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First reports of *Bactrophora dominans* Westwood, 1842 (Orthoptera: Romaleidae) from Venezuela and French Guiana (South America), with comments on biology, ecology and distribution of the species

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Abstract: New records of *Bactrophora dominans* Westwood, 1842 collected for the first time in Venezuela (Tepui Ichum), and French Guiana (Bélizon and Regina), are presented. Description of the insect, its colors, as well as ecological and biological notes and a historical overview of the known specimens in the genus and species are also included.

Key words: Bactrophorini, biogeography, biodiversity, geographic distribution

Bactrophora dominans Westwood, 1842 is a medium size grasshopper, subcylindrical, elongate, possessing a fastigial process with a moderately expanded apex (Figures 1 and 2). It is one of the two known species in the genus *Bactrophora* (Martínez 1921; Rehn 1938). Genus and species were originally described based on a female whose collecting site is still unknown (Westwood 1842). Years later, Bruner (1905) described the new genus *Scolocephalus* and the species *Scolocephalus mirabilis* from a male collected in Costa Rica. This was synonimized next as Westwood's *B. dominans* assuming they were both sexes of the same species and established "Pozo Azul, Costa Rica, Central America" as their typical locality (Bruner [1907]; Martínez 1921). Martínez (1921) found that besides Westwood's female, the British Museum (Natural History Museum, London, BMNH) also owned a male from British Guiana (today Guyana). A similar male was also found in Madrid (Museo Nacional de Ciencias Naturales, Madrid, CSIC-MNCN) from "Santa Fé Bogotá", Colombia (Martínez 1921). Martínez concluded, after examining the available insects and reported descriptions, that the genus *Scolocephalus* was a synonym of *Bactrophora* (as established earlier by Bruner [1907]) but he was not certain that the species *S. mirabilis* should be synonymized under *B. dominans*, and he retained this name only for the two BMNH's specimens and the one in Madrid (Martínez 1921). His conclusions corroborated Kirby's (1910) and were later ratified by Rehn (1938), who also confirmed that the distribution for *B. dominans* was "British Guiana and Colombia," while *B. mirabilis* (=*S. mirabilis* of Bruner 1905) was only found in Costa Rica. Rehn (1938) also mentioned that the only one of the two BMNH's *B. dominans* specimens, whose location was known, had labels reading "B. GUIANA, R. Paruni, May 1916, C.E. Bodkin." Then, Rehn (1938) mentions that "R. Paruni" is "doubtless a transliteration error for Rupununi River." He was mistaken since the Paruni is a known river different than the Rupununi. Both are tributaries of the Essequibo River and located in the same overall region (F. Beneluz pers. comm.).

Figure 1. *Bactrophora dominans* from Ichum, Bolívar state, Venezuela, walking on a stick placed in front on a raft. Fingers of collector are placed as reference scale. (Photo: Jeff Shea)

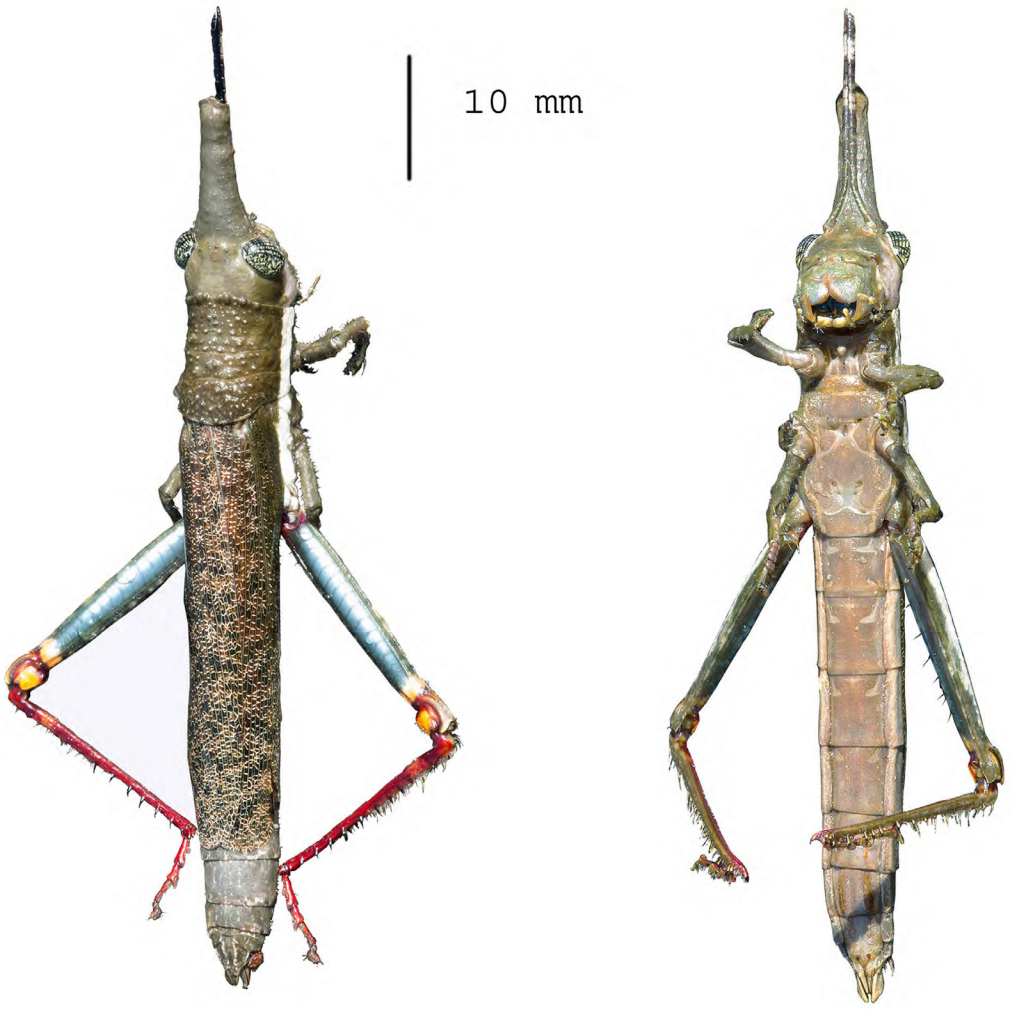

Figure 2. *Bactrophora dominans* from Tepui Ichum, Bolivar state, Venezuela. Left: Dorsal view; Rigth: ventral view. Scale: 10 mm. (Photo: Jeff Shea).

Considering the CSIC-MNCN specimen, its locality "Santa Fé Bogotá," Colombia, is certainly doubtful. The habitats where known *Bactrophora* specimens have been collected are basically Neotropical forests. *Bactrophora mirabilis* is known to be from Costa Rica rain forests (Bruner [1907]; Roberts 1973). At least one specimen of *B. dominans* at the BMNH, comes from an unknown location along the River Paruni which flows into forested territory, a similar habitat to that of Costa Rica. Chapman (1917) found that many "Bogotá" collections are certainly confusing since several foreign and native collectors used to ship animal and plant specimens from that Colombian city. Thus museums frequently assumed "Bogotá" (or Bogota) as a valid location even for species that are not present there. *Bactrophora dominans* populations from Colombia should be found either in the lowland forests of the upper Magdalena River or the Villavicencio region. These are places with direct access through well-travelled roads from Bogota since the early 19th century and where naturalists used to finance animals/plants collecting teams (Chapman 1917; Rehn 1938; González et al. 2013).

Three new South American locations (one in Venezuela, two in French Guiana) for *B. dominans* are reported herein. Some general information on the biology and ecology of these interesting insects is also provided.

A female specimen of *B. dominans* was discovered during an expedition to the headwaters of the Ichum River in the Tepui Ichum (Figure 3), in Bolívar state, Venezuela. Also known as "Meseta Ichum" or "Cerro Ichum" (and sometimes misspelled Ichun), this is an oval, large, wide, and low altitude sandstone tepui located in Southern Bolívar state, Venezuela (Montoya Lirola 1958; Reinoso 1962; Michelangeli 2005; Brewer-Carías 2010; Brewer-Carías and Audi 2011). The Tepui Ichum, whose surface is as wide as the island of Trinidad, acts as a basin outpouring its waters through the Ichum falls (Brewer-Carías and Audi 2011) (Figure 3).

While on a raft cruising the Ichum River, within the central region of the tepui, on 7 March 2014, a female of *B. dominans* was seen clinging on the 1.5 m long "palo" (a stick made from a sapling and used to test the depth of the river) placed in front of the boat. The "palo" was wet as well as the insect, which seemed dazed, and was

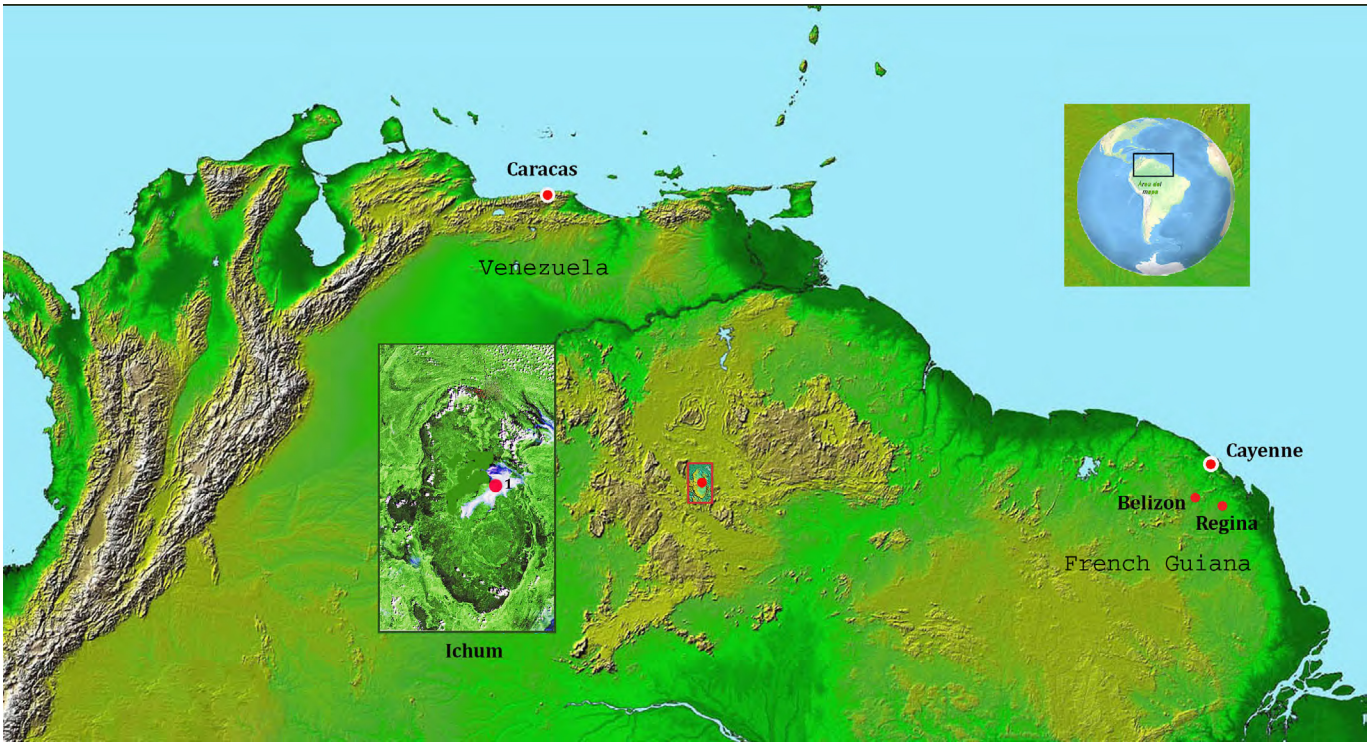

Figure 3. Location of new records of *Bactrophora dominans* in northern South America (Venezuela and the Guianas). The first site (1: 04°28′12.53″ N, 063°20′36.27″ W; 650 m) is in the Tepui Ichum (Bolívar, Venezuela), at the center of the map inside a rectangle that is enhanced at the center-left. Other *B. dominans* specimens where collected near Belizón (Belizón trail towards Regina) and Regina (Kapiri trail), French Guiana. Both localities are depicted.

walking sluggishly towards the end of the stick in the direction of the water (Shea 2014). It was photographed (Figure 1) and then collected and placed inside a plastic bag. At the collecting point, the river was approximately 20–30 m wide and surrounded by thick riparian forest (Figures 4 and 5).

The area of the river where the insect was collected is approximately 1 km downstream from a waterfall of about 3 m high in a series of cascades (fig. 5). The exact coordinates of the collecting site are 04°28′12.53″ N, 063°20′36.27″ W with an altitude of 650 m (Figure 3). The insect died before being photographed again, but it was fresh enough and the original colors had not faded (Figure 2). After the expedition ended, the dead insect was brought to the attention of the Venezuelan and US custom authorities and allowed to enter the US for study. Pictures of the insect alive and dead were shown to Brewer-Carías and several Venezuelan entomologists including González to be identified. The voucher specimen will be returned to Venezuela and deposited at the Museo del Instituto de Zoología Agrícola (MIZA-UCV), of the Universidad Central de Venezuela's Agronomy School, in Maracay, Aragua, Venezuela.

While in the process of this investigation, three additional specimens of *B. dominans* were found from French Guiana. They are all females; the first one captured at night, close to a light, in December 1989 in Bélizon trail, going to Regina road, French Guiana (Figure 3). The other two females were collected with the use of a Glass Interception Trap located some 50 cm above ground, in

Figure 4. Ichum River (Ichum, Bolívar state, Venezuela) surrounded by riparian forest. (Photo: Jeff Shea)

Figure 5. Ichum River (Ichum Tepui, Bolívar state, Venezuela). Waterfalls 1 km up river from collecting site of the Venezuelan specimen of *Bactrophora dominans*. (Photo: Jeff Shea)

Kapiri trail, close to the town of Regina, French Guiana (Figure 3). Two of them are in the Giugliaris collection, while the third is in private hands. A fourth specimen (unknown sex) from French Guiana is known to have been collected near Regina while feeding on a wild Passifloraceae (J.L. Giugliaris pers. comm.).

The specimens from Venezuela and French Guiana were identified based on the original descriptions and revisions (Westwood 1842; Bruner 1905; Bruner [1907]; Martínez 1921; Rehn 1938) and by comparison with specimens (including the types) of the two species within *Bactrophora* deposited at several insect collections. Institutions where studied insects are held [within brackets] are as follows:

Bactrophora mirabilis: 1♂, Type, Pozo Azul, Costa Rica, (Underwood), *Scolocephala mirabilis* Bruner Type, *Scolocephala mirabilis* Br. type H308, Measured specimen Rehn 1937, figured Rehn 1938 [Academy of Natural Sciences of Philadelphia—ANSP]; 1♀ (Nymph) Costa Rica, Osa Península, 3–10 mi. S. Rincón, 7-20-II-1967, Arboreal Habitat insecticide sta. 36, H.R. & EH. Roberts, M.S. Harrison, W.W. Moss, D.A. Nickle [ANSP]; 1♂, Est. Sirena, P.N. Corcovado, 0–100 m. prov. Punt., Costa Rica. G. Fonseca Abr 1990, L-S-270500,508300, Costa Rica INBio CRIooo 921673 [Instituto Nacional de Biodiversidad, Costa Rica, INBio]; 1♀, Costa Rica, prov. Puntarenas. P.N. Corcovado, Sector La Leona, Cerro Puma. 100–300 m 21 June – 10 July 2003. M. Moraga. Libre. L_S_267700 518900 #74484, INBooo3734486 INBioCRI Costa Rica [INBio].

Bactrophora dominans: 1♂, Type, B. Guiana, R. Paruni, May 1916, C.E. Bodkin, Pres. by Imp. Bur. Ent. 1920 – 350. *Bactrophora dominans* Westw. det. Uvarov, measured specimen Rehn 1938, Rehn 1938 figured [Natural History Museum, London, BMNH]; 1♀, no data, type [BMNH]; 1♂, Santa Fé Bogotá, *Bactrophora dominans* Westw. compared with type, det. Uvarov, MNCN_Ent 119721 [Colección de Insectos, Museo Nacional de Ciencias Naturales, Madrid, CSIC-MNCN]; The following specimens are mentioned in this work for the first time: 1♀, Ichum Tepui, Bolívar, Venezuela, 04°28′12.53″ N, 063°20′36.27″ W, 7-III-2013, Coll. J. Shea, to be deposited at MIZA-UCV, Maracay, Aragua, Venezuela; 1♀, Bélizon trail, close to light, 14-XII-1989, French Guyana, Coll. J.L. Giugliaris, J.L. Giugliaris Collection; 2♀♀, Kapiri Trail, Regina, Glass Interception trap, 02-VIII-2008, French Guyana, Coll. J.L. Giugliaris, one in J.L. Giugliaris Collection, the other in undisclosed private collection.

Detailed measurements were taken of two *B. dominans* specimens: Female 1 (from Tepui Ichum, Venezuela) (Figures 1 and 2): Length of body, including fastigium: 74 mm; length of fastigium: 12 mm; dorsal length of entire head: 17 mm; length of pronotum: 10 mm; greatest width of pronotum: 10 mm; length of tegmen: 38 mm; greatest width of tegmen: 9 mm; length of hindwing: 35 mm; greatest width of hindwing (costa to anal lobe): 21 mm; length of caudal femur: 24 mm. Antennae length: 19 mm. Female 2 (from Bélizon, French Guiana) (Figure 6): Length of body, including fastigium: 90 mm; length of fastigium: 14 mm; dorsal length of entire head: 21 mm; length of pronotum: 13 mm; greatest width of pronotum: 10 mm; length of tegmen: 39.5 mm; greatest width of tegmen: 9 mm; length of hindwing: 35 mm; greatest width of hindwing (costa to anal lobe): 22 mm; length of caudal femur: 26 mm. Antennae length: 20 mm.

Figure 6. Mounted female *Bactrophora dominans* from Bélizon (Bélizon trail, French Guiana). Scale: 10 mm. (Photo: Jean Louis Giugliaris)

The colors of these insects start fading after dead; however, a detailed description of the general coloration of *B. dominans* was provided by Rehn (1938) and supported by Martínez (1921). The Ichum insect was fortunately photographed alive and dead. Therefore additional details about the coloration of the species could be added. The general base color of the head, fastigium, frons, clypeus, labrum, pronotum, fore and middle legs are olive-citrine, while the thoracic and abdominal sterna are light olive-brownish. Femora are olive-citrine on the edges (facing outside) but crossed by a light white-cream "band" that go from base to apex of femur. A white-cream lateral band stars in the genae (where it is about 3 mm wide, and more diffuse than in

Figure 7. Internal view of hind leg of a specimen of *Bactrophora dominans* from Tepui Ichum, Venezuela, showing colors of femur (distal end), tibia and tarsus. The view of the leg shows how the tarsus moves to fold into the tibia. The inset shows the tarsus completely folded into the tibia, whose apical spines are clearly shown once the tarsus is folded. (Photo: Jeff Shea).

the rest of the body) and continues through the sides of pronotum and thoracic pleura (with about 2 mm wide) to continue to the femur (Figure 1). Inner side of the femur is bright blue but the base (apical) is red, while just before the distal end (inner side) it turns light blue almost white. The apex is orange, and the tip is orange surrounded by a red line (Figures 2 and 7). The tibiae are olive-citrine on the outside, but on the inner side are red with brick-orange bands, the most noticeable one is near the joint with the femur (Figure 7). Even though the tegmina are olive-citrine basically, they are spotted by minute cream and light orange-reddish markings. The hindwings are yellowish (but not as bright as in Figure 6; this French Guiana insect was mounted and dried but colors have not completely faded, however they certainly differ from the color in the live insect from Ichum) with a brownish apical band that starts at the apex of the costa, covering the lateral margin of the wing but diminishing in size while reaching the anal lobe. The antennae are black dorsally (Figures 1 and 2), and on the sides the two apical flagellomeres as well as the apex of the third, the back of the 6th, the 7th, apex of 8th, back of 10th, 11th, apex of 12th, back of 13th, 14th, 15th, 16th (counting from the apex) are olive-dark, almost black, rest are creamy-white (Figure 2). When not moving, the antennae are paired together and covered by the fastigium dorsally (Figure 2). In this position, only the eight apical flagellomeres can be seen from above when resting. Compound eyes are dark green with cream spots all over (Figure 2). As in many Romaleidae, the tarsi of the hind legs are highly mobile, but in the Ichum specimen they fold backwards completely into the tibia (Figure 7). In that fashion the terminal spines of the hind tibiae allow a spike that, when propelled by the hind femur, it could probably serve as strong defensive means or/and even a climbing aid.

Understanding and knowledge of the biology, natural history and geographic distribution of this insect is very incomplete. The genus *Bactrophora* appears to be distributed from the Amazon forest along the Orinoco and Amazon Basins, and up to Costa Rica in Central America. Undescribed species of the genus are known from Ecuador and Peru (H. Rowell, personal communication). However, based on the scarcity of specimens of *B. dominans* and the widely separated and scattered locations known so far, it seems that this species is widely distributed in northern South America from Colombia and Venezuela to the Guianas, including Suriname as well as northern Brazil. This covers forested areas south of the Orinoco river basin and north of the Amazon River basin. Most Bactrophorinae are forest dwelling and many are arboreal (Rowell 2012). The closely related *B. mirabilis* is typically arboreal (Roberts 1973), thus it is also possible that *B. dominans* populations live in the canopy of forests within its geographic range. The presence of the Venezuelan specimen on a tepui can be easily explained since many insects, especially those with good flying abilities, frequently move to the summits of these flat toped mountains from the surrounding forests (González 2005). Since one specimen from French Guiana was collected on a Passifloracea, it could be assumed that this species, as other members of the family, is also a vine-inhabitant or vine-feeder (Rehn 1938). Based on the collecting reports of two of the French Guiana specimens mentioned herein, it seems that females descend to the forest floor in order to lay eggs, as many other Romaleidae do (i.e., *Tropidacris* spp.). In addition, the whole color appearance of the insect body is cryptic and it surely allows the insect to "disappear" in its natural environment.

The particular habits and habitat of *B. dominans* could be accounted for the scarcity of known collected specimens. Particular efforts are being actually done to know the fauna of some Neotropical regions (Brûlé and Touroult 2014). Thus, collecting efforts, and sampling of canopies, particularly of unexplored areas of Northern South America's Amazonian forest along the countries of Brazil, Colombia, Venezuela, the Guianas and Suriname, could eventually shed light on this elusive but interesting species.

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