibiting the same variations as males. Habitus as shown in Fig. 1, B, D.

**Etymology.** *Pachyrhynchus mandaya* Agbas, Obrial, Pajota, Medina sp. nov. is named in honor of the Mandaya ethnic group of Davao Oriental.

**Distribution.** *Pachyrhynchus mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. is known so far in the Municipality of Tarragona, Davao Oriental, with a subspecies found in the municipality of Maragusan, Davao De Oro.

**Notes on Variability.** The species *Pachyrhynchus mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. as shown in Fig. 2 exhibit notable variations. The species was collected from a mountain range in Tarragona, Davao Oriental and appears to be restricted to this area (see taxonomic notes). The scaly markings of *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. exhibit a combination of the filled-spotted and open-spotted patterns seen in its subspecies *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. and in *P. jhonnellvillegasi* Agbas, Obrial, Medina, Cabras sp. nov.. Some specimens display both filled-spotted and open-spotted (annular) versions of these scaly markings, and some display scaly markings that almost covers the entire dorsal surface of the elytra characterized by merged scaly spots, a characteristic not observed in *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. and *P. jhonnellvillegasi* Agbas, Obrial, Medina, Cabras sp. nov..

This variability of the species has been documented only in specimens collected from this locality, where the scaly markings appear to be unstable, blending traits observed in *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov., from a mountain range in Maragusan, Davao de Oro, part of the Mt. Campalili-Puting Bato complex and *P. jhonnellvillegasi* Agbas, Obrial, Medina, Cabras sp. nov. from a mountain range in Pantukan, Davao de Oro. Despite this variation in scaly patterns, the species' morphological characteristics, particularly in the rostrum and aedeagus, remain consistent.

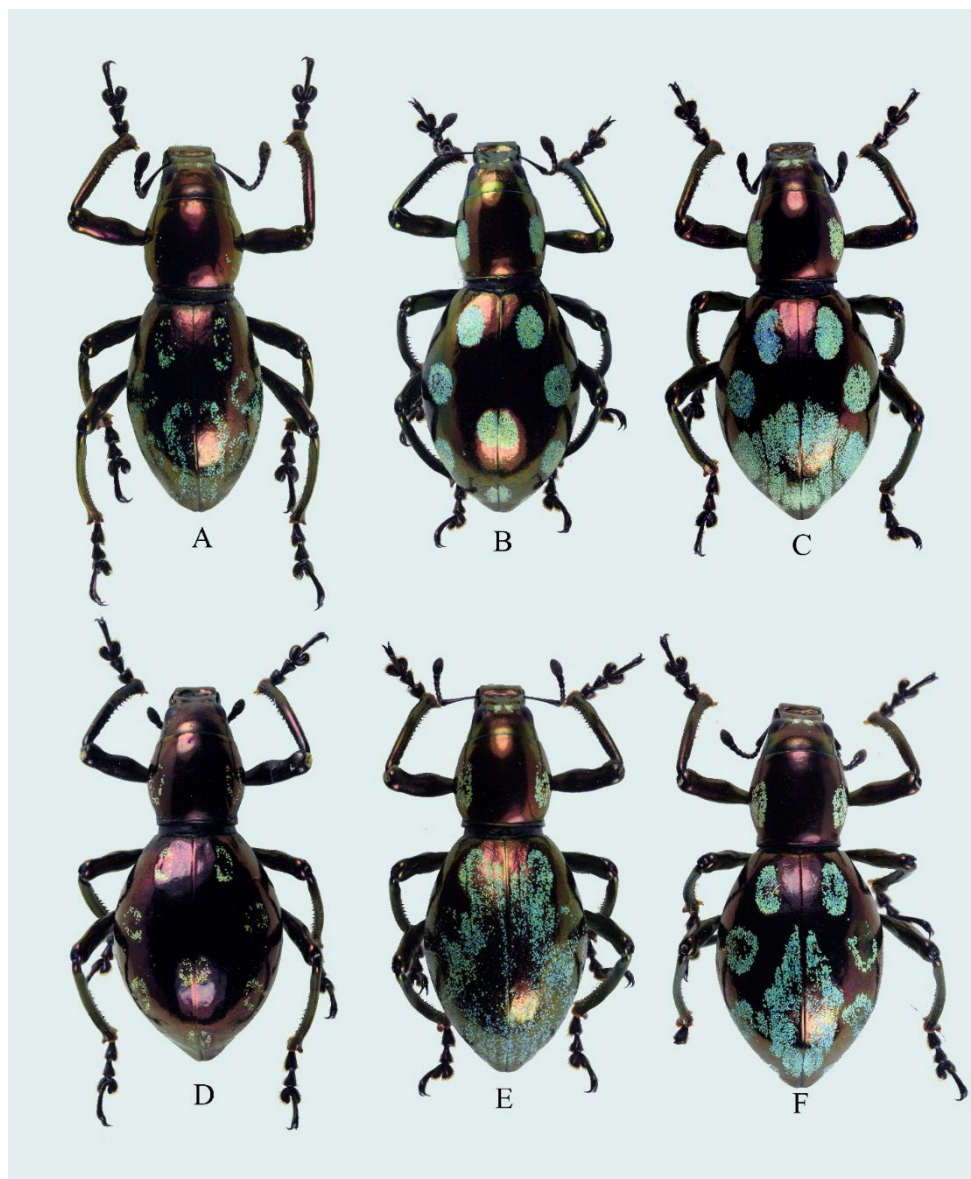


Fig. 2. Variations of *Pachyrhynchus mandaya* Agbas, Obrial, Pajota, Cabras sp. nov.. A. Paratype, male, B–F Paratypes, female.

***Pachyrhynchus mandaya maragusanensis***  
Agbas, Obrial, & Cabras ssp. nov.  
(Fig. 3 A–D)

**Material. Holotype** (Fig. 2A, C), male:  
Philippines – Mindanao / Davao de Oro/  
Maragusan / Mapawa/ ix.2023 / D. Agbas &  
G. Obrial leg./ (typed on white card) //  
HOLOTYPE ♂ / *Pachyrhynchus mandaya*

*maragusanensis* / Agbas, Obrial, Cabras, ssp. nov. (typed on red card). Presently in TIRL, it will be deposited in Philippine National Museum of Natural History (PNMNH) under the National Museum of the Philippines (NMP).

**Paratypes** (12 ♂♂, 17 ♀♀) 8 ♂♂, 13 ♀♀: same data with holotype; 2 ♂♂: Philippines – Mindanao / Davao de Oro/ Maragusan / Langgawisan/ x.2023 / D. Agbas & G. Obrial leg.; 1 ♀: same data as holotype but x.2023; 2 ♂♂, 3 ♀♀: same data as holotype but iv.26.2023.

Paratype deposition: 1 ♂ and 2 ♀♀ to be deposited in PNM; 1 ♂ and 1 ♀ to be deposited in CNM; 1 ♂ and 1 ♀ deposited in MMCP; 1 ♂ and 1 ♀, deposited in UMCRC; 5 ♂♂ and 9 ♀♀, deposited in DGC; 1 ♂ and 1 ♀, to be deposited in SMTD; 1 ♂ and 1 ♀ to be deposited in CAS; 1 ♂ and 1 ♀ to be deposited in DUBC. All Paratypes with additional yellow labels.

**Diagnosis.** *Pachyrhynchus mandaya maragusanensis* Agbas, Obrial, Cabras, ssp. nov. belongs to the *P. schoenherri* species complex and closely related to *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov., but differs in several characteristics. Rostrum of *P. mandaya maragusanensis* Agbas, Obrial, Cabras, ssp. nov. characterized by a bilobed, fan-shaped depression at basal half (vs. distinct triangular depression, rugose at sides of apical third of basal half, and weakly depressed on distal sides of basal third of apical half in *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov.). Scaly markings of *P. mandaya maragusanensis* Agbas, Obrial, & Cabras ssp. nov. consistently filled (vs. filled and unfilled scaly markings in *P. mandaya*). Aedeagus of *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. as viewed dorsally, lanceolate, blunt at apex (vs. lanceolate pointed apex in *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov.) (Fig. 6, D–E).

**Description male.** Dimensions: LB: 9.6mm–10.8mm (holotype 10.4mm). LR: 1.6mm–2.0mm (holotype 1.8mm). WR: 1.3mm–1.6mm (holotype 1.5mm). LP: 2.5mm–3.0mm (holotype 3.0mm). WP: 2.6mm–3.8mm (holotype 3.3mm). LE: 6.5mm–7.6mm (holotype 7.1mm). WE: 4.3mm–5.0mm (holotype 5.0mm). N=13.

**Integument** metallic burgundy. Body dorsal surface, rostrum, head, lustrous, ventral surface, moderately lustrous. Body mostly subglabrous with sparse, fine, minute setae and iridescent light green, round scales. Head subglabrous, with sparse, subappressed, minute, fine, white setae and sparse, punctures on margin along eyes. Forehead between eyes, very weakly depressed and very weakly rugose, with few iridescent pale-yellow elliptic scales; lateral surface before hind margin of eyes rugose; Lateral and lateroventral surface before eyes, with sparse elliptic, iridescent pale-yellow scales, interspersed with piliform scales of same color. Eyes, weakly convex, weakly prominent outer margin of head. Rostrum longer than wide (LR/WR: 1.9mm/1.5mm), weakly raised at sides of basal two-third of basal half, gradually declined before apical third of basal half, forming a distinct weak bilobed, fan shape depression extending before margined of eyes, abruptly raised towards apical third of apical half, forming a weak subarcuate oblique surface on each sides, gradually declined from apical two-thirds of apical half towards apex. Apical half bulging, weakly depressed at middle of dorsum, with sparse punctures; lateral margin in dorsal view of rostrum, with sparse small, thin, suberect white setae. lateral surface, with a few iridescent light-yellow subappressed, elliptic scales, and few sparse, long brown setae at anterolateral margin. Antenna, scape strongly clavate at apical half, shorter than funicle, with sparse, thin subappressed setae, longer towards apex. Funicle with longer suberect brownish setae. Funicular segment

I, nearly 2 times longer than wide; segment II, as long as segment I, twice longer than wide; segments III-V, nearly as long as wide; Segment VI, slightly longer and wider than segment V; segment VII, almost as long as wide; club, short, subellipsoidal, twice longer than wide.

**Prothorax** weakly subglobular, almost as long as wide (LP/WP: 3.0mm/3.3mm), truncate at base, mostly glabrous, widest at middle, weakly convex lateral contour, sparsely covered with fine punctures and minute, thin sparse subappressed white setae. Prothorax with the following scaly markings of iridescent pale-yellow with green sheen, elliptic to round scales, interspersed with piliform scales of the same color forming the following: a) two small, subcircular scaly patches on each side of disc and b) lateral surface near coxae with tessellated scaly patches on each side, reaching lateroventral surface anteriorly.

**Elytra** ovate, with rounded apex, longer than wide (LE/WE: 7.1mm/5.0mm), wider and more than twice longer than prothorax (WE/WP: 5.0mm/3.0mm, LE/LP: 7.1mm/3.0mm), subglabrous, broadly weakly convex lateral margin, covered with sparse minute thin subappressed setae. Each elytron with scaly patches of round iridescent, yellowish-green scales forming the following: a) two scaly patches, one small oblongate dorsally near base and one larger ovate scaly patch laterally near margin, b) one scaly patch on dorsolateral surface, subcircular at basal third of basal half, c) one, thick, scaly patch starting at lateral surface of basal third of basal half, extended towards apicad, d) on dorsal surface, at start of apical declivity, one long subovate scaly patch along suture, e) one oblongate scaly patch at apical declivity, near dorsolateral surface right above the thick scaly patch along apicad and f) at

lateral surface of apical declivity along suture before apex, one irregularly shaped scaly patch shortly extended away from suture. **Legs** with moderately clavate femora. Femora rugose. Tibiae denticulate at inner edge with sparse, brown setae. Fore, mid, and hind tibiae mucronate at apex. Tarsomeres covered with sparse, brown, suberect setae. Coxae with sparse minute to long, suberect setae.

**Abdomen:** Mesoventrite moderately rugose, with a few iridescent green scales. Metaventrite, weakly depressed, moderately, coarsely rugose, sparsely covered with subappressed, minute thin setae; metathorax with a patch of tessellated, iridescent yellowish green, round to lacrimiform scales with greenish sheen along margin, extended lateroventrally. Ventrite I, coarsely rugose, strongly depressed, sparsely, coarsely punctured at middle, some punctures with short suberect setae; at apex of each side near margin, with tessellated scaly patches of iridescent bluish and yellowish round to lacrimiform scales with greenish sheen. Ventrite II, very weakly rugose and weakly, coarsely, sparsely, punctate; Apex of each side near lateral margin, with sparse tessellated lacrimiform scaly patches of iridescent bluish-greenish scales. Ventrites III-IV, with fine, short, sparse, suberect setae at sides and irregular dents. Apical half of Ventrite V, sparsely, coarsely, punctate, punctures with short, suberect, setae, longer at sides towards apex. Male genitalia as shown in Figure 5, D-F.

**Description female.** Dimensions: LB: 10.8mm–12.0mm. LR: 1.7mm–1.8mm. WR: 1.4mm–1.5mm. LP: 2.5mm–2.9mm. WP: 2.7mm–3.5mm. LE: 7.5mm–8.4mm. WE: 5.5mm–6.3mm). N=17.

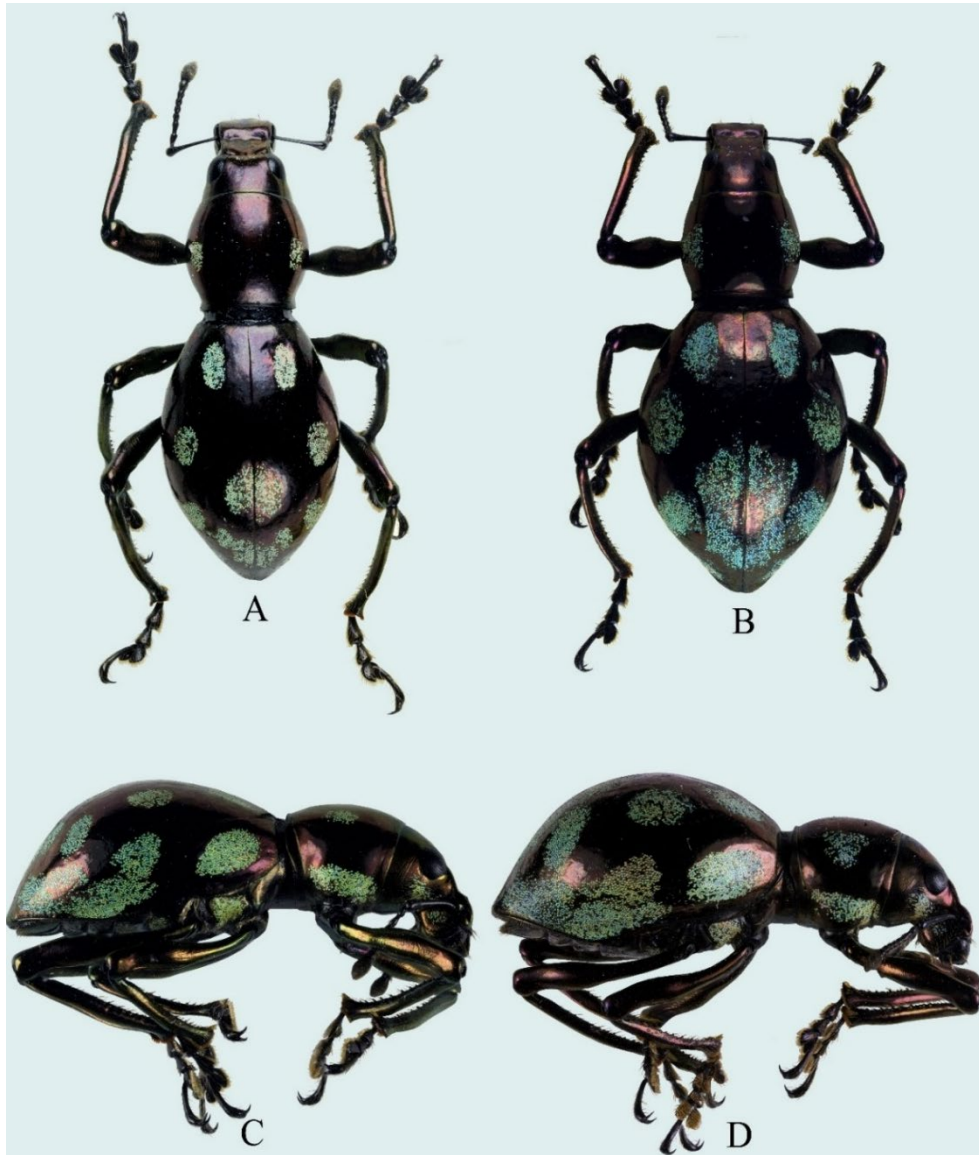


Fig. 3. Habitus of *P. mandaya maragusanensis* Agbas, Obrial, Cabras sub. sp. nov.. A) Male holotype in dorsal view. B) Female habitus in dorsal view. C) Male holotype in lateral view. D) Female habitus in lateral view.

Females are generally larger than males; Prothorax, with more weakly arcuate lateral profile dorsally; Elytra is also wider, exhibiting a variation characterized by merged spots (Fig. 3, B) at apical declivity,

but is also observed in some males. Otherwise mentioned, same as males.

**Etymology.** The specific epithet “*maragusanensis*” refers to the Municipality

of Maragusan in Davao de Oro where the species was discovered.

**Distribution.** *Pachyrhynchus mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. is known so far from Mt. Candalaga range, Maragusan, Davao de Oro.

***Pachyrhynchus jhonnelvillegasi* Agbas, Obrial, Medina, & Cabras sp. nov.**  
(Fig. 1 A–D)

**Material.** **Holotype** (Fig. 1A, C), male: Philippines – Mindanao / Davao de Oro / Pantukan / xi.2021 / Lg. local collector (typed on white card) // HOLOTYPE ♂ / *Pachyrhynchus jhonnelvillegasi* / Agbas, Obrial, Medina, Cabras, sp. nov. (typed on red card). To be deposited in PNM.

**Paratype** 1♀: same data with holotype, DGC, typed on yellow card.

**Diagnosis.** *Pachyrhynchus jhonnelvillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. belongs to the *P. schoenherri* species complex and is closely related to *Pachyrhynchus elegans* Waterhouse, 1842 and *P. mandaya*, but can be distinguished by several characteristics: The lateral profile of prothorax in dorsal view of *P. jhonnelvillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. is weakly convex (vs. pronounced convexity in *P. elegans*). Additionally, *P. jhonnelvillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. has two annular scaly patches on each side of the prothorax (vs. two inverted subtriangular scaly patches that exhibit both filled and unfilled variations in *P. elegans*). In dorsal view, the lateral elytral profile of *P. jhonnelvillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. is notably slenderer (vs. more convex lateral profile in *P. elegans*). *P. jhonnelvillegasi* Agbas, Obrial, Medina,

Cabras, sp. nov. also bears some resemblance to a variation of *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. but differs in the following characteristics: Rostrum as viewed dorsally, at middle of basal half with an indistinct subtriangular depression that is very weakly raised at both ends of basal two-thirds of basal half, whereas *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. as viewed dorsally, exhibits a distinct subtriangular depression, distinctly truncate at apical third of basal half, rugose along the sides of apical third of basal half and weakly depressed at the sides of apical two-thirds of apical half (Fig. 6, C, A). Eyes of *P. jhonnelvillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. are very weakly convex and do not prominently outline the head, whereas *P. mandaya* Agbas, Obrial, Pajota Cabras sp. nov. has weakly convex eyes that are set further apart and slightly more prominent on outline of head. The elytral lateral profile in dorsal view of *P. jhonnelvillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. is almost evenly arcuate from basal third of basal half up to apical two-thirds of apical half, while *P. mandaya* Agbas, Obrial, Pajota Cabras sp. nov. has a more tapered apical and a less evenly arcuate lateral profile profile. Laterally, *P. jhonnelvillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. has a subacuminate apex with a broadly arcuate dorsal contour, whereas *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. exhibits a weakly arcuate dorsal elytral profile with a subacute apex. Eedeagus of *P. jhonnelvillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. is dorsally viewed is subacute, blunt at apex, whereas *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. is alnceolate, with a pointed apex (see Fig. 6, D and F). Laterally, the aedeagus of *P. jhonnelvillegasi* Agbas, Obrial, Medina, Cabras sp. nov. is dorsally straight, whereas *P. mandaya* Agbas, Obrial, Pajota & Cabras sp. nov. is curved inwards (see Fig. 5, H, E).

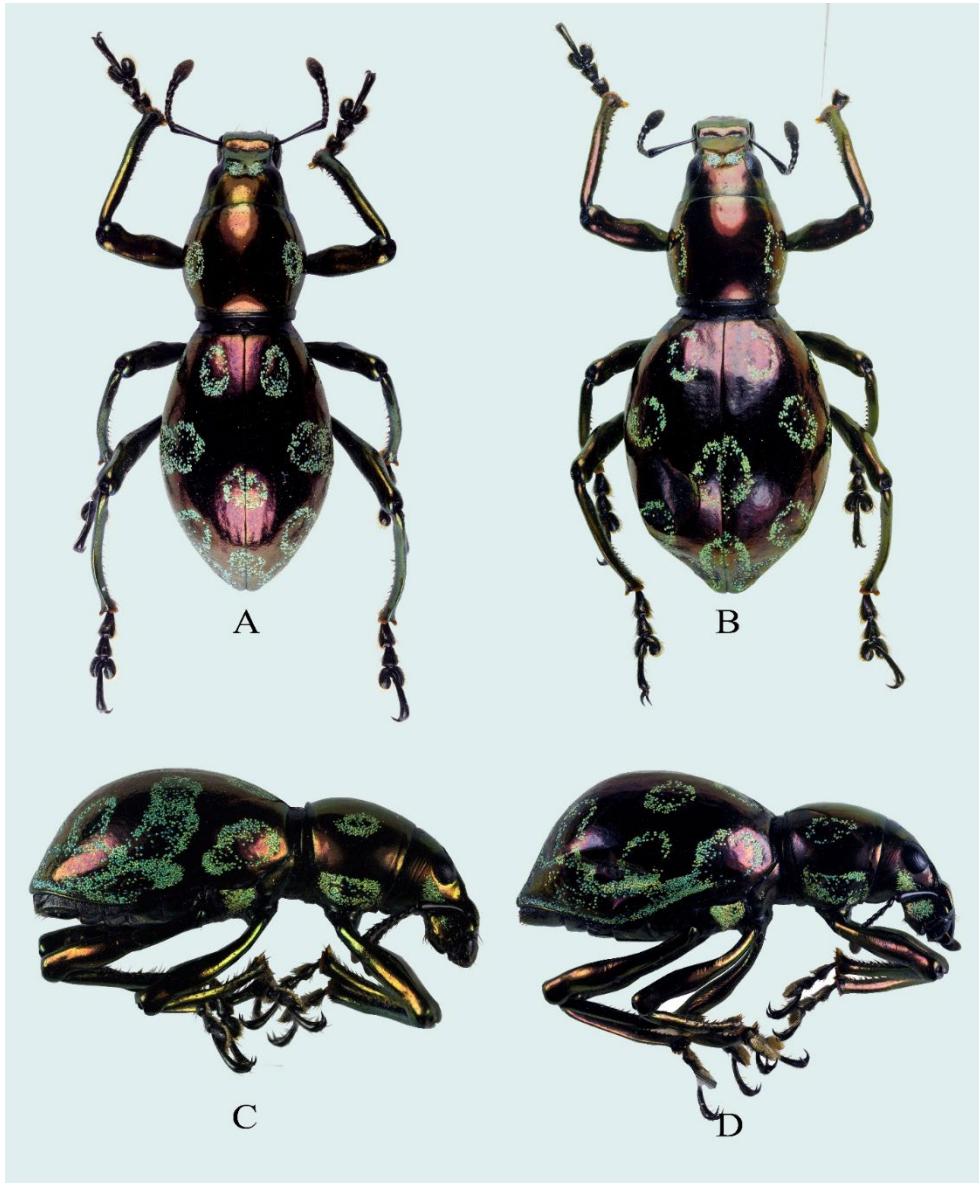


Fig. 4. Habitus of *P. jhonnelvillegasi* Agbas, Obrial, Medina, & Cabras sp. nov.: A) Holotype, male, dorsal view. B) Paratype, female, habitus dorsal view. C) Holotype, male, lateral view. D) Paratype, female, lateral view.

**Description male.** Dimensions: LB: 9.8mm. LR: 1.8. WR: 1.6mm. LP: 2.9mm. WP: 3.0mm. LE: 6.5mm. WE: 4.3.

**Integument** dark, metallic, coppery, burgundy. Body dorsal surface, rostrum, head, lustrous, ventral surface moderately lustrous. Body mostly subglabrous with

sparse minute subappressed setae and iridescent yellow green to turquoise round scales. Head subglabrous, with scaly markings of iridescent lime with greenish sheen, tessellated round to elliptic scales forming the following: a) two irregularly shaped spots in forehead between eyes, and b) subelliptic patch and sparse piliform scales on lateral side under eyes reaching lateroventral surface; Forehead between eyes, weakly depressed with a distinct deep single puncture at middle; Dorsolateral and lateral surfaces before hind margin of eyes, weakly rugose. Eyes, very, weakly convex, not pronounced on outline of head and situated more near dorsal surface. Rostrum longer than wide (LR/WR: 1.8mm/1.6mm), very weakly raised at sides of basal third of basal half, gradually declined towards apical third of basal half forming an indistinct triangular depression, abruptly raised towards basal third of apical half and gradually declined from two-thirds of apical half up to apical third of apical half. Apical half bulging, with sparse shallow punctures at dorsum; Some punctures with minute subappressed setae. Lateral surface with few iridescent light-green subappressed scales, interspersed with piliform scales, same color and sparse, short brown setae at anterolateral margin. Antenna, scape clavate, shorter than funicle, with sparse, fine and minute subappressed setae at apical half, oriented towards apex. Funicle with longer suberect brown setae. Funicular segment I, nearly 2 times longer than wide; segment II, slightly longer than segment I, twice longer than wide; segments III-V, nearly as long as wide; Segment VI, slightly longer and wider than segment V; segment VII slightly longer than wide; club sub-ovoid, nearly twice longer than wide. Prothorax very weakly subglobular, almost as long as wide (LP/WP: 2.9mm/3.0mm), mostly glabrous, widest at middle, weakly convex lateral contour, truncate at base, sparsely covered with minute punctures and minute thin sparse subappressed setae; Prothorax with the

following scaly markings of sparse turquoise with bluish to yellowish sheen round scales: a) annular scaly patches on each side of disc and b) lateral surface near coxae, with tessellated scaly patch, thick at sides, sparse at middle.

Elytra narrowly ovate (LE/WE: 6.5mm/4.3mm), slightly wider and more than twice longer than prothorax (WE/WP: 4.3mm/3.0mm, LE/LP: 6.5mm/2.8mm), subglabrous, broadly, very weakly convex lateral contour, covered with sparse, minute, thin subappressed setae. Dorsally with striapunctures forming a very shallow furrow absent at lateroventral and ventral sides. Each elytron with scaly patches of round, iridescent turquoise scales interspersed with piliform scales of the same color forming the following: a) two annular subovate scaly patches, one smaller dorsally near base, and one larger laterally near lateral margin, starting near base up to two-thirds of basal half of elytron, b) one annular scaly patch near middle on dorsolateral surface merging with the c) two confluent, subovate, annular lateral scaly patches on lateral surface, one near dorsolateral, one along lateral margin at apical two-thirds of apical half, d) before apical declivity, along suture, one small annular scaly patch, e) on dorsolateral surface of apical declivity, one suboval annular scaly patch confluent with, a large oblongate annular scaly patch along lateral margin of apical, and f) one sparse scaly patch divided by suture, confluent with the oblongate annulus along lateral surface of apical declivity.

Legs with moderately clavate femora. Femora weakly rugose, covered with sparse, minute, fine setae; inner surface at apical third of apical half, with sparse subappressed iridescent green scales. Tibiae covered with minute subappressed sparse setae, denticulate at inner edge with sparse brown setae. Fore, mid, hind tibiae, mucronate at apex. Tarsomeres covered with sparse

brown setae. Coxae with sparse, suberect setae.

**Abdomen:** Mesoventrite with few iridescent subappressed turquoise piliform scales. Metaventrite depressed; Metathorax with a patch of tessellated iridescent round, turquoise with yellowish sheen scales. Ventrite I, coarsely rugose, strongly depressed at base, covered with sparse subappressed, minute white setae. Ventrite II, sparsely covered with fine punctures and minute setae with scaly patches of iridescent greenish to bluish elliptic scales near lateral margin. Ventrites III-IV, with sparse minute punctures and fine sparse short setae on distal ends. Apical half of Ventrite V, mostly, coarsely punctured and weakly rugose. Male genitalia shown in Figure 5 G-I.

**Description female.** Dimensions : LB: 11.5. LR: 1.9. WR: 1.6. LP: 2.9. WP: 3.3. LE: 8.2. WE: 5.9.

Females have no sexual dimorphism but are generally larger than the males; Prothorax, dorsally viewed, weakly arcuate lateral profile; Elytra is also significantly wider. Habitus as shown in Fig. 4, B & D. Otherwise mentioned, same as males.

**Etymology.** The species name “*jhonnell-villegasi*” is named after Mr. Jhonnell P. Villegas to honor his scientific contribution to Mindanao and his assistance and the genuine friendship to the authors, especially to the senior author during and after her heart operation.

**Distribution.** *Pachyrhynchus jhonnell-villegasi* Agbas, Obrial, Medina, & Cabras, sp. nov. is known so far in Pantukan, Davao de Oro, Mindanao, Philippines.

#### **Notes on Distribution and Taxonomy.**

*Pachyrhynchus mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. and *P. mandaya* Agbas, Obrial, Pajota Cabras sp. nov. are both found within the Mt. Kampalili-Puting-Bato complex, a group of mountain ranges in between the provinces of Davao de Oro and Davao Oriental but are from different localities that are geographically separated by distance, mountains, and rivers. Specimens of *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. were collected within a mountain range in Maragusan Davao de Oro, while *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. was collected from a different mountain range in the municipality of Tarragona Davao Oriental. Despite their similar appearances, the specimens of *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. exhibit stable scaly patterns with consistently filled spots, although some variations are present for most females and a few males, by their scaly markings at the elytral apical region and at lateral side along margin, characterized by merging of scaly spots from apical declivity along suture of elytra up to apex (sometimes subapical) (Fig. 3, B). In contrast, *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. displays highly variable scaly markings, including specimens with: a) spots on the surface of pronotum and elytra (Fig. 2, B), b) merged spots on the elytra forming a scaly patch along the elytral suture (Fig. 2, C), c) nearly complete coverage of entire elytral dorsal surface by merged spots (Fig. 2, E), d) annular scaly markings on the pronotum and elytra (Fig. 2, D), and e) annular spots merging at the apical declivity (Fig. 2, F) which were never observed from *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. specimens.



Fig. 5. Aedeagus and sternite IX of the Holotypes of *Pachyrhynchus* spp., A—C *P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov.: A—aedeagus, dorsal view, B—idem, lateral view. C—sternite IX. D—F *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov.: D—aedeagus, dorsal view. E—idem, lateral view. F—sternite IX. H—J *P. johannelvillegasi* Agbas, Obrial, Medina, Cabras, sp. nov.: G—aedeagus, in dorsal view. H—idem, lateral view. I—sternite IX.

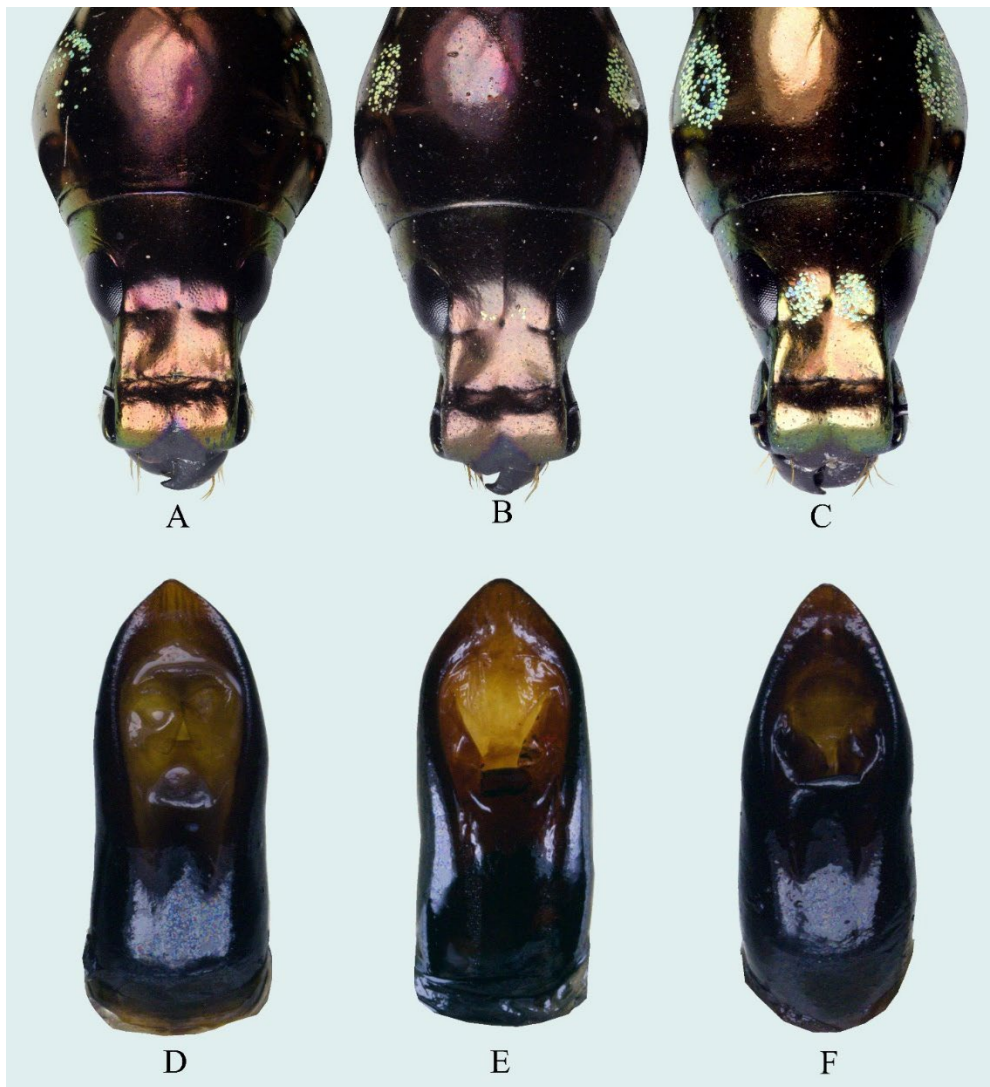


Fig. 6. Rostrum and aedeagus of the Holotype of *Pachyrhynchus* spp., A—*P. mandaya* Agbas, Obrial, Pajota Cabras sp. nov.. rostrum, dorsal view. B—*P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov.. rostrum, in dorsal view. C—*P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. rostrum, dorsal view. D—*P. mandaya* aedeagus, in dorsal view. E—*P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. aedeagus, in dorsal view. F—*P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras, sp. nov. aedeagus, in dorsal view.

*P. mandaya* Agbas, Obrial, Pajota, Cabras sp. nov. exhibits a blend of traits (scaly markings) observed in *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp.

nov. and *P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras, sp. nov.. As for *P. jhonnevillegasi* Agbas, Obrial, Medina, Cabras, sp. nov., only two specimens (male

and female) were collected, both displaying annular scaly markings on the prothorax and elytra. Although the limited data prevents determining whether this species also exhibits scaly pattern variability, its geographic separation and distinct morphological characteristics especially for the male genitalia and rostral characteristics (see species diagnosis) set it apart from *P. mandaya* Agbas, Obrial, Pajota Cabras sp. nov. and *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov.. Further, *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. and *P. mandaya* Agbas, Obrial, Pajota Cabras sp. nov. has variations that resembles *P. cebrem* Patano & Rukmane-Bārbale, 2022, but the two is easily set apart from *P. cebrem* because *P. cebrem*'s scaly marking of the prothorax and elytra is characterized by thick scaly patches, whereas for some of the variations of *P. mandaya* Agbas, Obrial, Cabras sp. nov. and *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov. has generally smaller spots compared to that of *P. cebrem*. Additionally, *P. cebrem* is larger in size compared to *P. mandaya* Agbas, Obrial, Pajota Cabras sp. nov. and *P. mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov..

### Brief Ecologic Notes

All two species and the subspecies described in this paper have been collected on riparian ecosystems from the mentioned mountain ranges from Davao Oriental and Davao de Oro (Fig. 7, Map of species), feeding on *Elatostema* sp., with no records from other plant species. The mountain ranges from the localities of the species are facing deforestation due to the conversion of forested areas into agricultural spaces. Since the genus *Pachyrhynchus* are phytophagous beetles highly specific to their food plants (Cabras et al., 2022), they have co-evolved with specific plant species, developing digestive adaptations for breaking down plant tissues, while plants, in turn, evolved

chemical defenses that further constrain Phytophagous beetles to specific host plants (McKenna et al., 2019). On another note, *Elatostema* spp. Are understory herbs and shrubs typically found in deep shade along stream sides, caves, gorges, and forests (Wei et al., 2011; Fu et al., 2021; Triyutthachai et al., 2022). The area where the species and subspecies were collected are shaded environments dominated mostly with fig trees (*Ficus* sp.) and other understory herbs and shrubs thriving beside the river with an elevation range of about 800-1600 masl. Another immersing threat for the species, particularly for the subspecies *Pachyrhynchus mandaya maragusanensis* Agbas, Obrial, Cabras ssp. nov., whose type locality is from a mountain range from the Municipality of Maragusan, Davao de Oro, is the ongoing small-scale tunnel gold mining that may weaken the integrity of the mountain and can cause landslides. Also, the ongoing deforestation and development of roads to connect isolated towns within the municipality (recorded in Obrial et al., 2024; Agbas et al., 2024), especially areas that are part of the road development and are near river bodies, have been buried under a pile of gravel used to create stable foundation for concrete roads to be built. The possibility of poaching due to accessibility is also an emerging threat for the species, a comprehensive environmental plan must be put in to action to halt and or prevent the further loss of the species.

### Checklist of *Pachyrhynchus schoenherri* species group in chronological order based on the date of description:

**Note:** \*type locality

1. *Pachyrhynchus schoenherri*  
Waterhouse, 1841, SMTD, BMNH  
Distribution: Mindanao PAIC,  
Leyte\*
2. *Pachyrhynchus elegans*  
Waterhouse, 1842, BMNH

- Distribution: Mindanao PAIC, Northern Samar\*
- Synonym: *Pachyrhynchus eos* Heller, 1924, SMTD
- Distribution: Mindanao PAIC, Insular Samar\*
3. *Pachyrhynchus ardentius* Schultze, 1919, SMTD  
Distribution: Mindanao PAIC, Siargao Islands\*
  4. *Pachyrhynchus corpulentus* Schultze, 1922, SMTD  
Distribution: Mindanao PAIC, Bukidnon, Lindaban\*  
  
*P. corpulentus balatukan* Patano & Macalaba, 2023, CMU-MZ (♂ Holotype and Paratypes 2 ♀♀)  
Distribution: Mindanao PAIC, Misamis Oriental, Mt. Balatukan\*
  5. *Pachyrhynchus apoensis* Yoshitake, 2012, NAIS (♂ Holotype, Paratypes: 51 ♂♂ and 47 ♀♀), PCKS (Paratypes: 21 ♂♂ and 13 ♀♀)  
Distribution: Mindanao PAIC, Mt. Apo\*  
Synonym: *Pachyrhynchus pseudoapoensis* Rukmane & Barsevkis, 2016, DUBC  
Distribution: Luzon, North Luzon\*
  6. *Pachyrhynchus nitcisi* Rukmane & Barsevkis, 2016, DUBC (♂ Holotype, Paratypes: 10 ♂♂ and 16 ♀♀).  
Distribution: Mindanao PAIC, Sarangani, Malungon\*
  7. *Pachyrhynchus esperanza* Bollino, Sandel, & Rukmane, 2017, SMTD (♂ Holotype); MBLI (Paratypes: 11 ♂♂ and 17 ♀♀); DUBC (Paratypes: 11 ♂♂ and 9 ♀♀); NIAES (Paratypes: 3 ♂♂ and 2 ♀♀), KUM (Paratypes: 2 ♂♂ and 3 ♀♀); CFS (Paratypes: 14 ♂♂ and 9 ♀♀).  
Distribution: Mindanao PAIC, Agusan del Sur, Esperanza\*
  8. *Pachyrhynchus obumanuvu* Cabras, Donato, Medina & Van Dam, 2021, PNM (♂ Holotype), UMCRC (Paratypes: 6 ♂♂ and 5 ♀♀); MBLI (Paratypes: 1 ♂ and 1 ♀).  
Distribution: Mindanao, Davao City
  9. *Pachyrhynchus cebrem* Patano & Rukmane-Bārbale, 2022, CMU-MZ (♂ Holotype, Paratypes: 2 ♀♀).  
Distribution: Mindanao; Davao de Oro, Mt. Candalaga.
  10. *Pachyrhynchus mandaya* Agbas, Obrial, Pajota & Cabras sp. nov.  
Distribution: Mindanao PAIC, Davao Oriental, Tarragona\*  
  
*Pachyrhynchus mandaya maragusanensis* Agbas, Obrial, & Cabras ssp. nov..  
Distribution: Mindanao PAIC, Davao de Oro, Maragusan\*
  11. *Pachyrhynchus johannelvillegasi* Agbas, Obrial, Medina, & Cabras, sp. nov.  
Distribution: Mindanao PAIC, Davao de Oro, Pantukan.

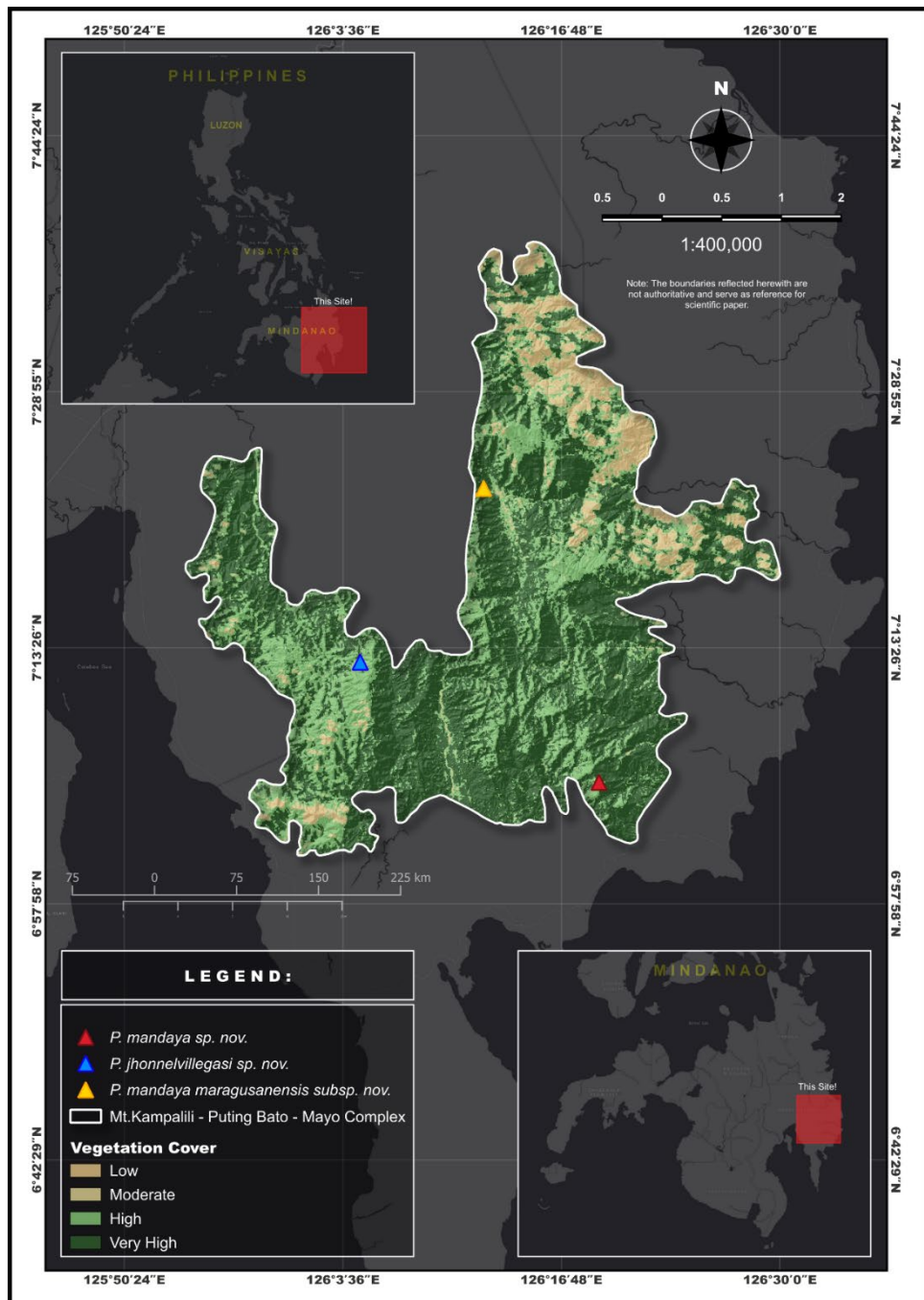


Fig. 7. Map showing the distribution and habitat vegetation cover of the two new species and one subspecies of *Pachyrhynchus* within Mt. Kampalili – Puting Bato – Mt. Mayo Complex

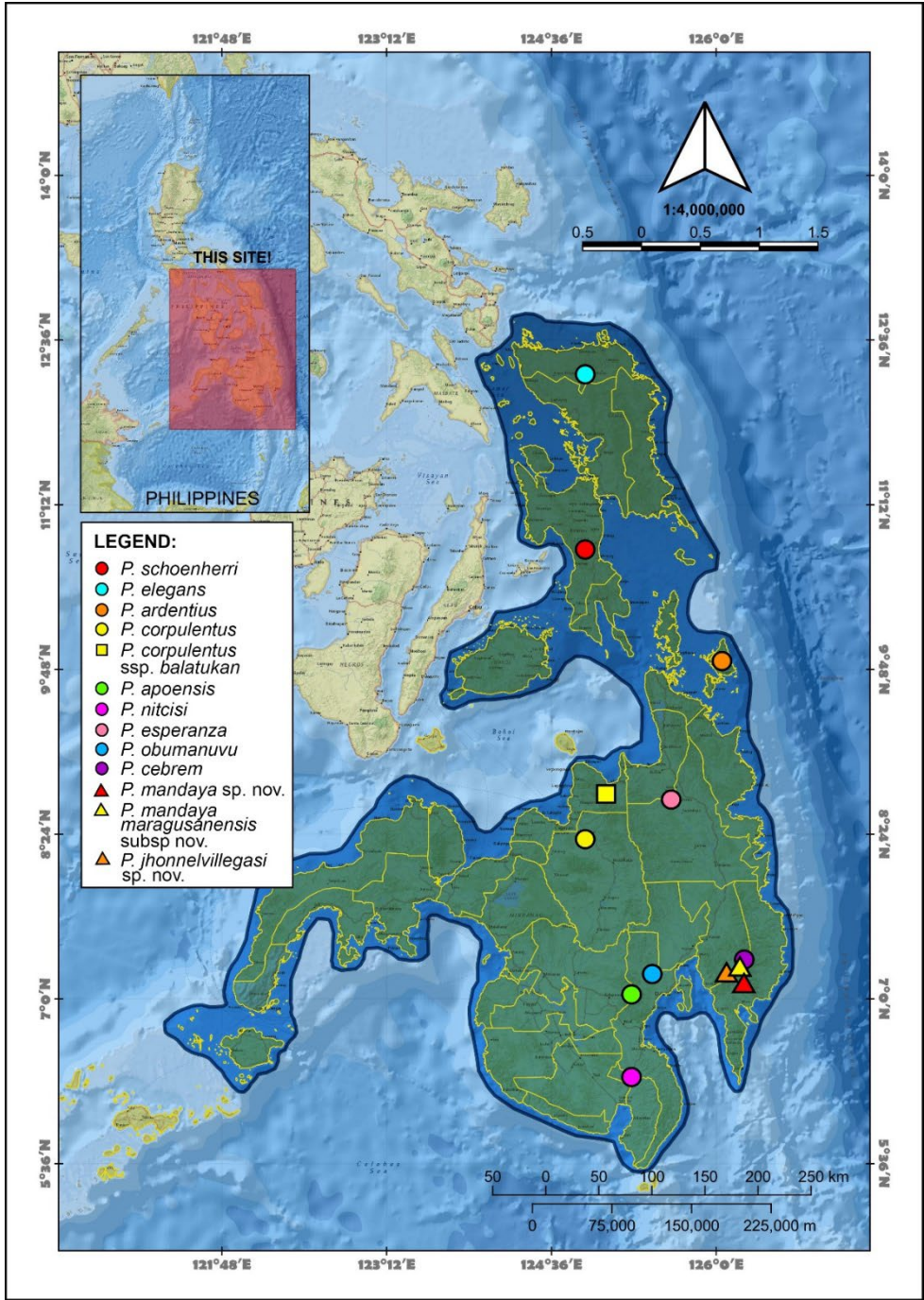


Fig. 8. Distribution map of the *Pachyrhynchus schoenherri* species group within Greater Mindanao - Pleistocene Aggregate Island Complex (PAIC).

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