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New and enigmatic cockroaches (Dictyoptera: Blattodea) of Guyana

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ABSTRACT

We report Blattodean taxa collected from three regions in Guyana. Our analyses associated with these specimens provide new geographic records, species descriptions, ecological information and genetic information. We report on the genera *Lamproblatta, Eublaberus, Epilampra, Dasyblatta, Ischnoptera, Xestoblatta, Dendroblatta* and *Euphyllodromia*. These include two new species, nine new records for Guyana and four new records for the Guiana Shield entirely. We also provide photographs, measurements, and some new biological information for our specimens.

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KEYWORDS
Lamproblattidae; Guiana; Iwokrama; Karanambu

Introduction

Although the Guiana Shield is among the world's hotspots for known cockroach biodiversity (Evangelista et al. 2015) Guyana is fairly poorly sampled given its size. Recently, three resources have become available, greatly expediting the speed at which Guianan species can be diagnosed. First, the 'Cockroach Species File' online database, which provides easy access to taxonomic names and citations for taxa (Beccaloni 2014). Second is the checklist of cockroaches of the Guiana Shield (Evangelista et al. 2015). Third is the 'Global Cockroach Library', a digital folder shared among taxonomists with the goal of accumulating all taxonomic works on cockroach taxa (George Beccaloni, pers. comm.).

Using these resources to analyse specimens collected on a series of expeditions (2011–2015), we are adding taxon records to the Guyanese fauna. Here we add nine new country records and describe two new species.

Methods

Specimens were collected from a variety of expeditions to Guyana in 2011–2014. The specific methods for these collections were reported in two previous studies (Evangelista et al. 2014, 2015) . Specimens were also collected during an additional trip in 2014–2015 at Iwokrama Forest and Karanambu Ecolodge, both of which are in the North Rupununi region of Guyana. The same collections methods were used as reported in earlier studies (Evangelista et al. 2014, 2015).

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All specimens were processed in the lab at Rutgers University in Newark. Voucher numbers and labels were provided to them and they were added to an ongoing database of Guianan cockroaches we collected.

The collection was identified using published species descriptions and keys. Traits used to identify specific taxa are indicated in the results section.

Select specimens were chosen for dissection based on necessity for description or illustration of genitalia or wings. Wings were cut off at the base and photographed. Genitalia were dissected by cutting along the left lateral edge of the abdomen to fold over the second and third most distal sternites. Subgenital plate and internal genitalia were removed by gently teasing apart the soft connective tissue. Supra-anal plate and paraprocts were also removed similarly. All removed sections of genitalia were placed in a 10% KOH solution for 8+ hours to clear opaque regions and digest soft tissue. All photographs were taken using an Infinity1 microscope camera.

Specimens were measured manually using a ruler with 0.25 mm precision. The cockroaches were kept in 70% ethanol at the time of the completion of this study; 70% ethanol provides sufficient preservation of genetic material and allows the specimen to remain truer to life (undeformed and flexible). Unless otherwise stated, all specimens reported here will ultimately be stored at the AMNH or the Center for Biodiversity at the University of Guyana.

The classification used in this paper is based on Beccaloni and Eggleton (2013) and Beccaloni (2014). All references to internal genital morphology follow McKittrick (1964) unless otherwise noted.

Results

Superfamily **BLATTOIDEA** Latreille
Family **LAMPROBLATTIDAE** McKittrick
Genus ***Lamproblatta*** Hebard, 1919 (Figures 1, 2)
Lamproblatta ancistroides Rehn, 1930

2 adult males, 1 adult female. Voucher numbers: DEIWO0279, DEIWO0422, DEIWO0470. Collection locality: Turtle Mountain, Iwokrama Forest, Guyana. GPS:4°43′ N, 58°43′ W. Collection date: 20–23 December 2014. Collectors: D. Evangelista, M. Davis, M. Johnney, M. Carter, O. Ambrose.

Morphological identification

These specimens were identified to genus by the valvate subgenital plate in the female and lack of wings. The specimen was further identified to species as follows: it differs from *L. mimetes* in the relatively narrower inter-stylar region (Rehn 1930); it shows less acute productions on the lateral tergites, and wider supra-anal plate than in *L. albipalpus* Hebard 1919; it is larger than *L. albipalpus* Hebard, 1919 and *L. meridionalis* (Bruner 1906); the female is larger than in *L. romani* Rehn, 1930. All measurements can be found in Table 1. In all other ways, this species agrees with the description of *L. ancistroides* Rehn, 1930.

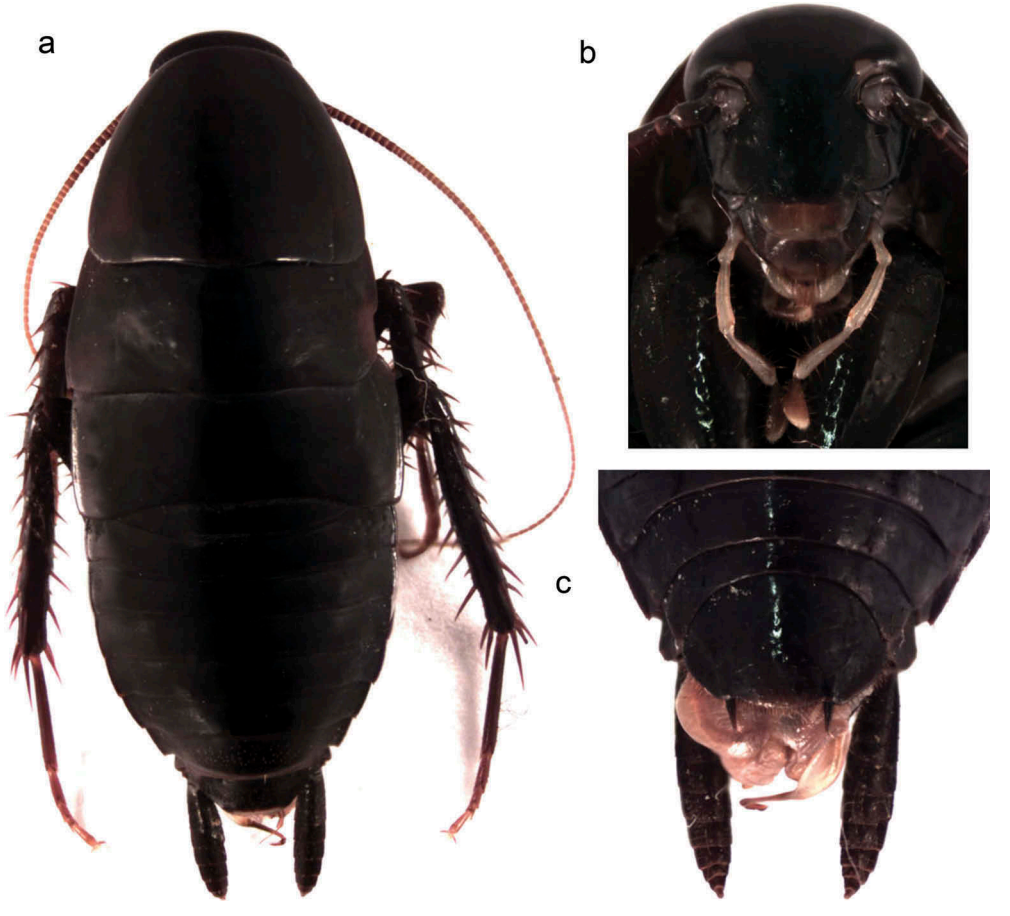

Figure 1. *Lamproblatta ancistroides* Rehn, 1930. Adult male. Voucher number: DEIWO0470. (a) Dorsal body; (b) ventral head; (c) ventral subgenital plate, terminal sternites and cerci.

Collection/ecological information

Although we only report three individuals here this species was numerous in our collection (43 total adults). Most specimens were collected by hand on low lying vegetation at night. A few other individuals were collected in pitfall traps baited with beer.

Known geographical distribution

Guyana (Iwokrama forest; new record), Colombia, Venezuela

Superfamily **BLABEROIDEA** Saussure
Family **BLABERIDAE** Saussure
Subfamily **BLABERINAE** Saussure
Genus ***Eublaberus*** Hebard, 1920

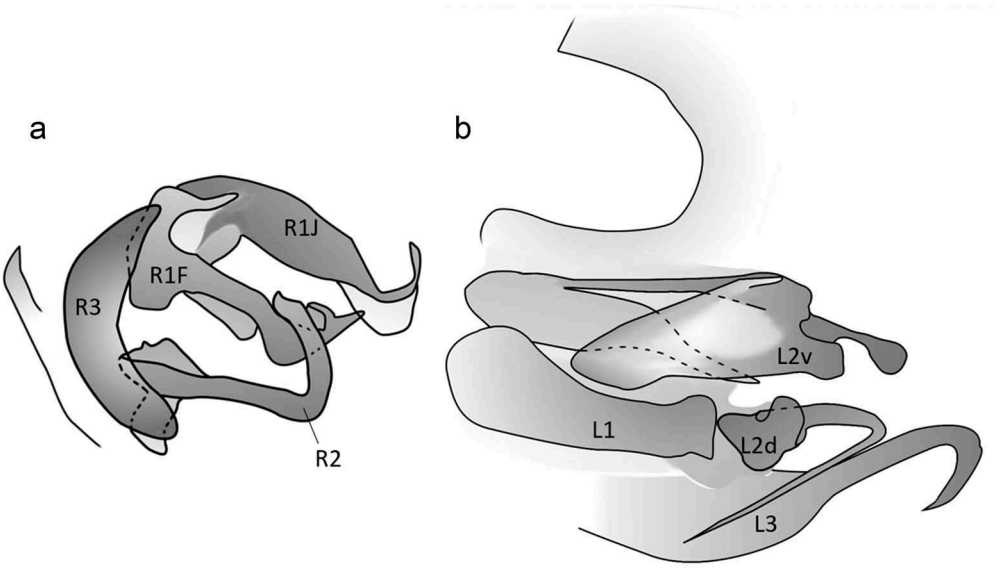

Figure 2. *Lamproblatta ancistroides* Rehn, 1930. Adult male genitalia. Voucher number: DEIWO0470. (a) Right genital phallomeres. We have differentiated two sections of R1 in accordance with Klass (1997). (b) Left genital phallomeres.

Eublaberus marajoara Rocha E Silva Albuquerque, 1972
(Figure 3)

1 female. Voucher number: DEKBO1034. Collection locality: Karanambu EcoLodge, Rupununi, Guyana. GPS: 3°45′ N, 59°18′ W. Collection date: 17–29 June 2013. Collectors: O. Ambrose, M. Wilson & D. Evangelista.

Collection/ecological information
This specimen was found in one of the benabs at the tourist lodge.

Morphological identification
This specimen was identified by the coloration of the pronotum, wings and head.

Known geographical distribution
Guyana (Rupununi savannah region; new record), Brazil (Amazonas, Para, Mato Grosso)

Subfamily **EPILAMPRINAE** Brunner von Wattenwyl
Genus ***Epilampra*** Burmeister, 1938
Epilampra colorata Rocha E Silva Albuquerque & Gurney, 1962
(Figure 4)

2 adult male, 1 adult female, 1 adult unknown, 2 juveniles. Voucher numbers: DEIWO0190, DECBA0213, DECBA1102, DECBA0501, DEKBO1219, DECBA0807. Collection locality: Iwokrama Research Station, Iwokrama, Guyana (IWO), GPS: 4°40′ N 58°41′ W; CEIBA Biological station, Madewini Guyana (CBA), GPS: 6°29′ N 58°13′ W; and Karanambu

Table 1. Allometric data for some species first recorded in Guyana in this paper. All measurements are in millimetres. Some specimens were damaged, in which case the measurement could not be completed (NA) or had to be estimated (est.).

			Lamproblatta ancistroides		*Eublaberus marajoara*	*Epilampra colorata*		*Dasyblatta thaumasia*			*Euphyllodromia amazonensis*	*Xestoblatta surinamensis*			
			Adult ♀	Adult ♂	Adult ♀	Adult ♀	Adult ♂	Adult ♂	Adult ♀	Adult ♀	Adult ♀	Adult ♀		Adult ♂	
Morphological feature			DEIWO 0279	DEIWO 0470	DEKBO 1034	DEIWO 0301	DEIWO 0190	DEKBO 0706	DEKBO 1308	DEKBO 0514	DEIWO 0173	DEIWO 0441	DEIWO 0449	DEIWO 0457	DEIWO 0497
Head	Greatest width		3.0	3.1	6.0	3.5	3.0	2.1	1.8	2.0	2.9	2.9	3.0	3.0	2.5
	Medial length		5.5	3.7	7.1	3.8	3.0	2.6	2.0	2.7	2.3	3.6	4.0	3.5	3.4
Pronotum	Greatest width		7.0	5.8	14.5	6.5	5.0	3.1	3.3	2.3	3.9	5.5	6.0	5.5	6.0
	Medial length		6.0	3.6	10.5	5.0	4.0	2.5	2.1	3.0	2.6	3.1	4.0	4.0	4.0
Leg	Front	Femur	3.7	3.5	7.1	3.1	3.0	2.2	2.1	2.1	2.5	3.9	4.1	3.9	4.0
		Tibia	3.2	2.7	4.0	2.0	1.8	1.0	1.1	1.5	1.9	2.8	2.9	2.9	2.3
	Middle	Femur	5.5	4.0	9.0	4.0	3.8	3.5	2.5	2.9	2.3	5.1	5.2	5.1	5.3
		Tibia	5.0	3.4	6.1	4.5	3.5	2.5	2.4	3.0	2.9	5.0	5.0	4.5	4.6
	Hind	Femur	6.5	5.0	9.0	5.0	4.1	4.9	3.0	3.5	3.0	6.2	5.9	6.0	5.6
		Tibia	7.0	6.0	10.0	7.0	6.5	4.1	3.5	3.8	4.0	8.0	8.0	8.0	7.9
Cerci length			3.2	2.9	2.5	2.0	2.0	3.0	2.0	NA	2.5	3.1	3.0	3.1	3.3
Tegmina length			NA	NA	31.3	20.0	16.0	9.9	10.0	10.4	10.1	18.2	20.0	19.0	18.5
Total body length			25.0	16.8	33.0	22.0	18.1	10.0 (est.)	11.1	NA	10.5	18.1	19.2	17.9	20.0

Figure 3. *Eublaberus marajaora* Rocha E Silva Albuquerque, 1972. Adult female. Voucher number: DEKBO1034. Body, dorsal. The individual was collected with a damaged right tegmen.

EcoLodge, North Rupununi, Guyana (KBO), GPS: 3°46′ N, 59°20′ W. Collection date: 19–29 December 2014. Collectors: D. Evangelista, M. Davis, M. Johnney, M. Carter, O. Ambrose.

Collection/ecological information

All specimens were collected by hand. No ecological information is known.

Morphological identification

We identified this species by comparing pronotal and facial coloration as well as allometry and total size (Rocha E Silva Albuquerque & Gurney 1962).

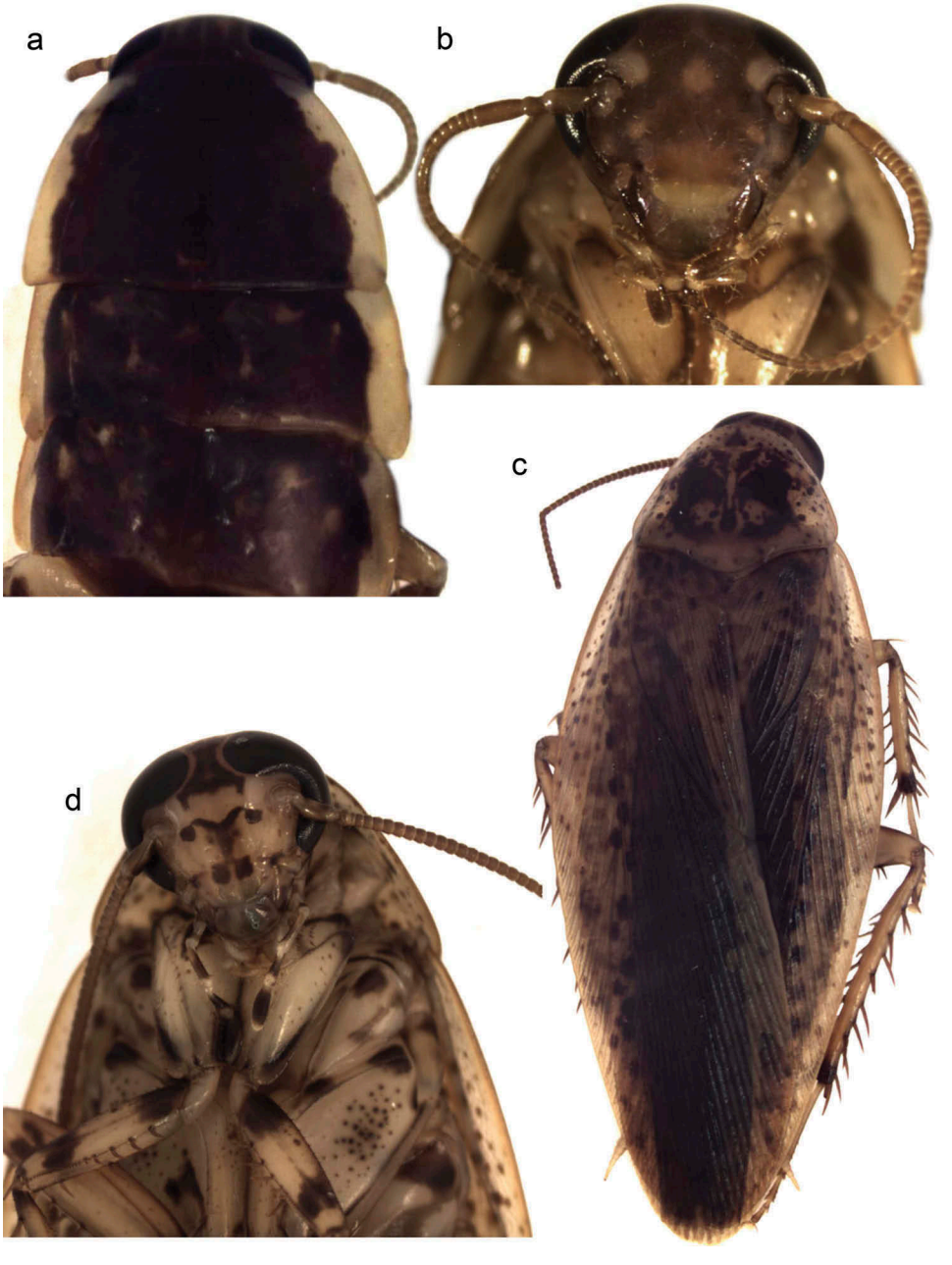

Figure 4. *Epilampra colorata* Rocha E Silva Albuquerque & Gurney, 1962 (a) Juvenile thorax, dorsal. (b) Juvenile head, ventral. Voucher number: DECBA0501. (c) Adult male dorsal aspect of body. (d) Adult male head. Voucher number: DEIWO0190.

Genetic information and evolutionary placement

The barcode tree of Evangelista et al. (2014) groups a number of individuals into one clade (Voucher and GenBank accession numbers: DECBA1102 – KF155086, DECBA0213 –

KF155038, DECBA0501 – KF155098, DECBA0807 – KF155077). The individuals include two juveniles, an adult male and an adult female that we now know are of the same species, due to the genetic data. We include photographs of one of these juveniles (DECBA0501; Figure 4(a, b)).

Known geographic distribution

Guyana (new record), Brazil (Amapa)

Family **ECTOBIIDAE** Brunner von Wattenwyl
Subfamily **BLATTELLINAE** Karny
Genus ***Dasyblatta*** Hebard, 1921

History

The genus *Dasyblatta* was first erected by Hebard in 1921 and included two species: *Dasyblatta thaumasia* Hebard, 1921, and *Dasyblatta chopardi* Hebard, 1921. Hebard differentiated *Dasyblatta* from the group 'Blattellae' by the fact that they were covered in hairs, and had a curled intercalated triangle when wings were at rest. In addition, Hebard noted similarities between individuals of *Dasyblatta* and *Ischnoptera* Burmeister, 1838 with regards to the general shape of the body, specifically the head and pronotum. He also believed *Dasyblatta* to be most closely related to the genera *Platylestes* Hebard, 1919 and *Chromatonotus* Hebard, 1920.

Since 1921 the genus has expanded to include eight species, with the most recently added species being *D. charpentierae* Bonfils 1975, *D. stylata* Bonfils 1975 and *D. warei* sp. nov., which we describe here.

Dasyblatta thaumasia Hebard, 1921
(Figure 5)

2 adult males, 1 adult female, 1 adult unknown. Voucher number: DECBA1777, DEKBO0706, DEKBO1308, DEKBO0514. Collection locality: CEIBA Biological Station, Madewini, Guyana (CBA) and Karanambu EcoLodge, North Rupununi, Guyana, (KBO). GPS: 6°29′ N, 58°13′ W (CBA), 3°46′ N, 59°20′ W (KBO). Collection date: 15 August 2012 (DECBA1777), 7 June 2013 (DEKBO0706) 9–10 January 2015 (DEKBO1308), and 15 June 2013 (DEKBO0514). Collectors: D. Evangelista, W. Kuhn (CBA voucher), S. George, O. Ambrose, M. Wilson (KBO vouchers).

Collection/ecological information

These specimens were collected both by hand and in pitfall traps baited with beer. Specimens from the Rupununi were found entirely at sites near flood zones or bordering bodies of water. CEIBA biological station has an overall wetter climate compared to Karanambu which might be why we did not collect the CBA specimen near a body of water.

Morphological identification

This species was identified by the shape of the subgenital plate, asymmetry of the penultimate tergite and coloration of the pronotum.

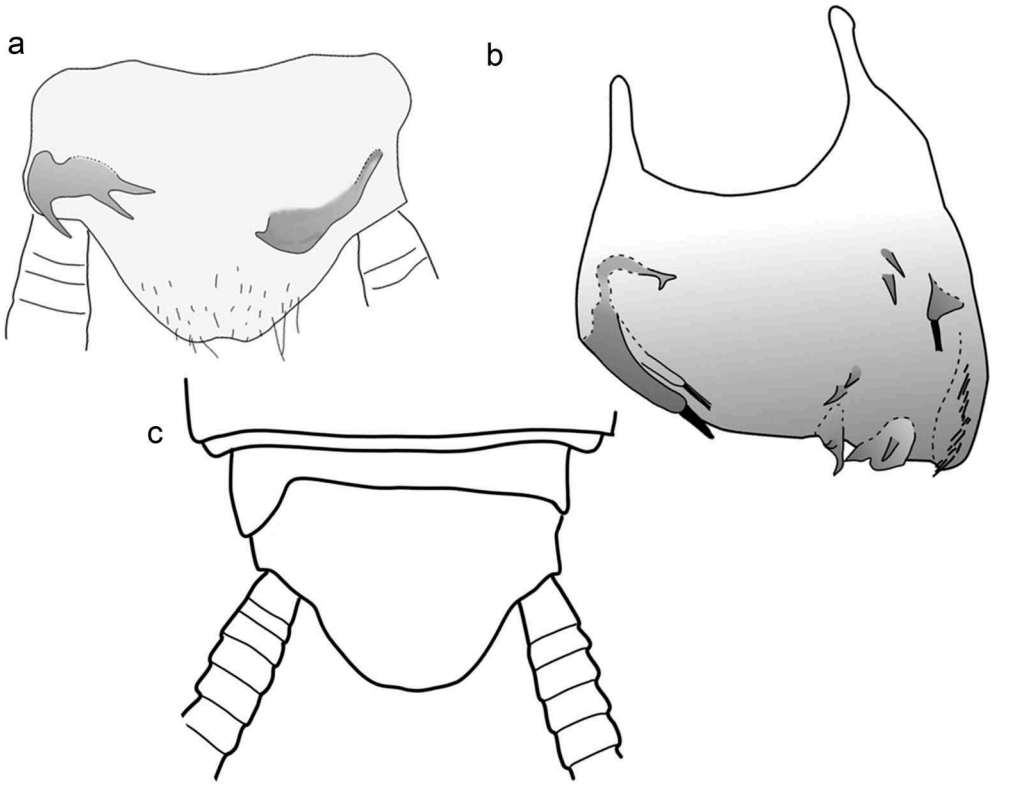

Figure 5. *Dasyblatta thaumasia* Hebard, 1921. Adult male. Voucher number: DEKBO0706. (a) Supra-anal plate, ventral aspect. (b) Terminal abdominal terga, dorsal aspect. (c) Terminal abdomen, dorsal aspect.

Genetic information and evolutionary placement

The individual from CEIBA Biological Station (DECBA1777 – KF155133) was a part of the tree in Evangelista et al. (2014) however they did not find a relationship to any other taxa.

Known geographic distribution

Guyana (new record), Suriname and Brazil (Para).

Dasyblatta warei sp. *nov*. Mendoza & Evangelista (Figures 6, 7; Table 2)

Holotype information

Adult male. Voucher number: DECBA0907. GenBank Accession number: KF155073. Locality: CEIBA Biological Station, Madewini, Guyana. GPS: 6°29′ N, 58°13′ W. Collection date: 11 August 2011. Collectors: I. Biazzo, D. Evangelista, M. Kohli, M. Sanchez, N. Sroczinski and J. L. Ware.

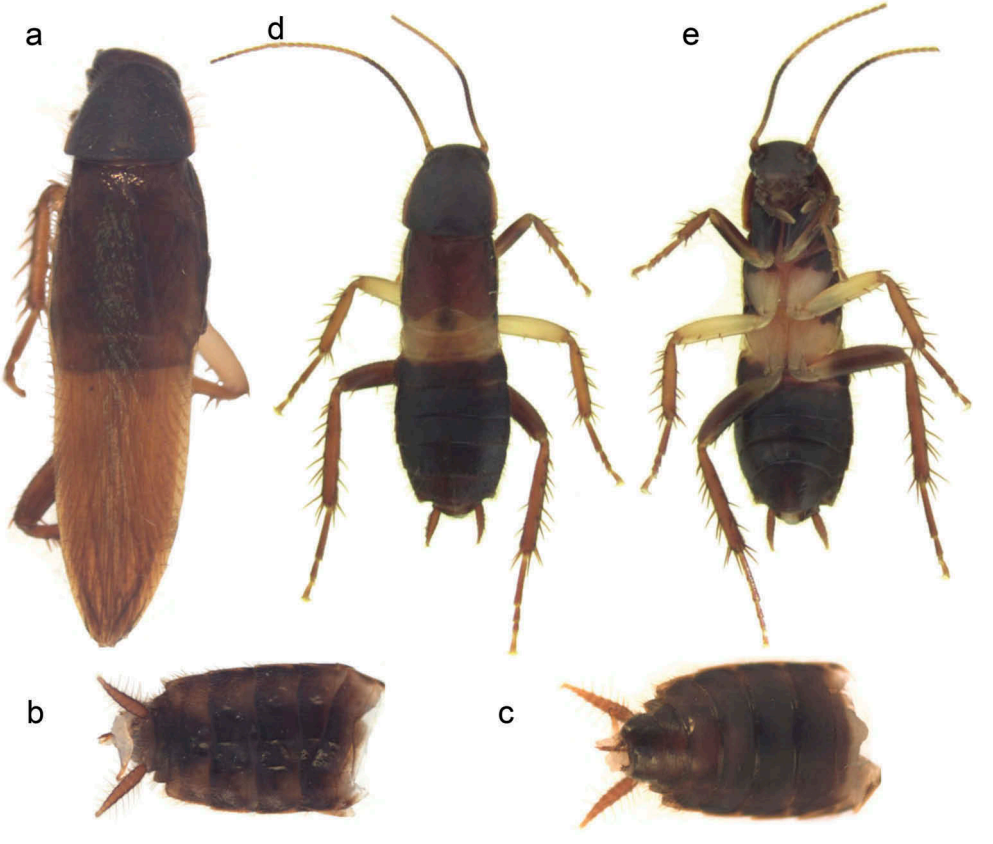

Figure 6. *Dasyblatta warei* sp. nov. (a–c) Adult male holotype. Voucher number: DECBA0907. (a) Dorsal body; (b) dorsal abdomen; (c). ventral abdomen. (d, e) Adult female allotype. Voucher number: DECBA1803. (d) Dorsal body; (e) ventral body.

Deposition

The holotype is stored in 70% ethanol and will be deposited in the Center for Biodiversity at the University of Guyana.

Collection/ecological information

This individual was collected within a bromeliad at the crown of a tree (22 m above ground).

Morphological identification

Assigning this species to a genus was very difficult given its derived form. We placed this species in the Blattellinae based on the location of the hooked phallomere (left). The shape of the right genital phallomere suggests a greater similarity to *Xestoblatta* Hebard 1916, or *Ischnoptera* Burmeister, 1838. However, our specimens were lacking the dorsal tergal gland common in both groups. Given the overall hairy nature, lack of tergal gland, fore leg spination, and slight curling of male hind wings at rest we have placed this species in *Dasyblatta* Hebard 1921.

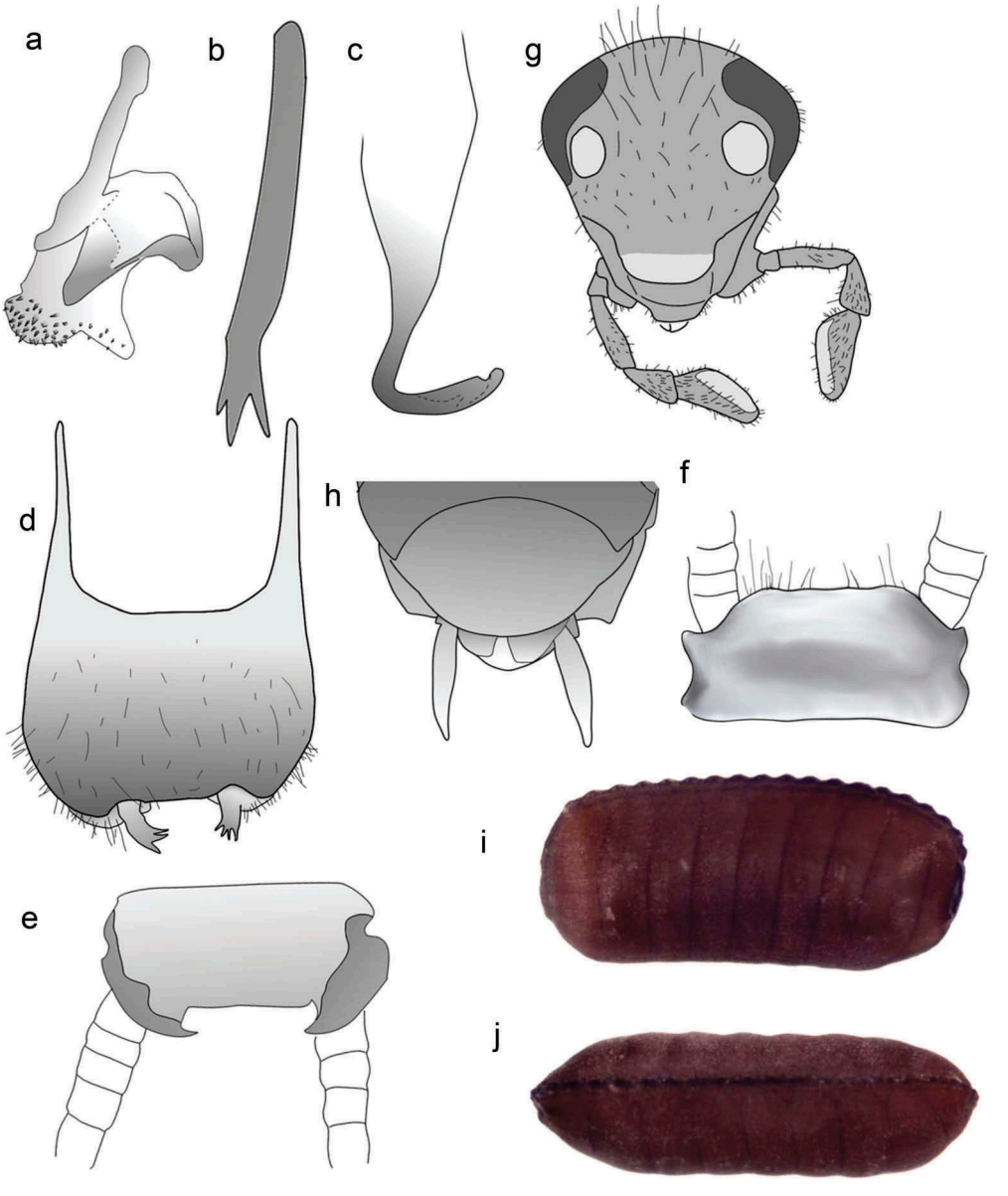

Figure 7. *Dasyblatta warei* sp. nov. (a–f) Adult male holotype. Voucher number: DECBA0907. (a) Right phallomere (R2); (b) medial phallomere (Lvm); (c) left phallomere (L3); (d) ventral subgenital plate; (e) ventral supra-anal plate; (f) Dorsal subgenital plate. (g, h) Female allotype. Voucher number: DECBA1803. (g) Head, ventral; (h) ventral subgenital plate. (i, j) Ootheca taken from allotype during live collection.

Description of holotype

Male. Head pale, chestnut brown; covered in medium-sized hairs, almost uniformly. Interocular space approximately equal to interantennal space. Ocelli absent. Antennae same colour as head, becoming increasingly light distally.

Table 2. Allometric data for *Dasyblatta warei* sp. nov. All measurements are in millimetres. The abdomen of the male specimen is not connected to its body so total body length was estimated (est.) based on the two parts.

			Dasyblatta warei sp. nov.	
			Adult ♂	Adult ♀
Morphological feature			DECBA0907	DECBA1803
Head	Greatest width		1.8	1.5
	Medial length		2.0	2.1
Pronotum	Greatest width		2.4	2.5
	Medial length		1.9	2.2
Leg	Front	Femur	1.8	1.7
		Tibia	1.5	1.2
	Middle	Femur	2.1	2.4
		Tibia	2.9	2.4
	Hind	Femur	3.4	2.9
		Tibia	2.9	3.0
Cerci length			1.6	1.1
Tegminal length			9.0	2.1
Total body length			9.2 (est)	8.5

Anteroventral margin of the fore legs armed with one large basal spine followed by a row of small spines (14-left and 9-right), one large preapical spine, and one large apical spine. Pulvilli present on all tarsal segments. Arolia present; medium to large size (not quite meeting tip of the tarsal claws). The anteroventral margin of the middle leg with two large spines and one slightly smaller spine just before large apical spine. Genicular spine present. Leg coloration: fore leg coxa is almost entirely brown and lightening to buffy apical section; femur, tibia, and tarsus are a light reddish amber. The middle leg same as fore leg, except buffy region on coxa is more prominent and femur buffy as well.

Pronotum does not entirely cover head; uniformly dark, chestnut-brown; large hairs covering anterior and lateral sides of pronotum, most prominently; lateral margin slightly less chitinized and more translucent.

Tegmina long and thin, covered in long hairs uniformly; translucent, brown amber.

Abdomen dorsally covered in large hairs, most dense laterally. Dorsal abdominal gland absent. Supra-anal plate trapezoidal and truncated. Abdominal tergum anterior to supra-anal plate only subtly, if at all, asymmetrical. Coloration as rest of body. Tergites slightly lighter laterally. Abdomen ventrally covered in medium-sized hairs throughout, and most obvious on posterior margins of the segments. Supra-anal plate rounded and curved modestly dorsally at the lateral sides. Coloration is deep, chestnut-brown overall.

Right stylus of subgenital plate curved medially, terminating in a crown of spines. Left stylus projecting posteriorly; shorter than right stylus, and similarly crowned. Medial phallomere stout, branched into three prongs. Right phallomere with a membrane of stout hairs or spines proximal to it. Paraprocts slightly asymmetrical, but not highly specialized.

Measurements can be found in Table 2.

Allotype

Voucher number: DECBA1803. Locality: CEIBA Biological Station, Madewini, Guyana. GPS: 6°29′ N, 58°13′ W. Collection date: 21 August 2012. Collectors: D. Evangelista, W. Kuhn.

Deposition

The allotype is stored in 70% ethanol and will be deposited in the Center for Biodiversity at the University of Guyana.

Collection/ecological information

This individual was collected on the trunk of a tree while it was ovipositing.

Morphological description of allotype

Female. Head is the same as described in male, except: interocular space is just slightly narrower than the inter-antennal space; antenna same colour as head, but light amber both distally and basally.

Anteroventral margin of fore leg lacking large basal spine (14 small spines present on both forelimb femurs). Middle leg anteroventral margin of femur same as male, except that small spine is much more minute. Hind leg anteroventral margin is same as middle leg. Legs coloration same as in male. Hind leg femur and tibia are orange amber colour, similar to that of fore legs.

Pronotum is equally or more hairy than male; small central region lacking large hairs. Tegmina and wings shortened, almost reaching first segment of abdomen (brachyptery). Tegmina covered in large hairs throughout; orange-amber coloration, darker at base of subcostal vein. Light colour of the lateral margins of terga is more pronounced in female than in male.

Abdomen dorsally same as male except first two segments are lacking brown coloration. Ventral abdomen same as male except that subgenital plate is simple, rounded, and hairier than remainder of abdomen. Ootheca as in Figure 7(i, j), 4.2 mm long.

Measurements can be found in Table 1.

Juvenile paratypes

Voucher numbers: DECBA0911, DECBA0906. (All collection information same as the holotype).

Description of juvenile paratypes

Ventral morphology same as adults but may have a duller pale brown coloration. When present, styles are finger-like, simple, and symmetrical. Pronotum is same amber colour as female thorax. Light amber colour extends posteriorly to first abdominal segment. Pronotum is dusky brown posteriorly.

Measurements for the juvenile paratypes can be found in Table 2.

Molecular data and evolutionary placement of *D. warei sp. nov.*

The tree of Evangelista et al. (2014) fails to associate the two individual sequences (DECBA0907 – KF155073, DECBA0906 – KF155072) with the sequence for *Dasyblatta thaumasia* Hebard, 1921 (DECBA1777 – KF155133).

Differential diagnosis and diagnostic features

The major features in which our species differ from the known *Dasyblatta* (*D. charpentierae* Bonfils, 1975; *D. stylata*, Bonfils, 1975; *D. chopardi* Hebard, 1921; *D. thaumasia*, Hebard, 1921; *D. maldonadoi* Rocha E Silva Albuquerque, 1964; *D. vogli* Princis, 1955; *D. melanocephala*, Princis, 1955) are: immaculate pronotum, styles only slightly curved, ocelli absent, subgenital plate not strongly asymmetrical, tergite anterior to supra-anal plate symmetrical, supra-anal plate trapezoidal. We suspect this species is not closely related to any of the known *Dasyblatta*.

Etymology

We name this species after Dr Jessica Lee Ware. She has contributed significantly to knowledge of Blattodea, Odonata and other insects. Not only this, but we find that this *Dasyblatta* (particularly the female) fits her exceptional and admirable character. The etymology of the generic name (dasy = hairy) is unrelated.

Known geographic distribution

Guyana (Madewini).

Genus ***Ischnoptera*** Burmeister, 1838
Ischnoptera galibi Hebard, 1926
(Figures 8, 9; Table 3)

7 adult males, 2 adult females, 2 juveniles. Voucher numbers: DECBA3301, DECBA1986, DEIWO0120, DEKBO0342, DEKBO0343, DEKBO0482, DEKBO1534, DEKBO0345, DEKBO0351, DEKBO0344, DEKBO0259. Collection locality: CEIBA Biological Station, Madewini, Guyana (CBA), Saw Mill, Iwokrama Forest, Guyana (IWO), Karanambu EcoLodge, Rupununi, Guyana (KBO). GPS: 6°29′ N, 58°13′ W (CBA), 4°36′33″ N, 58° 43′53″ W (IWO), 3°46′ N, 59°20′ W (KBO). Collection dates: June 2011–June 2013 (CBA), 27 December 2014 (IWO), June 2013 and January 2015 (KBO). Collectors: I. Biazzo, D. Evangelista, M. Kohli, M. Sanchez, N. Sroczinski and J. L. Ware (CBA). M. Davis, M. Johnny, M. Carter (IWO). M. Wilson, O. Ambrose (KBO).

Morphological identification

We identified this as *Ischnoptera* because of the presence of the dorsal tergal gland of the form of *Ischnoptera* and fore leg spination. We further identified this to species based on the appearance of the subgenital plate (styli that appear to be productions of the plate rather than distinct appendages) and the supra-anal plate shape (particularly the cone near the sinistral cercus and deflexed lateral sides). These characters are important for identification of this species as it otherwise appears very similar to *Ischnoptera paramacca* Hebard, 1926. Unfortunately, we are unaware of characters that separate the females of these two species. We have identified females and juveniles of *I. galibi* at Iwokrama and Karanambu only because *I. paramacca* was not collected at these two sites.

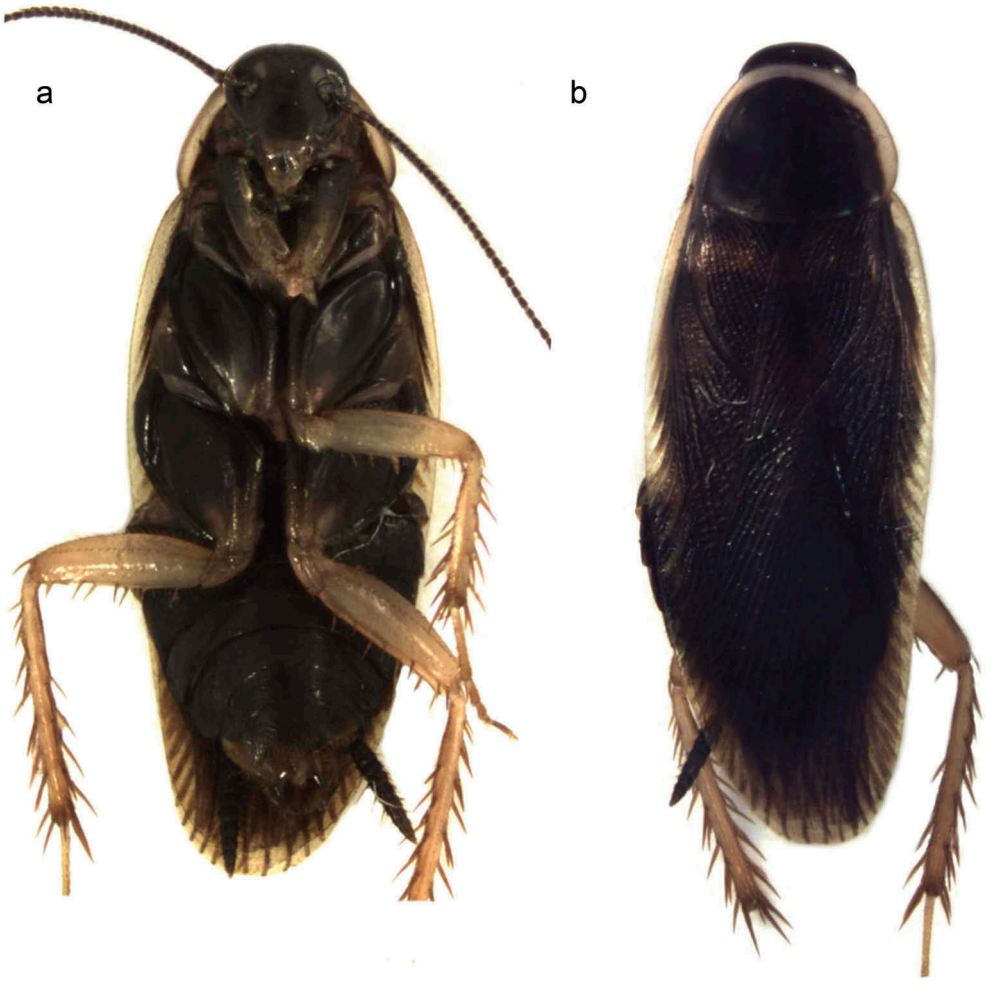

Figure 8. *Ischnoptera galibi* Hebard, 1926. Adult male. Voucher number: DEIWO0120. (a) Ventral aspect of male. (b) Dorsal aspect of male.

Collection/ecological information

We found this species to be numerous in the secondary coastal rainforests (Madewini) and even more numerous in the forests of the Rupununi savannah. We also found that this species was almost entirely absent from our collection localities in Iwokrama rainforest, except in the leaf litter at the edges of a deforested saw mill. Given this and data included with another publication (Evangelisa, Russell, Bourne & Ware, pers. comm.), we might categorize this species as having an affinity for disturbed or secondary successional forests.

Known geographical distribution

Guyana (new record), Suriname, and French Guiana.

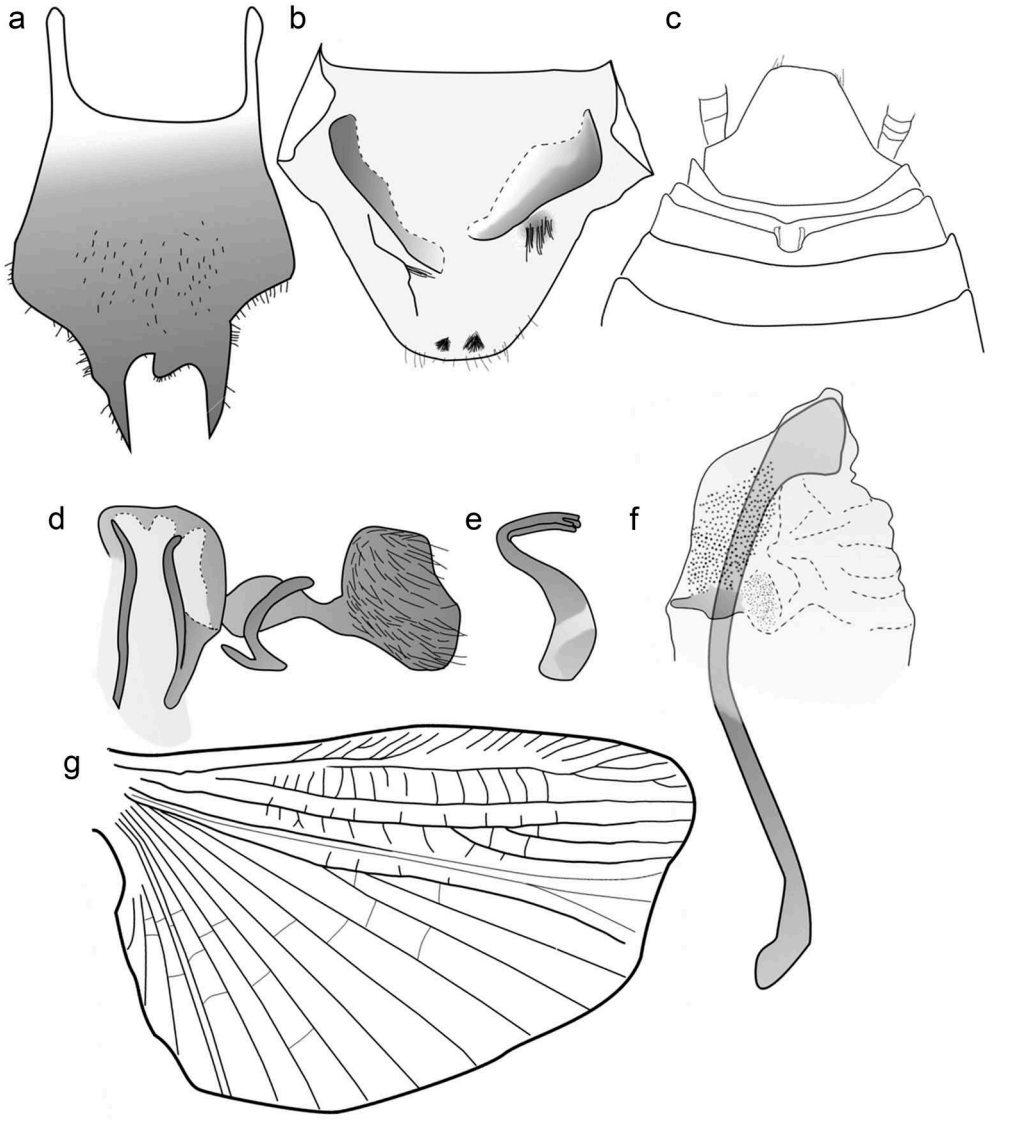

Figure 9. *Ischnopter galibi* Hebard, 1926. Adult male. (a) Ventral subgenital plate. Voucher number: DEKBO0869. (b) Ventral supra-anal plate. Voucher number: DEKBO0348. (c) Terminal terga showing supra-anal plate and tergal gland. Voucher number: DEKBO0344. (d) Right phallomere (R2). (e) Left phallomere (L3). (f). Medial phallomere (Lvm). Voucher number: DEKBO0869. (g) Wing. Voucher number: DEKBO0634.

Genus ***Xestoblatta*** Hebard, 1916
Xestoblatta surinamensis Bruijning, 1959
(Figure 10)

6 adult males, 16 adult females, 1 juvenile. Voucher numbers: DEIWO0197, DEIWO0415, DEIWO0441, DEIWO0480, DEIWO0457, DEIWO0354, DEIWO0497, DEIWO0503,

Table 3. Allometric data for *Ischnoptera galibi* Hebard. All measurements are in millimetres. Some specimens were damaged in which case the measurement could not be completed (NA) or had to be estimated (est.). Given the large number of specimens we measured, we summarize our measurements as average values ± their standard deviation.

			Ischnoptera galibi				
			Adult ♂ (Karanambu)	Adult ♀ (Karanambu)	Adult ♂ (CEIBA)	Adult ♂ (CEIBA)	Adult ♂ (Iwokrama)
Morphological feature			DEKBO 0345, DEKBO 0351, DEKBO 0344, DEKBO 0259	DEKBO 0342, DEKBO 0343, DEKBO 0482, DEKBO 1534	DECBA2210, DECBA2212	DECBA2211, DECBA2019	DEIWO 0120
Head	Greatest width		1.8±0.22	1.5±0.04	1.5±0.05	1.6±0.05	1.5
	Medial length		2.2±0.22	2.0±0.07	2.0±0.05	2.1±0.05	1.9
Pronotum	Greatest width		2.9±0.14	2.9±0.08	3.0±0.00	3.1±0.05	2.9
	Medial length		1.8±0.35	2.1±0.04	2.0±0.00	2.0±0.00	1.8
Leg	Front	Femur	1.9±0.09	2.0±0.08	2.0±0.00	2.2±0.15	1.6
		Tibia	1.4±0.52	1.1±0.05	1.1±0.05	1.2±0.15	1.1
	Middle	Femur	2.1±0.05	2.2 ±0.18	2.3±0.30	2.3±0.25	2.1
		Tibia	2.0±0.04	2.1±0.05	2.3±0.20	2.4±0.25	2.0
	Hind	Femur	2.6±0.29	2.7±0.15	2.8±0.15	2.4±0.15	2.4
		Tibia	3.0±0.07	3.2±0.11	3.1±0.05	3.4±0.25	3.0
Cerci length			1.5±0.10	1.9±0.09	2.0±0.05	1.8±0.35	1.7
Tegminal length			9.0±0.54	8.2±0.16	8.7±0.20	9.0±0.00	8.2
Total body length			9.8±0.64	8.9±0.51	9.3±1.30	8.3±0.00	8.5 (est)

DEIWO0382, DEIWO0420, DEIWO0184, DEIWO0373, DEIWO0442, DEIWO0504, DEIWO0305, DEIWO0229, DEIWO0292, DEIWO0306, DEIWO0419, DEIWO0445, DEIWO0449, DEIWO0450, DEIWO0458. Collection locality: Turtle Mountain, Iwokrama River Lodge and Atta lodge in Iwokrama Forest, Guyana. GPS: 4°39″ N, 58°41′ W; 4°43′ N, 58°43′ W; 4°14′ N, 58°54′ W. Collection dates: 20–29 December 2014. Collectors: D. Evangelista, M. Davis, M. Johnny, M. Carter, O. Ambrose.

Morphological identification

We identified these specimens as *Xestoblatta* Hebard, 1916 through the fore leg anteroventral margin spination (spines all large), modified styles and presence of abdominal tergal gland. We then further associated these species with *Xestoblatta surinamensis* Bruijning, 1959 by the shape of the right style being clubbed, and the modified shape of dorsal abdominal tergum 7.

Collection/ecological information

This species was mostly collected in pitfall traps baited with beer. It was fairly commonly caught by hand at night as well. This is the first record of this species in Guyana.

Known geographical distribution

Guyana (Iwokrama forest; new record), Suriname, French Guiana, and Brazil (Para)

Subfamily **Pseudophyllodromiinae** Brunner von Wattenwyl
Genus ***Dendroblatta*** Rehn, 1916

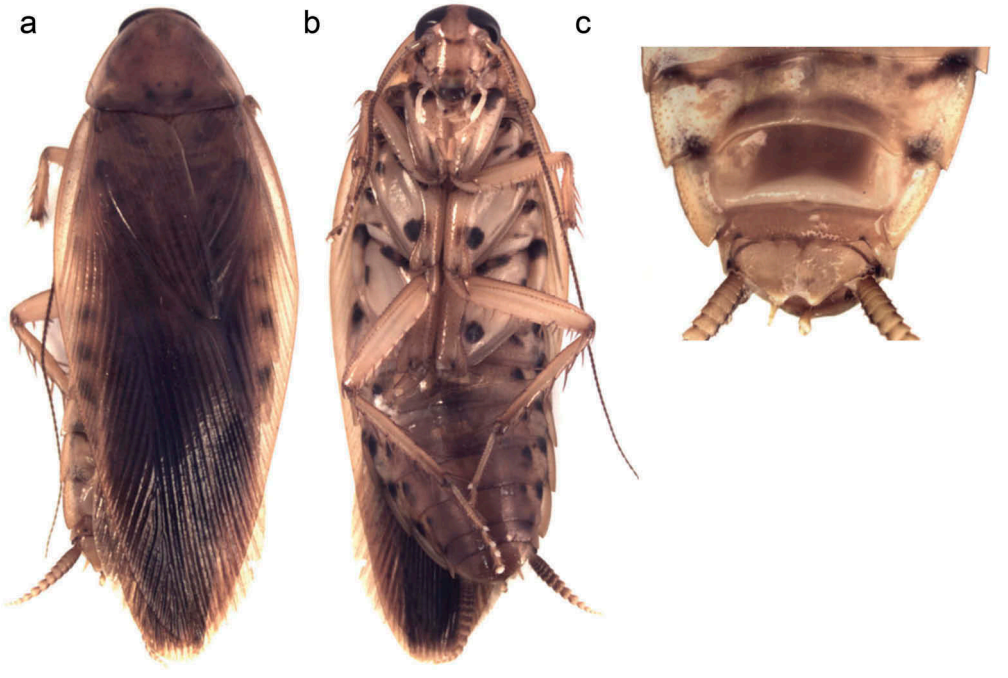

Figure 10. *Xestoblatta surinamensis* Bruijning, 1959. Adult male. (a) Dorsal body. (b) Ventral body. (c) Terminal terga, showing supra-anal plate and tergal gland. Voucher number: DEIWO0354.

History

Dendroblatta was originally described by Rehn (1916). Since its description, the genus has grown to include 19 species (including the one herein described) that have each slightly widened the morphological scope of the genus. The original description emphasized the following as the defining characters: intercalated triangle of wings small, elongate and narrow; dorsal tergal gland on 7th tergite; ventral surface hirsute (Rehn 1916). However, Rehn later revised this to say that the dorsal tergal gland was not common to all species of the genus and should therefore not be considered a diagnostic feature (Rehn 1932). Lopes et al. (2014) added *Dendroblatta iani* (Rocha E Silva Albuquerquee 1964) to the genus (originally described as *Xestoblatta iani*). The inclusion of this species diversifies the forms of spination of the anteroventral margin of the fore leg femur found in *Dendroblatta. D. iani* is the only member of the genus with a series of moderately sized spines preceding the apical spines, rather than the typical spination (moderately size spines basally, a dense row of small spines, and two larger apical spines). *D. iani* should be considered atypical of the genus in this respect.

Thus far, all taxonomic work on this genus has failed to provide a set of strong characters delimiting it. In fact, further work may find that this genus is not monophyletic. From what work has been done thus far, we find that the following characteristics are typical of the genus, but may be different among atypical species: 3–5 protrusions of the subgenital plate, usually one medial protrusion being more densely sclerotized; pronotum typically with some black coloration in the central region; spination of the fore leg femur having 3–7 moderately large spines basally, followed by 19–31 minute

spines, 1 large preapical and 1 large apical spine; dorsal tergal gland either absent, or represented by a simple patch of hairs on terga 7; supra-anal plate symmetrical, truncate, slightly bilobed in some species and simple in other species; body length between 8 and 20 mm.

Dendroblatta litura sp. nov. Sylvain & Evangelista (Figures 11, 12; Table 4)

Holotype information

Adult male. Voucher number: DEKBO1515. GenBank Accession number: KT906104. Locality: Karanambu EcoLodge, Rupununi, Guyana. GPS: 3°45′N, 59°18′W. Collection date: 31 December 2014. Collectors: Dominic A. Evangelista, Oswin Ambrose.

Deposition

The holotype is stored in 70% ethanol and will be deposited in the Center for Biodiversity at the University of Guyana.

Collection/ecological information

Most specimens were collected by hand around camp and the surrounding trails. Some females were captured in beer traps.

Morphological identification

We assigned this specimen to *Dendroblatta* Rehn, 1916 based on its subgenital plate with multiple protrusions, small body size (8–20 mm), and general shape of the genital phallomeres. Furthermore, we find that the subgenital plate of our species is very similar to that of *D. matograssensis* Lopes & Oliviera, 2005 and *D. mineira* Lopes & Oliveira 2005 with a general degree of similarity in the genital phallomeres as well.

Description of holotype

Male. Ocelli small, not obvious. Inter-ocular space very narrow (~0.25 mm). Inter-antennal space much wider (~0.75 mm). Maxillary palps long; second segment measures approximately 1 mm with the third segment slightly shorter; terminal segment shorter than third. Overall head coloration is dark amber with brown regions. Inter-ocular space entirely brown. Frons mostly amber with brown patterning (as in Figure 11(c)). Antennae sparsely covered with medium/long hairs throughout; beginning on the sixth or seventh segment of the flagellum, which is covered densely with minute hairs; coloration similar to the head.

Anteroventral margin of the fore leg femur (right) has 4 large proximal spines followed by 31 minute spines, 1 large apical and 1 large pre-apical spine. Left fore leg is missing due to damage. Posteroventral margin has 3 large spines and 1 apical spine. Ventral side of tarsus with two parallel rows of spines along entirety. Basal first, second, and third pulvilli very small or absent. Fourth pulvillus is large. Tarsal claws symmetrical and unspecialized. Arolia medium to large, reaching halfway to tip of tarsal claw. The anteroventral margins of the middle legs have 6 large spines, 1 apical spine and 1 genicular spine. Five spines on posteroventral margin plus 1 apical spine. Tarsi are same

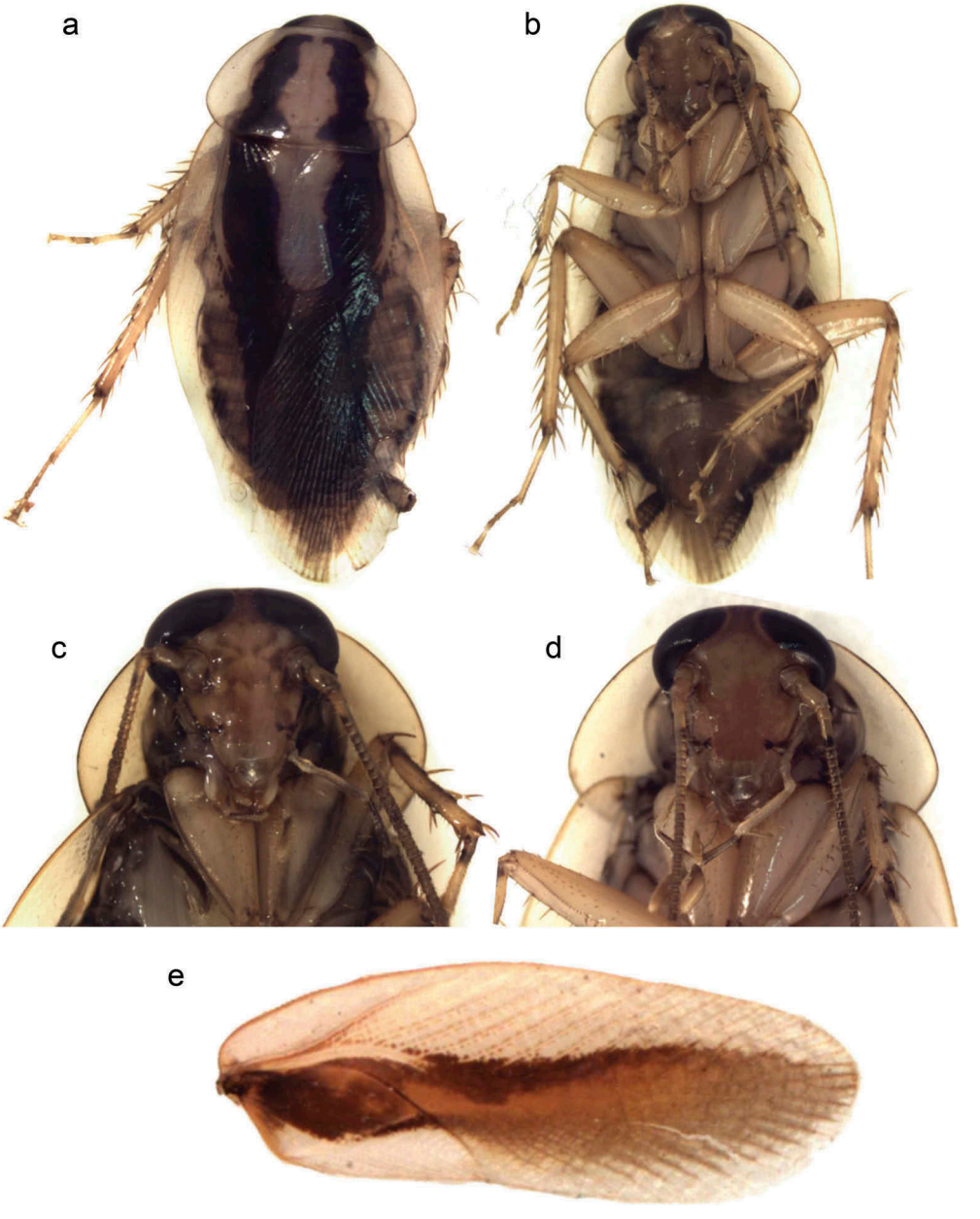

Figure 11. *Dendroblatta litura* sp. nov. (a, b) Adult female paratype. Voucher number: DEKBO0974. (a) Dorsal body; (b) ventral body. (c) Male head, ventral. Voucher number: DEKBO1083. (d). Female head, ventral. Voucher number: DEKBO0974. c and d show the variation in the facial coloration of this species. This variation seems to be present independently of sex. (e) Tegmina, dorsal. Voucher number: DEKBO0689.

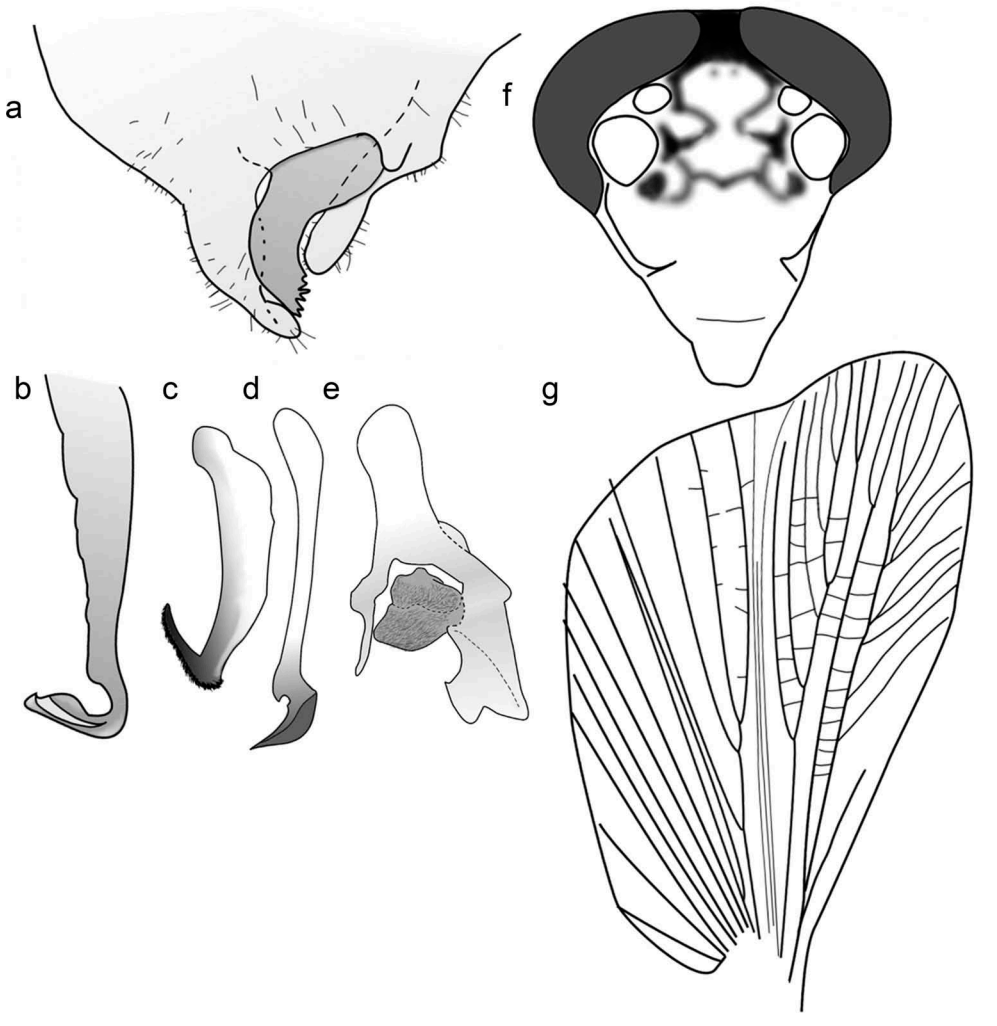

Figure 12. *Dendroblatta litura* sp. nov. Adult male paratype. Voucher number: DEKBO0975. (a) Subgenital plate, ventral. (b) Right genital hooked phallomere (R2). (c) Right phallomere (R1). This sclerite is placed just ventral and slightly more medial to R2. (d) Medial phallomere (L2vm). This sclerite is ventral and medial to R1. (e) Left phallomere (L1). (f) Head, ventral. Highlighting the extent of coloration on the face. Voucher number: DEKBO1083. (g). Right wing with anal field folded. Voucher number: DEKBO0689.

as front leg. Spination of the hind legs the same as middle legs. Pulvilli are missing on the three proximal segments. Overall colouring of legs a light amber highlighted with dark brown.

The abdomen ventrally is an orange amber. Colour is most prominent in posterior region. The lateral and anterior regions are a darker brown. Segments 2–6 are sparsely mottled with white, particularly on the posterior margins of the segments.

Four protrusions from the subgenital plate (Figure 12(a)). The left-most lateral protrusion (LP1) begins laterally and is reflexed medially, dorsally and posteriorly, almost meeting the right protrusion at a point medially. LP1 has a clubbed and hairy distal

Table 4. Allometric data for *Dendroblatta litura* sp. nov. All measurements are in millimetres. Some specimens were damaged in which case the measurement could not be completed (NA) or had to be estimated (est.). Given the large number of specimens we also summarized our measurements as average values ± their standard deviation in the two right-most columns.

			Dendroblatta litura sp. nov.								
			Adult ♀	Adult ♀	Adult ♀	Adult ♀	Adult ♂	Adult ♂	Adult ♂	Adult ♀	Adult ♂
Morphological feature			DEKBO 1507	DEKBO 1506	DEKBO 0963	DEKBO 0974	DEKBO 1515	DEKBO 1083	DEKBO 0975	Average ± SD	Average ± SD
Head	Greatest width		2.1	2.5	2.3	2.5	2.5	2.5	2.2	2.3±0.17	2.4±0.14
	Medial length		3.0	2.5	2.5	2.5	2.4	2.8	2.3	2.6±0.22	2.5±0.22
Pronotum	Greatest width		4.3	5.0	4.5	5.0	4.5	4.5	4.1	4.7±0.31	4.4±0.19
	Medial length		4.5	4.0	2.5	2.5	2.8	2.9	2.6	3.4±0.89	2.8±0.12
Leg	Front	Femur	3.0	3.0	2.8	2.9	2.2	2.6	2.5	2.9±0.08	2.4±0.17
		Tibia	1.6	1.5	1.5	1.7	1.7	1.9	1.6	1.6±0.08	1.7±0.12
	Middle	Femur	NA	3.3	3.0	3.0	3.0	3.5	3.0	3.1±0.12	3.2±0.24
		Tibia	NA	3.8	3.4	2.7	2.8	2.8	3.0	3.3±0.45	2.7±0.09
	Hind	Femur	3.6	3.5	3.5	3.6	3.7	NA	3.2	3.6±0.05	3.5±0.25
		Tibia	4.5	4.3	4.1	4.3	4.5	NA	4.4	4.3±0.14	4.5±0.05
Cerci length			NA	2.4	3.0	2.5	2.6	3.0	3.1	2.6±0.26	2.9±0.22
Tegminal length			11.0	10.0	11.0	10.9	12.0	13.3	12.2	10.7±0.42	12.5±0.57
Total body length			12.0	9.0	12 (est)	12.1	10.9	12.0	12.5	11.0±1.44	11.8±0.67

end. The next protrusion (LP2) is shortened and curved dorsally and slightly medially. The right protrusion is very wide and sticks out laterally before curving back medially. Overall it is obliquely cupped. Medial protrusion is within the cup of the right protrusion and meets at the tip of the right protrusion. It is more heavily sclerotized and has numerous spines at the tip, giving the appearance of a bear's paw.

Head is slightly visible from dorsal side and reaches past pronotum. Pronotum is more elliptical than trapezoidal with its widest point nearly halfway between anterior and posterior margins. Coloration of pronotum as in Figure 11(a). Notably, the longitudinal stripes do not meet anterior margin. The ventral margin of the anterior edge of the pronotum is either lacking hairs entirely or with very small hairs sparsely distributed throughout.

Costal areas of tegmina are translucent; central regions dark brown; demarcated laterally by the cubital vein with the colour reaching nearly the medial margin of the tegmina; radial veins bordered with small brown splotches.

Abdomen dorsally is lacking a tergal gland. Supra-anal plate simple, triangular with a broadly arched tip.

Dorsal coloration of abdomen same as ventral coloration but with brown being more prominent and white regions more pronounced at the lateral posterior margins. Dorsal side of cerci is a dark brown basally and predominantly white throughout the majority with a brown tip.

Measurements can be found in Table 4.

Paratype information:

2 males. Voucher numbers: DEKBO1083, DEKBO1084, DEKBO0975.

Morphology

Same as holotype except for the following. Anteroventral margin of the fore leg femur (both) has 3–4 large proximal spines followed by 27–34 minute spines, 1 large apical and 1 large pre-apical spine. Posteroventral margin of same with 2 spines on margin in addition 1 apical spine. Posterior margin of abdominal sterna lacking mottled white coloration. Middle leg not lacking pulvillus 1 and 2 entirely but they are greatly reduced as in the fore leg.

Allotype information

1 female. Voucher number: DEKBO0695. Locality: Karanambu EcoLodge, Rupununi, Guyana. GPS: 3°45′ N, 59°18′ W. Collection date: 31 December 2014. Collectors: D. A. Evangelista, O. Ambrose.

Deposition

The allotype is stored in 70% ethanol and will be deposited in the Center for Biodiversity at the University of Guyana.

Description

The interocular space is slightly wider than the male. Other features match male.

Hair on the antennae begins on the ninth segment of the flagellum instead of the sixth.

Anteroventral margin of fore leg femur has large basal spines (5 left, 4 right), a row of small spines (26 left, 27 right), 1 large pre-apical, and 1 large apical spine. All other leg morphology the same as in the male.

Subgenital plate is simple and the posterior portions are dark brown. Coloration of ventral abdomen same as male but lacking white.

Pronotum same as male except two dark spots present between the longitudinal bars on the posterior half.

Supra-anal plate similar to male but with more hairs posteriorly and a distinctly shaped notch cut out of the tip.

Tegminal coloration is same as in the male.

Abdomen dorsally has the same coloration as the male with no white spots and the lateral corners of the segments are lighter and translucent.

Measurements can be found in Table 4.

Paratype information:

7 females. Voucher numbers: DEKBO0689, DEKBO0974, DEKBO1280, DEKBO1402, DEKBO1468, DEKBO1506, DEKBO1507.

Morphology

The individuals closely match the description of the allotype. We found that two individuals had very pale (almost absent) patterning of the head and one had regions of white. One individual had a lighter ventral abdomen. Another individual had the same

ventral markings as the male. One individual had a shallower supra-anal plate than that of the allotype.

Differential diagnosis and diagnostic features

The subgenital plate of *D. litura* Evangelista and Sylvain sp. nov, is distinct when compared to that of all other *Dendroblatta*. It is also separable by the facial and pronotal coloration.

D. litura brings this genus into conflict with *Macrophyllodromia* Saussure and Zehntner, 1893 because of the similar pronotal coloration. This superficial similarity alone may not cause confusion but the protrusions of the subgenital plate are also similarly arranged. Following Vidlička (2013) the second left protrusion in *Macrophyllodromia* (LP2) typically crosses the medial gap and lays over the right protrusion (RP). This is not the case in our species and many other *Dendroblatta*. Furthermore, the spination of the anteroventral margin of the fore femur is distinct among these genera, with the exception of *D. iani*, who has spination similar to *Macrophyllodromia*.

Genetic information and evolutionary placement

The COI sequence we obtained for this species (KT906104) was found in a polytomy with *Dendroblatta callizona* Rehn, 1928 (GenBank accession number: KF155067), and an unidentified Pseudophyllodromiinae that Evangelista et al. (2015) speculated was *D. cnephaia* Hebard, 1926 (GenBank accession numbers: KF155070, KF155071).

Etymology

The specific epithet 'litura' (=erasure or blot) refers to the blotted coloration of the frons that is unique to this species, which appears blotted with various degrees of intensity.

Known geographic distribution

Guyana (Rupununi savannah region).

Genus ***Euphyllodromia*** Shelford, 1908

History

Euphyllodromia, first described by Shelford in 1908 as a subgenus of *Pseudophyllodromia* Brunner Von Wattenwyl, 1865, was established as a full genus by Hebard (1920). Since then the genus has expanded to include 42 species. The most recent review of the genus was done by Anisyutkin (2011) who also described three species, and described a fossil *E. angustata* (Latrielle, 1811) from the Pleistocene–Holocene epoch.

Euphyllodromia are characterized by the following traits. Sizes range from 11 to 19 mm long, and they possess unique pigmentation. The eyes protrude and the triangular head remains uncovered by the pronotum. The wings and tegmina are well developed. A few spines are present on the basal half of anteroventral margin of the front femur, which precede smaller, chitinous spines and three slender apical spines (2

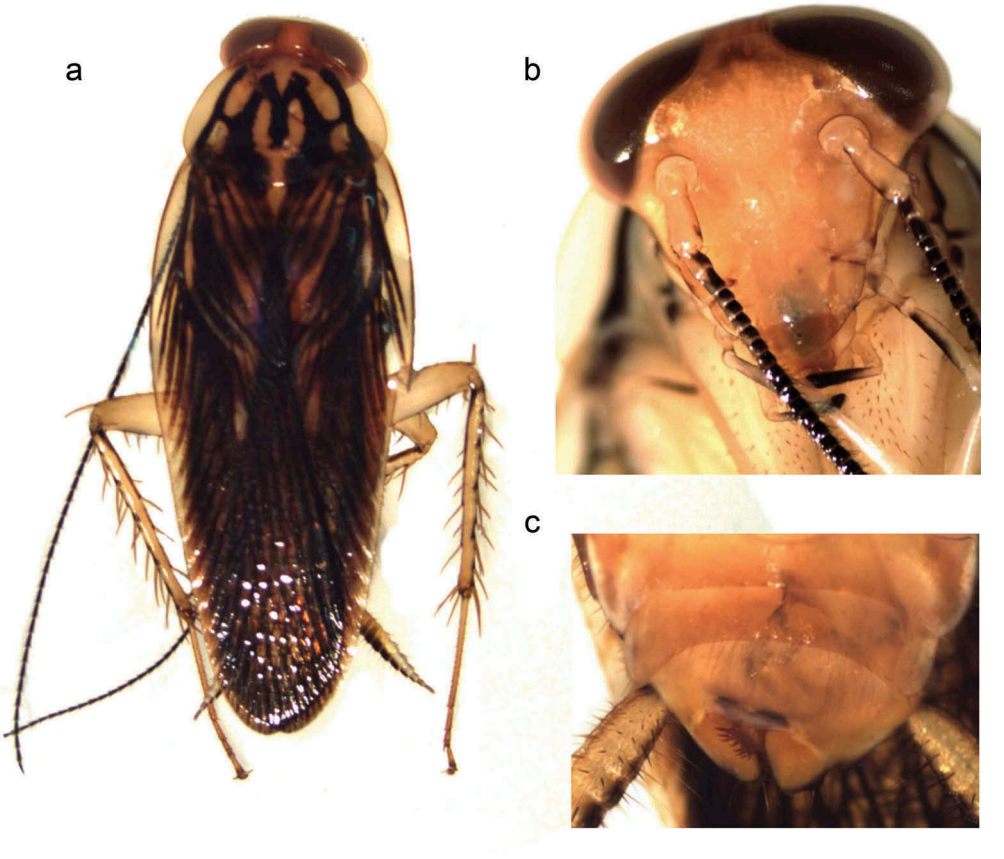

Figure 13. *Euphyllodromia amazonensis* Rocha E Silva Albuquerque, 1984. Adult male. Voucher number: DEIWO0173. (a) Dorsal body. (b) Head, ventral. (c) Male sub-genital plate.

preapical and one 1 apical). Pulvilli are present only on the fourth tarsal segment (Rocha E Silva Albuquerque 1984). In addition, they also have a phallomere that is both hooked on the right side in the dorsal view and in possession of a pre-apical incision (Lopes & da Silva 2012).

Euphyllodromia amazonensis Rocha E Silva Albuquerque, 1984 (Figure 13)

1 adult male. Voucher number: DEIWO0173. Collection locality: Iwokrama River Lodge, Iwokrama Forest, Guyana. GPS: 4°43′58″ N, 58°43′4″ W. Collection date: December 2014. Collectors: D. Evangelista, M. Davis, M. Johnny, M. Carter, O. Ambrose.

Collection/ecological information

This individual and other individuals that escaped collection were seen sitting on foliage in primary forest understory during the day.

Table 5. Distributional records within the Guiana Shield (as treated in Evangelista et al. 2015) for the cockroach species treated in this paper. These species may be present outside the areas listed as well. VEN = Venezuela, BRA = Brazil, GUY = Guyana, SUR = Surinam, FG = French Guiana. + indicates new record from this paper. 'o' indicates presence in this locality (taken from Evangelista et al. 2015). '?' indicates unverified or ambiguous geographic records.

Taxon			*Amaz VEN*	*Bolivar VEN*	*Del Ama VEN*	*Rora BRA*	*GUY*	*SUR*	*FG*	*Amapa BRA*
Blaberidae										
Blaberinae										
Eublaberus	*marajoara*						+			
Epilamprinae										
Epilampra	*colorata*	Rocha E Silva Albuquerque & Gurney 1962					+			o
Ectobiidae										
Blattellinae										
Dasyblatta	*thaumasia*	Hebard 1921					+	o		
	warei	sp. nov					+			
Ischnoptera	*galibi*	Hebard 1926					+	o	o	
Xestoblatta	*surinamensis*	Bruijning 1959					+	o	o	
Pseudophyllodromiinae										
Euphyllodromia	*amazonensis*	Rocha E Silva Albuquerque 1984					+			
Dendroblatta	*litura*	sp. nov					+			
Lamproblattidae										
Lamproblattinae										
Lamproblatta	*ancistroides*	Rehn 1930	?	?	?		+			

Morphological identification

This specimen was easily identified by comparing the pronotal pattern and subgenital plate shape to the illustration of Rocha E Silva Albuquerque (1984).

Known geographic distribution

Guyana (new record), Brazil (Jutai and Manaus)

Conclusions

Adding the species we report here (Table 5) to those listed in Evangelista et al. (2015) there are now 105 species known from Guyana (previously 96) and 238 species known from the entire Guiana Shield (previously 234). An updated checklist of the cockroaches of the Guiana Shield is provided in supplementary documentation 1.

Acknowledgements

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Disclosure statement

No potential conflict of interest was reported by the authors.

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