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New records of bark and ambrosia beetles (Coleoptera: Scolytinae) from Cuba with description of a new species

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Abstract

We present a reassessment of the diversity of bark and ambrosia beetles in Cuba. For the first time in decades, an official Cuban-American binational collaboration allowed us to re-visit all known entomology collections in Cuba, and collect in the field. There are at least 94 species of scolytine beetles in Cuba. We report a new species, *Xylosandrus aurinegro* Gomez & Hulcr (Coleoptera: Curculionidae), and 7 new species records, including the first genus record for *Dryocoetoides* Hopkins and *Tricolus* Blandford (both Coleoptera: Curculionidae) for the island. In terms of species with potential concern to the USA, we corroborate a subspecies of *Ips calligraphus* Wood & Bright (Coleoptera: Curculionidae) that acts as a pine pest in Cuba and is not yet present in North America.

Key Words: diversity; Xyleborini; taxonomy; forest health; wood borer

Resumen

En este trabajo evaluamos la diversidad de escarabajos de corteza y ambrosia de Cuba. Por primera vez en décadas, una colaboración oficial entre Cuba y Estados Unidos nos permitió visitar todas las colecciones entomológicas de Cuba y realizar trabajo de campo. Existen al menos 94 especies de escolitinos en Cuba. Reportamos una nueva especie, *Xylosandrus aurinegro* Gomez & Hulcr (Coleoptera: Curculionidae), y 7 nuevos registros, incluyendo el primer registro de los géneros *Dryocoetoides* Hopkins y *Tricolus* Blandford (ambos Coleoptera: Curculionidae) en la isla. En términos de especies de interés para EEUU, se corroboró la existencia de una subespecie de *Ips calligraphus* Wood & Bright (Coleoptera: Curculionidae), una plaga de pino en Cuba no presente en América del Norte.

Palabras Clave: diversidad; Xyleborini; taxonomía; protección forestal; perforador de madera

Increasing international trade and globalization have led to the unprecedented movement of species around the world (Westphal et al. 2008). In USA alone, the rate of establishment of non-native wood-boring insects has increased dramatically over the last few decades, principally because of the increasing use of wood packaging materials, such as pallets and dunnage made from low-value wood, that is moved along with imports (Aukema et al. 2010; Liebhold et al. 2012).

Most research attention on invasive wood borers has been paid to the species from Asia and Europe, but an appreciable percentage of non-native species in the US has arrived from Central and South America (Halbert et al. 2000; Coleman & Seybold 2008). The Caribbean, while geographically close, nevertheless hosts distinct fauna and flora, and has already contributed many invasive pests to North America (Godley et al. 1981; Meshaka 1996; Rodrigues et al. 2007). Additional species arriving from Central America and the Caribbean can be expected for at least 2 reasons. First, with increased global temperatures, additional subtropical species may expand their ranges northward (Cudmore et al. 2010). Second, the Caribbean increasingly is a pathway for the shipping and importation of goods, including agricultural and forestry products (Penca et al. 2016). Within the Caribbean, Cuba has the greatest biological biodiversity, with more than 15,000 species of insects (Woods 1989; UNEP-WCMC 2016).

Bark and ambrosia beetles (Coleoptera: Scolytinae) are among the most important players in natural and planted forest systems (Raffa et al. 2015). They cause severe impacts ranging from ecological to economic, political, and social. The Xyleborini, for example, the richest and most invasive tribe, includes some of the most destructive species, such as the redbay ambrosia beetle, *Xyleborus glabratus* Eichhoff (Coleoptera: Curculionidae), responsible for unprecedented damage to Lauraceae in the southeastern USA (Smith & Hulcr 2015). Similarly,

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the genus *Dendroctonus* Hopkins contains some of the major conifer-killing bark beetles, such as the southern pine beetle, *Dendroctonus frontalis* Zimmermann (Coleoptera: Curculionidae), considered the most destructive pest of native pine forests in Central and Eastern North America, with economic losses estimated at $1.2 billion during a 28-yr period (Pye et al. 2011).

Literature records on Cuban Scolytinae are scarce. Peck (2005) listed 87 species of bark and ambrosia beetles for the island. More recently, Bright (2019) reviewed the group for the West Indies listing 85 scolytine species. However, Cuban diversity is probably much greater than that, considering that in the nearby state of Florida (USA), over 160 species are known (Atkinson 2018). From the 85 species recorded from Cuba, only 11 were reported in the hyperdiverse Xyleborini (Peck 2005; Bright 2019), suggesting that many more await discovery.

Pathways of wood borer invasions generally are indirectly inferred from information from known or expected relationships between non-native insects and certain products or pathways, border interception records obtained from inspections of imports, and risk assessments for pests and pathways (Brockerhoff & Liebhold 2017). Because of the proximity between Cuba and the US, potential pests can travel and become established through the Cuba–Florida pathway in case of the reestablishment of mutual trade. Cuba has been functionally isolated from the US since the Cuban Revolution in 1958, and the subsequent commercial, economic, and trade embargo. In the past decades, the relationship between the 2 countries has experienced temporary warming. In 2015, a joint statement was signed between the 2 countries to increase cooperation and facilitate the exchange of scientific information. In 2016, the United States Department of Agriculture (USDA) and the Cuban Ministry of Agriculture signed a Memorandum of Understanding with the objective of establishing bilateral cooperation in the agricultural and forestry sectors, including plant health issues, standards related to agricultural trade, and exchange of scientific information.

The Cuba–Florida pathway is recognized as a significant potential gateway for pest exchange between Cuba and the US. It has been described as a potential blind spot in the US biosecurity continuum (Penca et al. 2016). In the US, several agencies in the USDA cooperate on the prevention, detection, and quarantine of exotic pests. For example, the Plant Protection and Quarantine division (PPQ) of USDA Animal and Plant Health Inspection Service (APHIS) is responsible for avoiding the entry and establishment of exotic pests. Furthermore, the Cooperative Agriculture Pest Survey from APHIS, together with the Forest Service's Early Detection and Rapid Response program help to detect potential pests post-introduction (Rabaglia et al. 2008; Rabaglia et al. 2019). Regulatory barriers such as the International Phytosanitary Standard 15 regulates wood packaging material, the primary route of entry for wood-boring insects. Despite increasing regulations, US Customs and Border Protection agriculture specialists still regularly intercept wood-boring organisms (Haack et al. 2014). However, the limited trade between Cuba and the US has not completely integrated these phytosanitary standards. In addition, the remarkable insect diversity in Cuba still is not completely described, because even economically important groups are under-documented, and information exchange between Cuban and American entomologists has been limited due to political reasons. This makes early detection of imported pests difficult in both nations.

In order to strengthen proactive regulatory approaches and enable a response against future pest exchange between the US and Cuba, it is critical to know potential threats in both source regions. While our team has been training the Cuban phytosanitary experts in identification of North American bark beetles, the goal of this analysis is to solidify knowledge on bark and ambrosia beetles in Cuba, with emphasis on those that are absent in the continental North America. We summarize records of scolytines for Cuba, present new ones, describe a new species, and summarize the scolytine holdings of the main entomological collections on the island.

Materials and Methods

CHECKLIST OF SPECIES IN CUBA

Records are based on several publications (Zorrilla 1985; Vázquez 1988; Vázquez Moreno & Monteagudo 1988; Vázquez et al. 1996; Vázquez et al. 2003; Peck 2005; Bright 2019), specimens from several entomological collections, or manually collected by the authors during various field trips to the provinces of Artemisa, Havana, Mayabeque, and Pinar del Rio in Cuba. Specimens were identified using a stereomicroscope AmScope SM-2TZ (AmScope, Irvine, California, USA) (Wood 1982; Bright 2019), and were deposited in the Entomological Collection of the Instituto de Investigaciones en Sanidad Vegetal in Havana, Cuba. For species where any ecological data are known, their potential to be an economically important invasive species in the US was assessed. Species accumulation curves were built based on sample units (branches or trees colonized by beetles) using R v 3.4.2 (iNEXT) (Hsieh et al. 2016; R Development Core Team 2018) (Fig. 1). Current distribution records are as reported in Vázquez et al. (2003), Peck (2005), Bright (2019), and new data from the authors. Countries in the Caribbean, Central America, and North America are listed, and Cuban provinces and localities where the specimens were collected are specified when available. Fourteen provinces are recognized since 1975, because the former province Oriente was divided into Granma, Guantánamo, Holguín, and Santiago de Cuba (Peck 2005). The entomological collections used are: Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba; Gundlach Collection, Havana, Cuba; Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba; Museum of Comparative Zoology, Cambridge, Massachusetts, USA; Naturhistorisches Museum Wien, Vienna, Austria; National Museum of Natural History, Washington, DC, USA; Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium; Universitets Zoologisk Museum, Copenhagen, Denmark; Museum für Naturkunde der Humboldt-Universität, Berlin, Germany.

ENTOMOLOGICAL COLLECTIONS

During October 2016, Scolytinae and Platypodinae were examined in the 3 main entomological collections in Cuba: Basic Collection of

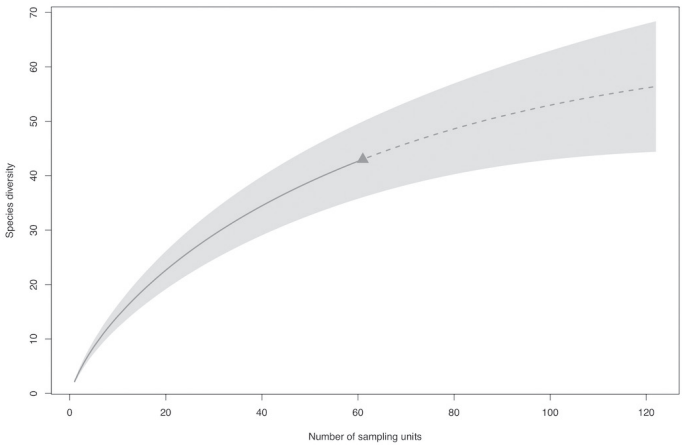


Fig. 1. Sample-unit based species accumulation curve with diversity estimates for interpolated (continuous line) and extrapolated (dashed line) samples.

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the Instituto de Ecología y Sistemática, Havana, Cuba; Gundlach Collection, Havana, Cuba; and Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba. A list of valid species names and synonyms deposited, as well as relevant information from the collections is presented.

DESCRIPTION OF NEW SPECIES

Images of type specimens were taken by DFG at the Instituto de Investigaciones en Sanidad Vegetal using a stereomicroscope AmScope SM-2TZ (AmScope, Irvine, California, USA) with side lighting through diffusers. Each image is a composite of separate images taken with a Canon EOS Rebel T3i camera (Canon, Tokyo, Japan), and later stacked using the software Helicon Focus (v 6.0, Helicon Soft, Kharkov, Ukraine).

Results

A new species of *Xylosandrus* Reitter (Coleoptera: Curculionidae) is described and 7 species new for the island are recorded from our field collecting trips, including the first genus record for *Dryocoetoides* Hopkins and *Tricolus* Blandford (both Coleoptera: Curculionidae). Additionally, *Hypothenemus birmanus* Wood & Bright (Coleoptera: Curculionidae) is reinstated as part of the Caribbean diversity. The observed and extrapolated richness based on our sampling effort is shown in Figure 1. Nineteen species of Scolytinae were recovered from entomological collections. One species of Platypodinae, *Euplatypus parallelus* Bright & Skidmore (Coleoptera: Curculionidae), was recovered from 2 entomological collections (Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba, and Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba, from *Eucalyptus* sp. [Myrtaceae] and *Ficus* sp. [Moraceae] in Havana, Isla de la Juventud, and Pinar del Río). An updated checklist of bark and ambrosia beetle from Cuba with 94 species is presented. From the species occurring in the island, 41 are not known to occur in the continental US.

In terms of damage potential, the only pest bark and ambrosia beetle species that were confirmed for Cuba are those that are already present in the US; those include significant pests such as *Xylosandrus compactus* Wood & Bright (Coleoptera: Curculionidae), or marginal pests such as *Hypothenemus erectus* LeConte (Coleoptera: Curculionidae). Our research did not detect any bark beetle species that acts as a pest in Cuba that is not yet present in North America. However, further studies on *Ips calligraphus interstitialis* (Coleoptera: Curculionidae), the subspecies from the Caribbean, should be conducted; it has been considered a synonym of *Ips calligraphus* Wood & Bright (Coleoptera: Curculionidae) until recently, and we know little of how it would behave in the southeastern US pine forests. Additional minor concerns are *Xylosandrus aurinegro* Gomez & Hulcr (Coleoptera: Curculionidae) **sp. nov.** and the recently described *Xylosandrus cubensis* Bright (Coleoptera: Curculionidae) and *Xyleborus anthracinus* Bright (Coleoptera: Curculionidae) (Bright 2019). Their ecology is not known, but other species of *Xylosandrus* and *Xyleborus* have caused significant damage in the US (Smith & Hulcr 2015). We did not detect several species recorded as pests present in Florida, including *Dendroctonus frontalis* Zimmerman, *Euwallacea fornicatus* Wood & Bright, and *Xyleborus glabratus* Eichhoff (all Coleoptera: Curculionidae).

CHECKLIST OF BARK AND AMBROSIA BEETLES OF CUBA

Species recovered in this study (*) and new country records (**) are emphasized. Species not known to occur in continental US (#) are indicated. Species of questionable occurrence (?) are highlighted. For specimens found in entomological collections, the collection name, distribution information, and host records for the specimens are provided. For the new country records, information on type material, distribution, and additional notes are provided. Complete synonymy of species is given in Wood & Bright (1992) and Bright (2019). All are Coleoptera: Curculionidae, unless otherwise noted.

1. *Ambrosiodmus hagedorni* (Iglesias) *
2. *Araptus caperatus* Bright #
3. *Araptus cubensis* (Blackman) #
4. *Araptus hymenaeae* (Eggers) #
5. *Araptus nigriculus* Bright #
6. *Araptus pallidus* (Blackman) #

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba.

Distribution. Caribbean: Cuba (Camagüey, Havana, Matanzas, Pinar del Río), Dominican Republic, Puerto Rico; South America.

Host. *Calophyllum brasiliense* Camb. (Calophyllaceae).

7. *Chaetophloeus cubensis* Bright #
8. *Chaetophloeus insularis* (Blackman)
9. *Chramesus opacicollis* Eggers
10. *Cladoctonus cubensis* (Wood) #
11. *Cnesinus cubensis* Blackman *, #
12. *Coccotrypes advena* Blandford *
13. *Coccotrypes carpophagus* (Hornung) *

Collection. Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba.

Distribution. Africa; Asia; Caribbean: Bermuda, Cuba (Havana), Dominican Republic, Grenada, Guadeloupe, Jamaica, Monserrat, Puerto Rico; Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Panama; Europe; North America: Mexico, United States; South America.

Host. *Phoenix dactylifera* L. (Arecaceae).

14. *Coccotrypes cyperi* (Beeson) *
15. *Coccotrypes dactyliperda* (Fabricius) *
16. *Coccotrypes distinctus* (Motschulsky) *
17. *Coccotrypes rhizophorae* (Hopkins)

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba.

Distribution. Asia; Caribbean: Cuba (Pinar del Río); North America: Mexico, United States; South America.

Host. *Rhizophora mangle* L. (Rhizophoraceae).

18. *Coccotrypes robustus* Eichhoff

Collections. Gundlach Collection, Havana, Cuba.

Distribution. Caribbean: Cuba (Matanzas), Puerto Rico; North America: United States.

Host. *Euterpe oleracea* Engel (Arecaceae).

19. *Corthylus papulans* Eichhoff *
20. *Corthylus subasperulus* Eggers #
21. *Cryptocarenus diadematus* Eggers **

Type material. Holotype female; Brazil; National Museum of Natural History, Washington, DC, USA.

Distribution. Caribbean: Cuba (Pinar del Río), Jamaica; Central America: Belize, Costa Rica, Panama; North America: Mexico, United States: Florida; South America.

Notes. Collected from a dead branch of an unknown host.

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22. *Cryptocarenus heveae* (Hagedorn) *
23. *Cryptocarenus seriatus* Eggers *
24. *Crypturgus alutaceus* Schwarz *
25. *Dendrocranulus carbonarius* (Ferrari)
26. *Dendrosinus bourreriae* Schwarz
27. *Dryocoetoides flavus* (Fabricius) **, #

Type material. Syntypes males and females; Guyana; Universitets Zoologisk Museum, Copenhagen, Denmark.

Distribution. Caribbean: Cuba (Artemisa, Pinar del Río); South America.

Notes. Recorded in the Caribbean for the first time. Collected from dead *Inga edulis* (Fabaceae) and *Psychotria* sp. (Rubiaceae).

28. *Euwallacea posticus* (Eichhoff) #
29. *Hylocurus quadrispinosus* Blackman *, #
30. *Hypocryphalus mangiferae* (Stebbing) *

Collection. Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba.

Distribution. Africa; Asia; Caribbean: Barbados, Cuba (Havana, Pinar del Río), Dominica, Guadeloupe, Puerto Rico; Central America: Costa Rica, Honduras, Panama; North America: Mexico, United States; Oceania; South America.

Host. *Mangifera indica* L. (Anacardiaceae).

31. *Hypothenemus areccae* (Hornung) **

Type material. Lectotype female; India; Museum für Naturkunde der Humboldt-Universität, Berlin, Germany.

Distribution. Africa; Asia; Caribbean: Bahamas, Cuba (Artemisa, Havana, Villa Clara), Martinique, Puerto Rico, Saint Lucia, Virgin Islands; Central America: Panama; Europe; North America: Mexico, United States; Oceania; South America.

Notes. Collected from *Annona reticulata* L. (Annonaceae) and *Pinus* sp. (Pinaceae).

32. *Hypothenemus atomus* Hopkins #
33. *Hypothenemus birmanus* (Eichhoff, 1878) **

Type material. Holotype female; "Birma"; Naturhistorisches Museum Wien, Vienna, Austria.

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba; material from Havana and Pinar del Río.

Distribution. Africa; Asia; Caribbean: Cuba (Artemisa, Havana, Mayabeque, Pinar del Río); Central America: Costa Rica, Honduras, Panama; North America: Mexico, United States; Oceania; South America.

Notes. Collected from old twigs and branches of unknown hosts. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba; material collected from *Syzygium jambos* (L.) Alston (Myrtaceae) and *Pinus caribaea* Morelet (Pinaceae). Bright (2019) noted that all the specimens observed from the Caribbean region previously labeled as *H. birmanus* were conspecific with *H. erectus*, suggesting that only *H. erectus* was present in the Americas. At least 30 of the specimens observed from Cuba (as well as additional specimens from peninsular Florida) do match *H. birmanus*, differing from *H. erectus* specimens from Cuba, the US, and Mexico (including the holotype of *Stephanoderes cubensis* Hopkins [Coleoptera: Curculionidae] at the National Museum of Natural History, Washington, DC, USA, and the holotype of *Stephanoderes erectus* LeConte [Coleoptera: Curculionidae] at the Museum of Comparative Zoology, Cambridge, Massachusetts, USA). The 2 species differ by the number of asperities on the pronotum (typically more than 25 on *H. birmanus* specimens and less than 20 on *H. erectus* specimens), by the short funicle (with usually only 3 funicle segments on *H. birmanus*, and 5 on *H. erectus*), and by the texture of the head behind the eyes (smooth on *H. birmanus*, and striate on *H. erectus*).

34. *Hypothenemus californicus* Hopkins **

Type material. Holotype female; United States; National Museum of Natural History, Washington, DC, USA.

Distribution. Africa; Asia; Caribbean: Antigua, Bahamas, Cuba (Artemisa), Grenada, Puerto Rico, Santa Lucia; Central America: Panama; North America: Mexico, United States; South America.

Notes. Collected from *Annona reticulata* L. (Annonaceae).

35. *Hypothenemus columbi* Hopkins *
36. *Hypothenemus crudiae* (Panzer) *
37. *Hypothenemus erectus* LeConte
38. *Hypothenemus eruditus* (Westwood) *

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba; Gundlach Collection, Havana, Cuba.

Distribution. Africa; Asia; Caribbean: Bahamas, Cuba (Artemisa, Havana, Matanzas, Oriente, Pinar del Río), Dominica, Dominican Republic, Jamaica, Virgin Islands; Central America: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama; Europe; North America: Canada, Mexico, United States; Oceania; South America.

Host. *Cucurbita* sp. twigs (Cucurbitaceae), *P. caribaea*, *Pinus cubensis* Griseb. (Pinaceae), *Pinus tropicalis* Morelet (Pinaceae), *Tectona grandis* L.f. (Lamiaceae).

39. *Hypothenemus fuscicollis* (Eichhoff) #, ?
40. *Hypothenemus glabratulus* (Schedl) #
41. *Hypothenemus gossypii* (Hopkins)
42. *Hypothenemus hampei* (Ferrari)
43. *Hypothenemus interstitialis* (Hopkins)
44. *Hypothenemus javanus* (Eggers) *
45. *Hypothenemus obscurus* (Fabricius) *

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba; Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba.

Distribution. Asia; Caribbean: Cuba (Havana), Dominican Republic, Guadeloupe, Puerto Rico; Central America: Costa Rica, El Salvador, Honduras, Panama; Europe; North America: Mexico, United States; Oceania; South America.

Host. *Calophyllum brasiliense* Camb. (Calophyllaceae), *Catharanthus roseus* (L.) G. Don (Apocynaceae).

Bright (2019) acknowledged synonymy between *H. obscurus* and *Hypothenemus seriatus* (Eichhoff) (*Stephanoderes*; Coleoptera: Curculionidae) by Wood (1954), reinstating the synonymy based on an unclear species boundary. Two distinct morphotypes exist (Vega et al. 2015), with some supporting molecular evidence (Johnson et al. 2018). The live-seed-feeding morphotype is present in Cuba (Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba, from *Calophyllum brasiliense* in the Calophyllaceae family), as is the non-pest morphotype (Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba, from *Catharanthus roseus* in the Apocynaceae family).

46. *Hypothenemus opacus* (Eichhoff) *
47. *Hypothenemus perexiguus* Bright #
48. *Hypothenemus pilosus* Hopkins #
49. *Hypothenemus pubescens* Hopkins
50. *Hypothenemus setosus* (Eichhoff) *
51. *Hypothenemus squamosus* (Hopkins) *
52. *Ips calligraphus interstitialis* (Eichhoff) *

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Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba; Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba.

Distribution. Caribbean: Bahamas, Cuba (Havana, Isla de la Juventud, Matanzas, Oriente, Pinar del Río, Sancti Spíritus), Dominican Republic, Haiti, Jamaica.

Host. *Pinus caribaea*, *P. cubensis*, *Pinus occidentalis* Kunth (Pinaceae), *P. tropicalis* (Pinaceae).

Notes. Bright (2019) recognizes the Caribbean populations as a subspecies based on the work of Lanier et al. (1991) using morphology, karyology, ecology, breeding experiments, and distribution.

53. *Ips grandicollis* (Eichhoff) *

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba.

Distribution. Caribbean: Bahamas, Cuba (Artemisa, Camagüey, Isla de la Juventud, Matanzas, Oriente, Pinar del Río, Sancti Spíritus), Dominican Republic, Jamaica; North America: Canada, United States.

Host. *Pinus caribaea*, *P. occidentalis*, *P. tropicalis.*

54. *Micracis cubensis* Blackman *, #
55. *Microcorthylus minutissimus* Schedl *, #
56. *Monarthrum mali* (Fitch)
57. *Pagiocerus frontalis* (Fabricius)
58. *Phloeotribus atlanticus* Schedl #

Collection. Gundlach Collection, Havana, Cuba.

Distribution. Caribbean: Cuba (Matanzas), Dominican Republic, Jamaica.

Host. Not recorded.

Notes. Another *Phloeotribus* sp. is hosted in Gundlach Collection, Havana, Cuba, but it is not well preserved, and there is no information on locality and host.

59. *Phrixosoma parva* Blackman #
60. *Pityophthorus concentralis* Eichhoff
61. *Pityophthorus eccentricus* Bright #
62. *Pityophthorus laevis* (Schedl) #
63. *Pityophthorus procerus* Bright #
64. *Pityophthorus pulicarius* Zimmermann

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba.

Distribution. Caribbean: Bahamas, Cuba (Camagüey); North America: Canada, United States.

Host. *Pinus caribaea*.

65. *Pityophthorus regularis* Blackman #
66. *Premnobius cavipennis* Eichhoff *

Collection. Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba.

Distribution. Africa; Caribbean: Bahamas, Cuba (Artemisa, Camagüey, Matanzas, Pinar del Río, Sancti Spíritus), Dominica, Jamaica, Puerto Rico; Central America: Belize, Costa Rica, Honduras, Panama; North America: Mexico, United States; South America.

Host. Not recorded.

67. *Pseudothysanoes insularis* (Blackman) #
68. *Pseudothysanoes minor* (Blackman) #
69. *Pseudothysanoes smithi* Bright #
70. *Pycnarthrum hispidum* (Ferrari) *

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba; Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba.

Distribution. Caribbean: Bahamas, Cuba (Havana, Pinar del Río), Dominican Republic, Guadeloupe, Haiti, Jamaica, Montserrat, Puerto Rico, Virgin Islands; Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama; North America: Mexico, United States; South America.

Host. *Ficus* sp., *Populus* sp. (Salicaceae)

71. *Pygmaeoborus cubensis* Bright #
72. *Scolytodes cubensis* (Schedl) #

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba.

Distribution. Caribbean: Cuba (Cienfuegos, Camagüey, Pinar del Río), Dominican Republic.

Host. *Ficus* sp.

73. *Scolytodes glaber* (Eichhoff) #
74. *Scolytodes pseudobicolor* (Eggers) #
75. *Scolytodes torresi* Bright #
76. *Scolytogenes jalappae* (Letzner)
77. *Scolytopsis puncticollis* Blandford #
78. *Scolytus dimidiatus* Chapuis #

Collection. Gundlach Collection, Havana, Cuba; Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba.

Distribution. Caribbean: Cuba (Cienfuegos), Jamaica; Central America: Costa Rica, El Salvador, Guatemala, Honduras, Panama; North America: Mexico; South America.

Host. *Cedrela odorata* Blanco (Meliaceae).

Notes. The specimen from Gundlach Collection, Havana, Cuba, is not well preserved and has no locality or host information.

79. *Theoborus theobromae* Hopkins *, #
80. *Tricolus gracilis* Eggers **, #

Type material. Holotype; Guadeloupe; National Museum of Natural History, Washington, DC, USA.

Distribution. Caribbean: Cuba (Pinar del Río), Dominican Republic, Guadeloupe, Jamaica.

Notes. Collected from a dead branch of an unknown host.

81. *Trypanophellos necopinus* Bright #
82. *Xyleborinus andrewesi* (Blandford) *
83. *Xyleborinus gracilis* (Eichhoff) **

Type material. Lectotype; Brasilia; National Museum of Natural History, Washington, DC, USA.

Distribution. Africa; Caribbean: Cuba (Pinar del Río), Dominica, Dominican Republic, Grenada, Guadeloupe, Monserrat, Puerto Rico; Central America: Costa Rica, Honduras, Panama; North America: Mexico, United States; South America.

Notes. Distinguished from other *Xyleborinus* by the blunt tubercles of declivital interstriae 3. Collected from a dead branch of an unknown host.

84. *Xyleborus affinis* Eichhoff *

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba; Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba.

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Distribution. Africa; Asia; Caribbean: Barbados, Cuba (Camagüey, Havana, Matanzas, Pinar del Río), Dominica, Dominican Republic, Guadeloupe, Jamaica, Puerto Rico, St. Vincent; Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama; Europe; North America: Canada, Mexico, United States; Oceania; South America.

Host. *Andira inermis* (Wright) DC (Fabaceae), *Cocos nucifera* L. (Arecaceae), *Ficus* sp. (Moraceae), *Pinus caribaea*, *Tectona grandis*.

85. *Xyleborus anthracinus* Bright #
86. *Xyleborus ferrugineus* (Fabricius) *

Collection. Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba.

Distribution. Africa; Caribbean: Bahamas, Cuba (Artemisa, Camagüey, Havana, Pinar del Río), Dominica, Dominican Republic, Guadeloupe, Jamaica, Puerto Rico, Virgin Islands; Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama; North America: Canada, Mexico, United States; Oceania; South America.

Host. *Cocos nucifera*, *Persea americana* Mill. (Lauraceae).

87. *Xyleborus pubescens* Zimmermann
88. *Xyleborus spinulosus* Blandford *
89. *Xyleborus volvulus* (Fabricius) *

Collection. Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba.

Distribution. Africa; Asia; Caribbean: Bahamas, Cuba (Artemisa, Camagüey, Havana), Dominican Republic, Grenada, Jamaica, Puerto Rico, Virgin Islands; Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama; North America: Mexico, United States; Oceania; South America.

Host. *Eucalyptus* sp. (Myrtaceae), *Pinus caribaea*.

90. *Xyleborus xylographus* (Say) ?

Collection. Gundlach Collection, Havana, Cuba.

Distribution. Caribbean: Cuba (Matanzas), Puerto Rico; North America: Canada, United States.

Host. Not recorded.

Notes. The specimens observed in the collection do not fit *X. xylographus*. Records from the literature do not include locality data (Vázquez et al. 2003), or are based on destroyed types specimens from synonymized species (Bright 2019).

91. *Xylosandrus aurinegro* Gomez & Hulcr **sp. nov.** (Fig. 2) **, #

TYPE MATERIAL

HOLOTYPE (female): Cuba, Artemisa, September 2018. Gomez coll. *Psychotria* L. (Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba). PARATYPES (female): Cuba, Artemisa, September 2018. Gomez coll. *Psychotria* L. (2, National Museum of Natural History, Washington, DC, USA).

DESCRIPTION. Female: Body oval, 2.0 mm to 2.2 mm long, 2.0 times longer than wide; bicolored, with pronotum yellowish brown and elytra dark brown to black, ventral side light brown.

Head. Frons convex with surface reticulate, sparsely punctured; punctures between eyes with erect setae. Epistoma with dense row of short setae along lower margin. Eyes deeply emarginate, upper portion smaller. Antennal funicle 5-segmented (including pedicel), scape (short and stout) and funicle with scattered hair-like setae of variable size; club obliquely truncate, first segment sclerotized, forming a circular



Fig. 2. Holotype of *Xylosandrus aurinegro* **sp. nov.**, female, from left to right: lateral view, dorsal view, posterior oblique view of declivity, anterior view of head. Specimen: 2.15 mm.

costa around the anterior face (type 1, Hulcr et al. 2007), segments 2 and 3 soft, pubescent, second segment not corneous; posterior face of club corneous, with sparse, short setae.

Pronotum. 0.75 times as long as wide with the summit situated at basal third, widest at basal third, anterior margin with 5 to 6 distinctive asperities; anterior slope densely asperate, asperities smallest at summit and increasing in size toward anterior margin; vestiture consisting of variable length hair-like setae, with a dense patch of mycangial setae on the base; dorsal aspect of pronotum rounded (type 1, Hulcr et al. 2007); lateral aspect of pronotum basic (type 0, Hulcr et al. 2007).

Scutellum. Triangular, dark brown, flush with elytra surface.

Elytra. 1.3 times as long as wide, 1.6 times as long as pronotum, shining, parallel-sided on basal two-thirds and then rounded toward apex. Striae slightly impressed along the entire length, punctate, punctures deep, short hair-like setae originating from punctures. Interstriae 1.5 times the width of striae along the declivity, punctate, long and short erect setae originating from punctures; interstriae 1, 2, and 3 each with 2 to 3 small tubercles, and 4 to 5 large tubercles evenly spaced from declivital base to apex. Interstriae 4 and 5 with a row of small tubercles. Declivity starting at basal third; lateral margins carinate to 7th interstriae; carina distinct, extending to the base of elytra.

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Legs. Procoxae widely separated. Protibiae flattened, broader at distal end, with 5 socketed teeth on lateral margin; mesotibiae with 8 to 9 socketed teeth; metatibiae with 7 to 8 socketed teeth. Abdominal ventrites evenly punctured, punctures with short and long hair-like setae.

MALE: Unknown.

ETYMOLOGY. The species epithet is a noun in apposition; *aurinegro* refers to the golden and black coloration of mature specimens, and to the colors of the Uruguayan soccer team Club Atlético Peñarol, commonly known as "aurinegros."

DIAGNOSIS. This species can be readily distinguished from all other known *Xylosandrus* species by the combination of its striking color pattern and the distinct tubercles on the interstriae 1, 2, and 3 of the elytral declivity.

DISTRIBUTION. Caribbean: Cuba (Artemisa).

NOTES. This species is known from a single collecting event from a dead *Psychotria* L.

92. *Xylosandrus compactus* (Eichhoff) *
93. *Xylosandrus cubensis* Bright #
94. *Xylosandrus curtulus* (Eichhoff) **

Type material. Holotype female; Brazil; Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium.

Distribution. Caribbean: Antigua, Bahamas, Cuba (Artemisa), Dominica, Dominican Republic, Grenada, Guadeloupe, Martinique, Saint Lucia, Virgin Islands; Central America: Costa Rica, Guatemala, Honduras, Nicaragua, Panama; North America: Mexico, United States; South America.

Notes. In the US, this species is currently only known from central and southern Florida. Distinguished from the very similar *X. compactus* by the dark brown body, the small size, the hairy and shagreened declivity, and the preference for dead branches, rather than live hosts. Collected from *Psychotria* sp. (Rubiaceae).

ENTOMOLOGICAL COLLECTIONS

Cuba's 3 principal forest entomology collections were examined, and the specimens within Scolytinae and Platypodinae are listed. These groups are poorly represented in all 3 collections. Most specimens were identified abroad. Nineteen species of Scolytinae and 1 species of Platypodinae, *Euplatypus parallelus* (Fabricius) (Collection of the Instituto de Investigaciones Agroforestales, Havana, Cuba, and Basic Collection of the Instituto de Ecología y Sistemática, Havana, Cuba, from *Eucalyptus* sp. and *Ficus* sp. in Havana, Isla de la Juventud, and Pinar del Río) were recovered.

Gundlach Collection

The Gundlach Collection contains 7 species of Scolytinae and Platypodinae. No type specimens were found. The material is not well preserved because it was kept in the Instituto de Segunda Enseñanza de la Habana for several years under high temperatures and humidity (Peck 2005). Each specimen within the collection has a label with Gundlach's handwriting with a species-level identification. It also has a vertical glued printed number in the left margin that refers to the Gundlach publication. However, these references are not always accurate and contain misspellings and identification errors. All specimens from the Gundlach Historical Collection are located in the Instituto de Ecología y Sistemática in a separate drawer from the Institute's Basic non-historical Collection.

Instituto de Ecología y Sistemática Basic Collection

The Basic Collection started with a donation of specimens for the "Estación Experimental de Santiago de las Vegas" (García IF, Instituto de Ecología y Sistemática, personal communication). Several collecting expeditions took place during 1950s and the collection has since continued to receive specimens from different collecting trips. There are currently 8 species of scolytine beetles and high numbers of unsorted material labeled as 'Coleoptera.'

Collection of the Instituto de Investigaciones Agroforestales

The Collection of the Instituto de Investigaciones Agroforestales started in 1969, with several collected specimens by R. Hochmut (López R, Instituto de Investigaciones Agro-Forestales, personal communication). Nine species were recovered, and there is no catalog for the collection, nor any type specimens.

Discussion

The Cuban institutions in charge of the phytosanitary safeguarding continuum have a solid organizational structure with a widespread network across the country involving research institutes, stations, and human capital (Clifford et al. 2018). However, some essential resources are lacking because the national entomological collections, the core of the national capacity for pest identification and management, is not developed enough to support that role. Despite the limited exports from Cuba to the US (charcoal is the only product exported), millions of dollars in agricultural products are exported from the US to Cuba every yr (USDA GATS 2019), increasing the probability of introduction of invasive species known to cause severe damage in Florida, such as *D. frontalis*, *X. glabratus* and *E. fornicatus*.

In terms of biodiversity, national collections in Cuba contain a fraction of the species that are present on the island. For example, only 2 species of *Xylosandrus*, *X. compactus* and *X. cubensis*, were known to occur in Cuba prior to this work. *Xylosandrus* Reitter is a genus of Xyleborini with widespread distribution in tropical and temperate regions with 41 recognized species (Dole & Cognato 2010; Bright 2019). Several *Xylosandrus* species are economically important in their native and introduced ranges, mainly because they are capable of breeding in drier woody material compared to the rest of the ambrosia beetles (Smith & Hulcr 2015). The black twig borer (*X. compactus*) and the granulate ambrosia beetle (*Xylosandrus crassiusculus* Wood), both widely distributed invasive species, are amongst the most damaging species in nurseries, commercial plantations, and natural forest ecosystems. The new species of *Xylosandrus* described here underlines the importance of the existence of identification resources for border control, because most aspects of their ecology is currently unknown. The information provided here is critical to develop coordinated efforts by USDA-APHIS and the Caribbean partners because 34% of the Cooperative Agriculture Pest Survey priority pests of economic and environmental importance currently exists in the Caribbean, and 10% occurs in Cuba (Penca et al. 2016).

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