TAKUMASA KONDO (*) (°) - ANDREA AMALIA RAMOS-PORTILLA (**)
ANA LUCIA B.G. PERONTI (***) - PENNY J. GULLAN (****)

KNOWN DISTRIBUTION AND PEST STATUS OF FLUTED SCALE INSECTS (HEMIPTERA MONOPHLEBIDAE ICERYINI) IN SOUTH AMERICA ⁽¹⁾

(*) Laboratorio de Entomología, Corporación Colombiana de Investigación Agropecuaria (CORPOICA), Centro de Investigación Palmira, Valle del Cauca, Colombia.

(**) Instituto Colombiano Agropecuario ICA, Museo Entomológico UNAB-Universidad Nacional de Colombia, sede Bogotá.

(***) Universidade Estadual Paulista Júlio de Mesquita Filho, Faculdade de Ciências Agrárias e Veterinárias de Jaboticabal.

(****) Division of Evolution, Ecology & Genetics, Research School of Biology, The Australian National University, Canberra, A.C.T. 2601, Australia. E-mail: penelope.gullan@anu.edu.au

(°) Corresponding author: E-mail: takumasa.kondo@gmail.com

Kondo T., Ramos-Portilla A.A., Peronti A.L.B.G., Gullan P.J. – Known distribution and pest status of fluted scale insects (Hemiptera Monophlebidae Iceryini) in South America.

Current information on the known distribution of all 18 species (12 species of *Crypticerya* Cockerell and 6 species of *Icerya* Signoret) of fluted scale insects (Hemiptera: Monophlebidae: Iceryini) found in South America is provided. A list of known host plants and natural enemies of these species is given and their pest status in South America is discussed.

KEY WORDS: *Crypticerya*, *Icerya*, Monophlebidae, South America, distribution, host plants.

INTRODUCTION

The tribe Iceryini (Hemiptera: Monophlebidae) is composed by 84 species distributed in five genera, i.e., *Crypticerya* Cockerell, *Icerya* Signoret, *Echinicerya* Morrison, *Gigantococcus* Pesson & Bielenin, and *Gueriniella* Targioni Tozzetti (GARCÍA MORALES *et al.*, 2016; UNRUH & GULLAN, 2008a, b). Of these, only *Crypticerya* and *Icerya* are known from South America. Twelve of 27 described species of *Crypticerya* and six of 35 species of *Icerya* have been recorded from one or more South American countries (GARCÍA MORALES *et al.*, 2016). For the purpose of this paper, we treat South America as including Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, and Venezuela, but exclude the ABC islands, Trinidad and Tobago, and Panama, which are sometimes considered as part of South America. In South America, the pest iceryine species are commonly called fluted scales because the female (often hermaphroditic) produces a white waxy ovisac marked with longitudinal grooves or flutes. The species of greatest economic importance in South America are *Crypticerya brasiliensis* (Hempel), *C. multicatrices* Kondo & Unruh, *C. genistae* (Hempel), *C. montserratensis* (Riley & Howard), *C. palmeri* (Riley & Howard), *C. zeteki* (Cockerell), *Icerya purchasi* Maskell and *I. seychellarum* (Westwood). All of the above species are polyphagous and attack plant species of economic importance. For example, *C. multicatrices* is known to feed on almost 150 plant

species and, when outbreaks occurred on San Andres Island, Colombia, the most common hosts included essentially all palm species (Arecaceae), breadfruit (*Artocarpus altilis* (Parkinson) Fosberg), *Citrus* spp., guava (*Psidium* spp.), all leguminous trees and weeds (Fabaceae), *Ficus* spp. (Moraceae), *Mammea americana* L. (Calophyllaceae), *Melicoccus bijugatus* Jacq. (Sapindaceae) and *Spondias* spp. (Anacardiaceae) (KONDO *et al.*, 2012a). Another species, *C. genistae*, has been reported on 80 species of plants, and was reported recently in Colombia, where it is considered a pest of chili peppers (KONDO *et al.*, 2016). We provide information on the distribution and host plants of the Iceryini species found in South America and discuss their economic importance.

MATERIAL AND METHODS

The present paper summarizes our current understanding of the distribution, host plants, pest status, natural enemies, and other information such as biological and taxonomic notes on scale insects of the tribe Iceryini (Hemiptera: Monophlebidae) in South America based on a literature review and personal observations.

RESULTS AND DISCUSSION

LIST OF ICERYINE SPECIES KNOWN FROM SOUTH AMERICA

Crypticerya abrahami (Newstead)
Llaveia abrahami Newstead, 1917: 1.

DISTRIBUTION IN SOUTH AMERICA - Colombia (KONDO & UNRUH, 2009), Guyana (FOLDI, 2009; NEWSTEAD, 1917; UNRUH & GULLAN, 2008b), Venezuela (FOLDI, 2009).

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PEST STATUS – Not considered a pest.

NATURAL ENEMIES - Unknown.

HOST PLANTS - Euphorbiaceae: *Sapium jenmanii* Hemsl. (UNRUH & GULLAN, 2008b); Fabaceae: *Pithecellobium dulce* (Roxb.) Benth. (NEWSTEAD, 1917); Myrtaceae: *Psidium guajava* L. (T. KONDO, personal observation).

REMARKS - The insects live underneath the bark of their host plant; adult females are covered by a thin layer of white wax and lack the typical ornamental waxy secretions seen in many species of *Crypticerya*. Instead of an ovisac, the females keep their eggs underneath their body in a marsupium, which may be an adaptation for living in crowded spaces. According to the original description by NEWSTEAD (1917), the type specimens were found “inhabiting indentations in the bark of a rubber-producing tree, *Sapium jenmani* Hemsl. (Euphorbiaceae); attended by ants which construct coverings over the Coccids”. Similarly, in Colombia they are often found on *Pithecellobium dulce* and *Psidium guajava*, underneath the bark, on bark crevices and inside ant cartons and tended by *Azteca* and *Crematogaster* (Formicidae) ants (T. KONDO, personal observation). Two other species, *C. pimentae* from Jamaica and *C. rosae* known from Guadeloupe, Haiti, Mexico, Puerto Rico and the U.S.A., are morphologically identical to *C. abrahami*, but are not genetically identical (Unruh & Gullan, 2008b).

***Crypticerya brasiliensis* (Hempel)**

Icerya brasiliensis Hempel, 1900: 370.

DISTRIBUTION IN SOUTH AMERICA - Argentina (LIZER Y TRELLES, 1938), Colombia (KONDO *et al.*, 2016), Brazil (HEMPEL, 1900, 1912; LIZER Y TRELLES, 1938; PALOMAR *et al.*, 2015; PERONTI & ROSA, 2006; UNRUH & GULLAN, 2008b), Guyana (UNRUH & GULLAN, 2008a).

PEST STATUS - This species is often found congregating in large numbers on the underneath of branches and twigs of its host, and has been reported as causing the dieback of numerous shade trees in São Paulo, Brazil (HEMPEL, 1900). Recently, in the Department of Boyacá in Colombia, *C. brasiliensis* was reported as causing great damage to many types of shrubs and guava trees (KONDO *et al.*, 2016).

NATURAL ENEMIES - Hymenoptera: Encyrtidae: *Brethesiella abnormicornis* (Girault), *Brethesiella longipes* Blanchard (NOYES, 2004; TRJAPITZIN & TRJAPITSYN, 2006).

HOST PLANTS - Arecaceae: *Caryota* sp.; Euphorbiaceae: *Codiaeum* sp.; Lauraceae: *Cinnamomum camphora* (L.) J. Presl.; Magnoliaceae: *Liriodendron tulipifera* L.; Moraceae: *Ficus* sp.; Myrtaceae: *Callistemon viminalis* (Sol. ex Gaertn.) G. Don, *Psidium guajava* L.; Rosaceae: *Rosa* sp. (HEMPEL, 1900, 1912; KONDO *et al.*, 2016; LIZER Y TRELLES, 1938; PALOMAR *et al.*, 2015; PERONTI & ROSA, 2006).

REMARKS - Outside South America, *C. brasiliensis* has been recorded from Panama (Canal Zone) by COCKERELL (1914). In the State of São Paulo, *C. brasiliensis* is commonly found on guava and various ornamental plants (PALOMAR *et al.*, 2015; PERONTI & ROSA, 2006). In life, the arrangement of waxy secretions in *C. brasiliensis*, *C. multicastrices* and *C. zeteki* is superficially similar, with all having a long caudal tuft and a shorter cephalic tuft (KONDO *et al.*, 2016). In *C. brasiliensis*, the waxy tufts laterad to the long caudal tuft are usually three or more times longer than other marginal tufts. However, in *C. zeteki*, the waxy tufts laterad to the long caudal tuft are about three times longer than the shorter marginal tufts, thus overlapping with *C. brasiliensis* (KONDO *et al.*, 2016). At this time, the only

reliable way to differentiate them is by looking at slide-mounted specimens.

***Crypticerya flava* (Hempel)**

Icerya flava Hempel, 1920: 334.

DISTRIBUTION IN SOUTH AMERICA - Brazil (HEMPEL, 1920).

PEST STATUS - Unknown.

NATURAL ENEMIES - Not reported.

HOST PLANTS - HEMPEL (1920) lists *C. flava* (as *Icerya flava*) as occurring on the bark of indigenous trees locally known as ‘cambará preta’ and ‘sucará’. UNRUH & GULLAN (2008b) identified ‘cambará preta’ as “black *Gochnatia*”, a plant in the family Asteraceae. The other plant, ‘sucará’ appears to be a plant in the genus *Xylosma*, in the family Salicaceae.

REMARKS - This species is known only from Brazil and very little information is available for it in the scientific literature.

***Crypticerya flocculosa* (Hempel)**

Icerya flocculosa Hempel, 1932: 312.

DISTRIBUTION IN SOUTH AMERICA - Brazil (HEMPEL, 1932).

PEST STATUS - Unknown.

NATURAL ENEMIES - Not reported.

HOST PLANTS - Fagaceae: *Castanea* sp.; Rutaceae: *Citrus* sp. (HEMPEL, 1932).

REMARKS - Only known from Brazil. UNRUH & GULLAN (2008b) were unable to examine specimens of *C. flocculosa* for their identification guide to species of Iceryini and suggested that this species may be a synonym of another species.

***Crypticerya genistae* (Hempel)**

Icerya genistae Hempel, 1912: 55.

DISTRIBUTION IN SOUTH AMERICA - Brazil (CULIK *et al.*, 2007; HEMPEL, 1912), Colombia (KONDO *et al.*, 2016).

PEST STATUS - *Crypticerya genistae* has been reported as a pest of eggplants, peanuts, peppers and tomatoes in Barbados (HODGES *et al.*, 2008). In Puerto Rico it has been reported as a devastating pest of soybeans and other legumes (JENKINS *et al.*, 2014). In Florida, hosts currently are restricted to common roadside plants, with no infestations observed in agricultural crops or on ornamental plants (HODGES *et al.*, 2008). In Colombia, it has been reported as a pest of chili peppers, *Capsicum* sp. cv. ‘Topito’ (Solanaceae) (KONDO *et al.*, 2016). Plants in the families Asteraceae, Euphorbiaceae and Fabaceae are favored by *C. genistae* (ETIENNE & MATILE-FERRERO 2008; HODGES *et al.*, 2008; STOCKS, 2013) and plants of the families Malvaceae and Solanaceae also appear to be common hosts of *C. genistae*.

NATURAL ENEMIES - Coleoptera: Coccinellidae: *Anovia circumclusa* (Gorham) (Ciomperlik 2010), *A. punica* Gordon (T. KONDO, personal observation), *Rodolia cardinalis* (Mulsant) (ETIENNE & MATILE-FERRERO, 2008). Diptera: Cecidomyiidae: *Pectinodiplosis erratica* (Felt) (GAGNÉ & ETIENNE, 2009), Phoridae: *Syneura cocciphila* (Coquillett) (CIOMPERLIK, 2010).

HOST PLANTS - Arecaceae: *Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf.; Asteraceae: *Ambrosia artemisiifolia* L., *Baccharis halimifolia* L., *Bidens pilosa* L., *Centratherum punctatum* Cass., *Conyza canadensis* (L.) Cronquist, *Eclipta prostrata* (L.) L., *Eleutheranthera ruderalis* (Sw.) Sch. Bip., *Emilia fosbergii* Nicolson, *Erigeron canadensis* L.,

Eupatorium capillifolium (Lam.) Small ex Porter & Britton, *Helianthus debilis* Nutt., *Heterotheca subaxillaris* (Lam.) Britton & Rusby, *Mikania micrantha* Kunth, *Parthenium hysterophorus* L., *Pluchea carolinensis* (Jacq.) G. Don, *Pluchea odorata* (L.) Cass., *Solidago leavenworthii* Torr. & A. Gray, *Sonchus oleraceus* L., *Sphagneticola trilobata* (L.) Pruski, *Tridax procumbens* L.; Cannabaceae: *Trema micrantha* (L.) Blume.; Casuarinaceae: *Casuarina equisetifolia* L.; Convolvulaceae: *Ipomoea batatas* (L.) Lam., *I. pes-caprae* (L.) R. Br., *Merremia aegyptia* (L.) Urb.; Cucurbitaceae: *Momordica charantia* L.; Cyperaceae: *Carex* sp., *Rhynchospora* sp.; Euphorbiaceae: *Euphorbia cyathophora* Murray, *E. heterophylla* L., *E. hirta* L., *E. hypericifolia* L., *E. mesembryanthemifolia* Jacq., *Ricinus communis* L.; Fabaceae: *Acacia cornigera* (L.) Willd., *A. macracantha* Humb. & Bonpl. ex Willd., *Aeschynomene americana* L., *Arachis pintoii* Krapov. & W.C. Greg., *Caesalpinia bonduc* (L.) Roxb., *Cajanus cajan* (L.) Huth, *Calopogonium mucunoides* Desv., *Canavalia rosea* (Sw.) DC., *Centrosema pubescens* Benth., *C. virginianum* (L.) Benth., *Crotalaria incana* L., *C. retusa* L., *Desmanthus virgatus* (L.) Willd., *Desmodium incanum* (Sw.) DC., *D. tortuosum* (Sw.) DC., *Desmodium* sp., *Genista scoparia* Lam., *Haematoxylum campechianum* L., *Indigofera suffruticosa* Mill., *I. tinctoria* L., *Kummerowia striata* (Thunb.) Schindl., *Macroptilium lathyroides* (L.) Urb., *Mimosa pigra* L., *M. pudica* L., *Pueraria phaseoloides* (Roxb.) Benth., *Rhynchosia baukea* Du Puy & Labat, *Senna obtusifolia* (L.) H.S. Irwin & Barneby, *S. polyphylla* (Jacq.) H.S. Irwin & Barneby, *Sesbania* sp., *Stylosanthes biflora* (L.) Britton, Sterns & Poggenb., *Teramnus labialis* (L. f.) Spreng., *Vicia acutifolia* Elliott, *Vigna luteola* (Jacq.) Benth., *Vigna* sp.; Malvaceae: *Malvastrum* sp., *Waltheria indica* L.; Onagraceae: *Ludwigia peruviana* (L.) H. Hara.; Passifloraceae: *Turnera subulata* Sm.; Phyllanthaceae: *Phyllanthus debilis* Klein ex Willd.; Poaceae: *Bothriochloa pertusa* (L.) A. Camus.; Primulaceae: *Samolus valerandi* L.; Rosaceae: *Fragaria* sp.; Rubiaceae: *Richardia grandiflora* (Cham. & Schltdl.) Steud., *Spermacoce verticillata* L.; Sapindaceae: *Filicium decipiens* (Wight & Arn.) Thwaites; Solanaceae: *Capsicum* sp. cv. 'Topito', *Solanum torvum* Sw.; Vitaceae: *Ampelopsis arborea* (L.) Koehne, *Vitis rotundifolia* Michx. (ESQUIVEL-RÍOS, 2015; ETIENNE & MATILE-FERRERO, 2008; HEMPEL, 1912; HODGES *et al.*, 2008; KONDO *et al.*, 2016).

REMARKS - Outside South America, *C. genistae* has been reported from Antigua and Barbuda (MILLER *et al.*, 2014), Bahamas (HODGES, 2006), Barbados (CIOMPERLIK 2010; HODGES, 2006), Curacao (VAN BUURT & DEBROT, 2011), Dominica (MILLER *et al.*, 2014), Grenada (EVANS & DOOLEY, 2013; MILLER *et al.*, 2014), Guadeloupe (ETIENNE & MATILE-FERRERO, 2008), Haiti (PESTNET, 2016), Jamaica (MILLER *et al.*, 2014), Mexico (MILLER *et al.*, 2014), Panama (ESQUIVEL-RÍOS, 2015), Puerto Rico (CIOMPERLIK, 2010; EVANS & DOOLEY, 2013; MILLER *et al.*, 2014), St. Kitts and Nevis (MILLER *et al.*, 2014), Saint Lucia (MALUMPHY, 2014), Trinidad and Tobago (EVANS & DOOLEY, 2013; MILLER *et al.*, 2014), USA (HODGES *et al.*, 2008), U.S. Virgin Islands (EVANS & DOOLEY, 2013; MILLER *et al.*, 2014), and West Africa (EVANS & DOOLEY, 2013).

***Crypticerya luederwaldti* (Hempel)**

Icerya luederwaldti Hempel, 1918: 197.

DISTRIBUTION IN SOUTH AMERICA - Brazil (HEMPEL, 1918).

PEST STATUS - Unknown.

NATURAL ENEMIES - Not reported.

HOST PLANTS - HEMPEL (1918) lists the host as a salt-

loving plant, with the insects living on the underside of the leaves near the central nerves (main veins).

REMARKS - Only known from Brazil. UNRUH & GULLAN (2008b) could not examine specimens of *C. luederwaldti* for their identification guide to species of Iceryini.

***Crypticerya minima* (Morrison)**

Icerya minima Morrison, 1919: 64.

DISTRIBUTION IN SOUTH AMERICA - Argentina (LIZER Y TRELLES, 1938; MORRISON, 1919).

PEST STATUS - Unknown.

NATURAL ENEMIES - Not reported.

HOST PLANTS - Amaranthaceae: *Suaeda divaricata* Moq. (LIZER Y TRELLES, 1938; MORRISON, 1919).

REMARKS - Only known from Argentina.

***Crypticerya montserratensis* (Riley & Howard)**

Icerya montserratensis Riley & Howard, 1890: 99.

DISTRIBUTION IN SOUTH AMERICA - Colombia (FIGUEROA-POTES, 1946), Ecuador (BARTLETT, 1978), Venezuela (GORDON, 1972).

PEST STATUS - Known as a major pest of citrus in Ecuador and a minor pest in Puerto Rico (BARTLETT, 1978).

NATURAL ENEMIES - Coleoptera: Coccinellidae: *Anovia punica* Gordon (GORDON, 1972), *Rodolia cardinalis* (Mulsant) (BARTLETT, 1978). Diptera: Cryptochaetidae: *Cryptochaetum iceryae* (Williston) (BARTLETT, 1978). Phoridae: *Syneura cocciphila* (Coquillett) (BARTLETT, 1978). Hymenoptera: Encyrtidae: *Brethesiella* sp., *Cheiloneurus pulvinariae* Dozier, *Homosemion bennetti* Annecke, *Iceromyia flavifrons* Noyes (NOYES, 2004).

HOST PLANTS - Arecaceae: *Cocos nucifera* L.; Calophyllaceae: *Calophyllum calaba* L., *Mammea americana* L.; Casuarinaceae: *Casuarina equisetifolia* L.; Fabaceae: *Albizia saman* (Jacq.) F. Muell., *Inga fagifolia* G. Don, *I. vera* Willd., *Prosopis* sp.; Lauraceae: *Persea americana* Mill.; Lythraceae: *Lawsonia inermis* L.; Malpighiaceae: *Byrsonima crassifolia* (L.) Kunth; Moraceae: *Ficus microcarpa* L. f.; Musaceae: *Musa* sp.; Myrtaceae: *Psidium guajava* L., *Psidium* sp.; Rutaceae: *Citrus aurantium* L., *C. maxima* (Burm.) Merr., *Citrus* sp.; Sapotaceae: *Chrysophyllum* sp. (FIGUEROA-POTES, 1946; FOLDI, 1995; MARTORELL, 1976; RILEY & HOWARD, 1890a, b; TOWNSEND & COCKERELL, 1898).

REMARKS - Outside of South America, *C. montserratensis* is known from Grenada (VAYSSIÈRE, 1926), Haiti (PEREZ-GELABERT, 2008), Mexico (FOLDI, 1995; COCKERELL, 1899), Montserrat (RILEY & HOWARD, 1890), Panama (COCKERELL, 1899), and Puerto Rico (MARTORELL, 1976).

***Crypticerya multicatrides* Kondo & Unruh**

Crypticerya multicatrides Kondo & Unruh, 2009: 95.

DISTRIBUTION IN SOUTH AMERICA - Colombia (KONDO & UNRUH, 2009).

PEST STATUS - *Crypticerya multicatrides* is present throughout the year, with infestations being more severe in times of drought (KONDO *et al.*, 2012a). It has been reported associated with stunted growth on soursop, *Annona muricata* L. (KONDO, 2008), and defoliation and death of the host in severe attacks (KONDO *et al.*, 2012a). The species produces honeydew that promotes the growth of fungi that cause sooty mold, resulting in cosmetic damage to the commercial parts of the plant and reducing the quality of the product. Outbreaks of *C. multicatrides* occurred on San Andres Island (Colombia) between 2010 and 2013, until the coccinellid beetle, *Anovia* sp. successfully controlled this

insect pest (KONDO *et al.*, 2014). This insect predator was later identified as *Anovia punica* Gordon (GONZÁLEZ & KONDO, 2014). In mainland Colombia, outbreaks of *C. multicatricres* commonly occur in the city of Cali, affecting urban trees such as *Caesalpinia pluviosa* var. *peltophoroides*, *Pithecellobium dulce* and *P. saman* (Fabaceae) and mango *Mangifera indica* (Anacardiaceae) (PINCHAO *et al.*, 2015).

NATURAL ENEMIES - Fungi: Eurotiales: Trichocomaceae: *Isaria* sp. (KONDO *et al.*, 2012a, SILVA-GÓMEZ *et al.*, 2013). Coleoptera: Coccinellidae: *Anovia punica* Gordon (GONZÁLEZ & KONDO, 2014), *Delphastus quinculus* Gordon, *Diomus seminulus* (Mulsant) (GONZÁLEZ *et al.*, 2012), *Rodolia cardinalis* (Mulsant) (PINCHAO *et al.*, 2015). Diptera: Phoridae: *Syneura cocciphila* (Coquillett) (GAIMARI *et al.*, 2012). Hymenoptera: Encyrtidae: *Brethesiella* cf. *abnormicornis* (Girault) (MONTEALEGRE *et al.*, 2016), *Cheiloneurus* sp. (an encyrtid hyperparasitoid). Neuroptera: Chrysopidae: *Chrysoperla* sp., *Ceraeochrysa* sp. (KONDO *et al.*, 2014).

HOST PLANTS - Acanthaceae: *Avicennia germinans* (L.) L., *Dicliptera assurgens* (L.) Juss., *Graptophyllum pictum* (L.) Griff., *Pseuderanthemum reticulatum* (Hort. ex Hook. fil.) Radlk.; Amaranthaceae: *Achyranthes* sp., *Spinacia oleracea* L.; Amaryllidaceae: *Allium cepa* L., *A. fistulosum* L., *Hymenocallis caribaea* (L.) Herb.; Anacardiaceae: *Mangifera indica* L., *Spondias mombin* L., *S. purpurea* L.; Annonaceae: *Annona cherimola* Mill., *A. muricata* L., *Annona squamosa* L.; Apocynaceae: *Catharanthus roseus* (L.) G. Don., *Nerium oleander* L., *Plumeria* sp.; Araceae: *Adonidia merrillii* (Becc.) Becc., *Alocasia macrorrhizos* (L.) G. Don., *Anthurium cubense* Engl., *Epipremnum aureum* (Linden & André) G.S. Bunting; Araliaceae: *Polyscias* sp., *Schefflera* sp.; Arecaceae: *Attalea butyracea* (Mutis ex L. f.) Wess. Boer, *Caryota* sp., *Cocos nucifera* L., *C. nucifera* L. "Malayan dwarf", *Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf., *Phoenix roebelenii* O'Brien, *Pritchardia pacifica* Seem. & H. Wendl., *Veitchia* sp.; Asparagaceae: *Cordyline terminalis* (L.) Kunth., *Cordyline* sp., *Dracaena* sp., *Sansevieria fasciata* Cornu ex Gérôme & Labroy; Asteraceae: *Emilia sonchifolia* (L.) DC.; Berberidaceae: *Nandina domestica* Thunb.; Bignoniaceae: *Crescentia cujete* L., *Spathodea campanulata* P. Beauv., *Tecoma stans* (L.) Juss. ex Kunth; Bixaceae: *Bixa orellana* L.; Boraginaceae: *Cordia sebestena* L.; Calophyllaceae: *Mammea americana* L.; Capparaceae: *Quadrella odoratissima* (Jacq.) Hutch.; Caricaceae: *Carica papaya* L.; Casuarinaceae: *Casuarina equisetifolia* L.; Chrysobalanaceae: *Licania tomentosa* (Benth.) Fritsch; Clusiaceae: *Rhedia madruno* (Kunth) Planch. & Triana; Combretaceae: *Conocarpus erectus* L., *Laguncularia racemosa* (L.) C.F. Gaertn.; Convolvulaceae: *Ipomoea batatas* (L.) Lam.; Crassulaceae: *Kalanchoe pinnata* (Lam.) Pers.; Cucurbitaceae: *Cucumis sativus* L., *Luffa cylindrica* (L.) M. Roem.; Cyperaceae: *Cyperus ligularis* L.; Euphorbiaceae: *Acalypha wilkesiana* Müll. Arg., *Codiaeum variegatum* (L.) Rumph. ex A. Juss., *Euphorbia aphylla* Brouss. ex Willd., *Euphorbia hirta* L., *E. pulcherrima* Willd. ex Klotzsch, *Jatropha gossypifolia* L., *J. integerrima* Jacq., *Manihot esculenta* Crantz; Fabaceae: *Albizia lebeck* (L.) Benth., *Arachis pintoi* Krapov. & W.C. Greg., *Bauhinia monandra* Kurz, *Caesalpinia peltophoroides* Benth., *Cajanus cajan* (L.) Huth, *Calliandra pittieri* Standl., *Calliandra* sp., *Cassia fistula* L., *C. grandis* L. f., *Delonix regia* (Bojer ex Hook.) Raf., *Erythrina variegata* L., *Erythrina* sp., *Flemingia strobilifera* (L.) R. Br., *Leucaena leucocephala* (Lam.) de Wit, *Gliricidia sepium* (Jacq.) Kunth ex Walp., *Phaseolus*

vulgaris L., *Phaseolus* sp., *Pithecellobium dulce* (Roxb.) Benth., *Tamarindus indica* L.; Lamiaceae: *Ocimum sanctum* L., *Plectranthus unguentarius* Codd, *Salvia* sp., *Tectona grandis* L. f.; Lauraceae: *Persea americana* L.; Musaceae: *Musa* × *paradisica* L., *Musa* × *sapientum* L.; Lythraceae: *Lagerstroemia indica* L., *Punica granatum* L.; Malvaceae: *Abelmoschus esculentus* (L.) Moench, *Ceiba pentandra* (L.) Gaertn., *Gossypium barbadense* L., *Guazuma ulmifolia* Lam., *Hibiscus rosa-sinensis* L., *Hibiscus sabdariffa* L., *Hibiscus* sp., *Malvaviscus arboreus*, *Thespesia populnea* (L.) Sol. ex Corrêa; Moraceae: *Artocarpus altilis* (Parkinson) Fosberg, *Artocarpus heterophyllus* Lam., *Ficus benjamina* L., *F. elastica* Roxb. ex Hornem., *F. lyrata* Warb., *F. microcarpa* L. f., *Ficus* sp.; Myrtaceae: *Pimenta dioica* (L.) Merr., *Psidium guajava* L., *Psidium* sp., *Syzygium jambos* (L.) Alston, *Syzygium samarangense* (Blume) Merr. & L. M. Perry; Nyctaginaceae: *Bougainvillea* sp.; Orchidaceae: *Brassavola nodosa* (L.) Lindl.; Oxalidaceae: *Averrhoa carambola* L.; Passifloraceae: *Passiflora edulis* fo. *flavicarpa* O. Deg.; Phyllanthaceae: *Phyllanthus acidus* (L.) Skeels; Poaceae: *Poa* sp., *Zea mays* L.; Polygonaceae: *Coccoloba uvifera* (L.); Rubiaceae: *Alibertia edulis* (Rich.) A. Rich. ex DC., *Ixora coccinea* L., *Morinda citrifolia* L.; Rutaceae: *Citrus* × *aurantiifolia* (Christm.) Swingle, *C. aurantium* L., *C. grandis* (L.) Osbeck, *C. latifolia* Tanaka, *C. × limon* (L.) Osbeck, *C. reticulata* Blanco, *C. sinensis* (L.) Osbeck, *Swinglea glutinosa* (Blanco) Merr.; Sapindaceae: *Melicoccus bijugatus* Jacq.; Sapotaceae: *Chrysophyllum cainito* L., *Manilkara zapota* (L.) P. Royen; Smilacaceae: *Smilax spinosa* Mill.; Solanaceae: *Capsicum chinense* Jacq. (Habanero pepper), *Capsicum* sp., *Cestrum nocturnum* L., *Solanum lycopersicum* Lam., *S. melongena* L.; Strelitziaceae: *Ravenala madagascariensis* Sonn.; Urticaceae: *Cecropia peltata* L., *C. schreberiana* Miq.; Zingiberaceae: *Alpinia purpurata* (Vieill.) K. Schum. (KONDO *et al.*, 2012a; SILVA-GÓMEZ *et al.*, 2013).

REMARKS - Only known from mainland Colombia and San Andres and Providence Islands (Colombian territory). In life, the species resembles *C. brasiliensis* and *C. zeteki*, which are also known to occur in Colombia (see Remarks section under *C. brasiliensis*).

Crypticerya palmeri (Riley & Howard)

Icerya palmeri Riley & Howard, 1890: 103.

DISTRIBUTION IN SOUTH AMERICA - Argentina (LIZER Y TRELLES, 1938), Chile (BARTLETT, 1978; LIZER Y TRELLES, 1938, VAYSSIÈRE, 1926).

PEST STATUS - *Crypticerya palmeri* has been reported as a serious pest of alfalfa, grapevines and ornamental plants in Chile (BARTLETT, 1978).

NATURAL ENEMIES - Coleoptera: Coccinellidae: *Rodolia cardinalis* (Mulsant) (BARTLETT, 1978). Hymenoptera: Encyrtidae: *Brethesiella flava* Timberlake (TIMBERLAKE, 1926).

HOST PLANTS - Fabaceae: *Coursetia* sp. (FOLDI, 1995; TOWNSEND & COCKERELL, 1898), *Medicago* sp. (BARTLETT, 1978). Poaceae: undetermined species (LIZER Y TRELLES, 1938). Rosaceae: *Acaena argentea* Ruiz & Pav. (LIZER Y TRELLES, 1938). Vitaceae: *Vitis vinifera* L. (BARTLETT, 1978; RILEY & HOWARD, 1890).

REMARKS - The species was originally described from specimens collected in Mexico, on grapevines (RILEY & HOWARD, 1890). Later, the species was reported from Argentina and Chile (see distribution above), but whether the South American specimens are conspecific with the

Mexican species needs to be verified. In their identification guide to species of *Iceryini*, UNRUH & GULLAN (2008b) examined only specimens from Mexico (the type locality), thus, currently we do not know whether the South American species are conspecific, and these may be an undescribed species or a different named species.

***Crypticerya subandina* (Leonardi)**

Icerya subandina Leonardi, 1911: 238.

DISTRIBUTION IN SOUTH AMERICA - Argentina (LEONARDI, 1911; LIZER Y TRELLES, 1917, 1938).

PEST STATUS - Unknown.

NATURAL ENEMIES - Not reported.

HOST PLANTS - Fabaceae: *Anadenanthera colubrine* (Vell.) Brenan (LIZER Y TRELLES, 1938); Zygophyllaceae: *Bulnesia retama* (Gillies ex Hook. & Arn.) Griseb. (LEONARDI, 1911; LIZER Y TRELLES, 1938).

REMARKS - Only known from Argentina.

***Crypticerya zeteki* (Cockerell)**

Icerya zeteki Cockerell, 1914: 148.

DISTRIBUTION IN SOUTH AMERICA - Colombia (KONDO *et al.*, 2016).

PEST STATUS - In Colombia, it is listed as a pest of coconut, oil palm and roses by POSADA (1989).

NATURAL ENEMIES - Not reported.

HOST PLANTS - Arecaceae: *Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf., *Cocos nucifera* L., *Elaeis guineensis* Jacq.; Fabaceae: *Trifolium repens* L., *Arachis pintoi* Krapov. & W.C. Greg.; Rosaceae: *Rosa* sp. (KONDO *et al.*, 2016; POSADA, 1989).

REMARKS - The species was originally recorded from Panama (Canal Zone) on an undetermined plant (COCKERELL, 1914). The arrangement of waxy secretions in live specimens of *C. brasiliensis*, *C. multicastrices* and *C. zeteki* is superficially similar, all sharing a long caudal waxy tuft and a shorter cephalic tuft (for more details see KONDO *et al.*, 2016). A discussion of the similarities of *C. brasiliensis*, *C. montserratensis*, *C. multicastrices* (latter referred to as an undescribed Colombian species) and *C. zeteki* can be found in UNRUH & GULLAN (2008b).

***Icerya chilensis* Hempel**

Icerya chilensis, Hempel, 1920, 333.

DISTRIBUTION IN SOUTH AMERICA - Chile (HEMPEL, 1920).

PEST STATUS - Unknown.

NATURAL ENEMIES - Not reported.

HOST PLANTS - Collected on the leaves of an undetermined wild tree (HEMPEL, 1920).

REMARKS - Only known from Chile. UNRUH & GULLAN (2008b) regarded this species as *incertae sedis*. The natural occurrence of an *Icerya* species in South America is doubtful. The genus *Icerya* is native to Indomalaya and Australasia, not South America. In the original description, HEMPEL, (1920) wrote that once the male of this species was discovered, that the species might be put into a different genus.

***Icerya insulans* Hempel**

Icerya insulans Hempel, 1923: 510.

DISTRIBUTION IN SOUTH AMERICA - Brazil (HEMPEL, 1923).

PEST STATUS - Unknown.

NATURAL ENEMIES - Not reported.

HOST PLANTS - Asteraceae: Undetermined species; Mela-

stomataceae: *Tibouchina clavata* (Pers.) Wurdack (HEMPEL, 1923).

REMARKS - Only known from Brazil. UNRUH & GULLAN (2008b) regarded this species as *incertae sedis*. The natural occurrence of an *Icerya* species in South America is doubtful as the genus *Icerya* is native to Indomalaya and Australasia, not South America. In the original description, HEMPEL (1923) writes that this species belongs to the same group as *Icerya taunayi* Hempel, which is now *Laurencella taunayi* (Hempel), and thus it is likely that *I. insulans* may also be a species of *Laurencella*.

***Icerya paulista* Hempel**

Icerya paulista Hempel, 1920: 336.

DISTRIBUTION IN SOUTH AMERICA - Brazil (HEMPEL, 1920).

PEST STATUS - Unknown.

NATURAL ENEMIES - Not reported.

HOST PLANTS - Poaceae: On the thorns of a plant locally known as "taquarucu", *Guadua* sp. (Hempel, 1920).

REMARKS - Only known from Brazil. UNRUH & GULLAN (2008b) regarded this species as *incertae sedis*. The natural occurrence of an *Icerya* species in South America is doubtful as the genus *Icerya* is native to Indomalaya and Australasia, not South America.

***Icerya purchasi* Maskell**

Icerya purchasi Maskell, 1879: 221.

DISTRIBUTION IN SOUTH AMERICA - Argentina (CABI, 1971; LIZER Y TRELLES, 1938; GRANARA de WILLINK & CLAPS, 2003), Bolivia (CABI, 1971), Brazil (CABI, 1971; CULIK *et al.*, 2007; HEMPEL, 1918, 1920), Chile (CABI, 1971; GONZÁLEZ, 1989; RIPA *et al.*, 2008), Colombia (CABI, 1971; FIGUEROA-POTES, 1946; KONDO, 2001; KONDO *et al.*, 2012b), Ecuador (CABI, 1971; Galapagos island: CAUSTON *et al.*, 2004; LINCANGO *et al.*, 2010), French Guiana (REMILLET, 1988), Paraguay (CABI, 1971), Peru (BEDERSKI, 1969; CABI, 1971; LINDINGER, 1942), Uruguay (CABI, 1971, LIZER Y TRELLES, 1938), Venezuela (CABI, 1971).

PEST STATUS - *Icerya purchasi* is a well-known pest of citrus and many other plants (CALTAGIRONE, 1981; Watson & MALUMPHY, 2004). In recent years it was reported as a serious pest in the Galapagos Islands, where it was successfully controlled by the vedalia beetle, *Rodolia cardinalis* (Mulsant) (CAUSTON *et al.*, 2004). In Colombia, *I. purchasi* is rather rare and generally not considered a pest of citrus (KONDO *et al.*, 2012b). In Brazil, *I. purchasi* has been found on *Citrus* spp. in the State of São Paulo and various ornamental plants (ALMEIDA *et al.*, 2015).

NATURAL ENEMIES - Hemiptera: Heteroptera: Anthracoridae: *Cardiastethus nazarenus* Reuter (AWADALLAH *et al.*, 1976). Coleoptera: Coccinellidae: *Anovia punica* Gordon (GORDON, 1972), *Chilocorus bipustulatus* (L.) (ARGYRIOU *et al.*, 1976), *Cryptolaemus montrouzieri* Mulsant (JASHENKO, 1999; PUTTARUDRIAH & CHANNABASAVANNA, 1957), *Hippodamia* sp. (JASHENKO, 1999), *Rodolia cardinalis* (Mulsant) (BRAIN & KELLY, 1917; GULLAN & CRANSTON, 2014; ZIMMERMAN, 1948), *Rodolia pumila* Weise (CHIU *et al.*, 1985), *Scymnus* sp. (FULLAWAY, 1913). Diptera: Cryptochaetidae: *Cryptochaetum iceryae* (Williston) (GULLAN & CRANSTON, 2014; MENDEL & BLUMBERG, 1991; QUEZADA & DEBACH, 1973; DENMARK, 1964), Phoridae: *Syneura cocciphila* (Coquillett) (AUTUORI, 1928). Hymenoptera: Aphelinidae: *Ablerus molestus* Blanchard, *Coccophagus lycimnia* Walker, *Coccophagus scutellaris*

Dalman (NOYES, 2004, 2016). Encyrtidae: *Brethesiella abnormicornis* Girault, *B. latifrons* Timberlake, *Cheiloneurus pulvinariae* Dozier, *Homalotylus eytelweinii* Ratzeburg, *H. flaminius* Dalman, *Homosemion bennetti* Annecke, *Isodromus iceryae* Howard, *Lamennaisia ambigua* Nees, *Tetracnemoidea brevicornis* Girault (NOYES, 2004, 2016). Eriaporidae: *Euryischia* sp., *Euryischia lestophoni* Riley (NOYES, 2016). Eulophidae: *Entedon coquillettii* Riley (NOYES, 2004, 2016). Mymaridae: *Alaptus iceryae* Riley (NOYES, 2004, 2016). Pteromalidae: *Austroterobia* sp., *Ophelosia crawfordi* Riley, *O. hypatia* Girault, *Oricoruna arcotensis* Mani & Kurian, *Parasaphodes townsendi* Ashmead, *Parasaphodes* sp. (NOYES, 2004, 2016). Lepidoptera: Pyralidae: *Laetilia coccidivora* (Comstock) (JASHENKO, 1999). Thysanoptera: Phlaeothripidae: *Megalothrips* sp. (JASHENKO, 1999). Neuroptera: Chrysopidae: *Chrysopa pallens* Rambur (JASHENKO, 1999), *C. sapporensis* Okamoto (JASHENKO, 1999), *Pseudomallada ventralis* (Curtis) (JASHENKO, 1999), *Semachrysa matsumurae* (Okamoto) (JASHENKO, 1999; KUWANA, 1922).

HOST PLANTS - This species is highly polyphagous. It has been recorded on more than 230 species of plants distributed in 162 genera in 66 plant families (GARCÍA MORALES *et al.*, 2016).

REMARKS - Of Australian origin, *I. purchasi* has now spread worldwide with infested plant material. In Colombia, the cottony cushion scale *Icerya* sp. (possibly *I. purchasi* Maskell) is considered as one of the first urban pests (KONDO, 2015). According to VALENZUELA (1993), on the occasion of the celebration of the IX Pan American Conference held in Bogota in 1948, a number of acacia trees were introduced to Colombia in order to beautify the streets of the capital city; however, the imported plants came infested with an insect pest, *Icerya* sp., for which populations increased to such an extent that it did not take long before the citizens started calling it the “white plague”. Fortunately, a successful classical biological control program was implemented through the importation of the lady beetle *R. cardinalis* (Mulsant) (VALENZUELA, 1993). Several subspecies of *I. purchasi* can be found in the literature (i.e., *Icerya purchasi citriperda* Hempel, *I. purchasi crawii* Cockerell and *I. purchasi maskelli* Cockerell), however, there is no evidence to recognize subspecies of *I. purchasi* and thus the name *I. purchasi citriperda* Hempel and other trinomens should not be used (GULLAN & KONDO, 2011).

Icerya schrottkyi Hempel

Icerya schrottkyi Hempel, 1900: 373.

DISTRIBUTION IN SOUTH AMERICA - Argentina (LIZER Y TRELLES, 1936, 1938), BRAZIL (FOLDI & SORIA, 1989; HEMPEL, 1900).

PEST STATUS - Considered a pest of grapevines in Brazil (FOLDI & SORIA, 1989).

NATURAL ENEMIES - Not reported.

HOST PLANTS - Euphorbiaceae: *Sebastiania commersoniana* (Baill.) L.B. Sm. & Downs (LIZER Y TRELLES, 1938); Vitaceae: *Vitis vinifera* L. (FOLDI & SORIA, 1989).

REMARKS - UNRUH & GULLAN (2008b) included this species in the “*Icerya aegyptiaca* group” which includes two species, i.e., *I. aegyptiaca* and *I. schrottkyi*. The adult females of both species have pores on the derm that resemble the vulvar pores, but *I. schrottkyi* possesses unique hexalocular pores on the ventral surface that are absent from all other iceryine species. The two species can be separated easily by the number of cicatrices on the venter of the adult

female (one in *I. aegyptiaca*, three in *I. schrottkyi*) (UNRUH & GULLAN, 2008b). The native distribution of this species may not be Brazil.

Icerya seychellarum (Westwood)

Dorthisia seychellarum Westwood, 1855: 836.

DISTRIBUTION IN SOUTH AMERICA - Colombia (FIGUEROA-POTES, 1946), French Guiana (WILLIAMS & WATSON, 1990).

PEST STATUS - This species has been reported from Fiji as a pest of guava and citrus (*Citrus* spp.) (LEVER, 1946) and *Rosa* sp. (HINCKLEY, 1965). It has also been reported killing citrus trees in Vanuatu (WILLIAMS & BUTCHER, 1987). *Icerya seychellarum* may produce copious amounts of honeydew that serve as a medium for sooty molds that grow on the leaves, reducing plant respiration and photosynthesis (COHIC, 1955).

NATURAL ENEMIES - Coleoptera: Coccinellidae: *Rodolia cardinalis* (Mulsant) (BARTLETT, 1978), *R. limbata* (Blackburn) (BARTLETT, 1978); *R. pumila* Weise (BEARDSLEY, 1955). Diptera: Cryptochaetidae: *Cryptochaetum iceryae* (Williston) (BARTLETT, 1978); Hymenoptera: Encyrtidae: *Zaplatycerus tachikawai* Subba Rao (NOYES, 2004, 2016). Eriaporidae: *Euryischia indica* Mani & Kurian (NOYES, 2004, 2016). Eulophidae: *Aprostocetus pauliani* Risbec (NOYES, 2004, 2016). Pteromalidae: *Ophelosia crawfordi* Riley, *Parasaphodes townsendi* Ashmead (NOYES, 2004, 2016).

HOST PLANTS - *Icerya seychellarum* is a highly polyphagous species, recorded from 166 plants distributed in 126 genera in 57 families (GARCÍA MORALES *et al.*, 2016).

REMARKS - In South America, it has been reported only from Colombia, where is considered to be an introduction. This is a widespread species in the Pacific region especially in the tropical South Pacific area, throughout Africa and southern Asia on many plant species (WILLIAMS & WATSON, 1990). The species was redescribed and illustrated by UNRUH & GULLAN (2008a).

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REFERENCES

- ALMEIDA L.F.V., PERONTI A.L.B.G., MARTINELLI N.M., 2015 – *Estudo diagnóstico e taxonômico das cochonilhas (Hemiptera: Coccoidea) associadas às plantas citricas no estado de São Paulo*. In: III Congresso Brasileiro de Fitossanidade, 2015, Águas de Lindóia. Anais do III Congresso Brasileiro de Fitossanidade, CD-Rom.
- ARGYRIOU L.C., STAVRAKI H.G., MOURIKIS P.A., 1976 – *A List of Recorded Entomophagous Insects of Greece*. - Benaki Phytopathological Institute, Athens. 73 pp.
- AUTUORI M., 1928 – *Syneura infrapospita Borgm.-Schmitz (Diptera, Phoridae): um novo parasita da Icerya purchasi Mask.* - Archivos do Instituto Biológico, São Paulo, 1: 193-200.
- AWADALLAH K.T., TAWFIK M.F.S., SWAILEM S.M., EL

- MAGHRABY M.M.A., 1976 – *The effect of feeding on various preys on the nymphal stage and oviposition of Cardistethus nazarenus Reuter (Hemiptera-Heteroptera: Anthicoridae)*. - Bulletin of the Entomological Society of Egypt, 1980 (60): 251-255.
- BARTLETT B.R., 1978 – *Margarodidae. Introduced Parasites and Predators of Arthropod Pests and Weeds: a World Review*. - Agricultural Research Service, United States Department of Agriculture Washington, D.C., 545 pp.
- BEARDSLEY J.W., 1955 – *Fluted scales and their biological control in United States administered Micronesia*. - Proceedings of the Hawaiian Entomological Society, 15: 391-399.
- BEDERSKI K.A., 1969 – *Insect population surveys and oil rotenone sprays: their use in Peruvian citrus orchards*. Proceedings First International Citrus Symposium, Vol. 2, University of California Riverside, pp. 933-940.
- BRAIN C.K., KELLY A.E., 1917 – *The status of introduced coccids in South Africa in 1917*. - Bulletin of Entomological Research, 8: 181-185.
- CABI, 1971 – *Icerya purchasi (Mask)*. Distribution Maps of Pests, Series A, Agricultural Map No. 51 (rev.): 3 pp.
- CALTAGIRONE L.E., 1981 – *Landmark examples in classical biological control*. - Annual Review of Entomology, 26: 213-232.
- CAUSTON C.E., LINCANGO M.P., POULSON T.G.A., 2004 – *Feeding range studies of Rodolia cardinalis (Mulsant), a candidate biological control agent of Icerya purchasi Maskell in the Galapagos Islands*. - Biological Control, 29: 315-325.
- CHIU S.-C., LO K.-C., CHING-CHIN C., CHEN C.-C., CHEN C.-F., 1985 – *Biological Control of Citrus Pests in Taiwan*. - Taiwan Agricultural Research Institute, Taiwan. Special publication No. 19: 1-8.
- CIOMPERLIK M., 2010 – *Crypticeria genistae scale, an invasive pest in Puerto Rico*. In: CPHST Biological Control Unit 2010. - Annual Report, U. S. Department of Agriculture, pp. 33-34. Available at: http://www.aphis.usda.gov/plant_health/cphst/downloads/2010BiologicalControlUnitAnnualReport.pdf (Accessed on August 12, 2016).
- COCKERELL T.D.A., 1899 – *Rhynchota, Hemiptera - Homoptera. [Aleurodidae and Coccidae]*. - Biologia Centrali-Americana, 2: 1-37.
- COCKERELL T.D.A., 1914 – *A new cotton scale from Panama*. - Journal of Economic Entomology, 7: 148.
- COHIC F., 1955 – *Rapport d'une mission aux établissements français de l'océanie. Fascicule III. Enquête sur les parasites animaux des cultures*. Institut français d'Océanie, Nouméa (Nouvelle-Calédonie), 68 pp.
- CULIK M.P., MARTINS D.S., VENTURA J.A., PERONTI A.L.B.G., GULLAN P.J., KONDO T., 2007 – *Coccidae, Pseudococcidae, Ortheziidae, and Monophlebidae (Hemiptera: Coccoidea) of Espírito Santo, Brazil*. - Biota Neotropica, 7 (3): 1-5.
- DENMARK H.A., 1964 – *Florida Department of Agriculture's position on parasites and predators introduced into Florida for biological control*. - Hyacinth Control Journal, 3: 16-19.
- ESQUIVEL-RÍOS E.A., 2015 – *Crypticeria genistae Hempel (Hemiptera: Margarodidae) sobre Mani forrajero Arachis pintoi (Fabaceae) en Panamá Oeste*. Agrociencia Panamensis. 1 p. Available at: <http://agrociencia-panama.blogspot.com.co/2015/06/crypticeria-genistae-hempel-hemiptera.html>
- ETIENNE J., MATILE-FERRERO D., 2008 – *Crypticeria genistae (Hempel), nouveau danger en Guadeloupe (Hemiptera, Coccoidea, Monophlebidae)*. - Bulletin de la Société Entomologique d'Egypte, 113 (4): 517-520.
- EVANS G.A., DOOLEY J.W., 2013 – *Potential invasive species of scale insects for the USA and Caribbean Basin*. In: Peña JE. Ed. *Potential invasive pests of agricultural crops*. CABI, Wallingford, pp. 320-341.
- FIGUEROA-POTES A., 1946 – *Catalogación inicial de las cochinillas del Valle del Cauca (Homoptera - Coccoidea)*. - Revista Facultad de Agronomía, Montevideo Universidad, 6: 196-220.
- FOLDI I., 1995 – *Margarodidae du Mexique (Hemiptera: Coccoidea)*. - Annales de la Société Entomologique de France, 31: 165-178.
- FOLDI I., 2009 – *Archaeococcoid scale insects (Hemiptera: Coccoidea) from the tropical high mountains of the Andean Cordillera, South America*. - Zootaxa, 2300: 1-38.
- FOLDI I., SORIA, S.J., 1989 – *Les cochenilles nuisibles a la vigne en Amerique du Sud (Homoptera: Coccoidea)*. - Annales de la Société Entomologique de France (N.S), 25 (4): 411-430.
- FULLAWAY D.T., 1913 - *Entomological notes*. - Annual Report. Guam Agricultural Experiment Station for 1911: 26-35.
- GAGNÉ R.J., ETIENNE J., 2009 – *Note on the Cecidomyiidae from Guadeloupe (West Indies) with description of a new species of Paracalmonia (Diptera)*. - Bulletin de la Société Entomologique de France, 114(3): 337-350.
- GAIMARI S.D., QUINTERO E.M., KONDO T., 2012 – *First report of Syneura cocciphila (Coquillett, 1895) (Diptera: Phoridae), as a predator of the fluted scale Crypticeria multicatrides Kondo & Unruh, 2009 (Hemiptera: Monophlebidae)*. - Boletín del Museo de Entomología de la Universidad del Valle, 13(2): 26-28.
- GARCÍA MORALES M., DENNO B., MILLER D.R., MILLER G.L., BEN-DOV Y., HARDY N.B., 2016 – *ScaleNet: A Literature-based Model of Scale Insect Biology and Systematics*. Available at: <http://scalenet.info>.
- GONZÁLEZ R.H., 1989 – *Insectos y ácaros de importancia agrícola y cuarentenaria en Chile*. Universidad de Chile Santiago, 310 pp.
- GONZÁLEZ G., KONDO T., 2014 – *Geographical distribution and phenotypic variation of Anovia punica Gordon (Coleoptera: Coccinellidae: Noviini), a predatory ladybeetle of fluted scales (Hemiptera: Coccoidea: Monophlebidae)*. - Insecta Mundi, 0398: 1-6.
- GONZÁLEZ G., LÓPEZ R., KONDO T., 2012 – *First report of Delphastus quinculus Gordon and Diomus seminulus (Mulsant) (Coleoptera: Coccinellidae) feeding on eggs and first-instar nymphs of Crypticeria multicatrides Kondo & Unruh (Hemiptera: Monophlebidae)*. - Insecta Mundi, 0268: 1-6.
- GORDON R.D., 1972 – *The tribe Noviini in the new world (Coleoptera: Coccinellidae)*. - Journal of the Washington Academy of Sciences, 62 (1): 23-31.
- GRANARA DE WILLINK M.C., CLAPS L.E., 2003 – *Cochinillas (Hemiptera: Coccoidea) presentes en plantas ornamentales de la Argentina*. - Neotropical Entomology, 32 (4): 625-637.
- GULLAN P.J., CRANSTON P.S., 2014 – *The Insects: An Outline of Entomology*, 5th Edition. Wiley-Blackwell, West Sussex, UK, 595 pp.
- GULLAN P., KONDO T., 2011 – *Nomenclator entomologicus. No. 79. [In Portuguese]*. Informativo da Sociedade Entomológica do Brasil. February, 36(1): 3.
- HEMPEL A., 1900 – *As coccidas Brasileiras*. - Revista do Museu Paulista, São Paulo 4: 365-537.
- HEMPEL A., 1912 – *Catalogos da fauna Brasileira editados pello Museu Paulista, São Paulo - Brasil*, 77 pp.

- HEMPEL A., 1918 – *Descrição de sete novas espécies de coccidas*. - Revista do Museu Paulista, São Paulo, 10: 193-208.
- HEMPEL A., 1920 – *Descrições de coccidas novas e pouco conhecidas*. - Revista do Museu Paulista, São Paulo, 12: 329-377.
- HEMPEL A., 1923 – *Hemiptera (Homoptera) familia Coccidae - Sub-familia Monophlebinae*. - Revista do Museu Paulista, São Paulo, 13: 510-512.
- HEMPEL A., 1932 – *Descrição de vinte a duas espécies novas de coccideos (Hemiptera - Homoptera)*. - Revista de Entomologia, 2: 310-339.
- HINCKLEY A.D., 1965 – *Trophic records of some insects, mites, and ticks in Fiji*. - Bulletin, Department of Agriculture, Fiji, 45: 1-116.
- HODGES G., 2006 – *Icerya genistae (Hemiptera: Margarodidae) A new exotic scale insect for Florida*. Available at: <http://www.doacs.state.fl.us/pi/enpp/ento/i.genistae.html>.
- HODGES G.S., HODGES A.C., UNRUH C.M., 2008 – *A new exotic pest for Florida's natural areas: Crypticerya genistae (Hemiptera: Monophlebidae)*. - Florida Entomologist, 91 (2): 335-337.
- JASHENKO R.V., 1999 – [Natural enemies of margarodids in northern Eurasia.] [Problems of Conservation and Sustainable Use of Animal Biodiversity in Kazakhstan. (Proceedings of an International Scientific Conference.)] Tethys Society Almaty, 198 pp.
- JENKINS D.A., MIZELL R.F. III, VAN BLOEM S., WHITMIRE S., WISCOVITCH L., ZALESKI C., GOENAGA R., 2014 – *An analysis of arthropod interceptions by APHIS-PPQ and customs and border protection in Puerto Rico*. - American Entomologist, 60: 44-55.
- KONDO T., 2001 – *The scale insects of Colombia (Hemiptera: Coccoidea)*. Biota Colombiana, 2(1): 31-48.
- KONDO T., 2015 – *Insectos plaga del árbol urbano con énfasis en los insectos escama (Hemiptera: Coccoidea) en Colombia*. 17 pp. Simposio: Entomología Forestal. 41 Congreso de la Sociedad Colombiana de Entomología (SOCOLEN). Julio 29-31, 2015. Universidad Nacional de Colombia, Sede Medellín, Medellín, Colombia, 329 pp.
- KONDO T., GULLAN P., GONZÁLEZ G., 2014 – *An overview of a fortuitous and efficient biological control of the Colombian fluted scale, Crypticerya multicatrices Kondo & Unruh (Hemiptera: Monophlebidae: Iceryini), on San Andres island, Colombia*. - Acta Zoologica Bulgarica. Suppl. 6: 87-93.
- KONDO T., GULLAN P., PORTILLA A.A.R., 2012 – *Report of new invasive scale insects (Hemiptera: Coccoidea), Crypticerya multicatrices Kondo and Unruh (Monophlebidae) and Maconellicoccus hirsutus (Green) (Pseudococcidae), on the islands of San Andres and Providencia, Colombia*. - Insecta Mundi, 0265: 1-17.
- KONDO T., GULLAN P.J., PERONTI A.L.B.G., RAMOS-PORTILLA A.A., CABALLERO A., PRETELT N.V., 2016 – *First records of the iceryine scale insects Crypticerya brasiliensis (Hempel) and Crypticerya genistae (Hempel) (Hemiptera: Monophlebidae) for Colombia*. - Insecta Mundi, 0480: 1-9.
- KONDO T., PERONTI A.L., KOZÁR F., SZITA E., 2012b – *Capítulo 7. Los insectos escama asociados a los cítricos, con énfasis en Praelongorthezia praelonga (Douglas) (Hemiptera: Coccoidea: Ortheziidae)* In: Pássaro Carvalho C.P. Ed. *Cítricos: Cultivo, Poscosecha e Industrialización*. Serie Lasallista Investigación y Ciencia. Artes y Letras S.A.S., Itagüí, Colombia, pp. 173-189.
- KONDO T., UNRUH C.M., 2009 – *A new species of Crypticerya Cockerell (Hemiptera: Monophlebidae) from Colombia, with a key to species of the tribe Iceryini found in South America*. - Neotropical Entomology, 38 (1): 92-100.
- KUWANA S.I., 1922 – *Studies on Japanese Monophlebinae. Contribution II: The genus Icerya*. - Bulletin of Agriculture and Commerce, Imperial Plant Quarantine Station, Yokohama, 2: 1-43.
- LEONARDI G., 1911 – *Contributo alla conoscenza delle cocciglie della Repubblica Argentina*. - Bollettino del R. Laboratorio di Entomologia Agraria di Portici, 5: 237-284.
- LEVER R.J.A.W., 1946 – *Insect pests in Fiji*. - Bulletin Department of Agriculture, Fiji, 16: 41-44.
- LINCANGO P., HODGSON C.J., CAUSTON C., MILLER D.R., 2010 – *An updated checklist of scale insects (Hemiptera: Coccoidea) of the Galapagos Islands, Ecuador*. - Galapagos Research, 67: 3-7.
- LINDINGER L., 1942 – *Coccoidea (Homopt.)*. - Beiträge zur Fauna Perus Bd., 3: 112-122.
- LIZER Y TRELLES C.A., 1917 – *Description du male de l' "Icerya subandina" Leon*. Physis, Buenos Aires, 3: 245-247.
- LIZER Y TRELLES C.A., 1936 – *Algunas cochinitas nuevas para la fauna de la República Argentina*. - Physis, Buenos Aires, 12: 113-116.
- LIZER Y TRELLES C.A., 1938 – *Cochinitas exóticas introducidas en la República Argentina y daños que causan*. - Jornadas Agronómicas y Veterinarias, 1937: 341-362.
- MALUMPHY C., 2014 – *An annotated checklist of scale insects (Hemiptera: Coccoidea) of Saint Lucia, Lesser Antilles*. - Zootaxa, 3846(1): 69-86.
- MARTORELL L.F., 1976 – *Annotated food plant catalog of the insects of Puerto Rico*. Agricultural Experiment Station, University of Puerto Rico, Department of Entomology, 303 pp.
- MASKELL W.M., 1879 – *On some Coccidae in New Zealand*. Transactions and Proceedings of the New Zealand Institute, 11: 187-228.
- MENDEL Z., BLUMBERG D., 1991 – *Colonization trials with Cryptochetum iceryae and Rodolia iceryae for improved biological control of Icerya purchasi in Israel*. - Biological Control, 1: 68-74.
- MILLER D.R., RUNG A., PARIKH G., 2014 – *Crypticerya genistae (Hempel). Fact Sheet*. In: *Scale Insects, edition 2, a tool for the identification of potential pest scales at U.S.A. ports-of-entry (Hemiptera, Sternorrhyncha, Coccoidea)*. Available at: <http://idtools.org/id/scales/factsheet.php?name=7063>.
- MONTEALEGRE X., SOTELO P.; KONDO T., 2016 – *Development and reproduction of Brethesiella cf. abnormicornis (Girault) (Hymenoptera: Encyrtidae), a parasitoid of the Colombian fluted scale, Crypticerya multicatrices Kondo & Unruh (Hemiptera: Monophlebidae)*. - Environmental Entomology, 8 pp. doi: 10.1093/ee/nvw004.
- MORRISON H., 1919 – *A report on collection of Coccidae from Argentina with descriptions of apparently new species (Hom.)*. Proceedings of the Entomological Society of Washington, 21: 63-91.
- NEWSTEAD R., 1917 – *Observations on scale-insects (Coccidae) - IV*. Bulletin of Entomological Research, 8: 1-34.
- NOYES J.S., 2004 – *Encyrtidae of Costa Rica (Hymenoptera: Chalcidoidea), 2. Metaphycus and related genera, parasitoids of scale insects (Coccoidea) and*

- whiteflies (Aleyrodidae)*. - Memoirs of the American Entomological Institute, 73: 1-439.
- NOYES J.S., 2016 – *Universal Chalcidoidea Database*. World Wide Web electronic publication. <http://www.nhm.ac.uk/chalcidooids>.
- PALOMAR J., PERONTI A.L.B.G., SOARES S.T., ROSA K.C.C., MARTINELLI N.M., 2015 – *Cochonilhas (Hemiptera: Coccoidea) associados à Psidium guajava no Estado de São Paulo*. In: III Congresso Brasileiro de Fitossanidade, 2015. Anais do III Congresso Brasileiro de Fitossanidade. CD-Rom.
- PEREZ-GELABERT D.E., 2008 – *Arthropods of Hispaniola (Dominican Republic and Haiti): a checklist and bibliography*. - Zootaxa, 1831: 1-530.
- PERONTI A.L.B.G., ROSA K.C.C., 2006 – *Cocóideos (Hemiptera: Coccoidea) associados à Psidium guajava (Myrtaceae) em áreas urbanas*. In: 19a Reunião Anual do Instituto Biológico, 2006, São Paulo. Anais da 19a Reunião Anual do Instituto Biológico, v. 68, supplement, p. 735-738.
- PESTNET, 2016 – *Soybean scale, Crypticerya genistae, Haiti*. 1 p. Available at: <http://www.pestnet.org/SummariesofMessages/Crops/Vegetables/Soybean/Soybeanscale,Crypticeryagenistae,Haiti.aspx>
- PINCHAO E.C., KONDO T., GONZÁLEZ F.G., 2015 – *Rodolia cardinalis (Mulsant) (Coleoptera: Coccinellidae), a new predator of Crypticerya multicatrices Kondo and Unruh (Hemiptera: Monophlebidae)*. - Insecta Mundi, 0431: 1-7.
- POSADA L.O., 1989 – *Lista de insectos dañinos y otras plagas en Colombia*. 4ta ed., Bogotá. Boletín Técnico 43. Instituto Colombiano Agropecuario, 662 pp.
- PUTTARUDRIAH M., CHANNABASAVANNA G.P., 1957 – *Notes on some predators of mealybugs (Coccidae: Hemiptera)*. - Mysore Agricultural Journal, 32 (1): 4-19.
- QUEZADA J.R., DEBACH P., 1973 – *Bioecological studies of the cottony cushion scale, Icerya purchasi Mask. and its natural enemies Rodolia cardinalis Mul. and Cryptochaetum iceryae Will., in southern California*. - Hilgardia, 41: 631-688.
- REMILLET M., 1988 – *Catalogue des insectes ravageurs des cultures en Guyane Française*. Editions de l'ORSTOM; Institut Française de Recherche Scientifique pour le Développement en Coopérat Paris, 235 pp.
- RILEY C.V., HOWARD L.O., 1890a – *An Icerya in Florida*. - Insect Life 2: 333.
- RILEY C.V., HOWARD L.O., 1890b – *Some new iceryas*. Insect Life, 3: 92-106.
- RIPA R., LARRAL P., ROJA S., 2008 – *Conchuela acanalada, cotton cushion scale. Icerya purchasi (Maskell). Manejo de plagas en paltos y cítricos*. Instituto de Investigaciones Agropecuarias, Ministerio de Agricultura, Colección Libros INIA-No. 23. La Cruz, Chile, 399 pp.
- SILVA-GOMEZ M., QUIROZ-GAMBOA J.A., YEPES F.C., MAYA M.F., SANTOS A., HOYOS-CARVAJAL L.M., 2013 – *Incidence evaluation of Crypticerya multicatrices and Maconellicoccus hirsutus in Colombian Seaflower Biosphere Reserve*. - Agricultural Science, 4(12): 654-665.
- STOCKS I.C., 2013 – *Recent Adventive Scale Insects (Hemiptera: Coccoidea) and Whiteflies (Hemiptera: Aleyrodidae) into Florida and the Caribbean Basin*. In: Peña J.E. Ed. *Potential Invasive Pests of Agricultural Crops*. CAB International, Wallingford, UK, pp. 342-362.
- TIMBERLAKE P.H., 1926 – *Miscellaneous new chalcid-flies of the hymenopterous family Encyrtidae*. - Proceedings of the United States National Museum, 69 (3): 1-37.
- TOWNSEND C.H.T., COCKERELL T.D.A., 1898 – *Coccidae collected in Mexico by Messrs. Townsend and Koebele in 1897*. - Journal of the Entomological Society of New York, 6: 165-180.
- TRJAPITZIN V.A., TRJAPITSYN S.V., 2006 – *A new species of Brethesiella (Hymenoptera: Encyrtidae) from California, USA, a parasitoid of Steatococcus tabernicolus (Hemiptera: Margarodidae)*. - Zootaxa, 1167: 1-16.
- UNRUH C.M., GULLAN P.J., 2008a – *Molecular data reveal convergent reproductive strategies in iceryne scale insects (Hemiptera: Coccoidea: Monophlebidae), allowing the re-interpretation of morphology and a revised generic classification*. - Systematic Entomology, 33: 8-50.
- UNRUH C.M., GULLAN P.J., 2008b – *Identification guide to species in the scale insect tribe Iceryini (Coccoidea: Monophlebidae)*. - Zootaxa, 1803: 1-106.
- VALENZUELA G., 1993 – *Aspectos históricos del control biológico*. In: Palacios F. Ed. *Control biológico en Colombia: historia, avances y proyecciones*. - Universidad Nacional de Colombia, Palmira, Colombia, pp. 1-8.
- VAN BUURT G. DEBROT A.O., 2011 – *Introduced agricultural pests, plant and animal diseases and vectors in the Dutch Caribbean, with an "Alert species" list*. Report number C193/11. IMARES Wageningen UR. 35 pp. Available at: <http://www.dcbd.nl/sites/www.dcbd.nl/files/documents/C%252011%2520193%2520diseasvec tor%2520Dutch%2520Caribb.pdf>.
- VAYSSIÈRE P., 1926 – *Contribution à l'étude biologique et systématique des Coccidae*. - Annales des Epiphyties, 12: 187-382.
- WATSON G.W., MALUMPHY C.P., 2004 – *Icerya purchasi Maskell, cottony cushion scale (Hemiptera: Margarodidae), causing damage to ornamental plants growing outdoors in London*. - British Journal of Entomology and Natural History, 17: 105-109.
- WESTWOOD J.O., 1855 – *The Seychelles Dorthesia*. - Gardeners' Chronicle and Agricultural Gazette, 51: 836.
- WILLIAMS D.J., BUTCHER C.F., 1987 – *Scale insects (Hemiptera: Coccoidea) of Vanuatu*. - New Zealand Entomologist, 9: 88-99.
- WILLIAMS D.J., WATSON G.W., 1990 – *The Scale Insects of the Tropical South Pacific Region. Pt. 3: The Soft Scales (Coccidae) and Other Families*. CAB International Wallingford. 267 pp.
- ZIMMERMAN E.C., 1948 – *Homoptera: Sternorrhyncha*. - Insects of Hawaii, 5: 1-464.