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First records of the iceryine scale insects *Crypticerya brasiliensis* (Hempel) and *Crypticerya genistae* (Hempel) (Hemiptera: Monophlebidae) for Colombia

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(Hemiptera: Monophlebidae) for Colombia

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Abstract. *Crypticerya brasiliensis* (Hempel) and *Crypticerya genistae* (Hempel) (Hemiptera: Monophlebidae: Iceryini) are herein reported for the first time in Colombia. The above two species and *Crypticerya multicitricipes* Kondo and Unruh and *Crypticerya zeteki* (Cockerell) are briefly diagnosed based on the adult females. The presence of *C. zeteki* in Colombia is confirmed and a key to the adult females of species of the tribe Iceryini reported in Colombia is provided.

Key Words. Distribution, *Icerya*, Iceryini, invasive species, species diagnosis, taxonomic key.

Resumen. Se reportan por primera vez a *Crypticerya brasiliensis* (Hempel) y *Crypticerya genistae* (Hempel) (Hemiptera: Monophlebidae: Iceryini) en Colombia. Las dos especies arriba mencionadas junto con *Crypticerya multicitricipes* Kondo y Unruh y *Crypticerya zeteki* (Cockerell) se diagnostican brevemente con base en morfología de las hembras adultas. Se confirma la presencia de *C. zeteki* en Colombia y se provee una clave para las hembras adultas de las especies de la tribu Iceryini registradas en Colombia.

Palabras Clave. Distribución, *Icerya*, Iceryini, especies invasoras, diagnóstico de especies, claves taxonómicas.

Introduction

Iceryine scale insects form a tribe of almost 80 species in five genera within the family Monophlebidae (Hemiptera: Coccoomorpha) (Unruh and Gullan 2008a, 2008b), with most species being relatively polyphagous (Ben-Dov 2005). Some iceryine species have proliferated and become serious plant pests when introduced to new areas without their adapted natural enemies. Notable examples are the cottony-cushion scale, *Icerya purchasi* Maskell, in California (USA), on the Galapagos Islands and in greenhouses in England (Caltagirone 1981; Causton et al. 2004; Watson and Malumphy 2004), *Icerya imperatae* Rao in Australia, Brunei, Fiji, Malaysia and the Republic of Palau (Hodgson and Łagowska 2011; Williams et al. 2006), *Icerya aegyptiaca* (Douglas) in the Ryukyu Islands (Japan) (Uesato et al. 2011), *Crypticerya multicatrices* Kondo and Unruh in Colombia (Kondo et al. 2012a), and *Crypticerya genistae* (Hempel) in Florida (USA) and Guadeloupe island (Hodges et al. 2008; Etienne and Matile-Ferrero 2008).

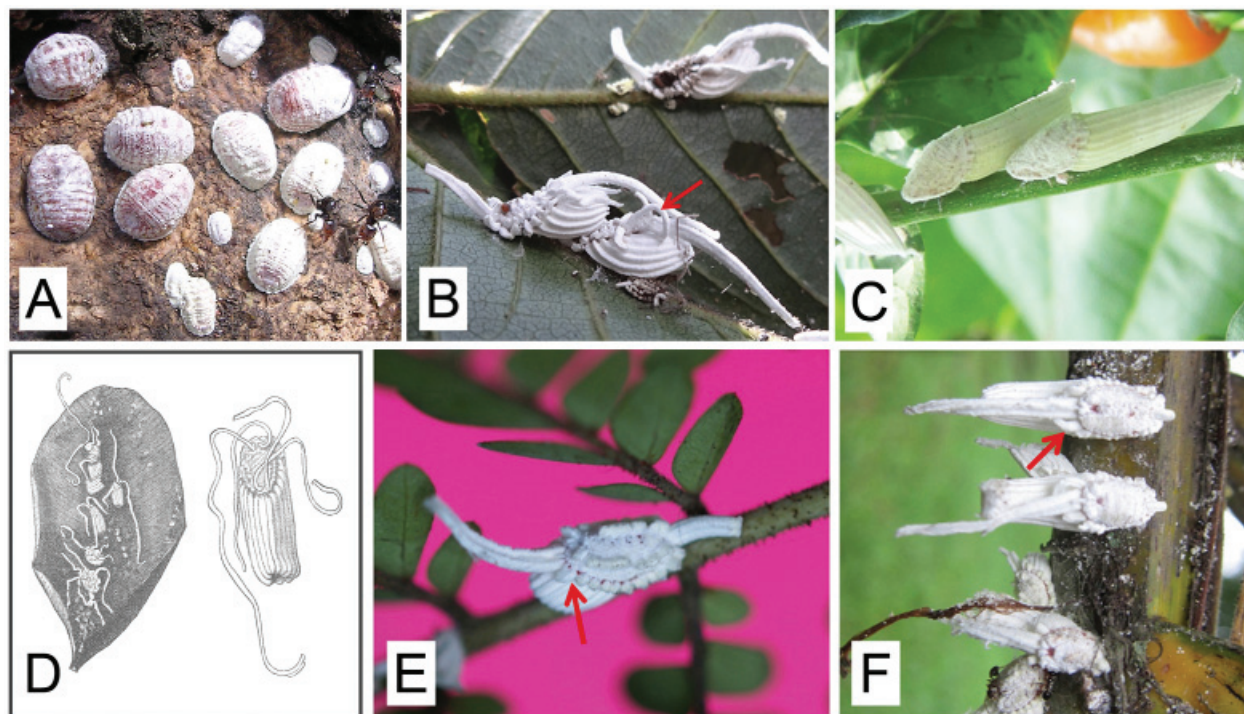


Figure 1. Colombian *Crypticerya* spp. **A.** *Crypticerya abrahami* (Newstead) after removing bark of tree trunk of *Pithecellobium dulce*. Note absence of long waxy secretions and ovisac. **B.** *Crypticerya brasiliensis* (Hempel). Note long and curved lateral waxy filament laterad to long caudal tuft (red arrow). **C.** *Crypticerya genistae* (Hempel). Note absence of long waxy tufts and presence of a long ovisac. **D.** *Crypticerya montserratensis* (Riley and Howard). Note very long thread-like waxy filaments. **E.** *Crypticerya multicatrices* Kondo and Unruh. Note shorter waxy filament laterad to long caudal tuft (red arrow). **F.** *Crypticerya zeteki* (Cockerell). Note filament of intermediate length laterad to long caudal tuft. Photos: B by A. Caballero, A, C, E, F by T. Kondo, D reproduced from illustration by Riley and Howard (1890).

Five iceryine species are currently recorded in Colombia, namely, *Crypticerya montserratensis* (Riley and Howard) (Fig. 1D) on *Citrus grandis* (Rutaceae), *Prosopis* sp. and *Samanea saman* (Fabaceae) (Figuroa 1946); *C. multicatrices* (Fig. 1E) on numerous hosts (Kondo 2001 (as *Icerya brasiliensis* Hempel), 2008 (as *Crypticerya* sp.), 2009; Kondo and Unruh 2009; Kondo et al. 2012a, 2014); *Crypticerya abrahami* (Newstead) (Fig. 1A) on *Pithecellobium dulce* (Fabaceae) (Kondo and Unruh 2009); *C. zeteki* (Cockerell) (Fig. 1F) on *Elaeis guineensis* (Arecaceae) (Posada 1989); and *I. purchasi* on *Citrus*

spp. (Rutaceae) (Figueroa 1946, 1952; Kondo et al. 2012b; Posada 1989). The record of *C. brasiliensis* on *Arecaceae* and *Mangifera indica* (Anacardiaceae) by Kondo (2001) was a misidentification of *C. multicutrices*, which resulted from the use of Hempel's (1900) original description, which is largely based on external morphology. *Crypticerya brasiliensis* (Fig. 1B), *C. multicutrices* (Fig. 1E) and *C. zeteki* (Fig. 1F) are very similar in life, and observation of cuticular microscopic features is needed to separate them with accuracy (Kondo and Unruh 2009).

ScaleNet (García et al. 2015), lists *Icerya seychellarum* (Westwood) in Colombia, citing Figueroa (1946). However, this is incorrect as Figueroa (1946) only lists *Icerya montserratensis* (Fig. 1D) and *Icerya* sp., mentioning *I. seychellarum* as the type species of the genus, but not as occurring in Colombia. *Crypticerya rosae* (Riley and Howard) has been recorded in Colombia on African oil palm, *Elaeis guineensis* (Arecaceae), and *Prosopis* sp. (Fabaceae) (Posada 1989), but according to Unruh and Gullan (2008a, 2008b), *C. abrahami*, *Crypticerya pimentae* (Newstead) and *C. rosae* are apparently morphologically identical in the adult stage, but differ genetically and are found in different regions, i.e., *C. abrahami* in Colombia and Guyana, *C. pimentae* in Jamaica and *C. rosae* in Mexico and the USA (Florida). Kondo and Unruh (2009) considered the record of *C. rosae* in Colombia to be a misidentification of *C. abrahami*. *Crypticerya abrahami* has also been recorded from Venezuela (Foldi 2009).

In 2014, specimens that were identified subsequently as *C. brasiliensis* (Fig. 1B) were collected on guava in the Department of Boyacá, Colombia. These specimens were compared with specimens from Brazil and turned out to be the first records of *C. brasiliensis* in Colombia. In the same year, a second iceryine species, *C. genistae* (Fig. 1C), was collected in the Departments of Córdoba, Sucre and Valle del Cauca (Colombia), and these records also are the first of this species for Colombia. Herein we confirm also the presence of *C. zeteki* (Fig. 1F) in Colombia, based on specimens collected in the Departments of Caquetá and Nariño.

Here we provide diagnoses of the live appearance of the adult females of *C. brasiliensis*, *C. genistae*, *C. multicutrices* and *C. zeteki* and a key to the Iceryini present in Colombia based on the live appearance and cuticular morphology of the adult females.

Materials and Methods

Specimens of adult females studied were slide-mounted following the methods of Kozarzhevskaya (1968) and Williams and Granara de Willink (1992). Specimens were identified using the keys of Kondo et al. (2012a) and the iceryine monograph of Unruh and Gullan (2008b). Specimens of *C. brasiliensis* from Colombia were compared with non-type material collected in Brazil.

All descriptions of the cuticular morphology of the species recorded in this study and illustrations of the diagnostic wax-exuding pores are available from Unruh and Gullan (2008b) and the PDF can be downloaded for free from *Zootaxa*.

Depositories

CTNI: Colección Taxonómica Nacional de Insectos "Luis María Murillo", Corpoica, C.I. Tibaitatá, Mosquera, Cundinamarca, Colombia.

ANIC: Australian National Insect Collection, CSIRO, Canberra, A.C.T., Australia.

Material studied

***Crypticerya brasiliensis* (Hempel). Colombia: Boyacá (Department):** Sutamarchán, 25.viii.2012, coll. A. Ramos, det. P.J. Gullan, ex *Psidium guajava* (Myrtaceae), 3 slides (3 adult females) (CTNI); Sutamarchán, 05°37'03.0"N, 73°38'11.9"W, 2177 m a.s.l., 7.iii.2013, coll. A. Ramos and A. Caballero, det. P.J. Gullan, ex leaf midribs and stems of *P. guajava*, 3 slides (3 adult females) (CTNI), 1 slide (1 adult female) (ANIC), specimens in poor condition. **Brazil: São Paulo (Department):** Tambaú, 4.x.2014, coll. Keila de Cassia Coelho Rosa, det. A. Peronti, confirmed by P.J. Gullan, ex unknown plant, 4 slides (4 adult females in poor condition) (CTNI); **Goiás (Department):** Goiânia, 17.ix.2014, Maurício José Fornazier, David dos Santos Martins and Ana Lucia B.G. Peronti, det. A. Peronti, confirmed by P.J.

Gullan, ex. *Callistemon viminalis* (Myrtaceae), 3 slides (3 adult females) (CTNI), 2 slides (2 adult females) (ANIC).

***Crypticerya genistae* (Hempel). Colombia: Córdoba (Department):** via Monteria-Cereté, km 13, Corpoica, Turipaná Research Station, 9.v.2014, coll. Nhora Jimenez, ex *Capsicum* sp. (chili pepper, Topito variety), 7 slides (6 adult females + 3 first-instar nymphs) (CTNI), 2 slides (2 adult females) (ANIC); **Sucre (Department):** Chocho, El Rosel, 29.i.2013, coll. Nelson Villarreal, ex berenjena (=eggplant), 1 slide (1 specimen) (CTNI). **Magdalena (Department):** near Santa Marta, 11°01'27"N, 74°12'27"W, 39 m, 20.viii.2014, coll. T. Kondo, det. P.J. Gullan, ex. *Malvastrum* sp. (Solanaceae), 5 slides (5 adult females) (CTNI), 1 slide (1 adult female) (ANIC); **Valle del Cauca (Department):** Palmira, Corpoica, C.I. Palmira, 4.viii.2014, coll. C. Pinchao, det. P.J. Gullan, ex. *Arachis pintoii* (Fabaceae), 4 slides (4 adult females) (CTNI), 1 slide (1 adult female) (ANIC).

***Crypticerya multicitricas* Kondo and Gullan. Colombia: Valle del Cauca (Department):** Palmira, 03°30'47"N, 76°17'48.1"W, 1018 m a.s.l., 19.ix.2013, coll. E.M. Quintero, ex. *Pithecellobium dulce* (Fabaceae), 4 slides (4 adult females in poor condition) (CTNI); Buga, Procampo, 03°55'10.3"N, 76°17'14.5"W, 1003 m a.s.l., 25.ix.2013, coll. E.M. Quintero, ex. *Cassia fistula* (Fabaceae), 8 slides (8 adult females in poor condition) (CTNI); Buenaventura, 03°52'50.1", 77°00'40.7", 19 m a.s.l., 12.xi.2013, coll. M. Manrique, ex. *Caesalpinia peltophoroides* (Fabaceae), 8 slides (8 adult females in poor condition) (CTNI); Zaragoza, 04°41'58.7"N, 75°55'22.4"W, 965 m a.s.l., 02.x.2013, coll. E. M. Quintero, ex. *Caesalpinia peltophoroides* (Fabaceae), 7 slides (7 adult females in poor condition) (CTNI); Cartago, 04°44'38,9"N, 75°54'40,7"W, 15.xi.2013, coll. E.M. Quintero, ex. *Cocos nucifera* (Arecaceae), 3 slides (3 adult females in poor condition) (CTNI). All specimens det. T. Kondo.

***Crypticerya zeteki* (Cockerell). Colombia: Nariño (Department):** Tumaco, 01°48'32.5"N, 7845'59,7"W, 3 m a.s.l., 31.x.13, coll. T. Kondo, ex. *Dypsisis lutescens* (Arecaceae), 7 slides (7 adult females in poor condition) (CTNI); **Caquetá (Department):** Florencia, Universidad de la Amazonia, 01°36'51"N, 75°36'42"W, 263 m a.s.l., 7.xi.13, coll. R. Simbaqueba, ex. *Trifolium repens* (Fabaceae), 4 slides (4 adult females in poor condition) (CTNI); same data, except, ex. *Arachis pintoii* (Fabaceae), 3 slides (3 adult females in poor condition) (CTNI). All specimens det. T. Kondo.

Taxonomic diagnoses

***Crypticerya brasiliensis* (Hempel) (Fig. 1A, B)**

Icerya brasiliensis Hempel 1900: 370.

Icerya braziliensis Hempel 1912: 18. Misspelling of species epithet.

Crypticerya brasiliensis Unruh and Gullan 2008a: 26. Change of combination.

Unmounted material (adapted from Hempel 1900). Adult female elliptical, pink; antennae and legs dark brown; entirely covered with white secretion consisting of one long caudal tuft, one cephalic tuft, a marginal and a submarginal row of nine tufts on each side, and a central longitudinal mass of secretion; a tuft on each side of both caudal and cephalic tufts longer than other marginal tufts (Figure 1B, arrow). Anal tuft up to 20.5 mm long; caudal and cephalic tufts usually fluted with four longitudinal ribs. Ovisac large, white, sometimes showing a creamy tinge, distal end curved up, convex beneath and slightly striated longitudinally; dorsum and sides of ovisac longitudinally fluted, with 14 or 15 longitudinal furrows.

Remarks. In life, the arrangement of waxy secretions in *C. brasiliensis*, *C. multicitricas* and *C. zeteki* is superficially similar, namely the presence of a long caudal tuft and a shorter cephalic tuft. *Crypticerya multicitricas* can be easily differentiated from the other two species by the shorter waxy tufts laterad to the long caudal tuft, which are no more than twice the length of other short marginal tufts. In *C. brasiliensis*, the waxy tufts laterad to the long caudal tuft are usually three or more times longer than other marginal tufts (Fig. 1B). Another iceryine species, *C. zeteki* (Fig. 1F) also recorded from Colombia has a similar arrangement of waxy secretions. According to the photograph of the type

material provided by Kondo and Unruh (2009) and Figure 1F from specimens collected on *D. lutescens* (Arecaceae) in Tumaco, Nariño, Colombia, the waxy tufts laterad to the long caudal tuft in *C. zeteki* are about three times longer than the shorter marginal tufts, thus overlapping with *C. brasiliensis*. *Crypticerya multicatrices* (Fig. 1E) appears to be recognizable to some extent by external morphology, however, the only way to identify these three species correctly is to slide-mount them and key out them according to their cuticular morphology.

***Crypticerya genistae* (Hempel)**

Icerya genistae Hempel: 1912, 55.

Iceria genistae Hempel 1912: 57. Misspelling of genus name.

Crypticerya genistae (Hempel); Unruh and Gullan 2008a: 26. Change of combination

Unmounted material (adapted from Hempel 1912). In life adult female light brown, yellowish at anterior margin; antennae, legs and eyes dark brown, nearly black; dorsal surface covered with waxy secretion, plus wax tufts forming medial, submarginal and marginal longitudinal rows, with tufts longest in middle and ends of each row. Ovisac slightly striated and tapering towards posterior end (Figure 1C).

Remarks. In life, the adult female of *C. genistae* can be distinguished readily from those of *C. brasiliensis*, *C. multicatrices* and *C. zeteki* by the absence of long tufts on the head and apex of abdomen (Fig. 1C).

***Crypticerya multicatrices* Kondo and Unruh**

Crypticerya multicatrices Kondo and Unruh 2009: 95.

Crypticerya sp.: Kondo 2008: 27.

Crypticerya brasiliensis Kondo 2001: 31. Misidentification (Kondo and Unruh 2009).

Crypticerya multicatrices Cockerell: Quiroga et al. 2011: 10. Incorrect authorship (Kondo et al. 2012a).

Crypticeria multicatrices Kondo and Unruh: González and Kondo 2014: 1. Misspelling of both genus name and species epithet (García et al. 2015).

Unmounted material (adapted from Kondo and Unruh 2009). Body of adult female elliptical in shape; antennae, legs and eyes brownish-black; body orange-red, covered dorsally by white wax, with one long caudal tuft (up to 20.5 mm long, usually less than 15 mm long, but always longer than cephalic tuft), one shorter cephalic tuft protruding anteriorly, a marginal row of nine waxy tufts on each side, mealy wax abundant around dorsal submargin just above row of lateral waxy processes and forming a thick elevated submarginal ridge, with a median longitudinal waxy ridge composed of about five short tufts; waxy processes on each side of the caudal and cephalic tufts longer than other marginal processes. Ovisac elongate, white, distal end narrow, often curved upwards, fluted, with 14 or 15 longitudinal furrows. Caudal and cephalic tufts with about four longitudinal furrows. Ovisac slit on dorsomedial line, where crawlers escape.

Remarks. See remarks for *C. brasiliensis* above.

***Crypticerya zeteki* (Cockerell)**

Icerya zeteki Cockerell 1914: 148.

Crypticerya zeteki (Cockerell); Unruh and Gullan 2008a: 24. Change of combination.

Unmounted material (adapted from Cockerell 1914). Adult female oval, 4.5 mm long, densely covered in white cottony tufts which are slightly stained with yellow; with an elongated central mass of white wax surrounded by a channel or depression, except anteriorly, and margined by a series of short quadrate tufts, about seven on each side, separated from each other only by slight depressions; on each side, about 10 short subquadrate tufts which are not separated by any interval; anteriorly with a suberect, horn-like but truncate waxy projection, 1 mm or more long; posteriorly with a similar waxy

projection, but much longer (up to 4 mm), projecting over the ovisac. Ovisac 3.0–3.5 mm long, strongly fluted, white suffused with pink; without glassy filaments; legs and antennae blackish (Figure 1F).

Remarks. See remarks for *C. brasiliensis* above.

Key to the adult females of iceryine species recorded in Colombia (adapted from Kondo et al. 2012a).

1. In life, with long glassy filaments present on dorsal surface. Derm of slide-mounted specimens with open-center pores (multilocular pores with a large central opening and thick rim formed by a variable number of smaller loculi) present in marginal clusters. Pores on derm variable, with bilocular or trilocular center and 6–12 outer loculi ***Icerya purchasi* Maskell**
- In life, long glassy filaments absent from dorsal surface. Derm of slide-mounted specimens without open-center pores; pores on derm variable, with a bilocular, trilocular, quadrilocular, reniform, cruciform or star-shaped center and 0–12 outer loculi **2**
- 2(1). In life, never with ovisac beneath abdomen (Fig. 1A). Slide-mounted specimens without an ovisac band of pores on ventral abdomen ***Crypticerya abrahami* (Newstead)**
- In life, long white waxy ovisac present, formed beneath abdomen of mature females and extending posteriorly. Slide-mounted specimens with an ovisac band of pores on ventral abdomen **3**
- 3(2). Simple multilocular pores with a quadrilocular (appearing cruciform) or quinquelocular (appearing star-shaped) center and 4–8 outer loculi absent marginally and submarginally on head and thorax. Ovisac band with dense mass of flagellate setae. With 3 ventral cicatrices. Dorsal multilocular pores not concentrated in medial and submarginal-marginal longitudinal bands ***Crypticerya genistae* (Hempel)**
- Simple multilocular pores with a quadrilocular or quinquelocular center and 4–8 outer loculi present submarginally and marginally on head and thorax. Ovisac band without a dense mass of flagellate setae. With 3 or more ventral cicatrices. Dorsal multilocular pores densest in medial and submarginal-marginal longitudinal bands **4**
- 4(3). With 3 ventral cicatrices **5**
- With 5 or more ventral cicatrices **6**
- 5(4). In life, adult female pink, but covered in white waxy secretion; with one elongate waxy tuft present on each end of body, posterior tuft longest, reaching up to 20 mm in length, these tufts often striated, each posterior tuft flanked by two slightly smaller tufts (Fig. 1B). Long hair-like setae in clusters of 3–5 around margin ***Crypticerya brasiliensis* (Hempel)**
- In life, adult female reddish-yellow, but covered in white waxy secretion; with two long extensions of wax present at each end of body (Fig. 1D), these reaching up to 20 mm in length, no flanking tufts or extensions. Long hair-like setae in clusters of 1–3 around margin ***Crypticerya montserratensis* (Riley and Howard)**
- 6(4). With 5–7 ventral cicatrices ***Crypticerya zeteki* (Cockerell)**
- Usually with 11–13 ventral cicatrices, but smaller specimens with as few as 9 cicatrices ***Crypticerya multicitricates* Kondo and Unruh**

Notes. The similarities of *C. brasiliensis*, *C. montserratensis*, *C. multicitricates* (this species referred to as an undescribed Colombian species) and *C. zeteki* were discussed by Unruh and Gullan (2008b).

Distribution and biological notes

Both *C. brasiliensis* and *C. genistae* are native to South America and may have originated in Brazil where they were described over 100 years ago by Hempel (1900, 1912). Hempel (1900) described *C.*

brasiliensis (as *I. brasiliensis*) based on specimens collected on *Codiaeum* sp. (Euphorbiaceae), *Ficus* sp. (Moraceae), *Rosa* sp. (Rosaceae) and other plants, and indicated that the insect segregates in large numbers on the underneath of branches and twigs of its host, and was observed causing dieback of numerous shade trees in São Paulo, Brazil. The report of the presence of hymenopterous parasitoids and coccinellid larvae (Hempel 1900) suggest that *C. brasiliensis* is native to Brazil. Hempel (1912) described *C. genistae* (as *I. genistae*) from specimens collected on *Cytisus scoparius* (as *Genista scoparia*) (Fabaceae), *Kummerowia striata* (as *Lespedeza striata*) (Fabaceae) and *Fragaria* sp. (Rosaceae), but did not give any information on its pest status, suggesting that *C. genistae* is also endemic to Brazil. Although these two species have been recorded from several other Neotropical countries (García et al. 2015), they have not been reported elsewhere with the exception of the introduction of *C. genistae* to Florida, U.S.A. (see below). Prior to our present records from Colombia, *C. brasiliensis* was known to occur in Argentina, Brazil and Panama Canal Zone, and *C. genistae* had been recorded from Barbados, Brazil, Guadeloupe, U.S.A. (García et al. 2015) and Aruba (P.J. Gullan unpublished data). Although ScaleNet (García et al. 2015) lists *C. brasiliensis* in Perú based on Vasquez et al. (2002), this is a record of *C. zeteki*, not *C. brasiliensis*.

Crypticerya brasiliensis was found causing serious damage to many types of shrubs and guava trees in a natural ecosystem at Sutamarchán, in the Department of Boyacá (A. Caballero and A. A. Ramos, personal observation). In Tumaco, in the Department of Nariño, *C. zeteki* was collected along the mid veins of the leaves of the palm, *Dypsis lutescens* (T. Kondo, personal observation). This species is likely to become more widespread in Colombia.

Crypticerya genistae has become very common in Colombia, having been collected in the Departments of Córdoba, Magdalena, Tolima, and Valle del Cauca. It is very common in Corpoica, Palmira Research Station, where it is often found on *Arachis pintoii*, *Caesalpinia pluviosa* var. *peltophoroides*, *Desmodium* sp., other leguminous weeds (Fabaceae), on *Malvastrum* sp. (Malvaceae), and various other undetermined weeds. In Palmira, *C. genistae* was recently found in high numbers on *Parthenium hysterophorus* L. (Asteraceae) (T. Kondo, personal observation). At Corpoica, Turipaná Research Station, in the Department of Córdoba, it is considered a pest of chili peppers (*Capsicum* sp. cv. 'Topito' (Solanaceae)) (N. Jimenez, personal communication). The species (judging by external morphology, has also been observed at the regional office of the Colombian Agricultural Institute (ICA), in the municipality of Espinal, Department of Tolima (A. A. Ramos, personal observation). The first author started noticing *C. genistae* in the grounds of Corpoica, Palmira Research Station, around March, 2014, and judging by the collection data in the present study and its rapid spread, we consider that *C. genistae* probably came to Colombia around 2012–2013, probably coming from the Caribbean region or a neighboring country. This species was detected for the first time in Florida in 2005, and subsequently recorded there on a wide range of plants in 16 families (Hodges et al. 2008). Members of the plant families Asteraceae and Fabaceae are favored hosts of *C. genistae* (Hodges et al. 2008; Etienne and Matile-Ferrero 2008).

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