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Scolytidae from the Galápagos Islands, Ecuador, with descriptions of four new species, new distribution records, and a key to species (Coleoptera: Scolytidae)

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Abstract

The Scolytidae fauna of the Galápagos Islands, Ecuador is reviewed. Twenty-four species in 10 genera are definitely recorded from the Archipelago, including one unnamed, unidentified species in *Hylocurus* EICHHOFF. *Araptus franzi, Hypothenemus pacificus*, *H. indigenus*, and *Pseudothysanoes isolatus*, new species, are described. *Xyleborinus gracilis* (EICHHOFF), recorded from Floreana by SCHEDL (1971), and *Hypothenemus cylindricus* (HOPKINS), recorded from Santa Cruz by PECK & KUKALOVA-PECK (1990), are removed from the list of species known from the Archipelago. New records of previously described species for the Archipelago include: *Coccotrypes dactyliperda* (FABRICIUS), *Xyleborinus saxeseni* (RATZBURG), *Hypothenemus californicus* HOPKINS, *H. crudiae* (PANZER), and *H. seriatus* (EICHHOFF). Numerous new island records are given for species previously known from the Archipelago. A key to all of the presently known species of Scolytidae from the Archipelago is included. Inbreeding species comprise 80 % of the taxa known from the Archipelago. Only 5 species (less that 21 % of the fauna) are considered endemic; while 14 species, including the endemics, (58 % of the fauna) are considered native. Nine species are considered to be unintentionally introduced, but some of the species listed as native may have also been introduced by early people.

Key words: Coleoptera, Scolytidae, Galápagos, distribution, new species, key.

Introduction

A recently completed sampling program in the Galápagos Archipelago, Ecuador, is attempting to provide a modern inventory and analysis of the beetle fauna of this important, young, volcanic, oceanic archipelago (PECK & KUKALOVA-PECK 1990). During the past decade, concentrated collecting has revealed several, previously unrecorded species of Scolytidae, provided additional distributional data for several species within the Archipelago, and discovered four evidently undescribed species. This paper contains a key to the species of Scolytidae presently known from the Galápagos Islands, descriptions of the four new species, new distributional records, and a brief statement about the occurrence and habits of each species.

The first record of a scolytid beetle from the Galápagos Islands was in the report by LINELL (1898), in which he mentions a single specimen without elytra, belonging in "the group Hylurgi". The second mention of a species from the Islands was from a series of specimens found in The Natural History Museum in London, collected from the Archipelago in 1925 by G. Bateson. This species was described as *Pycnarthrum insulare* by BLAIR (1933). In an annex to his paper, BLAIR (1933) stated "It is probable that the single damaged Scolytid recorded by LINELL (1898) from Charles Island was this species". The above species was later recorded in the list of the Coleoptera from the Galápagos Islands by MUTCHLER (1938). Additional species were recorded from the Archipelago by SCHEDL (1971, 1974). LINSLEY (1977), in his checklist of the insects of the Galápagos, lists 11 species of Scolytidae in 5 genera. PECK & KUKALOVA-PECK (1990) stated that the fauna then contained 5 genera and 13 species of Scolytidae, and gave detailed records of 5 species that represented new island or new Archipelago records. WOOD & BRIGHT (1992), in their world catalog, listed 12 species, with their subsequent name changes. Two more species were listed in BRIGHT & SKIDMORE (1997). Therefore, prior to the present paper, 14 species in 7 genera were known from the Archipelago. The species of Scolytidae known to occur on the various islands of the Galápagos Archipelago now totals 24 species in 10 genera.

The Galápagos Islands are an equatorial, volcanic, oceanic archipelago, which is about 3 million years old at the most. The Islands lie in the Pacific Ocean about 900-1000 km west of the coast of Ecuador, to which they politically belong. The low islands are semi-arid. The high islands have the following elevation-related vegetationally defined life zones: littoral, arid forest, transition forest, humid forest (often with *Scalesia* trees; mostly converted to an agricultural zone on some islands), "subalpine" evergreen shrubs (sometimes with *Miconia*), and an above-treeline "alpine" sedge-fern (or "pampa") zone (PECK 1997).

The Galápagos Islands are the most famous natural laboratory of evolution in the world because they record the dynamics of the colonization of young volcanic islands and their subsequent biotic differentiation. PECK (1997) gives a list of reviews discussing the composition and faunal structure of some of the nonmarine groups of Galápagos arthropods.

Material and methods

Collections of Galápagos Scolytidae were made during general insect survey fieldwork and included the use of Malaise traps, flight-intercept traps, and collecting at ultraviolet and white lights. These methods were used in villages, disturbed agricultural habitats, and natural, undisturbed habitats. Details of the six major habitats, or "life zones" are reviewed in PECK & KUKALOVA-PECK (1990). We use the standard Ecuadoran names for the islands (Fig. 1). Distribution of the Scolytidae on the principal islands is given in table 1. All major islands have been sampled, including Darwin and Wolf in the extreme northwestern corner of the Archipelago. Over 3000 specimens of Scolytidae were identified to species. Detailed lists of specimen data are available from the authors. When sufficient material is available, voucher specimens will be placed in the collections of the Canadian National Collection of Insects (Ottawa), the Catholic University (Quito, Ecuado), the Canadian Museum of Nature (Ottawa), the California Academy of Sciences (San Francisco, CA), the Bernice P. Bishop Museum (Honolulu, Hawaii), the Museum of Comparative Zoology (Harvard University, Cambridge, MA), the Naturhistorisches Museum (Wien, Austria), and the Charles Darwin Research Station.

When recording locality data, the exact information on the label is quoted. Several abbreviations were used in preparing the label data: CDRC = Charles Darwin Research Center; FIT = flight intercept trap; mal-FIT = malaise trap and flight intercept trap; trans. = transition (as in lower transition forest); gen. colln. = general collection; for. = forest. The Peck records include year of collection and collection (field) number, as in 89-4"; the number of specimens examined is given in parenthesis.

During the years that this study was in progress, some new island records were recorded, by island only, in BRIGHT & SKIDMORE (1997). Details of those records are included herein under "Material Examined". Other, previously published records, are not repeated here.

Systematic results

The following key is intended to be of use for making identifications by field biologists or entomologists, realizing that the identification of the Scolytidae can be difficult for the non-specialist. A good light source and a binocular microscope with a magnification of 30x and above are required. The major reference used for all systematic information for all species included herein is the world catalog by WOOD & BRIGHT (1992) and its first supplement (BRIGHT & SKIDMORE 1997).

For each species we give (1) original reference of description and pertinent literature references referring to Galápagos records, relevant distribution records or biological information; (2) its status as endemic (occurring only in the Galápagos Islands), native (occurring on the Galápagos Islands by natural dispersal), or introduced (through human agency); (3) geographic distribution outside of the Galápagos Islands (for native and introduced species) and for all species by island within the Archipelago; (4) information on hosts and habits; and (5) appropriate remarks.

Key to the Scolytidae of the Galápagos Islands

1. Epistoma with a conspicuous, median, pointed tubercle; anterior tibiae produced at the upper apical angles into a bifid process; pronotum glabrous, with dense, longitudinal, sharply elevated lines and shallow grooves; elytra deeply striate-punctate, interspaces with a median row of short, yellowish, narrow scales; anterior margin of elytra procurved, slightly elevated; antennal funicle 7-segmented, club stout, thickened near base, with one septate suture on basal half; length 2.0-2.6 mm .... *Pagiocerus frontalis* (FABRICIUS)

\- Epistoma unarmed; anterior tibiae with a simple tooth at apex; pronotum asperate or punctured, not as above; elytra finely striate-punctate, interspaces with hairs or scales; anterior margins of elytra straight, not elevated; antennal funicle 2- to 6-segmented, club flattened or obliquely truncate 2

2. Entire dorsal surface of pronotum densely and very finely punctured, with short scale-like bristles; elytra finely striate-punctate, interspaces with numerous short hairs and scales mainly arranged in triseriate rows; antennal club slightly flattened, with two oblique sutures, the first one partly septate; length 2.1-2.2 mm .... *Pycnarthrum insulare* BLAIR

\- Dorsal surface of pronotum asperate in front, punctured on posterior half; elytra with short scales or hairs; antennal club flattened or obliquely truncate 3

3. Protibia with sides parallel, armed by denticles only at apex; antennal funicle 6-segmented; procoxae moderately separated 4

\- Protibia with dorsal margin straight to distinctly procurved, armed by distinct denticles; antennal funicle 2-to 5-segmented; procoxae usually contiguous, if separated, then vestiture hairlike 5

4. Elytra broadly rounded behind; posterior face of protibia smooth, unarmed; posterior surface of pronotum punctured .... *Pseudothysanoes isolatus* sp.n.

\- Elytra acuminate behind; posterior face of protibia with parallel rows of rugae or tubercles; posterior surface of pronotum asperate .... *Hylocurus* sp.

5. Antennal club flattened, with sutures on both faces 6

\- Antennal club thickened at base, obliquely truncate 16

6. Pronotum elongate, base not margined; antennal club with two transverse sutures; funicle 5-segmented; vestiture hairlike .... *Araptus franzi* sp.n.

\- Pronotum subhemispherical, base finely margined; antennal club with side margins sinuate, with a short septum on one side; funicle 3- to 5-segmented; vestiture scale-like 7

7. Frons convex, with a narrow, smooth, longitudinal, median line extending from epistoma to upper level of eyes; elytral interstrial scales 3.0 times longer than wide; anterior margin of pronotum with 6 low serrations; length 1.4-1.5 mm .... *Hypothenemus seriatus* (EICHHOFF)

\- Frons either convex, without a smooth, longitudinal, median line, or weakly to strongly impressed above epistoma; interstrial scales and serrations on pronotal margin variable 8

8. Frons weakly to strongly transversely impressed above epistoma, upper margin of impression with a smooth, median tubercle or swelling 9

\- Frons convex, usually without a median tubercle, but if tubercle present, then declivity with fine, abundant hairs posterio-laterally 11

9. Frons with a small, rounded median tubercle at upper level of eyes; lower half of frons very

shallowly, transversely impressed, sometimes with a variable, shallow median groove ending at median tubercle; length 1.4-1.6 mm .... *Hypothenemus crudiae* (PANZER)

- Frons with a distinctly elevated tubercle at upper level of eyes; lower half of frons deeply, transversely impressed 10

10. Anterior margin of pronotum with 2 widely separated tubercles; length 1.3-1.5 mm .... *Hypothenemus brunneus* (HOPKINS)

- Anterior margin of pronotum with 6 equal-sized tubercles; length 1.0-1.2 mm .... *Hypothenemus columbi* HOPKINS

11. Interstrial ground vestiture on declivity consisting of fine, confused hairs on posterio-lateral areas, in addition to uniseriate rows of erect scales and strial hairs 12

- Interstrial ground vestiture on declivity absent, vestiture consisting only of uniseriate rows of erect interstrial scales and rows of fine strial hairs, one hair arising from each puncture 13

12. Elytral scales distinctly shorter than distance between rows, broad, apex distinctly broader than base; frontal tubercle, if present, very obscure, surface below tubercle very obscurely impressed .... *Hypothenemus eruditus* WESTWOOD

- Elytral scales only slightly shorter than distance between rows, very narrow, almost hairlike, apex equal in width to base; frontal tubercle distinct, surface below tubercle weakly but distinctly impressed .... *Hypothenemus indigenus* sp. n.

13. Anterior margin of pronotum armed with 4 serrations 14

- Anterior margin of pronotum with 6 serrations 15

14. Smaller species, about 1.1 mm in length; anterior margin of pronotum armed with 4 widely separated, equal-sized teeth .... *Hypothenemus pacificus* sp.n.

- Larger species, about 1.5-2.1 mm in length; anterior margin of pronotum armed with 4 serrations, the median 2 much larger and basally contiguous .... *Hypothenemus birmanus* (EICHHOFF)

15. Serrations on anterior margin of pronotum increasing in size from lateral to middle, median pair basally contiguous; punctures in elytral striae large, distinct, striae weakly impressed; length 1.2-1.6 mm, 2.3 times longer than wide .... *Hypothenemus obscurus* (FABRICIUS)

- Serrations on anterior margin of pronotum all of equal size, all widely separated; punctures in elytral striae usually obscure, striae not impressed; length 1.1-1.2 mm, 2.6 times longer than wide .... *Hypothenemus californicus* HOPKINS

16. Anterior slope of pronotum with very small asperities; declivity evenly convex, unmodified; frons with convergent scratches or finely punctate-rugose 17

- Anterior slope of pronotum with distinct asperities; declivity usually with distinct teeth or granules; frons smooth, punctate 19

17. Strial setae entirely absent; anterior margin of pronotum not serrate; strial punctures coarse, striae almost as wide as interspaces; length 2.2-2.5 mm .... *Coccotrypes rhizophorae* (HOPKINS)

- Strial setae conspicuously present between rows of longer, finer, interstrial setae; anterior margin of pronotum serrate; strial punctures variable 18

18. Length 1.5-1.9 mm; strial punctures slightly smaller, shallowly impressed; interstrial setae on declivity slightly longer than distance between rows .... *Coccotrypes carpophagus* (HORNUNG)

- Length 1.8-2-3 mm; strial punctures larger, more deeply impressed; interstrial setae on declivity almost twice as long as distance between rows .... *Coccotrypes dactyliperda* (FABRICIUS)

19. Procoxae widely separated; body very stout, 1.9 times longer than wide; elytra 1.0 times longer than wide, declivity commencing at posterior one-third of elytra, evenly convex, without conspicuous granules or tubercles; length 1.4-1.7 mm .... *Xylosandrus morigerus* (BLANDFORD)

- Procoxae contiguous; body elongate, 2.0 or more times longer than wide; elytral declivity commencing well behind middle of elytra, convex or sulcate, armed with granules, tubercles or spines; length 1.8 mm or more 20

20. Scutellum cone-shaped, not filling scutellar notch, sometimes obscured by a brush of setae 21
- Scutellum flat, triangular, filling scutellar notch, always distinctly visible 22
21. First and third declivital interspaces with a median row of 4-6 acute tubercles; second declivital interspace slightly impressed, devoid of tubercles; apex of elytra with small, distinct, acute tubercles; length 1.9-2.4 mm .... *Xyleborinus saxeseni* (RATZEBURG)
- Declivital interspaces 1 and 2 with a median row of small, rounded granules, third interspace with a median row of larger, more acute tubercles; second declivital interspace not impressed; apex of elytra devoid of distinct tubercles; length 1.8-1.9 mm ..... *Xyleborinus gracilis* (EICHHOFF)
22. Elytra cuneiform towards apex, teeth in continuation of third interspaces on apical margin rather long and slender; elytral declivity broadly impressed and with two conical teeth on third interspaces in upper half; length 2.2 mm .... *Xyleborus spinulosus* BLANDFORD
- Elytra cylindrical, teeth on lateral border of short declivity rather small and conical, declivital face short and applanate, with granules or conical tubercles on alternating interspaces 23
23. Elytral declivity flattened or very shallowly impressed, with a rather prominent conical tubercle in the middle of third interspace; length 2.4-3.0 mm .... *Xyleborus ferrugineus* (FABRICIUS)
- Elytral declivity more gently convex, with a median row of small, equal sized, acute granules in first and third interspaces 24
24. Elytral declivity opaque to silky shining, very finely punctate, pointed granules on the alternating interspaces rather remotely placed; length 2.2-2.6 mm .... *Xyleborus affinis* EICHHOFF
- Elytral declivity brightly shining, finely punctate, pointed granules of alternating interspaces more numerous and more conspicuous; length 2.2-2.5 mm .... *Xyleborus volvulus* (FABRICIUS)

Pagiocerus frontalis (FABRICIUS)

P. frontalis (FABRICIUS) 1801: 389 (*Bostrichus*); SCHEDL 1974: 48, 50; LINSLEY 1977: 26; WOOD 1977: 72; WOOD 1982: 246; PECK & KUKALOVA-PECK 1990: 1637; WOOD & BRIGHT 1992: 213; BRIGHT & SKIDMORE 1997:44.

This species occurs from the southern United States through the Antilles and Mexico to Argentina (WOOD & BRIGHT 1992). In the Galápagos Archipelago it has been previously recorded only from Santa Cruz (SCHEDL 1974; LINSLEY 1977, and PECK & KUKALOVA-PECK 1990); this record was omitted in WOOD & BRIGHT (1992).

On Santa Cruz, this species has been collected in avocado seeds, *Mictonia* zone FIT, leaf and fruit litter, and bottletraps in litter. No specimens from other islands were seen.

This species infests large seeds of various trees. It has been transported to many areas of the world in infested maize (WOOD 1977; WOOD & BRIGHT 1992), and is undoubtably introduced into the Galápagos.

Pycnarthrum insulare BLAIR

P. insulare BLAIR 1933: 487; VAN DYKE 1953: 160; SCHEDL 1974: 48, 50; LINSLEY 1977: 26; FRANZ 1985: 99; WOOD & BRIGHT 1992: 385.

This is an endemic species that has been previously recorded from Española, Floreana, Genovesa, Isabela, Santa Cruz, and Seymour (SCHEDL 1974; LINSLEY 1977).

NEW ISLAND RECORDS: Baltra: 30 m, 24.I.89, arid zone, grass + *Bursera* forest, u. v. light, S. Peck 89-4 (3). **Fernandina:** 10 km NE Cabo Hammond, 400 m, 6-9.V.91, open meadow, uv light, S. & J. Peck 91-126B (8); 5 km NE Cabo Hammond, 110 m, 4-10.V.91, Cerro Verde, low trans. forest, uv light, S. & J. Peck 91-116 (1). **Marchena:** Pta. Espejo, 11-24.III.92, arid zone, *Bursera* grassland, FIT, S. Peck 92-19 (1); SW Playa, 30 m, arid zone, *Bursera* forest, FIT, 12-24.III.92, S. Peck 92-29; same data except date is 12.III.92, uv light, S. Peck 92-25 (2); Pta. Espejo, 11.III.92, arid zone, *Bursera* grasslands, uv light and night collecting, S. Peck 92-16 and 92-17 (3). **San Cristobal:** Baquerizo, 11-23.II.89, arid zone, FIT, S. Peck 89-48 (1).

Nothing is recorded on the biology or habits of this species.

Hylocurus sp.

One specimen was collected on **Santa Cruz**, 5 mi. north of Ayora, 110 m, low transition zone, mal-FIT, 1-30.V.1991, by S. & J. Peck. Because of the sexual dimorphism displayed by members of this genus and because of the large number of species in Central and South America, we are leaving this specimen unidentified until more specimens become available.

Pseudothysanoes isolatus sp.n.

TYPE MATERIAL: **Holotype** (♂), **allotype**, and 5 **paratypes** are labelled: ECU: Galap., **Floreana**, Fuica (sic) Cruz, 130 m, arid zone forest FIT, 27.III-16.IV.96, S. Peck 96-59. Additional paratypes are labelled: ECU: Galap; **Floreana**, Cerro Pajas, 335 m, 27.III.-18.IV.96, forest edge FIT, S. Peck 96-55 (2); Finca Cruz, 130 m, arid zone forest, 16-22.IV.96, FIT, S. Peck 96-108 (2). ECU: Galap; **Pinta**, 14-22.III.92, 200 m, trans. zone forest, FIT (*Bursera, Trema, Zanthoxylon*), S. Peck 92-39 (1), and Galápagos: **Floreana Is.**, NE Coast, Las Cuevas, 23.I.1991, B. D. Valentine (7). The holotype, allotype and 11 paratypes are in the Canadian National Collection of Insects, Ottawa (CNC Type No. 22318). Four paratypes are in the Canadian Museum of Nature, Ottawa.

DESCRIPTION: Length 1.4 - 1.5 mm, 2.8 - 2.9 times longer than wide. Colour black to very dark reddish-black.

Male: Frons very weakly impressed above epistoma, very weakly convex above impression; surface shining, very finely minutely reticulate, with short, scattered, yellowish setae, those above epistomal margin longer, extending downward to near apex of mandibles. Antennal scape with long, sparse setae. Antennal club about 1.2 times longer that wide, sutures transverse. Pronotum as long as wide; sides moderately arcuate, anterior margin broadly rounded, armed by 6 small, basally separated serrations; anterior slope with numerous, small, scattered, erect asperities and short, erect, flattened scales; summit distinctly elevated; posterior area minutely asperate-reticulate, with very short, semi-recumbent scales. Elytra 1.7 times longer than wide; sides parallel on basal three-fourths, apex broadly rounded, almost truncate at suture; discal striae weakly impressed, with large, shallow punctures in even rows; discal interspaces about as wide as striae, basal half of each interspace smooth, unarmed, posterior portion of each interspace with a median row of small, acute, basally contiguous granules or tubercles, these gradually increasing in size toward and over declivity, each interspace also with a median row of erect, flattened, narrow scales, these about 6 times longer than wide, apex truncate. Declivity convex; sutural interspace weakly elevated, with a median row of small, acute granules; interspace 2 with a median row of slightly larger, acute granules; interspace 3 more strongly elevated, also with a median row of larger, more distinct, acute granules, this interspace joining interspace 9, then both continuing to suture; interspaces 4 - 8 each bearing a median row of acute granules; interspace 9 elevated, with a similar row of acute granules; all interspaces with a median row of erect, hairlike setae. Terminal mucro on anterior tibia simple, unmodified. Last abdominal sternite mucronate, slightly projecting beyond elytral apices, with rather dense narrow scales.

Female: Very similar to male. Frons very weakly convex; surface shining, minutely reticulate, with scattered, small, erect scales. Pronotum as in male except anterior margin unarmed; asperities on anterior slope more sparse. Elytra as in male except interstrial granules much smaller, rounded at apex. Declivity more evenly convex; interspaces 1 and 3 less strongly elevated, with much smaller granules in median row; granules in remaining interspaces smaller, rounded. Terminal mucro on anterior tibia simple, unmodified. Last abdominal sternite resembling that of male except scales less evident or absent.

Remarks: Males of this species are readily recognized by the presence of coarse, acute granules on the elytral interspaces on the posterior half of the disk and on the declivity, by the moderately elevated third declivital interspace, and by the joining of interspaces 3 and 9 on the lateral portions of the declivity with an elevated extension continuing on to the suture. The female is similar except that the granules and sculpturing are finer.

Nothing is known of the habits of this species. The holotype was collected in a transition zone forest of *Bursera, Trema*, and *Zanthoxylon*. The specimens of the series obtained by Valentine were collected from a very dry stem of an unidentified plant (Valentine, personal communication).

Pseudothysanoes is in the tribe Micracini and is one of only two taxa of this tribe so far known from the Galápagos Islands. We consider this species to be endemic, based on the collection localities on a small, isolated, unpopulated island (Pinta) or a sparsely populated island (Floreana), and on the unlikely possibility that the species would be transported by humans, based on the known habits of other members of the genus.

Coccotrypes carpophagus (HORNUNG)

C. carpophagus (HORNUNG) 1842: 116 (*Bostrichus*); WOOD 1977: 69; WOOD & BRIGHT 1992: 594; BRIGHT & SKIDMORE 1997: 131.

This introduced species occurs throughout Africa, Asia, the Pacific Islands, eastern United States, and Mexico to Brazil and Peru (WOOD & BRIGHT 1992). It was recently recorded from San Cristobal and Santa Cruz (BRIGHT & SKIDMORE 1997). The Santa Cruz record should be deleted since the specimens documenting this record have not been located.

MATERIAL EXAMINED: **San Cristobal:** 4 km E. of Baquerizo, 150 m, trans. zone, 12-23.II.89, FIT, Peck & Sinclair 89-53 (1).

This species occurs in large seeds and nuts of numerous tree species (WOOD & BRIGHT 1992). It is commonly intercepted in temperate countries in infested seeds and nuts, and was probably introduced to the Galápagos Archipelago this way.

Coccotrypes dactyliperda (FABRICIUS)

C. dactyliperda (FABRICIUS) 1801: 387 (*Bostrichus*); WOOD 1977: 69; WOOD 1982: 739; WOOD & BRIGHT 1992: 599.

This cosmopolitan species has been transported throughout the world in infested seeds, but breeding occurs only in the tropical and subtropical regions where hosts occur. The species has not been previously recorded from the Galápagos Archipelago.

NEW GALAPAGOS RECORD: Santa Cruz: Pto. Ayora, 30 m, 30.VI.91, uv light at village house, S. Peck 91-261 (1).

This introduced species breeds mostly in seeds of various palms, but the seeds and nuts of a large number of tropical trees are also attacked (WOOD & BRIGHT 1992).

Coccotrypes rhizophorae (HOPKINS)

C. rhizophorae (HOPKINS) 1915: 48 (*Spermatoplex*); WOOD 1977: 69; WOOD 1982: 734; WOOD & BRIGHT 1992: 609.

This introduced species occurs naturally in Southeast Asia, but is now found in Veracruz (Mexico), Florida, and in the Galápagos Archipelago on Albemarle (= Isabela) (WOOD & BRIGHT 1992), where it was first captured in 1985.

NEW ISLAND RECORD: Santa Cruz: Puerto Ayora, 10-15.I.91, B. D. V. [B.D. Valentine] (1).

This species breeds in fallen viviparous seeds of *Rhizophora mangle* (red mangrove) (WOOD 1977).

Xylosandrus morigerus (BLANDFORD)

X. morigerus (BLANDFORD) 1894: 264 (*Xyleborus*); WOOD 1977: 74; WOOD 1982: 765; WOOD & BRIGHT 1992: 797; BRIGHT & SKIDMORE 1997:169.

This species is native to southeast Asia. It was introduced into the Americas prior to 1959 and now breeds from southern Mexico to northern South America (WOOD 1977). It was recently recorded from Santa Cruz (BRIGHT & SKIDMORE 1997).

MATERIAL EXAMINED: **Santa Cruz:** 3 km W Bellavista, Finca Vilema, 210 m, forest litter, 19.IV.92, S. Peck 92-128 (1); 3 km W Bellavista, Finca Vilema, 210 m, *Scalesia*-pasture FIT, 1-3-.V.92, S. Peck 92-214 (1); Pto. Ayora, CDRC, 1 m, bottle traps tied to mangroves, 7-13.III.92, J. Cook, S. Peck, 92-6 (1); 1.7 km north of Sta. Rosa, 1-30.VI.91, 550 m, *Scalesia* forest, FIT, S. Peck 91-234, 91-233 and 91-113 (38); 10 km north of Sta. Rosa, 7-30.III.92, trans. zone forest, FIT, S. Peck 92-5 (1); 10 km N Sta. Rosa, 1-30.V.92, 500 m, trans. zone forest, *Pisonia*, FIT, S. Peck 92-83 and 92-220 (5).

This species occurs in many regions of the world, breeding in a wide variety of trees, shrubs, vines, and herbaceous plants (WOOD & BRIGHT 1992). It is probably introduced into the Archipelago.

Xyleborinus saxeseni (RATZEBURG)

X. saxeseni (RATZBURG) 1837: 167 (*Bostrichus*); WOOD 1977: 73; WOOD 1982: 847; WOOD & BRIGHT 1992: 810.

This very common species is native to Europe, but has been transported to almost all temperate areas of the world. The species has not previously been recorded from the Galápagos Archipelago, where it must be introduced.

NEW GALAPAGOS RECORDS: Isabela: Sierra Negra, 1000 m, 29,IV.96, pampa zone, litter in crevices, S. Peck 96-138 (1). **Santa Cruz:** various localities and dates, *Scalesia*, Peck & Sinclair (+100). **Santiago:** Aguacate Camp (3) and Playa Espumilla (1), various dates, S. Peck.

This species is an ambrosia beetle that breeds deep in the wood of a wide variety of woody plants (WOOD & BRIGHT 1992).

Xyleborinus gracilis (EICHHOFF)

X. gracilis (EICHHOFF) 1868a: 145 (*Xyleborus*); SCHEDL 1971: 149; SCHEDL 1974: 49, 51; LINSLEY 1977:26; WOOD & BRIGHT 1992: 808.

This species is known in the New World from the southern United States, through the West Indies to Argentina. It has apparently been introduced into the Azores and the Galápagos Archipelago, where it was collected from Floreana in 1934 (SCHEDL 1971).

The Galápagos record of this species originates from one specimen labelled "Post Office, Tsay, Floreana, Galapagos, 30-1-1934, Monsunen" in the Zoological Museum of the University in Copenhagen examined by Schedl. That specimen was examined during this study and found to be correctly identified. However, since no specimens of this species were collected by S. Peck and his associates despite the intensive collecting methods employed over a period of at least 10 years, we consider this specimen to be a introduction that did not become established. Therefore, we have deleted the species from the Galápagos list and do not consider the species further. We have, however, included the species in the key to species to enable its identification, in case it is collected again on the islands.

This species is an ambrosia beetle that breeds deep in the wood of trunks and branches of several genera of woody plants (WOOD & BRIGHT 1992).

Xyleborus affinis EICHHOFF

X. affinis EICHHOFF 1868b: 401; SCHEDL 1971: 149 (as *X. mascarensis*); SCHEDL 1974: 49, 52; LINSLEY 1977: 26; WOOD 1977: 73; WOOD 1982: 830; WOOD & BRIGHT 1992: 706.

This very abundant species is probably native to tropical America, but now occurs throughout the world. It was previously recorded from the Galápagos Archipelago on Floreana and Santa Cruz (SCHEDL, 1974; LINSLEY 1977); these records were omitted in WOOD & BRIGHT (1992). Its occurrence on the Archipelago is probably the result of natural dispersal.

NEW ISLAND RECORDS: Isabela: Sto. Tomas, 4-15.III.89, 300 m, humid forest, FIT, Peck & Sinclair 89-100 (8); same locality, 3.III.89, 300 m, frass under bark, S. Peck 89-94 (1); 5 km NW Sto. Tomas, 600 m, 3-15.III.89, guava for., S. Peck 89-97 (2); Villamil, 12 km NW, 2-15.III.89, trans. forest FIT, 150 m, Peck & Sinclair 89-92 (2). **San Cristobal:** Baquerizo, 11-23.II.89, 10 m, arid zone, S. Peck 89-48 (2); 3 km E. Baquerizo, 100 m, trans. zone, 12-23.II.89, FIT, Peck & Sinclair 89-51 (2); Cerro Mundo, guava thicket, 550 m, 13-23.II.89, FIT, Peck & Sinclair 89-58 (1); 4 km E Baquerizo, 150 m, trans. zone, 12-23.II.89, FIT, Peck & Sinclair 89-53 (11); 1 km E Progresso, guava ravine, 370 m, 15-23.II.89, FIT, Peck & Sinclair 89-62 (2). **Pinta:** Playa Ibbetson, 40 m, 13-22.III.92, open *Bursera* forest FIT, S. Peck 92-37 (1). **Santiago:** Playa Espumilla, 5 m, open *Cordia* woodland FIT, 4-13.IV.92, S. Peck 92-101 (4); Aguacate Camp, 520 m, humid forest FIT, 7-13.IV.92, S. Peck 92-108 (1).

This species breeds in almost any woody plant species. Hundreds of hosts are listed in WOOD & BRIGHT (1992).

We believe that this species reached the Galápagos by natural dispersal because it is widespread in the Archipelago and on islands such as Pinta where human caused introductions are unlikely. It is possible that the species was introduced to one of the main islands and then spread naturally to other islands.

Xyleborus ferrugineus (FABRICIUS)

X. ferrugineus (FABRICIUS) 1801: 388 (*Bostrichus*); SCHEDL 1974: 49, 52; LINSLEY 1977: 26; WOOD 1977: 73; WOOD 1982: 827; WOOD & BRIGHT 1992: 735.

This is one of the most widely distributed, common, abundant ambrosia beetles in the world. It has a similar distribution as that of *X. affinis* described above. In the Galápagos Archipelago, it has been previously recorded only from Santa Cruz (SCHEDL 1974, LINSLEY 1977). Its occurrence is probably the result of natural dispersal.

NEW ISLAND RECORDS: Baltra: 30 m, 24.I.89, arid zone, grass + *Bursera* forest uv light, S. Peck 89-4 (5). **Floreana:** Black Beach, 20-28.III.89, arid zone, beating, S. Peck 89-163 (10); same locality, 21-28.III.89, littoral-arid FIT, Peck & Sinclair 89-139 (1); 3 km E Black Beach, 21-28.III.89, 120 m, upper arid zone FIT, Peck & Sinclair 89-141 (11); 5 km E Black Beach, 22-28.III.89, 250 m, trans. zone FIT, Peck & Sinclair 89-145 (10); 6 km E Black Beach, 21-28.III.89, *Scalesia* for. FIT, Peck & Sinclair, 89-143 (1); Pta. Cormorant, 26.III.89, lagoon edge mangrove litter, S. Peck 89-158 (1). **Isabela:** Sto. Tomas, 4-15.III.89, 300 m, humid forest FIT, Peck & Sinclair 89-100 (10); same locality, 3.iii.89, 300 m, frass under bark, S. Peck 89-94 (2); same locality, 8-12.III.89, 300-350 m, agric. zone, night, Landry & Peck 89-112 (2); 1/2 km W Sto. Tomas, 7.VII.85, beating burned trees, S. & J. Peck (1); 3 km NW Sto. Tomas, 1.III.89, 180 m, rotting logs in coffee, S. Peck 89-120 (1); 5 km NW Sto. Tomas, 3-15.III.89, 600 m, guava for. FIT, S. Peck 89-97 (2); Villamil, 3-15.III.89, 0-5 m, arid-littoral zone, S. Peck 89-134 (1); 1 km W Villamil, 2-15.III.89, 1 m, littoral scrub on sand FIT, Peck & Sinclair 89-88 (1); 1 km E Villamil, 7.III.89, mangrove litter, S. Peck 89-109 (1); 2 km W Villamil, 2-15.III.89, 2 m, brackish meadow FIT, Peck & Sinclair 89-86 (9); 4 km NW Villamil, 2-15.III.89, 20 m, arid forest FIT, Peck & Sinclair 89-89 (10); 12 km NW Villamil, 2-15.III.89, 150 m, trans. forest FIT, Peck & Sinclair 89-92 (9); same locality, 6.III.89, 150 m, jaboncillo forest litter, S. Peck 89-107 (2); same locality and habitat, 9.III.89, light, Landry & Sinclair 89-115 (10). **Marchena:** SW playa, arid zone, beach forest, bottle traps, 12.III.92, S. Peck 92-30 (9). **Pinta:** Playa Ibbetson, 1-5 m, 13-23.III.92, arid zone, gen. colln., S. Peck & J. Cook 92-43 (4). **San Cristobal:** Baquerizo, 11-23.II.89, 10 m, arid zone FIT, S. Peck 89-48 (5); 3 km e Baquerizo, 12-23.II.89, 10 m, trans. zone FIT, Peck & Sinclair 89-51 (11); same locality, 17.II.89, *Cryptocarpus* litter at iguana roost, S. Peck 89-69 (1); same locality, 11.II.89, littoral zone litter under beach plants, S. Peck 89-49 (1); 4 km E Baquerizo, 12-23.II.89, 150 m, trans. zone FIT, Peck & Sinclair 89-53 (16); 2 km NW El Junco, 21.II.89, 620 m, *Miconia* ravine, S. Peck 89-75 (1); 1 km E Progresso, 15-23.II.89, 370 m, guava ravine FIT, Peck & Sinclair 89-62 (1); same locality, 19.II.89, rose apple thicket litter, S. Peck 89-73 (1). **Santiago:** Playa Espumilla, 12-14.IV.92, arid zone, gen. colln., J. Cook & S. Peck 92-120 (2). **Seymour:** 10 m, 23.I.89, arid zone, *Bursera* forest u. v. light, S. Peck 89-5 (4).

This species breeds in numerous species of woody plants (WOOD & BRIGHT 1992).

Xyleborus spinulosus BLANDFORD

X. spinulosus BLANDFORD 1898: 201; SCHEDL 1974: 49, 51 (as *X. artespinulosus)*; LINSLEY 1977: 26 (as *X. artespinulosus*); WOOD 1977:73; WOOD 1982: 799; WOOD & BRIGHT 1992: 775.

This species occurs throughout the West Indies, Mexico, Central America, and South America (WOOD & BRIGHT 1992). It has been introduced into Hawaii, and we suspect it has also been introduced into the Galápagos Archipelago, where it has been previously recorded only from Santa Cruz (SCHEDL 1974, LINSLEY 1977). Its presence on Pinta could be argued as evidence that this species is a naturally occurring species.

NEW ISLAND RECORDS: Floreana: 6 km e Black Beach, 21-28.III.89, 380 m, *Scalesia* forest FIT, Peck & Sinclair 89-143 (1). **Isabela:** Sto. Tomas, 4-15.III.89, 300 m, humid forest FIT, Peck & Sinclair 89-100 (1). **Pinta:** 200 m, 14-22.III.92, trans. zone forest FIT, (*Bursera, Trema, Zanthoxylon*), S. Peck 92-39 (1); 400 m, 14-22.III.92, *Zanthoxylon*-lichen humid forest FIT, S. Peck 92-41 (2). **San Cristobal:** 3 km E Baquerizo, 12-23.II.89, 100 m, trans. zone malaise trap, Peck & Sinclair 89-50 (4); 4 km E Baquerizo, 12-23.II.89, 150 m, trans. zone malaise trap, Peck & Sinclair 89-52 (18) and 89-53 (7); 1 km E El Junco, 13-23.II.89, 550 m, *Miconia* ravine FIT, Peck & Sinclair 89-55 (1); 1 km E Progresso, 15-23.II.89, 370 m, guava ravine malaise, Peck & Sinclair 89-63 (10). **Santiago:** Aguacate Camp, 7-13.IV.92, 520 m, humid forest FIT, S. Peck 92-108 (2); same locality, 7-13.IV.92, 550 m, mossy forest, blue cheese bottle traps, S. Peck 92-113 (2).

This species breeds in branches and trunks of a number of woody plants; WOOD & BRIGHT (1992) list 15 species of host plants.

Xyleborus volvulus (FABRICIUS)

X. volvulus (FABRICIUS) 1775: 454 (*Bostrichus*); SCHEDL 1974: 49, 52 (as *X. torquatus*); LINSLEY 1977: 26 (as *X. torquatus*); WOOD 1977: 73; WOOD 1982: 833; PECK & KUKALOVA-PECK 1990: 1638; WOOD & BRIGHT 1992: 780.

This is another of the exceedingly abundant, widespread, pantropical ambrosia beetles. In the Galápagos Archipelago, it has been recorded from Floreana, Isabela, and Santa Cruz (SCHEDL 1971, SCHEDL 1974, LINSLEY 1977, PECK & KUKALOVA-PECK 1990, BRIGHT & SKIDMORE 1997). Its occurrence is probably the result of natural dispersal.

NEW ISLAND RECORDS: San Cristobal: Baquerizo, 11-23.II.89, arid zone FIT, S. Peck 89-48 (1); 3 km E Baquerizo, 12-23.II.89, 100 m, trans. Zone FIT, Peck & Sinclair 89-51 (1); 3 km E Baquerizo, 12-23.II.89, 150 m, trans zone FIT, Peck & Sinclair 89-53 (8); same locality, 15.II.89, trans. Zone leaf litter, S. Peck 89-68 (1); Cerro Mundo, 13-23.II.89, 550 m, guava thicket FIT, Peck & Sinclair 89-58 (2); 1 km E Progresso, 12-23.II.89, 370 m, guava ravine FIT, Peck & Sinclair 89-53 (5). **Santiago:** Aguacate Camp, 7-13.IV.92, 520 m, humid forest FIT, S. Peck 92-108 (1).

The biology of this species is similar to that of *X. affinis* and *X. ferrugineus*. Hundreds of species of host plants are listed (WOOD & BRIGHT 1992).

Hypothenemus birmanus (EICHHOFF)

H. birmanus (EICHHOFF) 1878: 486; SCHEDL 1974: 49, 51; WOOD 1977: 70; WOOD 1982: 886; PECK & KUKALOVA-PECK 1990: 1638; WOOD & BRIGHT 1992: 909.

This very common species is recorded from Southeast Asia, Australia, Micronesia, Hawaii, Jamaica, Central America, Mexico, and Florida (WOOD & BRIGHT 1992). In the Galápagos Archipelago, it has been recorded from Floreana (SCHEDL 1974), Santa Cruz and Española (PECK & KUKALOVA-PECK 1990). We assume that the species is native to the Galápagos Archipelago.

NEW ISLAND RECORDS: Fernandina: 5 km NE Cabo Hammond, 110 m, Cerro Verde, low trans. forest, 4-10.V.91, uv light, S & J Peck 91-116 (1). **Isabela:** Tagus Cove, arid zone, 100 m, 14-22.V.92, FIT, *Bursera* forest,

S. Peck 92-185 (1); Villamil, 1 km W., 2-15.III.89, FIT, littoral scrub on sand, 1 m, Peck & Sinclair 89-88 (3). **San Cristobal:** Baquerizo, 11-23.II.89, 10 m, arid zone FIT, S. Peck 89-48 (1).

This species breeds in twigs and small branches of a wide variety of trees, shrubs, and woody vines (WOOD 1977). Over 20 species of host plants are recorded by WOOD & BRIGHT (1992).

Hypothenemus brunneus (HOKPINS)

H. brunneus (HOPKINS) 1915: 31 (*Stephanoderes*); SCHEDL 1974: 49, 51 (as *S. bituberculatus*); WOOD 1977:70; WOOD 1982: 910; WOOD & BRIGHT 1992: 911.

This species occurs from Florida to Texas, south to Panama and the West Indies (WOOD & BRIGHT 1992); in the Galápagos Archipelago it was previously recorded only from Santa Cruz (SCHEDL 1974). This species is presumed to be of African origin (WOOD 1977) and is almost certainly introduced.

NEW ISLAND RECORDS: Fernandina: 5 km NE Cabo Hammond, 110 m, Cerro Verde, trans. forest, 4-11.II. V.91, flight intercept, S & J Peck 91-120 (1). **Floreana:** Black Beach, 21-28.III.89, 10 m, littoral-arid FIT, Peck & Sinclair, 89-139 (6); 3 km E Black Beach, 120 m, 21-28.III.89, up. arid zone, FIT, Peck & Sinclair, 89-141 (3); Finca Cruz, 130 m, arid zone forest, 16-22.IV.96, FIT, S. Peck 96-108 (3). **Isabela:** Tagus Cove, arid zone, 100 m, 14-22.V.92, FIT, *Bursera* forest, S. Peck 92-185 (4). **Marchena:** SW Playa, arid zone, *Bursera* forest, FIT, 12-24.III.92, 30 m, S. Peck 92-29 (8); Pta. Espejo, arid zone, 11-24.III.92, *Bursera* grassland, FIT, S. Peck 92-19 (4). **Pinta:** 14-22.III.92, 200 m, trans. zone forest, FIT, (*Bursera*, *Trema*, *Zanthoxylon*), S. Peck 92-39 (13). **San Cristobal:** 3 km E Baquerizo, 100 m, 11-23.II.89, FIT, Peck & Sinclair, 89-51 (3); 3 km SE Wreck Bay, 14-19.III.96, 2 m, upper littoral, FIT, S. Peck 96-12 (1).

This species breeds in a large number of plant species (WOOD & BRIGHT 1992). Adults attack injured or broken branches.

Hypothenemus californicus HOPKINS

H. californicus HOPKINS 1915: 19; WOOD 1982: 897; WOOD & BRIGHT 1992: 912.

This species is recorded from the eastern and southern United States, California, Brazil, Mexico, Liberia, Israel, and Korea. Specimens from Australia have also been seen. This species is undoubtedly introduced into the Galápagos, probably from southeast Asia or possibly Africa, and is probably known under other names in these areas. WOOD & BRIGHT (1992) suggest synonymy with other species, possibly *H. leprieuri* (PERRIS). It has not been previously recorded from the Galápagos Archipelago.

NEW GALAPAGOS RECORDS: Española: Bahia Manzanillo, 5 m, arid zone, FIT, 23.IV-2.V.92, S. Peck 92-146 (2); ridge crest, 125 m, 26.IV.92, under *Opuntia* bark and rocks, S. Peck & J. Cook 92-143 (1). **Fernandina:** 5 km NE. Cabo Hammond, 110 m, Cerro Verde, trans. forest, 4-11.II.V.91, flight intercept, S & J Peck 91-120 (3). **Floreana:** Black Beach, 21-28.III.89, 10 m, littoral-arid FIT, Peck & Sinclair 89-139 (1); Black Beach, *Cryptocarpus* litter, 24.III.89, S. Peck 89-149 (1); 3 km E Black Beach, 120 m, 21-28.III.89, up. arid zone, FIT, Peck & Sinclair 89-141 (2); 5 km E Black Beach, 250 m, 22-28.III.89, trans. z. FIT, Peck & Sinclair 89-145 (4); Finca Cruz, 130 m, arid zone forest, 16-22.IV.96, FIT, S. Peck 96-108 (4). **Isabela:** Villamil, 1 km W, 2-15.III.89, FIT, littoral scrub on sand, 1 m, Peck & Sinclair 89-88 (3); Villamil, 2 km W, 2-15.III.89, brackish meadow, FIT, 2 m, Peck & Sinclair 89-86 (1); Villamil, 4 km NW, 2-15.III.89, arid forest FIT, 20 m, Peck & Sinclair 89-89 (1). **San Cristobal:** 3 km SE Wreck Bay, 14-19.III.96, 2 m, upper littoral, FIT, S. Peck 96-12 (3). **Santa Cruz:** CDRS, 10 m, arid zone FIT, 1-30.III.89, S. Peck 89-168 (1); Los Gemelos, *Scalesia*, FIT, 600 m, 1-30.III.89, Peck & Sinclair 89-175 (2); 13 km N Sta. Rosa, 7-30.III.92, 300 m, arid zone *Bursera* for. FIT, S. Peck 92-3 (2).

This species feeds on a wide variety of host plants; 18 species of hosts are recorded in WOOD & BRIGHT (1992).

Hypothenemus columbi HOPKINS

H. columbi HOPKINS 1915: 18; WOOD 1982: 907; WOOD & BRIGHT 1992: 912; PECK & KULALOVA-PECK 1990: 1638 (as *H. cylindricus)*.

This species is known from the southern United States to northern South America (WOOD & BRIGHT 1992). It has not been previously recorded from the Galápagos Archipelago. Its occurrence on the Galápagos Islands is probably the result of natural dispersal.

PECK & KUKALOVA-PECK (1990: 1638) record the species *Hypothenemus cylindricus* (HOPKINS) as new to the Galápagos Archipelago, based on identifications by D. E. Bright. Further examination of those specimens during the preparation of this paper showed that the identification was in error. The specimens represent the species *H. columbi* HOPKINS.

NEW GALAPAGOS RECORDS: Española: Bahia Manzanillo, 5 m, 23.IV-2.V.92, arid zone FIT, S.Peck 92-146 (13). **Genovesa:** Bahia Darwin, 20 m, *Bursera* forest FIT, 10-27.III.92, S. Peck 92-14 (1). **Isabela:** 1 km W Villamil, 2-15.III.89, littoral scrub on sand FIT, 1 m, Peck & Sinclair 89-88 (13); 4 km NW Villamil, 2-15.III.89, arid forest FIT, 20 m, Peck & Sinclair 89-89 (3); 1.5 km NW Villamil, 9.III.89, *Ceiba* litter, S. Peck 89-117 (1). **Marchena:** Pta. Espejo, 11-24.III.92, arid zone, *Bursera* grassland malaise tp., S. Peck 92-18 (9); SW Playa, 12-24.III.92, 30 m, arid zone, *Bursera* forest malaise, S. Peck 92-28 (4), 92-29 (4) and 92-25 (1). **San Cristobal:** Baquerizo, 11-23.II.89, 10 m, arid zone FIT, S. Peck 89-48 (6). **Santa Cruz:** Academy Bay, ECCD, 10.V-14.VII.85, 30 m, arid zone, thorn shrub malaise-FIT, S. & J. Peck (8); CDRS, 1-28.II.89, 10 m, arid zone malaise, Peck & Sinclair 89-44 (1), 89-43 (1), 89-168 (1); CDRS, above baranca, 1-30.VI.91, 40 m, arid zone malaise, S. Peck 91-266 (1).

The biology of this species is similar to that of *H. eruditus*. It is recorded from a wide variety of woody plants (WOOD & BRIGHT 1992).

Hypothenemus crudiae (PANZER)

H. crudiae (PANZER) 1791: 35 (*Bostrichus*); WOOD 1982: 891; WOOD & BRIGHT 1992: 914.

This widely distributed species occurs throughout the New World, in Africa, Asia, and on various islands in the Pacific (WOOD & BRIGHT 1992). It has not been previously reported from the Galápagos Archipelago. Its occurrence on the Galápagos Islands is probably the result of natural dispersal, so we consider it a native species.

NEW GALAPAGOS RECORDS: San Cristobal: 3 km E. Baquerizo, 100 m, 12-23.II.89, trans. z. FIT, Peck & Sinclair 89-51 (1). **Santa Cruz:** Tortoise Reserve, 180 m, 7.II.89, trans.for. frass u. bark, S. Peck 89-35 (1).

This species has been recorded from a large number of host plants (WOOD & BRIGHT 1992).

Hypothenemus eruditus WESTWOOD

H. eruditus WESTWOOD 1833: 34; SCHEDL 1974: 49, 51; WOOD 1977: 71; WOOD 1982: 900; PECK & KUKALOVA-PECK 1990: 1638; WOOD & BRIGHT 1992: 919.

This is probably the most widely distributed and most commonly encountered species of Scolytidae in the world, having been introduced by humans into all parts of the world. It occurs in virtually all tropical and subtropical areas of the world. In the Galápagos Archipelago it was collected from Floreana in 1934 and from Santa Cruz and Española in 1964 (SCHEDL 1974). The Galápagos records were omitted from the catalog published by WOOD & BRIGHT (1992).

NEW ISLAND RECORDS: Isabela: Sto Tomas, Corazon Verde, agric. zone ex *Inga* pods, 30.IV.96, S. Peck 96-137 (3); Villamil, 1 km E., 7.III.89, mangrove litter, S. Peck 89-109 (6); Villamil, 2 km W., 2-15.III.89, brackish meadow FIT, 2 m, Peck & Sinclair 89-86 (2); Villamil, 4 km NW, 2-15.II.89, arid forest FIT, 20 m, Peck & Sinclair 89-89 (1). **Marchena:** SW playa, arid zone, *Bursera* forest, FIT, 12-24.III.92, 30 m, S. Peck 92-29 (1). **Pinta:** 14-22.III.92, 200 m, trans. zone forest, FIT, (*Bursera, Trema, Xanthoxylon*), S. Peck 92-39 (4). **Rábida:** NE coast, 100 m, 10.VI.1991, J.Heraty, arid forest, H91/087 (1); Red Beach, 1.0 m, 11.VI.91, *Cryptocarpus* litter, back beach S. Peck 91-215 (1). **San Cristobal:** Baquerizo, 11-23.II.89, 10 m, arid zone FIT, S. Peck 89-48 (12); Baquerizo, 3 km E., 100 m, trans. z., 12-23.II.89, FIT, Peck & Sinclair 89-51 (8); Baquerizo, 3 km SE., littoral zone litter under beach plants, 11.II.89, S. Peck 89-49 (1); Baquerizo, 4 km E., 150 m, trans. z., 12-23.II.89, FIT, Peck & Sinclair 89-53 (10); Baquerizo, 4 km E., 150 m, trans. zone, 15.II.89, leaf litter, S. Peck 89-68 (1); Progresso, 1 km E., Guava ravine, 370 m, 15-23.II.89, Peck & Sinclair 89-62 (16). **Santa Fé:** littoral, 5.IV.89, soil wash, u. *Cryptocarpus*, S. Peck 89-203 (1); littoral, *Cryptocarpus* litter, 6.IV.89, S. Peck 89-193 (8). **Santiago:**

Aguacate Camp, 520 m, humid forest, FIT, 7-13.IV.92, S. Peck 92-108 (2); Aguacate Camp, 550 m, mossy forest, FIT, 7-13.IV.92, S. Peck 92-112 (4); 3 km NE Aguacate Camp, 740 m, 5.VI.91, moss elfin forest litter, S. Peck 91-202 (1), 91-201 (7); trail to Aguacate, 3-9.VI.91, 300 m, FIT in Guayabillo grove, S. Peck 91-191 (1); Playa Espumilla, 12-14.IV.92, arid zone, gen. colln, J. Cook & S. Peck 92-120 (7); Playa Espumilla, 5 m, open *Cordia* woodland FIT, 4-13.IV.92, S. Peck 92-101 (1). **Seymour:** 10 m, 23.I.89, S. Peck, arid zone, *Bursera* forest, u. v. light, 89-5 (2).

This species breeds in the bark of the trunk or branches of numerous species of plants, in flowers, seeds, weeds, grass, and in fruiting bodies of fungi (WOOD 1977). Hundreds of host species are listed in the literature (WOOD & BRIGHT 1992).

Hypothenemus indigenus sp.n.

TYPE MATERIAL: **Holotype** (♀) and 4 **paratypes** are labelled: ECU: Galapagos, **Santa Cruz:** Puntudo, 650 m, *Scalesia* forest, 1-29.I.89, FIT-trough, Peck & Sinclair, 89-41. The holotype and 2 paratypes are in the Canadian National Collection of Insects, Ottawa (CNC Type No. 22316). Two paratypes are in the Canadian Museum of Nature, Ottawa.

DESCRIPTION: Length 1.3 - 1.4 mm, 2.6 times longer than wide. Colour black, legs and antennae may be lighter than elytra.

Female: Frons generally convex, may be very weakly impressed above epistoma, with a very faint, shining swelling at upper margin of impression; surface dull, very finely minutely reticulate, with very short, scattered, yellowish setae, those above epistomal margin longer, extending downward to near apex of mandibles. Antennal funicle 4-segmented. Antennal club about 1.6 times longer than wide, sutures transverse, first suture partly septate. Pronotum very slightly wider than long; sides weakly arcuate, anterior margin broadly rounded, armed by 6 large, basally separated serrations; anterior slope with more than 25 small, scattered, distinctly erect asperities and inconspicuous, short, erect, setae; summit distinctly elevated; posterior area minutely reticulate, with short, scattered, erect scales. Elytra 1.65 times longer than wide; sides parallel on basal two-thirds, apex broadly rounded; discal striae not impressed (except first), with small, very shallow, obscure punctures in even rows, each strial puncture with a minute seta; discal interspaces as wide as striae, minutely reticulate, each with a median row of erect scales, each scale narrow, about 5 to 6 times longer than width at apex, each scale in row separated by a distance about equal to length of scale; posterio-lateral area of declivity with fine, confused setae. Declivity convex, sculpture and vestiture essentially as on disc except scales slightly longer.

Male: Not recognized in the material at hand.

Remarks: Adult females of this species are readily recognized by the narrow, almost hairlike, interstrial scales, by the presence of 6 equal-sized serrations on the anterior margin of the declivity, and by the convex frons that may appear faintly transversely impressed above the epistoma.

This species resembles the adults of *H. eruditus* but is larger and has much narrower elytral scales. Adults seem to resemble those of *H. gossypii* (HOPKINS), but that species is only known from the southern United States (Florida), the West Indies (Cuba), and Mexico (Hidalgo) (WOOD & BRIGHT 1992).

Hypothenemus obscurus (FABRICIUS)

H. obscurus (FABRICIUS) 1801: 395 (*Hylesinus*); SCHEDL 1974: 49, 51; WOOD 1977: 71; WOOD 1982: 893; WOOD & BRIGHT 1992: 936.

This species occurs naturally in the American tropics but has been transported throughout the world in seeds and nuts, especially Brazil nuts. In the Galápagos Archipelago, it is recorded only from Santa Cruz (SCHEDL 1974); this record was omitted from the WOOD & BRIGHT catalog

(1992). Its occurrence in the Galápagos Archipelago is probably a result of natural spread.

NEW ISLAND RECORDS: **Española:** Bahia Manzanilla, 5-10.VI.85, S & J Peck, littoral *Cryptocarpus* & *Prosopis*, FIT, malaise (1). **Floreana:** 5 km E Black Beach, ,250 m, 22-28.III.89, trans. z. FIT, Peck & Sinclair 89-145 (1); 8 km E Black Beach, 360 m, 22-28.III.89, *Scalesia* FIT, Peck & Sinclair 89-147 (1); Cerro Pajas, 335 m, 27.III-18.IV.96, forest edge FIT, S. Peck 96-55 (1); Cerro Pajas crater, 18-22.IV.96, 320 m, *Scalesia* forest FIT, S. Peck 96-121 (1). **Genovesa:** Bahia Darwin, 2-20 m, arid zone, bottle trap, 10-25.III.92, Moraima & Peck 92-57 (1). **Isabela:** Sto Tomas, Corazon Verde, agric. zone ex *Inga* pods, 30.IV.96, S. Peck 96-137 (1); Tagus Cove, arid zone, 100 m, 14-22.V.92, FIT, *Bursera* forest, S. Peck 92-185 (1); Villamil, 1 km W, 2-15.III.89, FIT, littoral scrub on sand, 1 m, Peck & Sinclair 89-88 (1); Villamil, 2 km W., 2-15.III.89, brackish meadow, FIT, 2 m, Peck & Sinclair 89-86 (2); Villamil, 4 km NW, 2-15.III.89, arid zone forest FIT, 20 m, Peck & Sinclair 89-89 (3). **San Cristobal:** 4 km E Baquerizo, 150 m, trans. zone, 12-23.II.89, FIT, Peck & Sinclair 89-53 (2); 5 km E Wreck Bay, 14-19.III.96, arid zone, 100 m, FIT, S. Peck 96-15 (3). **Santiago:** Aguacate Camp, 520 m, humid forest, FIT, 7-13.IV.92, S. Peck 92-108 (1); trail to Aguacate, 3-9.VI.91, 300 m, FIT in Guayabillo grove, S. Peck 91-191 (1). **Wolf:** arid z., 11.V.96, 75 m, night beating & uv light, S. Peck 96-172 (1).

This species breeds in a wide variety of fruit pods, seeds, and twigs (WOOD 1977).

Hypothenemus pacificus sp.n.

TYPE MATERIAL: **Holotype** (♀) is labelled: ECU: Galapagos, **Isabela:** Villamil, 1 km W, 2-15.III.89, FIT, littoral scrub on sand, 1 m, Peck & Sinclair, 89-88. **Paratypes:** 3, with the same data; 3, Ecu: Galapagos, **Isabela**, Villamil, 2 km w, 2-15.III.89, brackish meadow, FIT, 2 m, Peck & Sinclair, 89-86. The holotype and 3 paratypes are in the Canadian National Collection of Insects, Ottawa (CNC Type No. 22317); three paratypes are in the Canadian Museum of Nature, Ottawa.

DESCRIPTION: Length 1.1 - 1.2 mm, 2.35 times longer than wide. Colour light to dark yellow-brown, often pronotum, head, and appendages lighter than elytra.

Female: Frons generally convex, may be very weakly impressed above epistoma, with a very faint, longitudinal carina extending from epistoma to about mid-level of eyes; surface shining, very finely minutely reticulate-granulate, with very short, scattered, yellowish setae, those above epistomal margin longer, extending downward to near apex of mandibles. Antennal funicle 4-segmented. Antennal club about 1.8 times longer than wide, sutures transverse, first suture partly septate. Pronotum 1.1 times longer than wide; sides weakly arcuate, anterior margin narrowly rounded, armed by 4 large, widely separated serrations, the median pair separated from each other by a distance equal to 4 or more times the basal width of a serration; anterior slope with more than 25 small, scattered, distinctly erect asperities and inconspicuous, short, erect setae; summit distinctly elevated; posterior area minutely reticulate, with short, scattered, erect scales. Elytra 1.5 times longer than wide; sides parallel on basal two-thirds, apex broadly rounded; discal striae distinctly, but weakly, impressed, with small, shallow punctures in even rows, each strial puncture with a minute seta; discal interspaces narrower than striae, each with a median row of small, erect scales, each scale about 3.0 times longer than width at apex, each scale in row separated by a distance equal to or less than length of scale. Declivity convex, sculpture and vestiture essentially as on disc except scales may be closer together and slightly longer.

Male: Not recognized in the material at hand.

Remarks: Adult females of this species are readily recognized by the 4-segmented antennal funicle, by the presence of 4 widely separated, erect serrations on the anterior margin of the pronotum, by the evenly convex frons, and by the elytral vestiture that consists only of rows of erect scales in each interspace and rows of minute setae in the stria.

Hypothenemus seriatus (EICHHOFF)

H. seriatus (EICHHOFF) 1872: 133 (*Stephanoderes*); WOOD 1977: 72; WOOD 1982: 895; WOOD & BRIGHT 1992: 940.

This species occurs in eastern North America from Delaware and Arkansas to Brazil, the West Indies, Hawaii to Australia, Indonesia, Madagascar, and Africa (WOOD & BRIGHT 1992). It has not been previously recorded from the Galápagos Archipelago. Its occurrence in the Galápagos Archipelago is probably a result of natural spread.

NEW GALAPAGOS RECORD: Floreana: 6 km E. of Black Beach, 380 m, 21-28. III.89, *Scalesia* for., FIT, Peck & Sinclair 89-143 (5).

This species breeds in twigs and small branches of many species of woody plants, but may also occur in seeds, pods, weeds, or other plant material (Wood 1877). WOOD & BRIGHT (1992) list over 57 species of host plants.

Araptus franzi sp.n.

TYPE MATERIAL: **Holotype** (♀), **allotype** and 5 **paratypes** are labelled: ECU: Galap., **Isabela**, Tagus Cove, arid zone, 100 m, 14-22.V.92, FIT, *Bursera* forest, S. Peck 92-39. Additional paratypes are labelled: (2) ECU: Galap., **Isabela**, Tagus Cove, arid zone, 20 m, 13-22.V.92, FIT, valley between craters, S. Peck 92-179; (1) ECU: Galap., **Pinta**, 14-22.III.92, 200 m, trans. zone forest, FIT, (*Bursera, Trema, Zanthoxylon*), S. Peck 92-39; (1) ECU: Galop., **St. Cruz**, CDRS, 1-30.V.91, arid zone, mal. FIT, 40 m, S. & J. Peck 91-110; (1) ECU: Galap., **Fernandina**, 5 km NE Cabo Hammond, 110 m, Cerro Verde trans. forest, 4-11.V.91, flight intercept, S. & J. Peck 91-120. The holotype, allotype and eight paratypes are in the Canadian National Collection of Insects, Ottawa (CNC Type No. 22315); two paratypes are in the Canadian Museum of Nature, Ottawa.

DESCRIPTION: Length 1.5 - 1.7 mm, 2.9 times longer than wide. Color reddish-brown, lateral portions of elytra and elytral declivity usually dark brown.

Female: Frons flattened from epistoma to well above eyes, laterally flattened from eye to eye; surface brightly shining, closely, minutely punctured; periphery of flattened area bordered by a fringe of moderately long, incurved, yellowish setae, remainder of surface with short, erect, very fine setae. Antennal club 1.3 times longer than wide, widest beyond middle; one incomplete, oblique, sclerotized suture visible. Pronotum 1.2 times longer than wide; sides weakly arcuate, anterior margin broadly rounded, with about 8 small serrations; anterior portion moderately declivitous, with numerous, scattered asperities; summit not elevated; surface of posterior area with deep, close punctures except on narrow, median area at base; surface between punctures shining, very finely micropunctate. Elytra 1.8 - 1.9 times longer than wide; sides parallel on basal three-fourths, apex broadly rounded; discal striae punctured in regular, even rows, only first striae weakly impressed, each puncture with a very fine, recumbent seta; discal interspaces about 1.5 times wider than striae, shining, with numerous, fine micropunctures, glabrous except interspace 1 bears 3 - 4 very fine, semi-erect setae, interspace 3, 5, and 7 bear 1 or 2 fine, semierect setae near declivity. Declivity evenly convex, unmodified except interspace 1 weakly elevated, with a median row of extremely fine granules and 3-4 fine, semierect setae, interspaces 3, 5, 7, and 9 bearing 3 - 4 fine, semierect setae; apex of each elytron separately rounded, sutural notch weakly incised.

Male: Frons very weakly convex, almost flattened, with a distinct, fine, weakly elevated, longitudinal carina; surface moderately shining, finely punctate-granulate, without conspicuous setae. Otherwise as in female.

Remarks: This is the only species of this genus, and in fact the only representative of the tribe Corthylini, that so far has been found in the Galápagos Archipelago.

Adults may be recognized by the presence of a dense semicircular brush of setae on the female frons, by the presence of only an incomplete, oblique, sclerotized suture in the antennal club, by the nearly glabrous elytra, and by the weakly elevated, fine, longitudinal carina on the male frons.

Nothing is known of the hosts of this species. Adults were collected in a *Bursera* forest and in a mixed forest of *Bursera*, *Trema*, and *Zanthoxylon*.

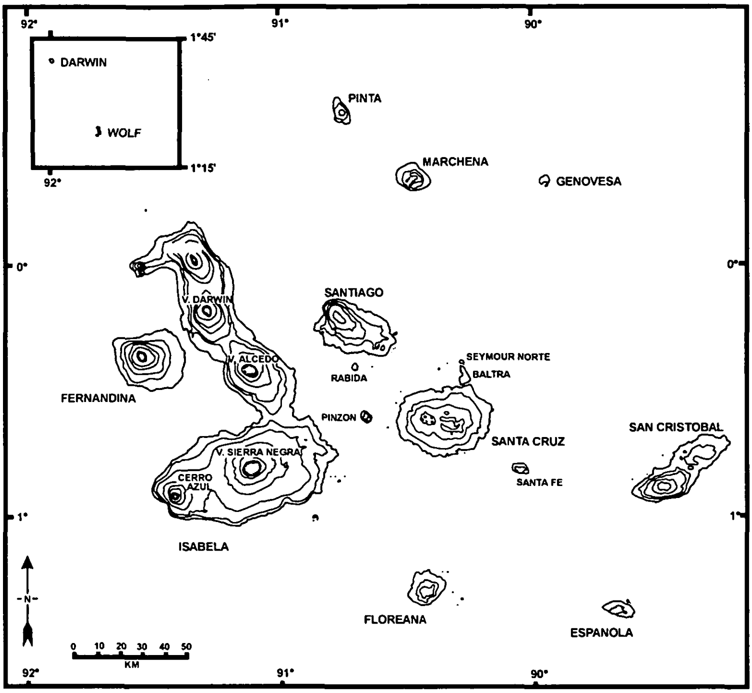

Fig. 1. The Galápagos Archipelago (numbers on contour lines indicate elevation in hundreds of metres).

Discussion

The islands of the Galápagos Archipelago have been considered one of the unique biological regions of the world since the first biological investigations were conducted there by Darwin in 1835. Numerous subsequent investigations into the biogeography of various animal and plant groups in the Galápagos Islands have been published, but little has been done with the insects except for some of the more obvious elements of the fauna. Previous entomological investigation on the Galápagos Archipelago have been summarized by PECK & KUKALOVA-PECK (1990). PECK (1997) provides a more detailed summary of the origin and structure of the insect fauna of the Archipelago. We have categorized the bark beetle species on the Galápagos islands as either introduced, native, or endemic following the definitions of PECK & KUKALOVA-PECK (1990). Introduced species were unintentionally brought to the islands by humans after the islands were discovered in 1535. Native species are those that occur on the Galápagos and also on the continental mainland or on adjacent island groups. The native category may possibly include species that reached the Galápagos through the movement of early humans, or by other natural dispersal means such as rafting or wind transport. These colonizations would have occurred long before the 1535 discovery date of the islands so that the resulting present-day distributions appear to be natural. We realize that the native and introduced category may not be entirely mutually exclusive. Endemic species are those that occur only on the Galápagos.

Of the twenty-four species discussed in this paper, only 5 could be considered endemic, e. g. *Pycnarthrum insularis*, *Pseudothysanoes isolatus*, *Hypothenemus indigenus, H. pacificus*, and *Araptus franzi*. A sixth endemic species may be the unnamed species of *Hylocurus*.

Species	Endemic	Native	Introd.	Bal.	Cri.	Cru.	D+W	Esp.	Fer.	Flo.	Gen.	Isa.	Mar.	Pin.	Rab.	Sey.	S.Fe.	Sgo.
Pagiocerus frontalis			x															
Pycnarthum insulare	x	x		•	•	x		x	•	x	x	x	•			x		
Hylocurus sp. ✚		?	?			•												
Pseudothysanoes isolatus ✚	x	x								•				•				
Coccotrypes carpophagus ★			x		x													
Coccotrypes dactyliperda ✚ ★			x		•	•												
Coccotrypes rhizophorae ★			x			•						x						
Xylosandrus morigerus ★			x			•												
Xyleborinus saxeseni ✚ ★			x			•						•						•
Xyleborus affinis ★		x			•	x				x		•		•				•
Xyleborus ferrugineus ★		x		•	•	x				•		•	•	•		•		•
Xyleborus spinulosus ★			x		•	x				•		•		•				•
Xyleborus volvulus ★		x			•	x				x		x						•
Hypothenemus birmanus ★		x			•	x		x	•	x		•						
Hypothenemus brunneus ★			x		•	x			•	•		•	•	•				
Hypothenemus californicus ✚★			x		•	•		•	•	•		•						
Hypothenemus columbi ★		x			•	x		•			•	•	•					
Hypothenemus crudiae ✚ ★		x			•	•												
Hypothenemus eruditus ★		x				x		x		x		•		•	•	•	•	
Hypothenemus indigenus ✚ ★	x	x				•												
Hypothenemus obscurus ★		x			•		•	•		•	•	•						•
Hypothenemus pacificus ★	x	x										•						
Hypothenemus seriatus ✚ ★		x								•								
Araptus franzi ✚	x	x				•			•			•		•				
Total (24 species)	5	14	9	2	12	18	1	6	5	12	3	15	4	7	1	3	1	6

Table 1: Distribution of Scolytidae in the Galápagos Archipelago. Species marked by a " ✚ " are new for the archipelago, those marked by a " ★ " are wholly or partly inbreeding. Abbreviations for the islands are as follows: Bal, Baltra; Cri, San Cristobal; Cru, Santa Cruz; D+W, Darwin and Wolfe; Esp, Española; Fer, Fernandina; Flo, Floreana; Gen, Genovesa; Isa, Isabela; Mar, Marchena; Pin, Pinta; Rab, Rabida; Sey, Seymore; S Fe, Santa Fe; Sgo, Santiago.
" • " denotes a new island record.

Obvious introductions (post-1535) include *Pagiocerus frontalis, Coccotrypes carpophagus, C. dactyliperda*, *C. rhizophorae*, *Xylosandrus morigerus, Xyleborinus saxeseni, Xyleborus spinulosus*, *Hypothenemus brunneus*, *H. californicus*, and *H. eruditus*.

In addition to the five endemic species, eight additional species are presently widespread (native) throughout the tropical and/or subtropical areas of the world, or are known from throughout the Pacific area, and their occurrence in the Galápagos Archipelago could be a result of natural dispersal or possible introduction by early humans, although there is no compelling evidence of pre-Columbian human visitation. Included in this group are: *Xyleborus affinis*, *X. ferrugineus*, *X. volvulus*, *Hypothenemus birmanus*, *H. columbi*, *H. crudiae*, *H. obscurus*, and *H. seriatus*.

PECK & KUKALOVA-PECK (1990) comment that owing to the harsh environment of the Galápagos littoral and arid zones, the possibility of establishment of an beetle propagule is low if it is a herbivore, except in the rainy season. Bark-beetles certainly fit into the herbivore designation. Also, if the founding bark-beetle is to survive, suitable host plants must be available, and a mate must be found (if it is not already an unmated female). The reason why species of *Coccotrypes, Xyleborus*, *Xyleborinus*, *Xylosandrus*, and *Hypothenemus* are so successful in island situations such as the Galápagos, is that species in these genera are polyphagous and wholly or partly parthenogenetic, or have inbred polygyny as their mating system. Males are dwarfed and flightless; females of these species normally mate with siblings prior to emergence from the brood host. Therefore, in many cases, only one female is needed to establish a population, although, in reality, probably several or more females are required to establish a successful population. It is also of interest to note that most of the native and introduced species are able to feed and reproduce on a great range of host plants. This has undoubtably favored their colonization success.

Inbreeding should be an advantage to colonizing animals, just as self-fertilization seems to be for colonizing plants (KIRKENDALL 1993). Mate-finding among offspring of a founding female for an outbreeding species would be much more difficult, in which both sexes disperse before mating, than in sib-mating (inbreeding) species in which mating occurs before dispersal. It should therefore lead to the conclusion that isolated islands should have a higher proportion of inbreeding species than mainland localities or islands close to pools of potential colonizers (KIRKENDALL 1993).

KIRKENDALL (1993) presents an extensive list analysing the biogeography of the Scolytidae for numerous regions of the world. He indicates that, for the Hawaiian Islands, there are 33 species of Xyleborini, but only two species of Platypodidae, and that from of a total of 56 Hawaiian bark and ambrosia beetles, 52 (93 %) are inbreeding species. The present study showed that on the Galápagos, from a total of 25 species, 20 (or 80 %) are inbreeding. In KIRKENDALL'S (1993) list, the percentage of inbreeding species on various isolated islands ranges from 56 % to 93 %, with an average of about 70 %. For comparison, the percentage of inbreeding species on various continental or large island landmasses are: Japan- 313 species, 34 % inbreeding; Europe- 156 species, 7 % inbreeding; Philippine Islands- 355 species, 50 % inbreeding; Australia- 172 species, 36 % inbreeding; New Zealand- 20 species, 25 % inbreeding; and North and Central America- 1441 species, 12 % inbreeding.

The very low percentage of endemic species is difficult to explain. The islands are old enough (about 3 million years old) that founding species should have had sufficient time to evolve into endemic species. PECK (1997) comments that much of the Galápagos insect fauna is composed of endemic species, from 1/3 to 2/3 of the fauna depending on the order. In those cases colonization evidently occurred far enough in the past that differentiation through geographic and genetic isolation has occurred. Since less than 1/4 of the bark beetle species can be considered endemic, it appears, at least with the Scolytidae, that early colonization was more difficult than it was for species of other families. DARLINGTON (1957) remarks that if species cross great widths of ocean naturally, they should have been doing so for millions of years, and distinct endemic forms, including endemic genera as well as species, ought to occur on remote islands. If transported by man (or recent natural spread), they would have been on remote islands only a few thousand years, and their level of endemism on the islands should be low.

Lastly, although we now know the bark beetle fauna to be richer than previously thought, still little is known of the host plants and bionomics of the species in the Galápagos Archipelago.

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