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Authors: Roth, Louis M., and Naskrecki, Piotr

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A new genus and species of cave cockroach (Blaberidae: Oxyhaloinae) from Guinea, West Africa

Louis M. Roth† and Piotr Naskrecki

Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138 USA. E-mail: p.naskrecki@conservation.org
† Deceased

Abstract

A new genus and species of ovoviviparous blaberid cockroach, *Simandoa conserfariam* is described that lives in bat guano in a cave in Guinea, West Africa. The male's subgenital plate, styles, and genitalia clearly place it in the Blaberidae: Oxyhaloinae: Nauphoetini. It is close to *Henschoutedenia* and *Nauphoeta*, but lacks stridulating structures on the pronotum and tegmina which are present in some species of the other 2 genera. The taxon belongs in the "Guanobies" group of cockroaches and lives in bat guano that accumulates not far from the entrance of the cave where light is present: *Simandoa* shows none of the characteristics of a troglobite (obligate cave-dweller) which, compared to surface dwellers, has reduced eyes and wings.

Key words

bat, guano, hotspot, cavernicolous, Simandoa, Phaeophilacris, mining

Introduction

The Simandou range, including the "Foret Classe de Pic de Fon" in the southeastern part of the Republic of Guinea, is located within the "Guinean Forest Hotspot" (Mittermeier *et al.* 1999), and consists of a strip of fragmented forests that runs perpendicular to the coast of West Africa. It has habitat types ranging from true rainforest to humid Guinea savanna, and the altitude ranges from about 500 to > 1600 m. The Guinean Forest Hotspot is one of the 2 highest-priority regions in the world for primate conservation, and an important target for many international efforts in biodiversity conservation. It is also a region with exceptional mineralogical wealth, and a number of mining companies are targeting it for extensive exploration.

Mount Nimba in southeastern Guinea has already been badly affected by mining activity, and portions of native habitat have been destroyed. Faced with an imminent threat of large-scale mining operations within the Simandou Range, in Nov to Dec 2002, Conservation International conducted a rapid assessment survey of 2 selected sites in the Simandou Range, in order to evaluate the species richness and abundance of selected groups of animals and flowering plants. The collected information might then be used to modify the original development plans so that the impact of the mining operations is minimized, or at least reduced. During the survey a number of new and rare species of insects and other animals were discovered, including a new genus and species of cavernicolous cockroach described in the present paper.

Types of the new species are deposited in the collection of the Museum of Comparative Zoology, Harvard University, Cambridge.

***Simandoa* Roth & Naskrecki, n. gen.**

Sexes similar. Tegmina and wings fully developed, reaching to about 6th abdominal tergite (Fig. 1A), supra-anal plate, or end of abdomen, but not exceeding it (female wings may be slightly longer thanmale's). Tegmina with oblique discoidal sectors. Hind wing with anterior field dark, coriaceous. Posterior field lighter, membranous (Fig. 2F). Stridulating structures absent from posterolateral corners of pronotum and base of tegmina. Front femur completely unarmed, without terminal spine on anteroventral margin, knee spine absent; mid and hind femurs with a knee spine, and only with a small, single terminal spine on the anteroventral margins. All tarsi short, the basitarsus shorter than succeeding segments combined (Fig. 2H); all tarsomeres (including 5th segment; Figs 2G, H) with well developed pulvilli; some other blaberids (Blaberinae: *e.g.*, *Blaberus discoidalis, Archimandrita tessellate*) have a similar pulvillus on the 5th tarsal segment when examined in a living specimen; in a pinned specimen, the dried pulvillus on the 5th tarsomere tends to collapse and disappear, although those on the other segments are still recognizable. Large spines on outer and inner margins of tibiae essentially arranged in threes, tarsal claws simple, symmetrical, arolia well developed (Fig. 2G). Male abdominal tergites unspecialized. Supra-anal plate, styles, and genitalia (Figs 2B, 2E) typically Oxyhalinae: Nauphoetini.

Etymology.— The generic name is derived from the Simandou Range in Guinea, West Africa, the type locality of the genus.

***Simandoa conserfariam* Roth & Naskrecki, n. sp.**
Figs 1A-C, 2A-H

Male: (Fig. 1A) Head exposed; eyes relatively well developed, interocular space about same as distance between ocelli; left mandible with 4 large spine-like teeth (Fig. 2A). Pronotum subelliptical (Figs 1A, 2B), surface minutely and sparsely punctulate. Tegmina and wings fully developed but not exceeding end of abdomen; when the abdomen is extended in the living specimen the front and hind wings may reach to about the 7th tergite (Fig. 1A); however, when dead and dried, they may reach the supra-anal plate. Hind wing with coriaceous anterior field, cubitus vein with 4 complete and 6 incomplete branches, apical triangle small, elongate (Fig. 2F). Stridulating structures absent from pronotum and tegmina (see remarks).

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Front femur completely unarmed, anterior ventral margin with dense row of spinules or microtrichia, short stout spines (including a terminal and knee spine) absent; mid and hind femurs with a knee spine, their anteroventral margins armed only with a very small terminal spine. Tarsomeres of all legs (including the 5th segment) with large, well developed pulvilli; those on segments 2 to 4 round, occupying entire segment, those on 1st segment occupying practically entire length of segment; pulvillus on 5th segment narrow, elongate, extends practically full length of the segment and is white, as are all other pulvilli (Figs 2G-H). Large spines on tibia biseriately arranged on inner and distal half of outer margins; tarsal claws symmetrical, simple, arolia well developed (Fig. 2G). Supra-anal plate hind margin convex, broadly rounded, with medial invagination (Fig. 2C). Subgenital plate of Oxyhaloinae type, symmetrical, transverse, lateral corners acute, excised, with pair of similar cylindrical styles, each located just anterior to the excision, interstylar margin convex, entire (Fig. 2E). Genitalia as in Fig. 2B (to save space, the phallomeres are here oriented horizontally, with the hook on top, but in their normal position they are longitudinal, with the hook on right side; see Fig. 1 in Roth, 1971); sclerotized hook on the right side, strongly curved, apex with small acute, clear membrane (transparent and not visible in Fig. 2B), attached to elongate, retractable, membranous tube, the whole phallomere enclosed in a membrane that has to be peeled away to see the structure clearly; left phallomere greatly reduced, only cleft region remaining; the L2d sclerotized and separated from apex of the elongated, rod-like L2vm, and enclosed in lightly sclerotized, membranous "bag" which has to be removed to reveal its shape.

Color: Occiput and vertex black, ocelli white, area between them pale but slightly darker; region below pale zone down to clypeus, brownish black, labrum dark with pale spots; mandibles yellow, the toothed distal borders black; maxillary palpomeres light brown (Fig. 2A). Pronotum black, completely surrounded by narrow, white margin, which is slightly broader along anterior and posterior borders (Fig. 2B). Tegmina dark brown, sparsely speckled with small pale, variably sized spots, mediastine vein dark (Fig. 1A). Hind wing with very dark anterior field, posterior field distinctly lighter (Fig. 2F). Abdominal tergites black with broad yellow anterior borders, supra-anal plate ringed with yellow (F), and narrow medial longitudinal stripe (Figs 1A, 2C).

Female: Habitus similar to male. Head exposed. Eyes fully developed; interocular space about same as distance between round ocelli, less than distance between antennal sockets. Pronotum subelliptical. Tegmina and wings fully developed but reaching only to about anterior margin of supra-anal plate, or end of abdomen. Tegmina with discoidal sectors oblique. Hind wing with anterior field darkly sclerotized, coriaceous, apical margin broadly rounded, cubitus vein with about 4 incomplete and about 6 complete branches, apical triangle narrowly elongate, colorless; posterior field mostly pale, veins dark, including incomplete veinlets found between the complete rami (Fig. 2F). Laterocaudal angles of abdominal tergites 1 to 4 not produced, angles of segments 5 to 7 weakly produced caudad. Supra-anal plate broadly rounded, weakly indented mesad (Fig. 2D). Subgenital plate symmetrical, not valvular, hind margin laterally oblique, distally broadly rounded.

Color: Occiput and vertex black, succeeded by a transverse pale band between round, whitish ocelli, which almost touch the antennal sockets (Fig. 2A). Face dark, posterior clypeus, labrum, labial and maxillary palps, and mandibles, pale (Fig. 2A); antennae brown. Left tegmen sprinkled with small, different sized, whitish specks (Fig. 1A). Abdominal tergites blackish with narrow yellowish bands along anterior and posterior margins; laterally tegmina and wings do not completely cover the abdominal tergites, and the ends of the yellowish bands are visible. Abdominal tergites with narrower yellow bands; supra-anal plate black, the yellowish margin very narrow, median longitudinal pale line absent (Fig. 2D). Abdominal sternites with broad, median longitudinal orangish band, lateral regions black, anterior margins in lateral black zones with yellow comma-shaped mark directed caudad (Fig. 1B). Cerci light orange. Legs with coxae dark brown, mid and hind ones with whitish outer border; femurs, tibiae, and tarsi light orange, pulvilli and arolia white.

The striking yellow markings of adults and nymphs of *Simandoa* suggest aposematic coloration. Bright colors in cave dwellers are rare: troglobites often lose their pigmentation.

Measurements.— (mm; n = 1 ♂, 1 ♀) (♀ in parentheses): Length 30.0 [abdomen contracted] (39.0); pronotum length × width 8.2 × 10.8 (8.8 × 13.5); tegmen length 22.0 (26.7); interocular width 1.9 (2.1).

Nymphs (length 24 mm; Fig. 1C): apterous. Large nymphs are dark brown. Head black without yellow interocular band. Pronotum dark with narrow yellowish stripe only along anterior and posterior margins. Abdominal tergites dark with a narrow yellowish stripe along the posterior margins; abdominal sternites dark, lighter mesad on proximal segments, lateral dark regions without yellow comma-shaped maculae. Cerci and legs orange.

Specimens examined.—Holotype, ♂ (genitalia on slide 379), GUINEA): Simandou Mts., Camp 1, nr Pic du Fon (lat 8°31′52″N, long 8°54′21.3″W), 1300 m, 27-30.xi.2002, coll. P. Naskrecki; MCZ, Type no. 35101. Paratypes.- same data as holotype, 3 ♀♀ (MCZ).

The species was collected in a bat cave, burrowing in guano. (Fig. 1D). One ♂, 3 ♀♀, and several nymphs were collected alive and a culture established in the MCZ.

Etymology.— The specific epithet *conserfariam*, derived from Latin words *conservo* (to preserve) and *multifariam* (in many places) honors Conservation International, a non-profit organization responsible for preservation of a number of endangered habitats and species across the globe.

Habitat.—The cockroaches were found in a small cave (lat 8°31′N, long 8°54′W) located at an elevation of 1100 m within a deep valley having almost pristine high forest; this is near a fast flowing river on the eastern slope of Pic de Fon. The cave is open on both ends, allowing for a considerable amount of light to penetrate most of its area. The distance between the openings was about 35 m, and the distance from the floor of the cave to the highest point of its ceiling was about 20 m. Despite the open character of the cave, humidity was high, maintained by a small stream running through it (Fig. 1D).

The cave was inhabited by a large colony of Egyptian fruit bats (*Rousettus aegyptiacus*) (Fig. 1E). The number of bats in the colony was estimated in the range of 1000 to 1500 individuals of both sexes and all ages. Most of the floor of the cave was completely covered with bat guano, forming a layer in some places at least 1 m deep. *Simandoa conserfariam* was abundant in the cave, congregating in groups of 20 to 50 individuals of all ages at a depth of 5 to 30 cm within the guano (Fig. 1D, arrow). Whether the species also occurs outside caves is unknown. There were usually only 2 to 3 adults within each aggregation. When handled, live adults

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and nymphs defecate, possibly a defensive mechanism. Nymphs do not produce a viscous, sticky, defensive substance, which many other species (mostly nymphs of Blattellidae and Blattidae) secrete on their terminal abdominal tergites. No cockroaches were found on the surface of the guano, even in those portions of the cave, that were in complete darkness. Also, no cockroaches were found in deep crevices in the walls of the cave where no bat guano was present, although large groups of cave crickets (*Phaeophilacris* sp.) inhabited nearly all cracks. Each congregation of cockroaches was usually accompanied by 5 to 10 individuals of a yet-unidentified, large, darkling beetle (Tenebrionidae). In addition to *S. conserfariam*, 2 other cockroaches were present on the ground, and walls of the cave, but not buried in the guano: *?Margattioidea* sp. (Blattellidae: Pseudophyllodromiinae) and *Anaplecta* sp. (Blattellidae: Blattellinae). Brief descriptions of these species are given here so they can be recognised, if collected in the future.

Anaplecta sp.

Female: Pronotum with yellowish disk, lateral borders pale, translucent. Tegmina dark with 2 or 3 longitudinal sectors; hind wing appendicular field brownish, longer than rest of the wing.

Measurements.— (mm; n = 1♀): pronotum length × width 1.5 × 1.8; tegmen length 5.5; wing length 7.7 (length of appendicular field 3.2, length of rest of wing 4.5).

Specimen examined.— 1 ♀, same data as holotype of *Simandoa conserfariam* Roth & Naskrecki (MCZ.)

?Margatteoidea sp.

Male: Ocelli large, touching margins of eyes and antennal sockets. Tegmina and wings fully developed, extending well beyond end of abdomen, the former with oblique discoidal sectors: hind wing costal veins thickened (not clubbed), median vein straight, cubitus curved with 2 complete (one branched) and 0 incomplete branches, apical triangle small. Anteroventral margin of front femur Type B2, with 2 terminal spines; pulvillus appears to be only on the 4th tarsomere, tarsal claws symmetrical, simple, arolia present. Seventh abdominal tergite with median specialization. Supra-anal plate symmetrical, transverse, narrow, its hind margin subtruncate, entire. Subgenital plate symmetrical, convex, deeply invaginated mesad forming 2 lobes, each bearing a small, similar, style.
Color: Head brownish yellow, ocelli yellowish white; antennae with proximal segments yellow, remainder brown. Pronotum with lateral borders transparent, succeeded by broad lateral, oblique, black stripes, medial region yellowish. Tegmen proximal area yellowish brown, succeeded by a broad, pale, transparent, transverse band, remainder yellowish brown. Abdominal tergites pale; abdominal sternites pale mesad, dark laterad. Cerci yellowish white.

Measurements.— (mm; n = 1♂): Length 6.3; pronotum length × width 1.7 × 2.6; tegmen length 8.3; interocular width 0.6.

Specimens examined.— 2 ♂♂, same data as holotype of *S. conserfariam* Roth & Naskrecki (MCZ.)

Species relationships

Simandoa shows none of the characteristics of a true cave dweller (troglobite), *i.e.*, one with reduced or absent eyes and ocelli, and reduced, or absent tegmina and wings. It belongs in the cavernicolous "Guanobies" group (*e.g.*, some species of *Gyna*, *Apotrogia*, *Ergaula*, *Pycnoscelus*; Roth and Willis 1960: 16) whose cockroaches live in the guano of cavernicolous vertebrates. Based on the shape of the subgenital plate and styles (Figs 2B, 2E) (*cp.* Figs 2-5 in Roth 1971) the species keys to Blaberoidea: Oxyhaloinae in Princis' (1960: 444) and Kumar's (1975: 31, 32) keys. The shape of the subgenital plate with its shallow excavated posterolateral corners, above which is found a small cylindrical style, is similar to that found in the following genera of Oxyhaloinae tribes (based on male genitalia: Roth 1971: 86): (1) Oxyhaloini: *Oxyhaloa*; (2) Nauphoetini: *Griffiniella*; Henschoutedenia; *Jagrehnia; Nauphoeta; Rhyparobia* (= *Leucophaea*); (3) Gromphadorhinini: *Gromphadorhina; Aleuropoda*.

Based on the shape of the hook and the L2d the new genus belongs in the Nauphoetini, near *Nauphoeta* (Figs 50-52, in Roth 1971) and *Henschoutedenia* (Figs 56-67 in Roth, 1971). These 2 genera (and others), have some species with stridulating structures on the cubitus vein of the tegmina and the posterolateral corners of the pronotum (Gurney 1953; Hartman & Roth 1967a, Figs 2, 3; 1967b, Figs 3, 4). The new genus lacks stridulating structures.

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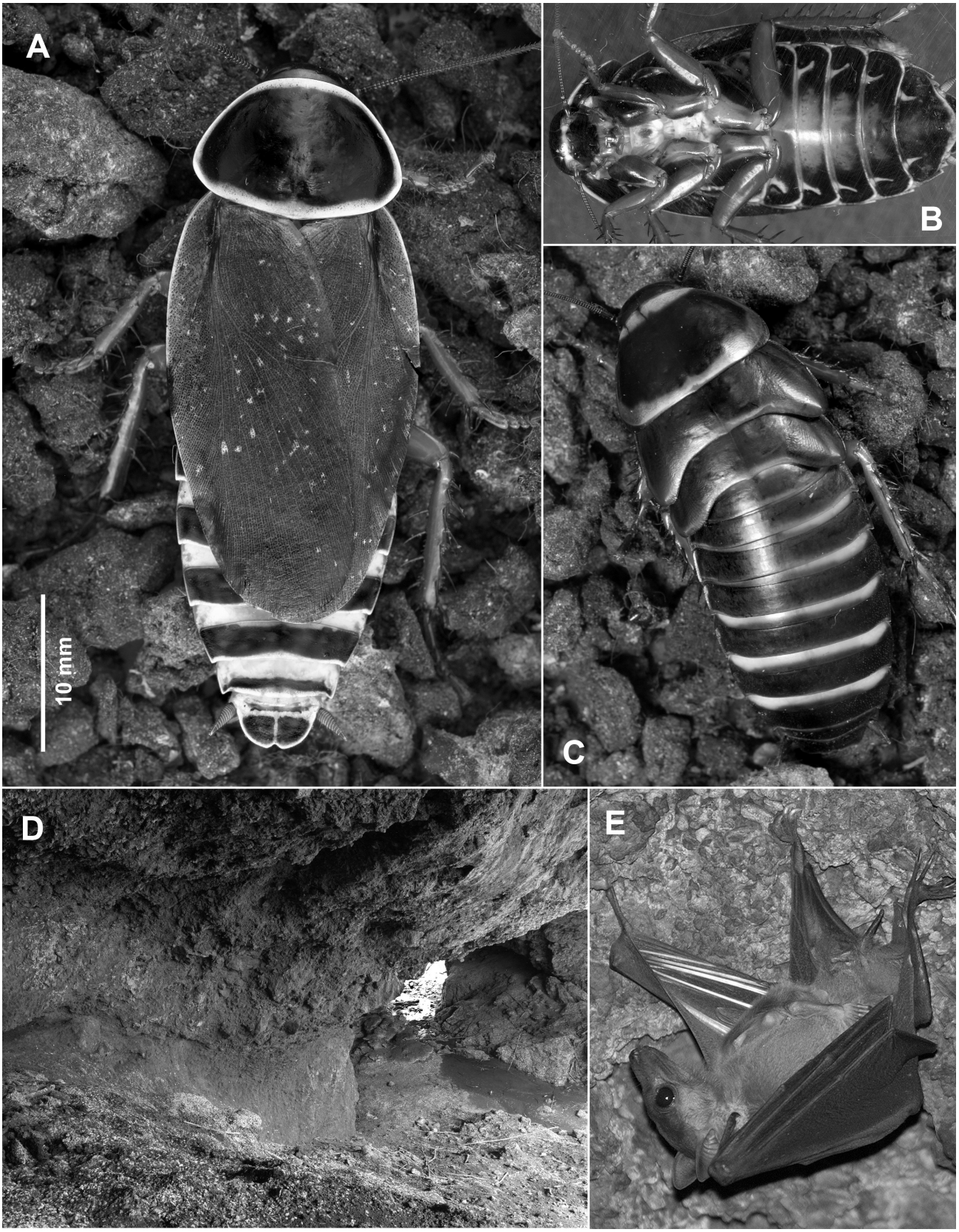
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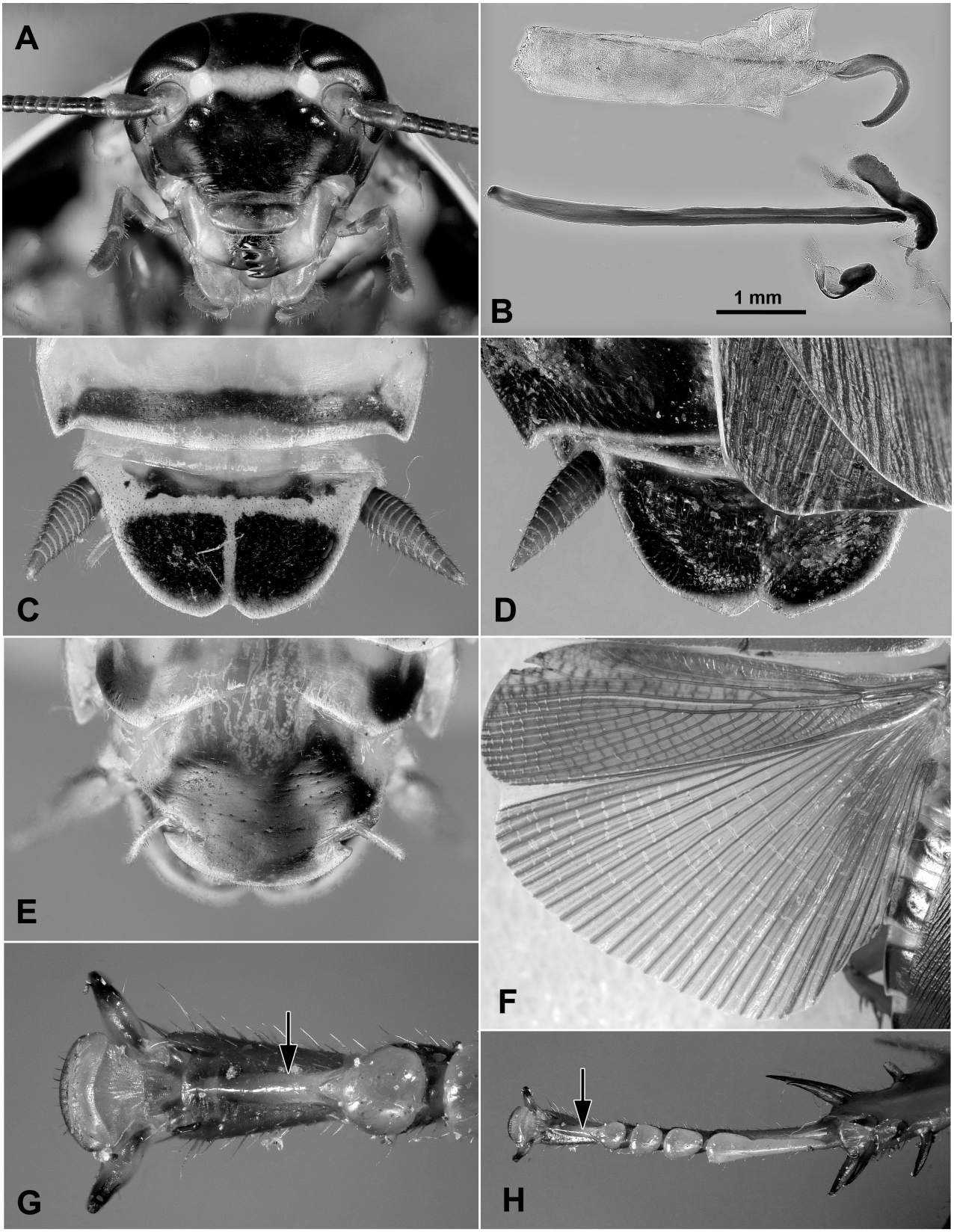
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Figs 1A-E. A-C, *Simandoa conserfariam* Roth & Naskrecki, male holotype, habitus (abdomen extended; note the sparse, small pale specks on the tegmina); B, female paratype (ventral view); C, large male nymph. D, Bat cave in which *Simandoa* lives in the guano. E, One of the many bats (*Roessetus aegyptius*) inhabiting the cave.

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Figs 2A-H. *Simandoa conserfariam* Roth & Naskrecki. A-C, E-H. Male holotype: A, head (frontal); B, genitalia (the phallomeres are oriented horizontally, with the hook on top rather than longitudinally i.e., their normal position with the hook on the right side: see Fig. 1 in Roth, 1971, for their normal position); C, supra-anal plate; D, female paratype: supra-anal plate (dorsal); E, subgenital plate and styles; F, hind wing; G, fourth and fifth tarsomeres (arrow indicates the pulvillus on segment 5), tarsal claws and arolium (ventral); H, complete tarsus (arrow indicates pulvillus on fifth tarsomere).

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