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Description of a New Genus and New Species of Soft Scale Insect (Hemiptera: Coccoomorpha: Coccidae) from Cuba

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ABSTRACT: A new neotropical genus and species of soft scale insect from Cuba, *Hamonococcus* Mestre and Kondo gen. nov. is described and *Hamonococcus alayoi* Mestre and Kondo sp. nov. (Hemiptera: Coccoomorpha: Coccidae) is described and illustrated based on the adult female. The species was collected in Cayos de las Cinco Leguas, Matanzas Province, on *Capparis cynophallophora* (Capparaceae), and in Surgidero de Batabanó, Mayabeque Province, on *Rhizophora mangle* (Rhizophoraceae). The affinities of *H alayoi* sp. nov. with closely related species is discussed based on published literature. An updated list of soft scale insects (Hemiptera: Coccidae) known from Cuba is provided.

KEYWORDS: Coccid, host plants, neotropical region, species list, taxonomy

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Introduction

Coccidae is the third most species-rich family among the scale insects (Hemiptera: Coccoomorpha), with approximately 1200 species described, only surpassed by Diaspididae and Pseudococcidae.^{1,2} The Coccidae are classified into a group of scale insects known as “neococcoids”; an informal group composed of 17 extant families, namely, Acleridae, Asterolecaniidae, Beesonidae, Cerococcidae, Coccidae, Conchaspidae, Dactylopiidae, Diaspididae, Eriococcidae, Halimococcidae, Kermesidae, Kerriidae, Lecanodiaspididae, Micrococcidae, Phoenicococcidae, Pseudococcidae, and Stictococcidae; and 2 extinct families, the Inkaidae and Pennygullaniidae.³ In the neotropical region, 295 species in 59 genera of soft scale insects have been recorded.² Among the genera that are best represented in the neotropical region are *Ceroplastes* Gray (77 spp.), *Coccus* Linnaeus (19 spp.), *Pulvinaria* Targioni Tozzetti (26 spp.), and *Saissetia* Deplanche (18 spp.).²

In Cuba, there are 177 species of scale insects; 174 spp. recorded until 2015,⁴ plus 3 more recent records, namely, *Coccus moestus* De Lotto (Coccidae),⁵ *Crypticerya genistae* (Hempel) (Monophlebidae),⁶ and *Maconelliococcus hirsutus* (Green) (Pseudococcidae).⁷ The Coccidae is the third most species-rich family in Cuba, with 31 species, only surpassed by Diaspididae with 75 species and Pseudococcidae with 40 species.^{4,5} The scale insect fauna of Cuba is characterized by a high percentage of introduced species (48%); 30% are considered native, and 22% have an unknown origin; only 13 scale insect species are endemic, of which *Toumeyella cubensis* Heide and Köhler was hitherto the only endemic soft scale species.⁴ In this study, a new genus and a new species of Coccidae are described and illustrated. The affinities of the new species with closely related species are discussed

based on published literature. In addition, information on its host plants and geographical distribution is presented.

Materials and Methods

Specimens of the new species were collected in Cayos de Las Cinco Leguas (23°08'13.2"N, 80°51'05.8"W) in the northeast of Matanzas province, in a semideciduous mesophilic forest and at Surgidero de Batabanó (22°41'15.1"N, 82°17'37.1"W) to the southwest of Mayabeque province (Figure 1) in vegetation categorized as a mangrove forest.⁸

In the field, insects were collected manually on the host plants and placed in 70% ethanol. In the laboratory, specimens were slide-mounted chiefly following the method described by Williams and Granara de Willink.⁹ Each slide was labeled with the collecting data, ie, place, date, and collector. Observations of the dermal structures were made with a compound microscope with phase contrast (Carl Zeiss-Axioskop 2) and digital images were taken with a camera attached to the microscope (AxioCam). Measurements of the structures were made on these images using the AxioVision program (v.3.1 software at 1300 × 1030 dpi). The sizes of the specimens were measured on the images taken in a stereoscopic microscope (Carl Zeiss-Stemi SV6) using the same camera and the same program mentioned above and are expressed as a range. The outline of the insect drawing was made using the images taken under the stereoscopic microscope and drawings of the dermal structures were based on images taken under the phase contrast microscope, using the computer program Adobe Illustrator and a Wacom Digital Tablet. The illustration of the adult female shows the dorsum on the left side and the venter on the right side, following the traditional



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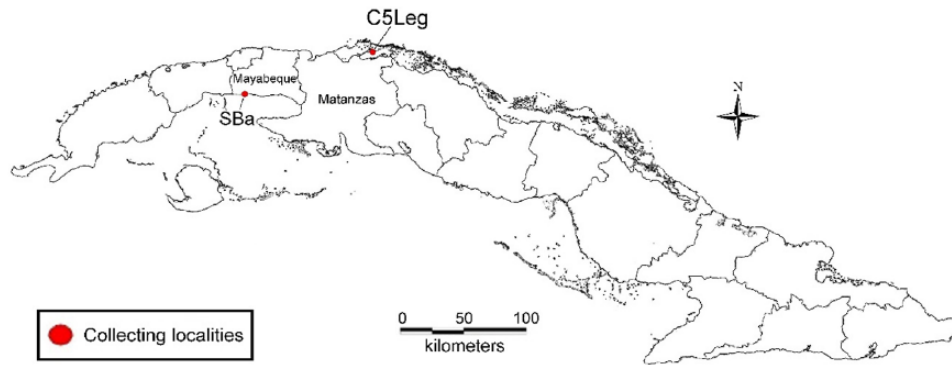


Figure 1. Collecting localities of *Hamonicoccus aloyoi* Mestre and Kondo, sp. nov. in Cuba. C5Leg: Cayos de Las Cinco Leguas (Matanzas Province). SBa: Surgidero de Batabanó (Mayabeque Province).

format used by scale insect taxonomists. Here, we coined the term “membranous cribriform plates” to refer to unique structures on the dorsal derm which resemble the cribriform plates of some coccids but remain membranous even in old sclerotized adult females. The length and width of the body of the 11 adult females mounted on slides is given in millimeters (mm), all other measurements are given in microns (μm). Host plants were identified in the herbarium of the Instituto de Ecología y Sistemática (La Habana). The cartographic representation of the collection locations was done using the MapInfo Professional Version 4.5 program on a base map at a scale of 1:250 000 (Figure 1). Type material is deposited in the Colecciones Zoológicas del Instituto de Ecología y Sistemática (CZACC), La Habana, Cuba.

Results and Discussion

Taxonomy

Hamonicoccus, gen. nov.

Type species: *Hamonicoccus aloyoi* Mestre and Kondo, sp. nov., by present designation.

Generic description, adult female

In life, body pyriform to oval, flattened, or slightly convex. Anal cleft about 1/5 of body length. Eyes present on dorsal margin.

Dorsum. Derm membranous, corrugated, becoming highly sclerotized in older adult females; submargin with a quadrate pattern formed by groups of oval areolations, less sclerotized areolations also present submedially, but less dense and scattered, absent from mid-dorsum. Dorsal setae clavate. Simple pores present, oval to round in shape. Dorsal microducts present. Membranous cribriform plates present submedially on dorsum on each side of body from level of anal plates to metathorax. Preopercular pores present in groups in a longitudinal line from area anterior to anal plates to mesothorax. Anal plates together quadrate. Anal ring with 8 setae. Submarginal tubercles, pocket-like sclerotizations and tubular ducts absent. A sclerotized area with areolated outer margins present around anal plates.

Margin. Stigmatic cleft well developed, in the form of a notch. Marginal setae clavate, similar in shape to dorsal setae but shorter. Stigmatic setae totaling 3 per stigmatic cleft, differentiated from marginal setae, median stigmatic setae longest, straight, or slightly curved at apex. Stigmatic setae often displaced toward posterior part of stigmatic cleft.

Venter. Derm membranous. Pregenital disc-pores with 5 to 10 loculi, distributed in the perivulvar area and on the last 2 abdominal segments. Spiracular disc-pores with 3 to 8 loculi, pores with 5 and 6 loculi abundant, extending from area around spiracles to body margin. Microducts oval in shape, scattered on ventral surface. Ventral setae scattered on venter; ventral submarginal setae in pairs; with 3 pairs of long prevulvar setae. Spiracles well developed. Antennae 6 segmented. Legs well developed, with tibiotarsal sclerosis, claws with a denticle, claw digitules with expanded apex. Ventral tubular ducts absent. Mouthparts normal.

Diagnosis. *Hamonicoccus* gen. nov. can be diagnosed by having the following combination of character states: (1) body oval to pyriform; (2) membranous cribriform plates present submedially on dorsum; (3) anal cleft 1/5 of body length; (4) dorsal derm areolated, areolations more pronounced submarginally, divided by less sclerotized clear areas; (5) dorsal setae clavate; (6) preopercular pore clusters on both sides of a mid-longitudinal line; (7) a sclerotized area around anal plates present; (8) submarginal tubercles, pocket-like sclerotizations and tubular ducts absent; (9) marginal setae clavate, similar to dorsal setae; (10) median stigmatic seta distinctly longer and wider than the lateral stigmatic setae; (11) pregenital disc-pores with 5 to 10 loculi; (12) spiracular disc-pores with 3 to 8 loculi; (13) with 3 pairs of long prevulvar setae; (14) antennae with 6 segments; and (15) legs well developed, with tibiotarsal sclerosis; and (16) claw with a denticle.

Etymology. The genus is named after the American entomologist and coccidologist, Dr Avas B Hamon for his contributions to the development of Coccidology, especially in Cuba and in the United States.

Remarks. *Hamonicoccus* gen. nov. keys out to the subfamily Coccinae, tribe Coccini, when using the keys to subfamilies and genera provided by Hodgson.¹⁰ It appears closest to *Mesolecanium* Morrison, which it shares the following character states: (1) body flat, derm becoming sclerotized at maturity, covered by a thin layer of wax; (2) dorsal tubular ducts absent; (3) preopercular pores present; (4) few setae present along anogenital fold; (5) mature female with radial lines of less sclerotized derm on marginal area of dorsum; and (6) dorsal setae and marginal setae similar, cylindrical, capitate (ie, with swollen apex; clavate in *Hamonicoccus*). *Hamonicoccus* gen. nov. differs from *Mesolecanium* by the following combination of features (character states of *Mesolecanium* in parenthesis): (1) preopercular pores in clusters in 2 parallel rows anterior to anal plates (not in clusters, present loosely on area anterior to anal plates); (2) membranous cribriform plates present submedially on dorsum (entirely absent); and (3) a sclerotized area around anal plates with areolated outer margins present (sclerotized area around anal plates absent). Character states of *Mesolecanium* taken from Hodgson.¹⁰

Hamonicoccus alayoi Mestre and Kondo sp. nov.

Proposed common name: Spanish: Escama blanda rojiza cubana. English: Cuban reddish soft scale.

Material studied—Holotype: Cuba, Matanzas, Cayo de las Cinco Leguas, 2.IV.2011, coll. D. Reyes, *Capparidophora* (Capparaceae) adult female ♀ 1(1) (CZACC). Paratypes: Cuba, Artemisa, Batabanó, 15.XI.2009, coll. E. Fonseca, *Rhizophora mangle* (Rhizophoraceae); 10 adult females ♀♀ in 10 slides (CZACC).

Description

Unmounted material: Body shape oval to pyriform, flattened or slightly convex; mid abdominal region broad, rounded at anterior and posterior ends; reddish to reddish brown in color; dorsal surface corrugated, covered by a thin layer of semitransparent wax; body submargin formed by a pattern of irregular dark reddish-brown spots, divided by 20 to 22 translucent radial lines; mid-dorsum darkened to blackish in old females (no photographs available).

Mounted material (Figure 2): Body outline pyriform to oval in shape, length: 3.5 to 5.5 mm, width: 3.2 to 4.7 mm. Stigmatic cleft well developed, forming a notch. Anal cleft well-developed, about 1/5 of body length.

Dorsum. Derm areolated, especially submarginally, less dense or absent on mid-dorsum; areolations divided into quadrate areas separated by 20 to 22 clear radial lines; derm slightly sclerotized in young adult females, becoming highly sclerotized in older ones. Eyespots present on dorsal margin, each 21.2 to 29.3 μm wide. Dorsal setae (dset) clavate, each 11.1 to 14.7 μm long, scattered over dorsum, but more abundant toward margin. Simple pores (sp) oval to round in shape, each 4.5 to 9.0 μm wide, scattered on

dorsum. Dorsal microducts (dmic) each 2.5 to 3.5 μm wide, with a long inner ductule. Membranous cribriform plates (mcp) present, each circular to ovoid in shape and composed of 6 to 14 spherical vacuoles, each plate 58.0 to 120.0 μm wide, located submedially on dorsum on each side of body from level of anal plates to metathorax. Preopercular pores oval in shape, each 7.3 to 14.7 μm wide, forming 6 conspicuous preopercular pore clusters (propc) of 5 to 16 pores on both sides of mid-dorsum, present from area anterior to anal plates to mesothorax. Anal plates (aplt) together quadrate, each plate 138.0 to 155.2 μm long, 75.3 to 91.0 μm wide, with a midway indentation on anterolateral and posterolateral margins; anterolateral margin 92.6 to 115.6 μm long, posterolateral margin 95.2 to 115.7 μm long; internal margins straight and parallel, each plate with 4 to 5 subapical setae, anogenital fold with 2 setae. Anal ring (ar) with 8 setae. Submarginal tubercles, pocket-like sclerotizations, and tubular ducts absent. A sclerotized area around anal plates with areolated outer margins present.

Margin. Marginal setae clavate (mset), similar in shape to dorsal setae but shorter, each 7.3 to 11.9 μm long. Stigmatic setae (stgset) totaling 3 per stigmatic cleft, differentiated from marginal setae, median stigmatic setae longest, 32.2 to 53.5 μm long, sharply spinose, with bent tips, lateral stigmatic setae sharply spinose, 2 or 3 times shorter than median setae, each 16.5 to 29.5 μm long.

Venter. Derm membranous. Pregenital disc-pores (pdp) with 5 to 10 loculi, each 6.0 to 8.0 μm wide, distributed in the perivulvar area and on 2 preceding abdominal segments. Spiracular disc-pores (spdp) small, 4.3 to 6.6 μm wide, each with 3 to 8 loculi, pores with 5 and 6 loculi abundant, forming an irregular row of 1 to 3 pores wide in each spiracular furrow, with some pores present on anterior margins of each spiracle. Ventral microducts (vmic) oval in shape, each 2.2 to 3.9 μm wide; scattered on ventral surface. Ventral setae (vset) scattered on venter, each 9.6 to 14.7 μm long; longer setae on perivulvar region 15.1 to 22.1 μm long; setae surrounding mouthparts 13.3 to 22.6 μm long; ventral submarginal setae in pairs, each 5.7 to 8.5 μm long; 3 pairs of long prevulvar setae on last abdominal segments, each 30.7 to 119.4 μm long; interantennal setae in 2 pairs, each seta 22.9 to 54.6 μm long. Spiracles well-developed; anterior spiracles each 54.0 to 77.3 μm long, peritreme 42.1 to 52.7 μm wide; posterior spiracles each 67.9 to 84.9 μm long, peritremes each 52.5 to 72.4 μm wide. Antennae (ant) each 272.8 to 290.3 μm long, 6 segmented, third segment longest (103.4–109.6 μm). Legs well developed, coxa 113.6 to 159.4 μm wide at widest point; trochanter + femur 172.3 to 256.1 μm long; tibia + tarsus 204.8 to 308.5 μm long, with tibiotarsal sclerosis, tarsal digitules 42.0 to 53.6 μm long; claws 21.5 to 27.9 μm long, each with a denticle, claw digitules each 36.6 to 49.8 μm long, and with an expanded apex. Ventral tubular ducts absent. Mouthparts: clypeolabral shield 171.8 to 189.9 μm long, 118.1 to 145.1 μm wide; labium 46.0 to 62.8 μm long, 85.3 to 114.7 μm wide.

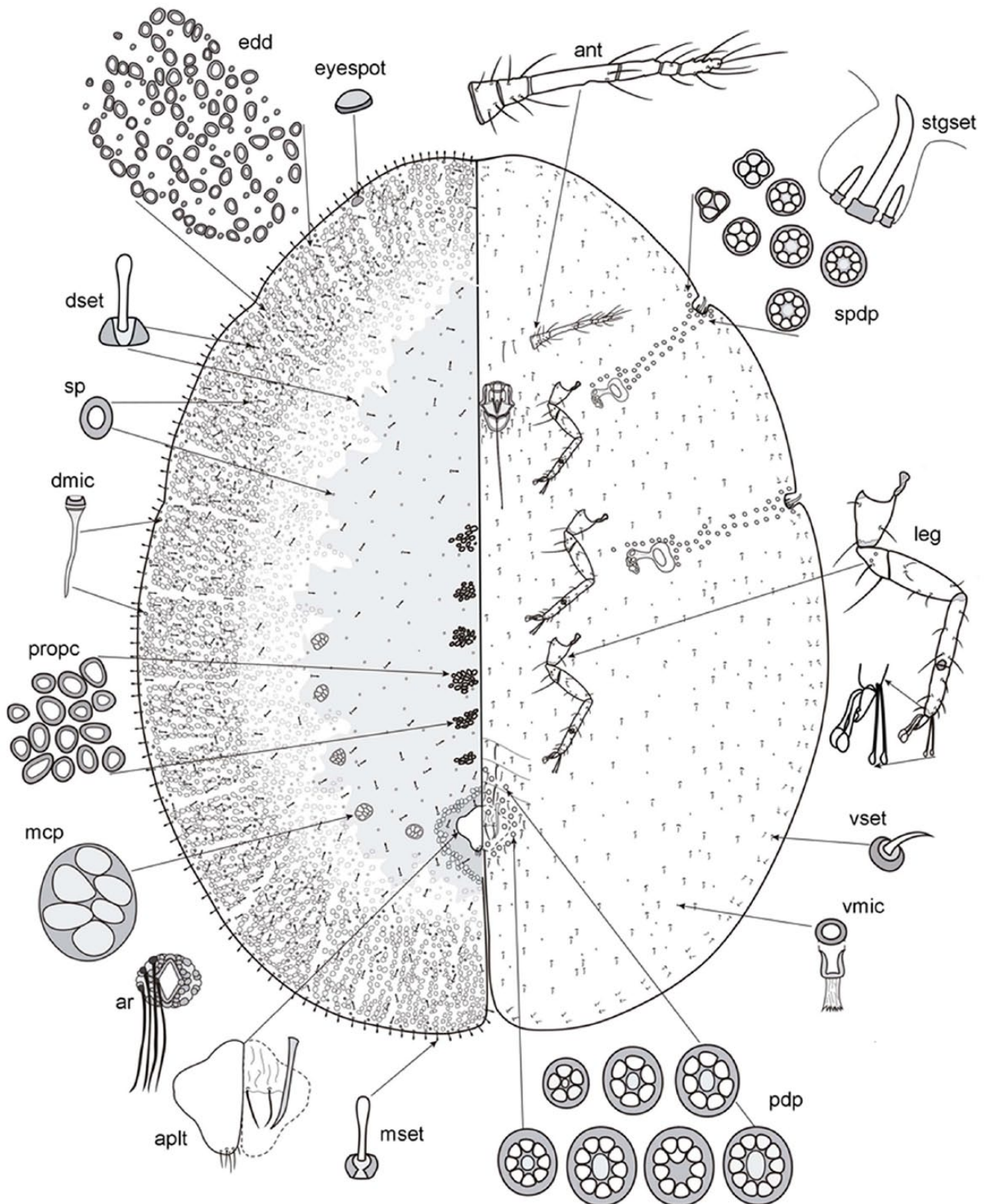


Figure 2. *Hamonicoccus alayoi* Mestre and Kondo, sp. nov., adult female. ant indicates antenna; aplt, anal plate; ar, anal ring; dmic, dorsal microduct; dset, dorsal setae; edd, enlargement of dorsal derm; mcp, membranous cribriform plate; mset, marginal setae; pdp, pregenital disc-pore; propc, preopercular pore cluster; sp, simple pore; spdp, spiracular disc-pore; stgset, stigmatic setae; vmic, ventral microduct; vset, ventral seta.

Etymology. The species is named after the Cuban entomologist Dr Pastor Alayo Dalmau, who dedicated his life to the

study of insects in Cuba with innumerable contributions to this science and in the training of Cuban entomologists.

Table 1. List of soft scale insects (Hemiptera: Coccidae) known from Cuba.

SPECIES	VALIDATION SOURCE
<i>Ceroplastes cirripediformis</i> Comstock	2, 4, 13, 14
<i>Ceroplastes cistudiformis</i> Cockerell	2, 4, 13
<i>Ceroplastes depressus</i> Cockerell	2, 4, 13
<i>Ceroplastes dugesii</i> Lichtenstein	2, 4, 14-16
<i>Ceroplastes floridensis</i> Comstock	2, 4, 13, 14, 17-19
<i>Ceroplastes nakaharai</i> Gimpel	2, 4, 15
<i>Ceroplastes stellifer</i> (Westwood)	2, 4, 14, 16, 18
<i>Ceroplastes utilis</i> Cockerell	4, 20
<i>Coccus capparidis</i> (Green)	2, 21, 22
<i>Coccus hesperidum</i> Linnaeus	2, 4, 13, 14, 18, 19, 23
<i>Coccus longulus</i> (Douglas)	2, 4, 13, 19
<i>Coccus moestus</i> De Lotto	5
<i>Coccus viridis</i> (Green)	2, 4, 13, 14, 16-19, 23
<i>Cryptostigma inquilinum</i> (Newstead)	2, 21
<i>Eucalymnatus tessellatus</i> (Signoret)	2, 4, 13, 14, 16, 19
<i>Hamonicoccus alayoi</i> Mestre and Kondo, sp. nov.	Present study
<i>Kilifia acuminata</i> (Signoret)	2, 4, 13, 19, 24
<i>Milviscutulus mangiferae</i> (Green)	2, 4, 13-15, 18, 19, 24
<i>Parasaissetia nigra</i> (Nietner)	2, 4, 14, 19, 25
<i>Protopulvinaria longivalvata</i> Green	2, 4, 13, 14, 19
<i>Protopulvinaria pyriformis</i> (Cockerell)	2, 4, 13, 14, 15, 17-19, 24
<i>Pseudokermes vitreus</i> (Cockerell)	2, 4, 13, 14, 19
<i>Pulvinaria elongata</i> Newstead	2, 4, 13
<i>Pulvinaria iceryii</i> (Signoret)	4, 13
<i>Pulvinaria psidii</i> Maskell, 1893	2, 4, 13, 14, 26
<i>Pulvinaria urbicola</i> Cockerell	2, 4, 13-15, 27
<i>Saissetia coffeae</i> (Walker)	2, 4, 13, 15-19, 24, 27
<i>Saissetia miranda</i> Cockerell and Parrott	2, 4, 16-19, 22
<i>Saissetia neglecta</i> De Lotto	2, 4, 14, 19, 25
<i>Saissetia oleae</i> (Olivier)	2, 4, 13, 24
<i>Toumeyella cubensis</i> Heidel and Köhler	2, 4, 14
<i>Toumeyella liriodendri</i> (Gmelin)	2, 4, 18, 22

Biological notes. Specimens of *H alayoi* Mestre and Kondo sp. nov. were found on the leaves of 2 host plants, *Rhizophora mangle* and *Capparis cynophallophora*. Male second-instar nymphs were found and thus the species appears to be sexual.

Taxonomic notes. *Hamonicoccus alayoi* Mestre and Kondo sp. nov. appears closest to *Mesolecanium rhizophorae* (Cockerell), both collected on *Rhizophora mangle* in Cuba and Brazil, respectively. However, the 2 species can be separated by the presence of marginal setae of 2 sizes, with longer setae

tending to have knobbed tips and being twice as long as shorter setae in *Mrhizophora*.¹¹ In *H alayoi* sp. nov. marginal setae, all have knobbed tips and are 7.3 to 11.9 µm long. Furthermore, in the original description given by Cockerell,¹¹ preopercular pores and membranous cribriform plates were not mentioned. However, preopercular pores arranged in 2 parallel lines on mid-dorsum anterior to anal plates is a character state also found in *Mesolecanium perditum* (Cockerell) and *Mesolecanium planum* Hempel,¹² but *H alayoi* sp. nov. differs from these species by the presence of membranous cribriform plates and a sclerotized area around anal plates with areolated outer margins (absent in the above species of *Mesolecanium*).

Discussion

Hamonicoccus alayoi Mestre and Kondo sp. nov. was collected in 2 coastal locations: one in the south of Mayabeque province and the other in the north of Matanzas province, in localities that are only about 100 km from each other (Figure 1). The species may be more widely distributed in Cuba in other sites with this type of habitat. With the addition of *H alayoi* sp. nov., the total number of soft scales in Cuba is elevated to 32 species (Table 1).

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Author Contributions

NMN and TK contributed to the writing of the manuscript, agree with manuscript results and conclusions, and made critical revisions and approved final version. NMN drew the main drawing and measured the specimens. TK helped improved the drawing and map and translated the original Spanish text into English. All authors reviewed and approved the final manuscript.

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