

Termites of the Genus *Cryptotermes* Banks (Isoptera: Kalotermitidae) from the West Indies

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Abstract: A taxonomic revision of the genus *Cryptotermes* occurring in the West Indies is given based on recent collections from the Greater Antilles, Lesser Antilles, and the Bahamas. Seventeen indigenous and four non-indigenous species are described from external morphology of the soldier. The imago caste is also described for all but one species. The indigenous *Cryptotermes* comprise twelve new species, including *C. aequicornis*, *C. cryptognathus*, *C. cylindroceps*, *C. cymatofrons*, *C. darlingtonae*, *C. juliani*, *C. mangoldi*, *C. nitens*, *C. parvifrons*, *C. rotundiceps*, *C. spathifrons*, and *C. undulans*. Five indigenous species are redescribed, including *C. cavifrons* Banks, *C. chasei* Scheffrahn, *C. hemicyclius* Bacchus, *C. pyrodomus* Bacchus, and *C. rhicnocephalus* Bacchus. The imagos of *C. pyrodomus* and *C. rhicnocephalus* are described for the first time. The four non-indigenous species are redescribed including *C. brevis* (Walker), *C. domesticus* (Haviland), *C. dudleyi* Banks, and *C. havilandi* (Sjöstedt). A report of *C. domesticus* in the West Indies could not be confirmed. Distribution maps and a soldier identification key are included for all *Cryptotermes* in the West Indies and Florida.

Key Words: Insecta, drywood termites, taxonomy, identification, distribution, Neotropics, Greater Antilles, Lesser Antilles, Bahamas.

Introduction

Cryptotermes Banks (1906) is the third largest genus in the Family Kalotermitidae after *Neotermes* and *Glyptotermes* (Krishna 1961). *Cryptotermes* spp. occur in all zoogeographic regions, and a number are important pests of wood products. Snyder (1949) listed 26 *Cryptotermes* species worldwide. In his revision of the Kalotermitidae, Krishna (1961) recognized only 23 *Cryptotermes* species. Bacchus (1987) conducted a global revision of *Cryptotermes* following the Oriental and Australian revisions of the genus by Chhotani (1970) and Gay and Watson (1982), respectively. Bacchus (1987) recognized 47 species worldwide.

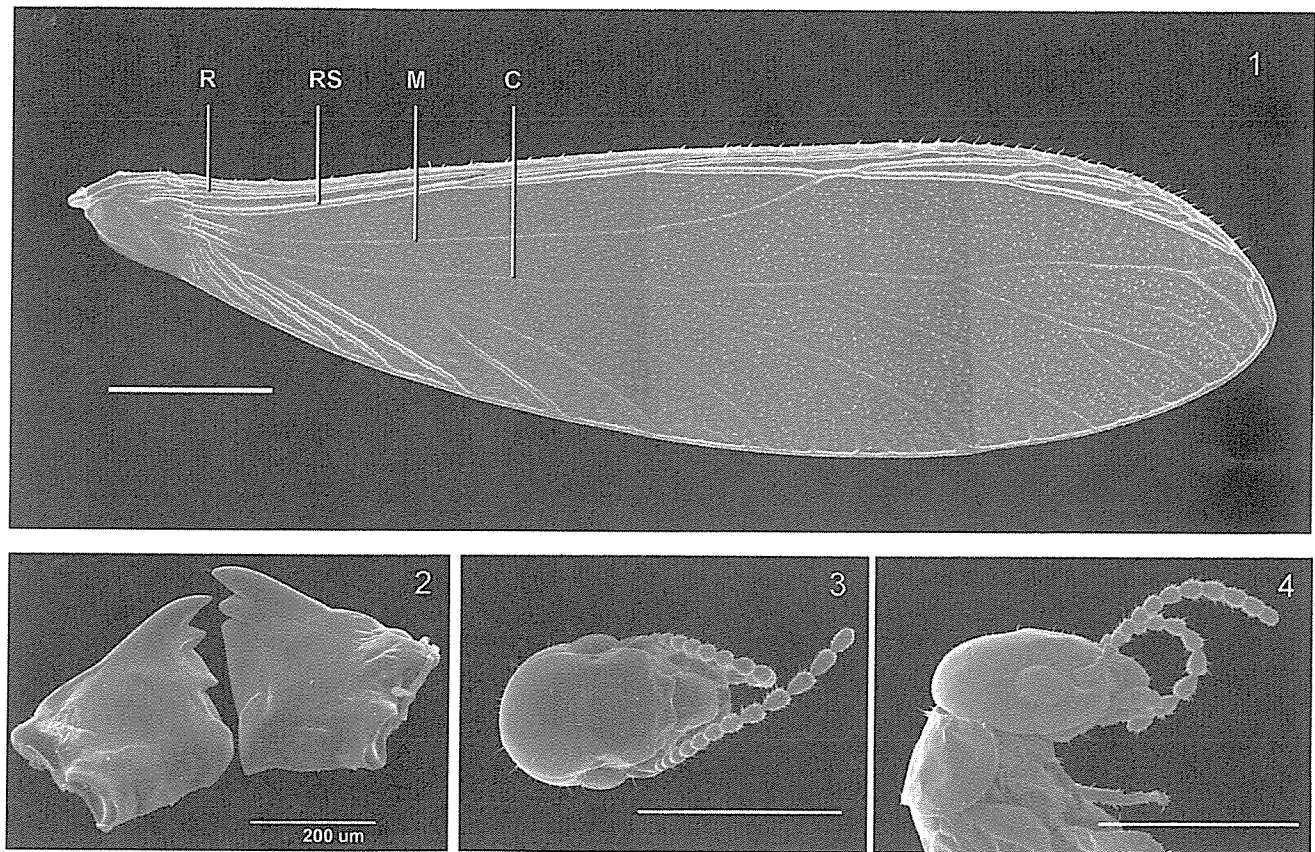
The first *Cryptotermes* species described from the West Indies was *C. brevis* (Walker 1853) from Jamaica. Adamson (1940) collected *C. dudleyi* Banks in Trinidad along with *C. brevis* and two undescribed *Cryptotermes* species. Snyder (1956) reported *Cryptotermes havilandi* (Sjöstedt) from Barbados and *C. cavifrons* Banks from New Providence (Bahamas), Cuba, and several other islands. Araujo (1970, 1977)

reported *C. domesticus* (Haviland) from Trinidad. Bacchus (1987) described 3 new species, *C. hemicyclius*, *C. pyrodomus*, and *C. rhicnocephalus*, from Jamaica, Barbados, and Trinidad, respectively. Most recently, Scheffrahn (1993) described *C. chasei* from Hispaniola and Scheffrahn et al. (1994) listed *C. longicollis* Banks from Hispaniola. After further examination, it was determined that a new species, not *C. longicollis*, had been collected.

We herein describe or redescribe all *Cryptotermes* species now known from the West Indies including 12 new indigenous species, 5 known indigenous species, and 4 non-indigenous species.

Materials and Methods

The source of material for this study includes about 800 *Cryptotermes* nest series (samples) from three survey collections. The first consists of over 8,000 termite samples collected during 1990-1998 from most of the larger land areas of the West Indies with the exception of Cuba and Haiti. The second is a



Figures 1-4. Right fore wing (1) of *Cryptotermes cavifrons* (BA289, Bahamas, N Andros Is, 3 km SE Coakley Town) with radius (R), radial sector (RS), media (M), and cubitus (C) veins labeled; scale bar = 1 mm. Imago mandibles (2) of *C. cavifrons* (BA289). Imago head of *C. mangoldi* (DR0936, Dominican Republic, Janico Arriba) in dorsal (3) and lateral (4) views; unmarked scale bars = 1 mm.

collection of termites from Florida begun in 1985 containing about 1300 samples, including over 700 taken from structures by Scheffrahn et al. (1988). The third collection numbers about 800 samples from Cuba collected between 1964-1975. The absence of collections from Haiti is, at least in part, reconciled by the 1600 samples taken from the Dominican Republic. All collections are in the custody of the authors. The following names of collectors are abbreviated in the text as follows: Paul Ban (PB), James A. Chase (JC), Johanna P.E.C. Darlington (JD), Jan Krecek (JK), Boudanath Maharajh (BM), John R. Mangold (JM), Yves Roisin (YR), Julian de la Rosa (JR), and Rudolf H. Scheffrahn (RS).

Latitude and longitude coordinates of collection localities before 1996 were measured from various surface maps or ESRI Digital Map of the World version 1.0 (Environmental Systems Research Institute, Inc. Redlands, CA). Beginning in 1996, coordinates were recorded at collection sites using a Magellan GPS model 2000 (Magellan Systems Corp, San

Dimas, California) or Garmin GPS model 12 or model 38 (Garmin International, Olathe, Kansas) hand-held global positioning receivers. Coordinates of collection sites were converted to decimal degrees and mapped using ArcView GIS version 3.0a software (Environmental Systems Research Institute, Inc. Redlands, CA) and relevant map data from Digital Map of the World version 1.0.

The morphometrics of specimens preserved in 85:15 (ethanol:water) were measured with stereomicroscopes fitted with calibrated ocular micrometers. Scanning electron micrographs (SEMs) were taken with a Hitachi S530 instrument at 20kV of specimens that were dehydrated in absolute ethanol and 1,1,1,3,3,3-hexamethyldisilazane (Nation 1983) and then sputter-coated with gold or platinum. Some soldier specimens that were coated with buccal exudate or other debris were sonicated in acetone before dehydration. Scanning electron micrographic prints were scanned at 600 dpi, the digital images were cropped to uniform size, detail contrasted with the

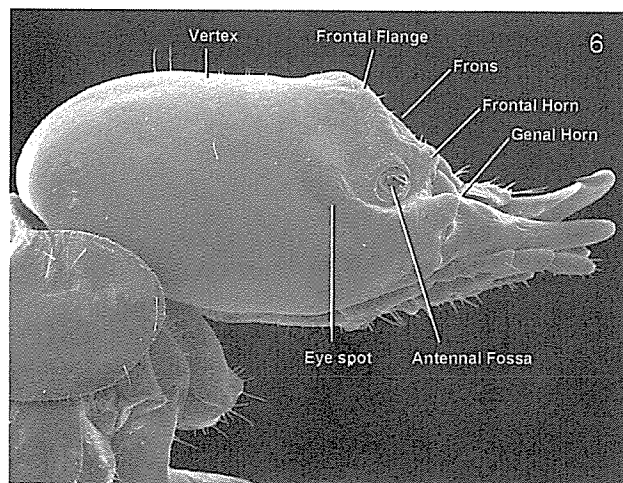
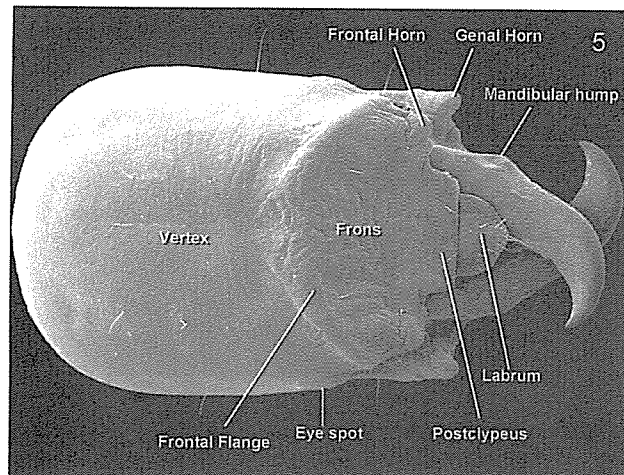
unsharp mask tool, and the subject outlined using photograph-enhancing software (Photo Magic, Micrografix, Inc., Richardson, TX). Subject backgrounds were converted to black, and scale bars digitally redrawn. Soldier antennae were removed from SEM specimens and palps were digitally deleted from dorsal views for clarity.

Measurements and nomenclature were mainly adopted from those of Krishna (1961), Gay & Watson (1982), and Bacchus (1987). Terms for color follow those of Sands (1965). Several structures are particularly useful in describing the phragmotic head capsule of *Cryptotermes* soldiers. These include the frontal flange or ridge which divides the vertex from the frons; and two pairs of protuberances: one dorsal pair in front of the antennal fossae, and one ventral pair projecting forward from the genae. These are called the frontal and genal horns, respectively (Gay & Watson 1982). Formulae are given for relative lengths of antennal articles 2-5. For example, the formula $2 > 3 = 4 = 5$ indicates that the second article is longer than the third and the third through fifth are subequal. The blade is the rather flattened portion of the mandible distal to the basal hump, angle, or similar enlargements.

The holotype soldiers and morphotype imagos will be deposited in the collection of the American Museum of Natural History, New York, New York. Paratype soldiers and imagos will be deposited in the National Museum of Natural History (Smithsonian), Washington, D.C.; the Florida State Collection of Arthropods, Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville, Florida; and in the authors' collections at the University of Florida Research and Education Center, Ft. Lauderdale, Florida.

Diagnosis of *Cryptotermes* Banks

Banks' (1906) original generic description of *Cryptotermes* has been subjected to dozens of taxonomic revisions (Krishna 1961). Krishna's (1961) revisionary diagnosis of *Cryptotermes* added several species that were previously assigned to *Procryptotermes* Holmgren by Snyder (1949) and others. Gay and Watson (1982) accepted Krishna's (1961) diagnosis for their treatise on Australian *Cryptotermes*. Krishna's (1961) version was expanded by Bacchus (1987) to accommodate twice the number of species known to Krishna (1961). Below are slightly revised versions of the imago and soldier diagnoses as presented by Bacchus (1987) with italicized modifications to accommodate the new West Indian species described herein.



Figures 5-6. Soldier head structures of *Cryptotermes chasei* (DR1425, Dominican Republic, La Altagracia Province, 0.5 km W Club Mediterraneo) in dorsal (5) and lateral (6) views.

Genus *Cryptotermes* Banks

Type species: *Cryptotermes cavifrons* Banks, 1906: 336.

Description. Imago. Head capsule pale yellow to dark yellowish-brown, reddish-brown, brown to dark brown, sparsely to moderately hairy; posterior margin evenly rounded from behind or from a point away from the eyes. *Chevron pattern on fore wing scales very distinct to absent in contrast to underlying mesonotum.* Epicranial sutures generally present, *but often vestigial.* Eyes small, round, nearly round, or oval. Ocelli suboval to oval, or round, touching eye or near to eye. Antennae with 12-19 articles. Clypeus subtrapezoidal; anterior margin straight, convex, or concave. Labrum *as broad* or broader than long. Left mandible with first plus second marginal tooth half as

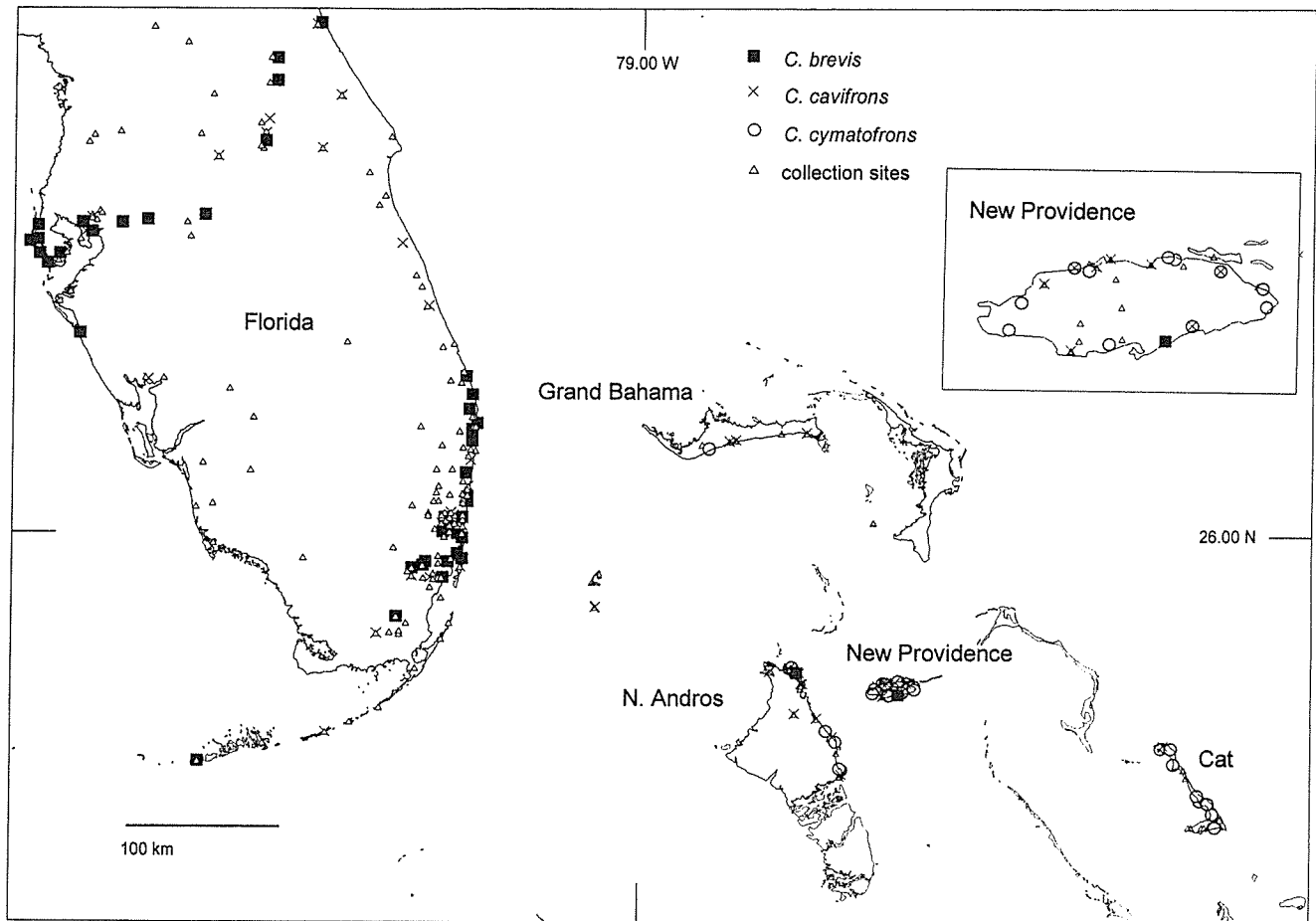


Figure 7. *Cryptotermes* distribution on the northern and central Bahamas and peninsular Florida.

wide at base as third marginal tooth; anterior margin of third marginal tooth twice as long as posterior margin of first plus second marginal tooth. Right mandible with posterior margin of second marginal tooth distinctly longer (1.5X) than molar plate. Pronotum narrower, as wide as, or slightly wider than head width at eyes. Legs with three apical spurs on each tibia; tarsi four-jointed. Arolia present in vast majority of species. Fore wing with all major veins arising independently at wing suture; radius simple; radial sector with 3-9 anterior branches; media weak and unsclerotised, running midway between radial sector and cubitus in proximal half of wing, near middle or beyond middle of wing to meet radial sector.

Soldier. Head capsule generally dark brown, almost black in front *grading posteriorly to chestnut brown, orange brown, or orange-yellow*; phragmotic, short, thick, and in some species *rugose* in the region of frons, vertex, and sides. Head capsule with no or weak lateral constriction near eyes. *Frontal plane*

sloping 30-90° from plane of vertex, or in a few species, forming a frontal peak with frontal plane overhanging to slope >90° from plane of vertex; usually with a broad or narrow frontal ridge (flange) between frons and vertex; with or without a median notch. Two pairs of prominent horn-like projections; one in the lateral margin of the postclypeus in front of antennal fossae (frontal horns), the other formed by an anterior prolongation of the ventral genae, in front of and below the antennal fossae (genal horns); weakly developed in some species. Frons generally concave or flat; may be adorned with ridges or convexity. Vertex behind frontal flange usually depressed medially. Eyes usually distinct, unpigmented. Antennae with 10-16 articles, third article not especially long. Clypeus subtrapezoidal. Labrum subtriangular or tongue-shaped. Mandibles extremely short to long, weakly to strongly shouldered externally in the middle, about middle or basal third, straight or curved inwards from middle to tip of point, weakly to strongly

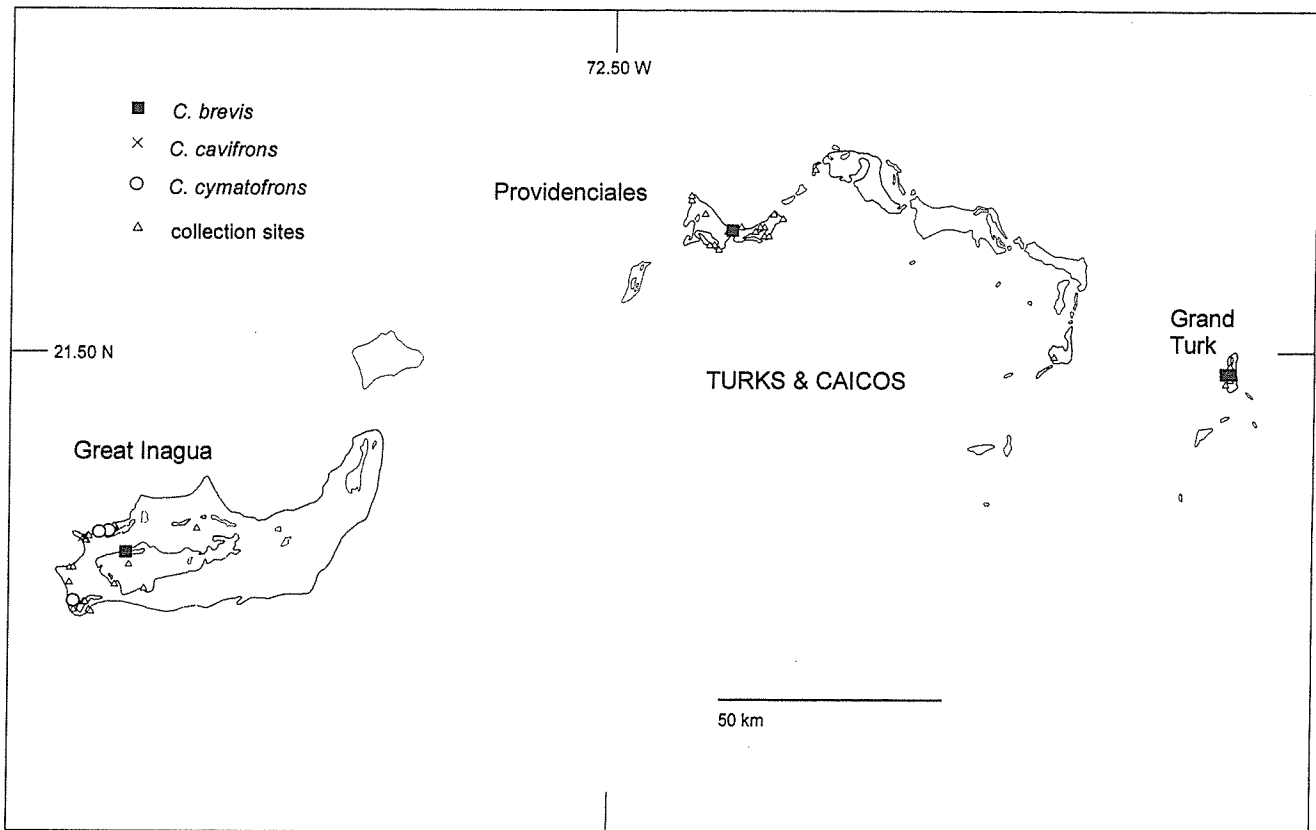


Figure 8. *Cryptotermes* distribution on Great Inagua, Bahamas, and Turks and Caicos Islands.

toothed. Postmentum broad posteriorly. Pronotum either slightly narrower, wider, or as wide as head; anterior margin strongly concave, usually irregularly sinuous or serrated; sides and hind margin rounded. Legs short, *not inflated*; apical tibial spurs 3:3:3; tarsi four-jointed; cerci two-jointed.

Key to Soldiers of *Cryptotermes* Banks of the West Indies

The morphological characters of *Cryptotermes* imagos (Figs. 1-4) are rather conservative and specific differences are weighted heavily on overlapping characters of form, size, and coloration. This makes species identification keys for imagos difficult to use and unreliable. Additionally, primary reproductives may be difficult to locate and extract from a colony and winged imagos may not be present at all times of the year.

Cryptotermes soldiers can readily be taken from colonies throughout the year. Because of the richness of soldier characters, especially structures associated with the frons and mandibles, soldiers are well suited

for species identification. Figures 5 and 6 depict important structures referred to in the key.

1. Mandibles conspicuous, variable in size and shape, but projecting prominently beyond frontogenal boundaries of head capsule in dorsal view; mandible points not covered by labrum; size and shape of head capsule highly variable (Figs. 19, 22, 25, 28, 34, 37, 40, 43, 46, 49, 52, 55, 58, 61, 64, 67, 70, 73, 76, 79) 2
- 1'. Mandibles inconspicuous in dorsal view, retracted within frontogenal boundaries; mandible points covered by labrum (Figs. 31-33) *C. cryptognathus* n. sp.
2. Genal horns prominent or at least tips visible from above; if only tips visible in dorsal view, then they form acute anterolateral protuberances of the head capsule boundary (Figs. 28, 43, 46, 49, 52, 76) 3
- 2'. Genal horns not prominent or only tips visible from above; if only tips visible in dorsal view, then they do not form acute anterolateral protuberances of the head capsule boundary; anterolateral limits formed by lateral processes of the frontal flange

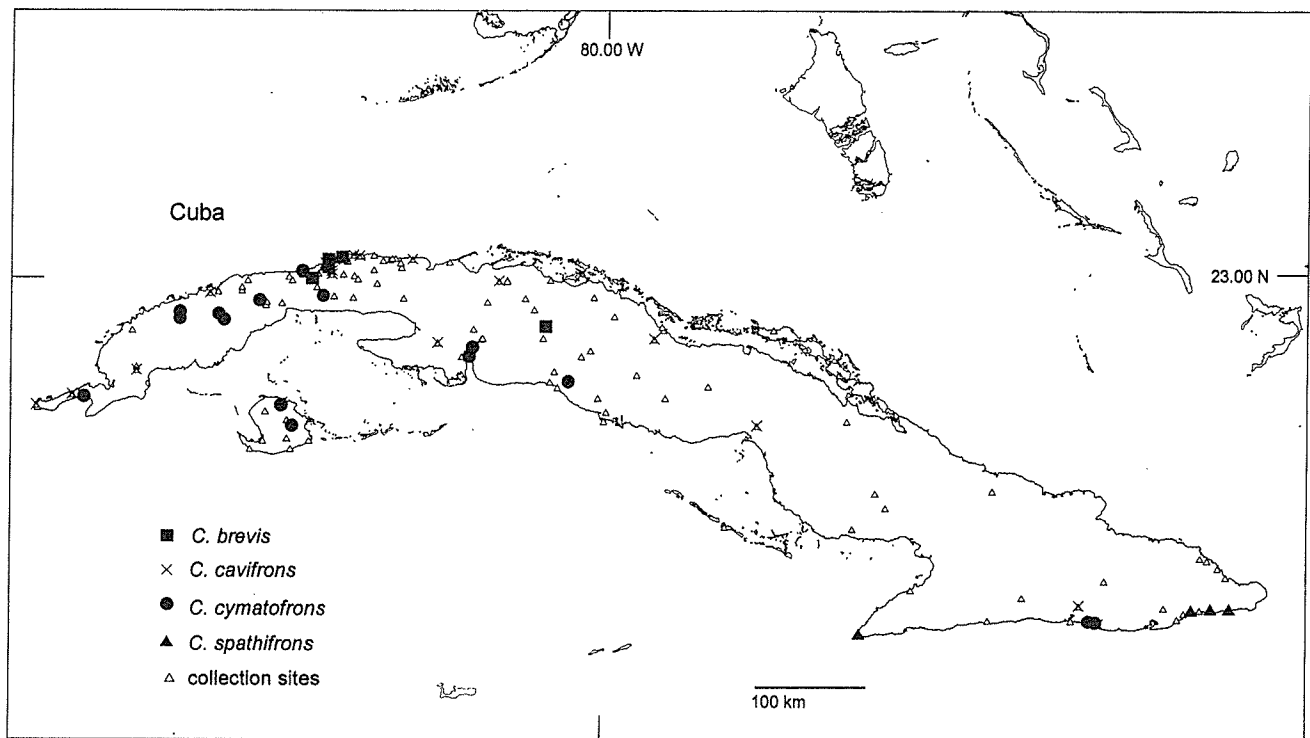


Figure 9. *Cryptotermes* distribution in Cuba.

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| <p>or by the frontal horns (Figs. 19, 22, 25, 37, 34, 40, 55, 58, 61, 64, 67, 70, 73, 79) 8</p> <p>3. Head, from above, subquadrate (length with mandibles/maximum width ca. 1.3-1.4); frons nearly perpendicular to vertex; head surface smooth and mandibles short, angulate, and not hooked at tips (Figs. 43-44, 49-50) 4</p> <p>3'. Head, from above, elongate (length/width ratio ≥ 1.6), frons sloping from vertex at much less than 90° making frons visible from above; head somewhat rugose and mandibles long, blade-like, and hooked at tips (Figs. 28-29, 46-47, 52-53, 76-77) 5</p> <p>4. Frontal flange convex, forming characteristic frontal peak and obscuring view of frons from above; head capsule surface dull (Figs. 43-45) <i>C. domesticus</i></p> <p>4'. Frontal flange concave, brow-like, not obscuring dorsal view of frons; head capsule glossy (Figs. 48-50) <i>C. havilandi</i></p> <p>5. Mandibles with basal inflations forming robust shelf-like humps (Figs. 52, 76) 6</p> <p>5'. Mandibles without basal inflations, humps weak, not shelf-like (Figs. 28, 46) 7</p> | <p>6. Frontal flange semicircular from above, frons occupying anterior 1/3 of head capsule (Figs. 52-54) <i>C. hemicyclius</i></p> <p>6'. Frontal flange semihexagonal from above, frons occupying anterior 1/2 of head capsule (Figs. 76-78) <i>C. spathifrons</i> n. sp.</p> <p>7. Frontal flange elevated, narrow, with median notch; mandibles narrow (Figs. 46-48) <i>C. dudleyi</i></p> <p>7. Frontal flange shallow, broad, without median notch; mandibles broad (Figs. 28-30) <i>C. chasei</i></p> <p>8. Head capsule coarsely rugose; vertex deeply concave (Figs. 19-24, 40-42, 67-69) 9</p> <p>8'. Head capsule rugosity weaker or absent, vertex flat or shallowly concave (Figs. 25-27, 37-39, 34-36, 55-66, 73-75, 79-81) 11</p> <p>9. Head capsule not obviously constricted laterally in dorsal view, posterior not bulbous; frons, in frontal view, ovoid; (Figs. 19, 40, 67) 10</p> <p>9'. Head capsule constricted laterally in dorsal view near anterior 1/3, posterior bulbous; frons, in frontal view, much wider than high; (Figs. 22-24) <i>C. brevis</i></p> <p>10. Frontal horns, in lateral view, about 3 times larger than genal horns; genal horns projecting forward</p> |
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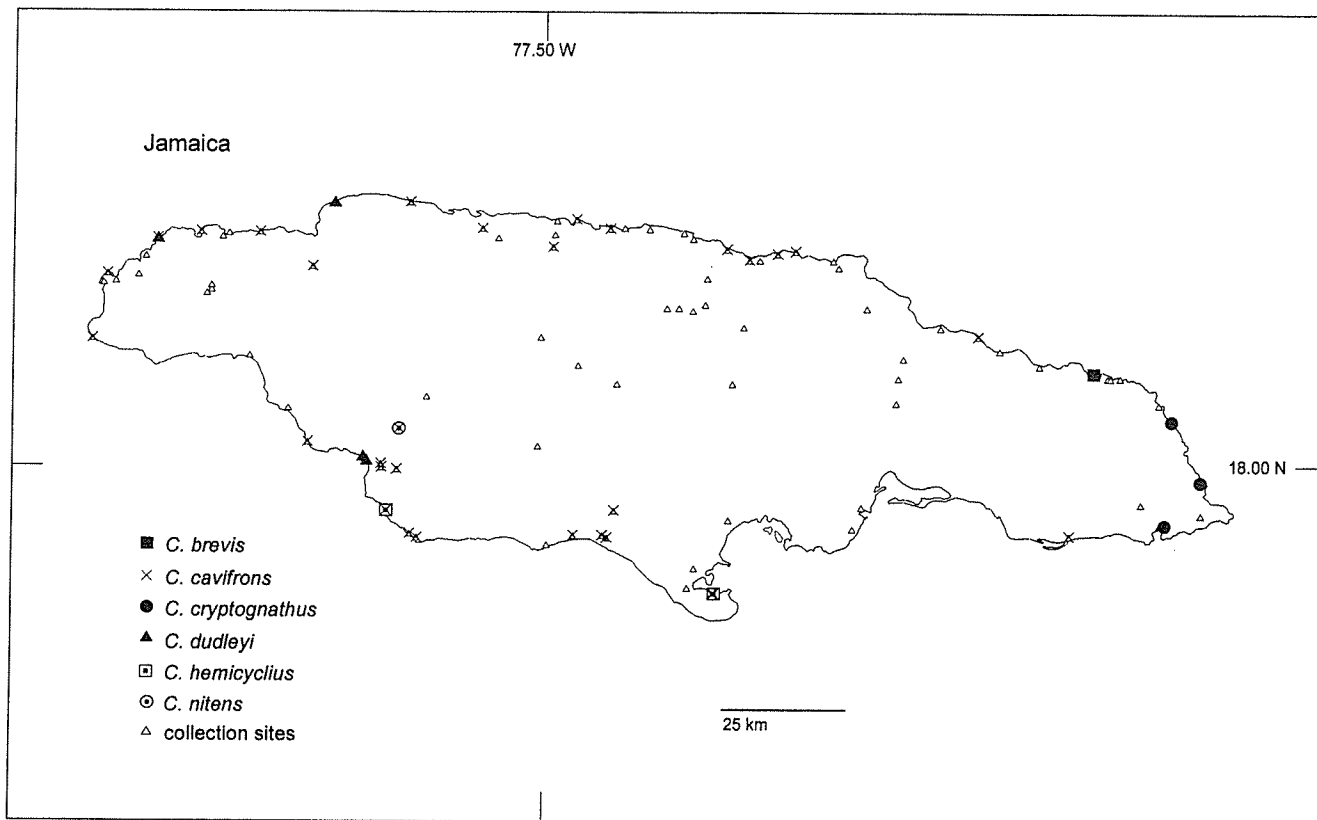


Figure 10. *Cryptotermes* distribution in Jamaica.

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| <p>and only slightly recessed behind frontal horns, left mandible 0.68-0.75 mm long (Figs. 40-42) <i>C. darlingtonae</i> n. sp.</p> <p>10'. Frontal horns, in lateral view, about 5 times larger than genal horns; genal horns projecting more dorsally and greatly recessed behind frontal horns, left mandible 0.63-0.72 mm long (Figs. 67-69) <i>C. pyrodomus</i></p> <p>10''. Frontal horns, in lateral view, subequal; smaller species, left mandible 0.56-0.62 mm long (Figs. 19-21) <i>C. aequacornis</i> n. sp.</p> <p>11. Head capsule rugosity cerebraform; flange not elevated (Figs. 34-36, 70-72) 12</p> <p>11'. Head capsule rugosity slightly sinuous or near absent, frontal flange more or less elevated (Figs. 25-27, 37-39, 55-66, 73-75, 79-81) 13</p> <p>12. Head capsule cylindrical; frons smooth, glossy; mandibles very short (left ≤ 0.60 mm) and angular, tip of left mandible barely overlapping right when closed (Figs. 34-36) <i>C. cylindroceps</i> n. sp.</p> <p>12'. Head capsule constricted in anterior 1/3, vertex concave; frons dull and rugose; mandibles longer (left ≥ 0.64 mm) and curved, tip of left mandible greatly overlapping right when closed (Figs. 70-72) <i>C. rhinocephalus</i></p> | <p>13. Mandible blades, from basal hump or angle to point, forming major visible portion of mandibles; mandibles in closed position with points reaching or extending beyond lateral margins of labrum; frontal flange, in lateral view, not curving broadly around antennal fossae; frontal horns variable but not as below; head width 1.01-1.32 mm (Figs. 25-27, 37-39, 55-66, 78-81) 14</p> <p>13'. Mandible blades, from basal hump to point, forming minor portion of mandibles; mandibles in closed position with points not extending beyond lateral margins of labrum; frontal flange, in lateral view, turning in as a broad, sweeping 90° curve to antennal fossae; frontal horns large and rounded, diverging laterally; larger species but variable is size, head width 1.19-1.42 mm (Figs. 73-75) <i>C. rotundiceps</i> n. sp.</p> <p>14. Frontal horns, in dorsal view, forming finger, thumb, or knob-like protuberances; mandibles, in dorsal view, with gradually narrowing and slender points; head width 1.01-1.26 mm, left mandible length ≤ 0.78 mm (Figs. 25, 37, 58, 61, 64, 79) 15</p> <p>14'. Frontal horns, in dorsal view, short, forming right triangles with median sides sloped twice as long as lateral sides to give impression of acute lateral divergence; mandibles, in dorsal view, massive and broad, narrowing abruptly to points;</p> |
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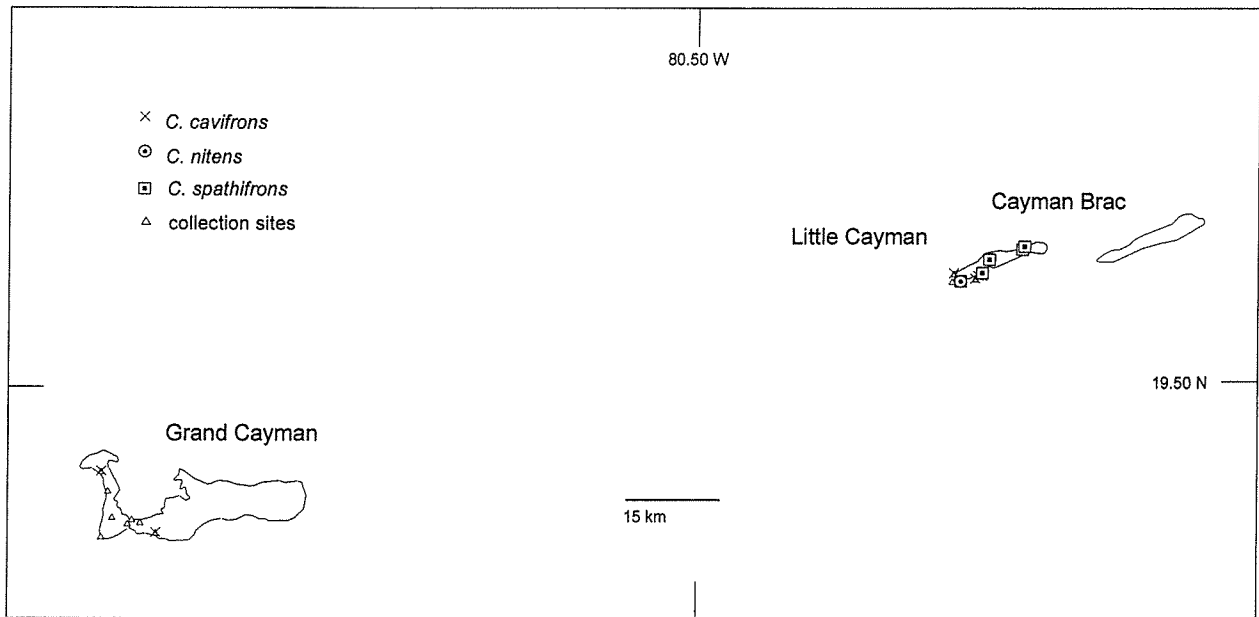


Figure 11. *Cryptotermes* distribution on the Cayman Islands.

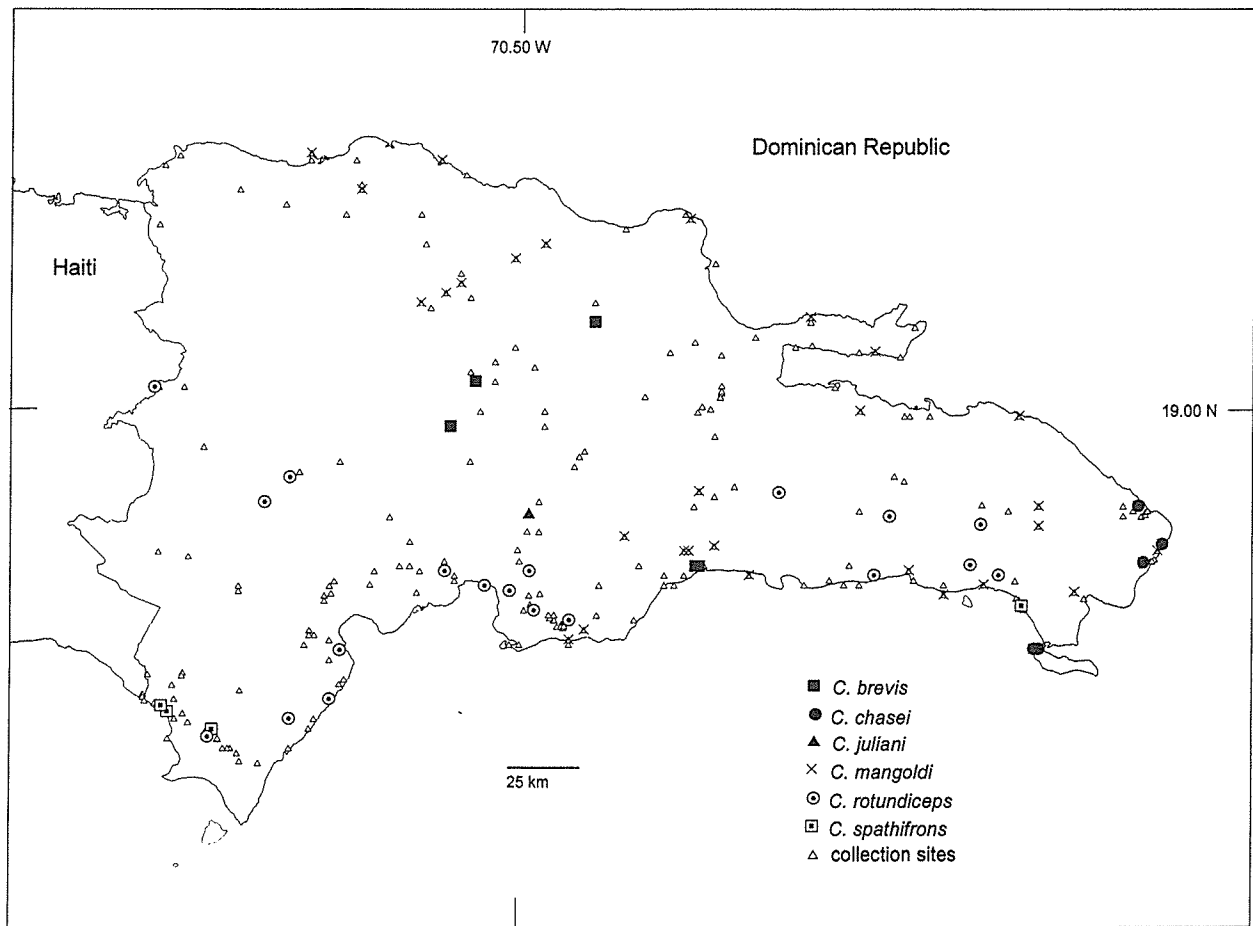


Figure 12. *Cryptotermes* distribution in the Dominican Republic.

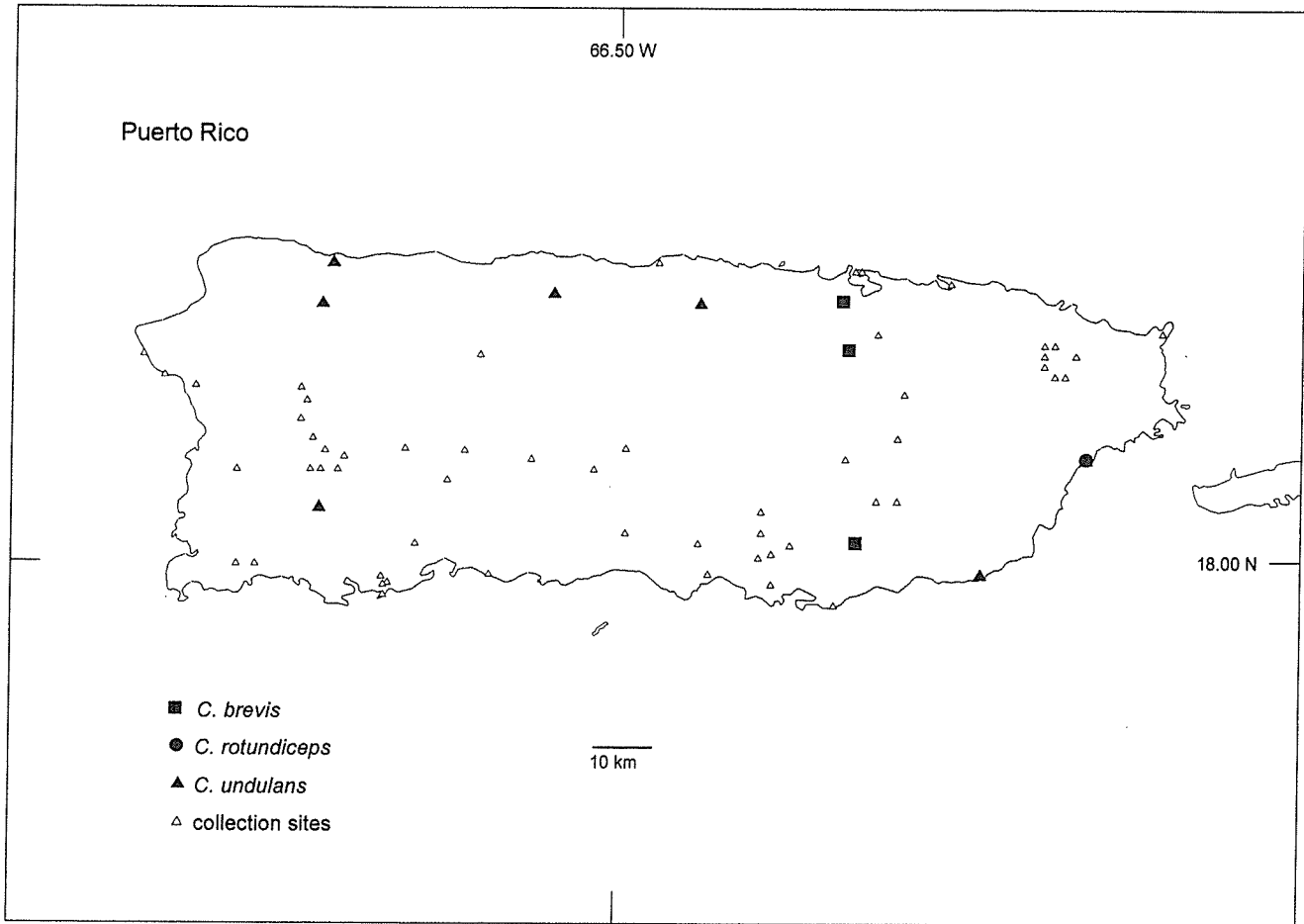


Figure 13. *Cryptotermes* distribution in Puerto Rico.

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| <p>larger species, head width ≥ 1.26 mm, left mandible length ≥ 0.78 mm (Figs. 55-57) <i>C. juliani</i> n. sp.</p> <p>15. Frontal horns, in dorsal view, consist of finger or thumb-like projections independent of the frontal flange (Figs. 25, 37, 61, 64, 79) 16</p> <p>15'. Frontal horns, in dorsal view, consist of knob-like extensions of the lateral termini of the frontal flange (Figs. 58-60) <i>C. mangoldi</i> n. sp.</p> <p>16. Frontal horns, in dorsal view, divergent, projecting to sides; head capsule smooth or very faintly rugose (Figs. 37-39, 61-63) 17</p> <p>16". Frontal horns, in dorsal view, parallel, projecting forward; head capsule rugosity variable but present (Figs. 25-27, 64-66, 79-81) 18</p> <p>17. Frons concave; frontal flange, in lateral view, abruptly elevated and cresting over vertex; frontal flange, in dorsal view, incised or concave; mandibles shorter, left mandible length 0.69-0.74 mm (Figs. 37-39) <i>C. cymatofrons</i> n. sp.</p> | <p>17'. Frons flat, not recessed; frontal flange, in lateral view, elevated but not cresting vertex; frontal flange, in dorsal view, nearly linear; mandibles longer, left mandible length 0.74-0.78 mm (Figs. 61-63) <i>C. nitens</i> n. sp.</p> <p>18. Median notch in frontal flange demarcated by criss-crossed furrows giving a "zippered" appearance; mandible blades broad and short, left mandible length 0.49-0.62 mm (Figs. 64-66) <i>C. parvifrons</i> n. sp.</p> <p>18'. Median notch in frontal flange not as above; mandibles narrow and longer, left mandible length 0.67-0.77 mm (Figs. 25-27, 76, 78) 19</p> <p>19. Vertex smooth, head capsule with weak rugosity behind frontal flange only; frontal horns, in dorsal view, narrow (Figs. 25-27) <i>C. cavifrons</i></p> <p>19'. Vertex and anterior head capsule covered with sinuous rugosity; frontal horns, in dorsal view, stout (Figs. 76-78) <i>C. undulans</i> n. sp.</p> |
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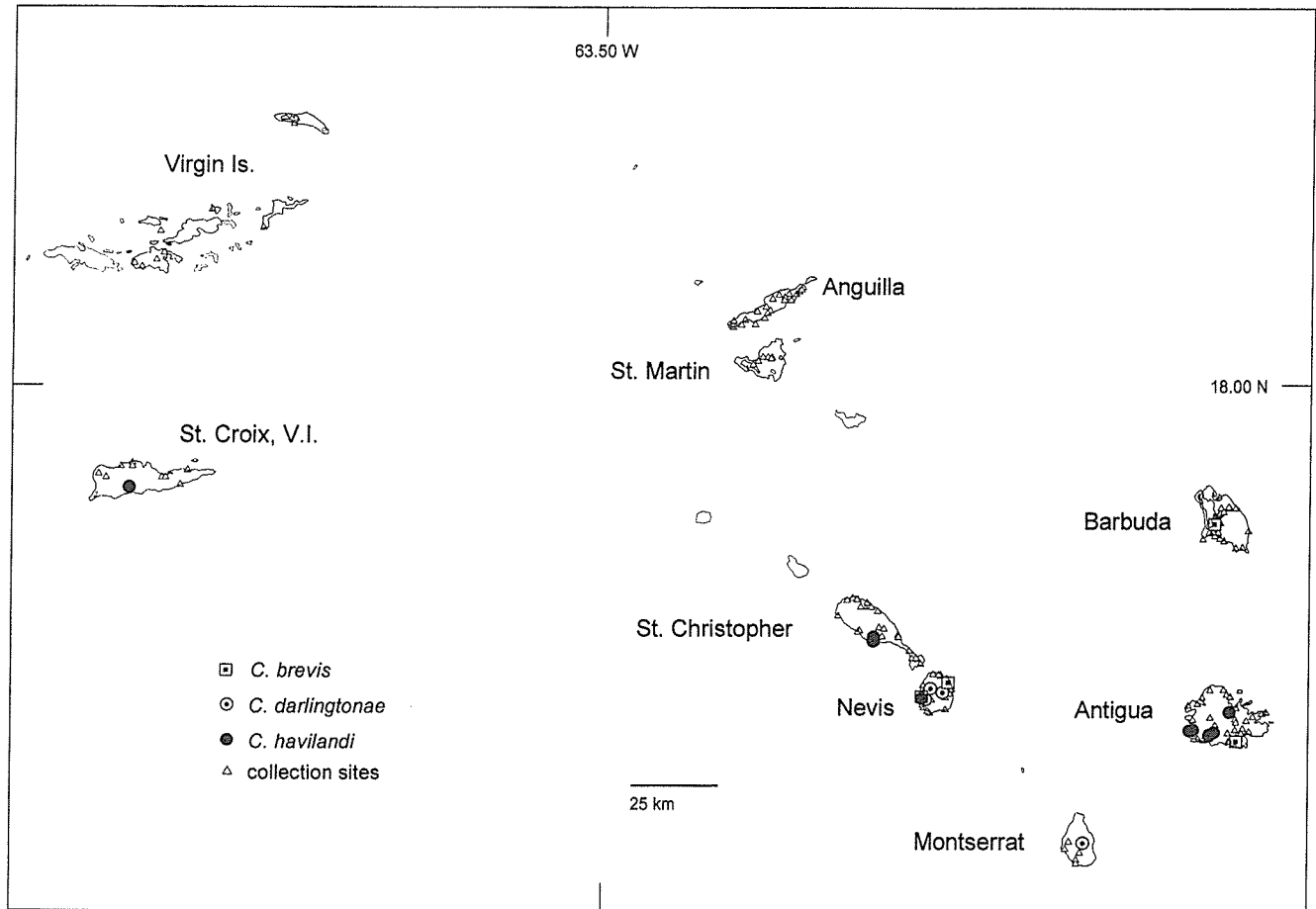


Figure 14. *Cryptotermes* distribution on the Virgin Islands and northern Lesser Antilles.

Geographical Distribution

Records of *Cryptotermes* species from islands of the West Indies are given in Table 1 and distribution maps (Figs. 7-18) indicate regional collection localities of *Cryptotermes* species based on our data. Jamaica (Fig. 10) and Hispaniola (Fig. 12) both support the greatest diversity of *Cryptotermes* with 6 species each, however, Hispaniola has five indigenous species compared with four from Jamaica. Trinidad (Fig. 17) has 6 known species (3 indigenous), Cuba (Fig. 9) has 4 (3 indigenous), and Puerto Rico (Fig. 13) has 3 (2 indigenous). Interestingly, Little Cayman Island (Fig. 11) supports the same number of indigenous species as Cuba, although portions of central and eastern Cuba have not been intensively collected. The Bahamas archipelago (Figs. 7-8) supports two indigenous species, *C. cavifrons* and *C. cymatofrons*, with the former also occurring across the Florida peninsula. On the central and southern Lesser Antilles north of Tobago (Figs. 15-16), *C. darlingtonae* and *C. pyro-*

domus are the only known indigenous species. No indigenous *Cryptotermes* species have been collected from the Virgin Islands west to Antigua with the exception of *C. darlingtonae* from Nevis (Fig. 14) and *C. cavifrons* from St. Croix (Snyder 1956) the latter being a very doubtful record. Aruba, Bonaire, and Curaçao (Fig. 18) support a single indigenous species, *C. cylindroceps*, which, like the species of Trinidad and Tobago, may also occur on the nearby Venezuelan mainland.

Although little is known about the economic importance of the indigenous species, the four non-indigenous *Cryptotermes* reported from the West Indies are all widely distributed pests of dry structural lumber. Although the origin of *C. brevis* remains obscure (Scheffrahn et al. 1998), the introduction and spread of all non-indigenous species can be associated with the movement of wood products and maritime commerce, possibly dating back to the early slave trade. *Cryptotermes dudleyi* has its likely origins in the Indomalayan Region, while *C. havilandi* is native

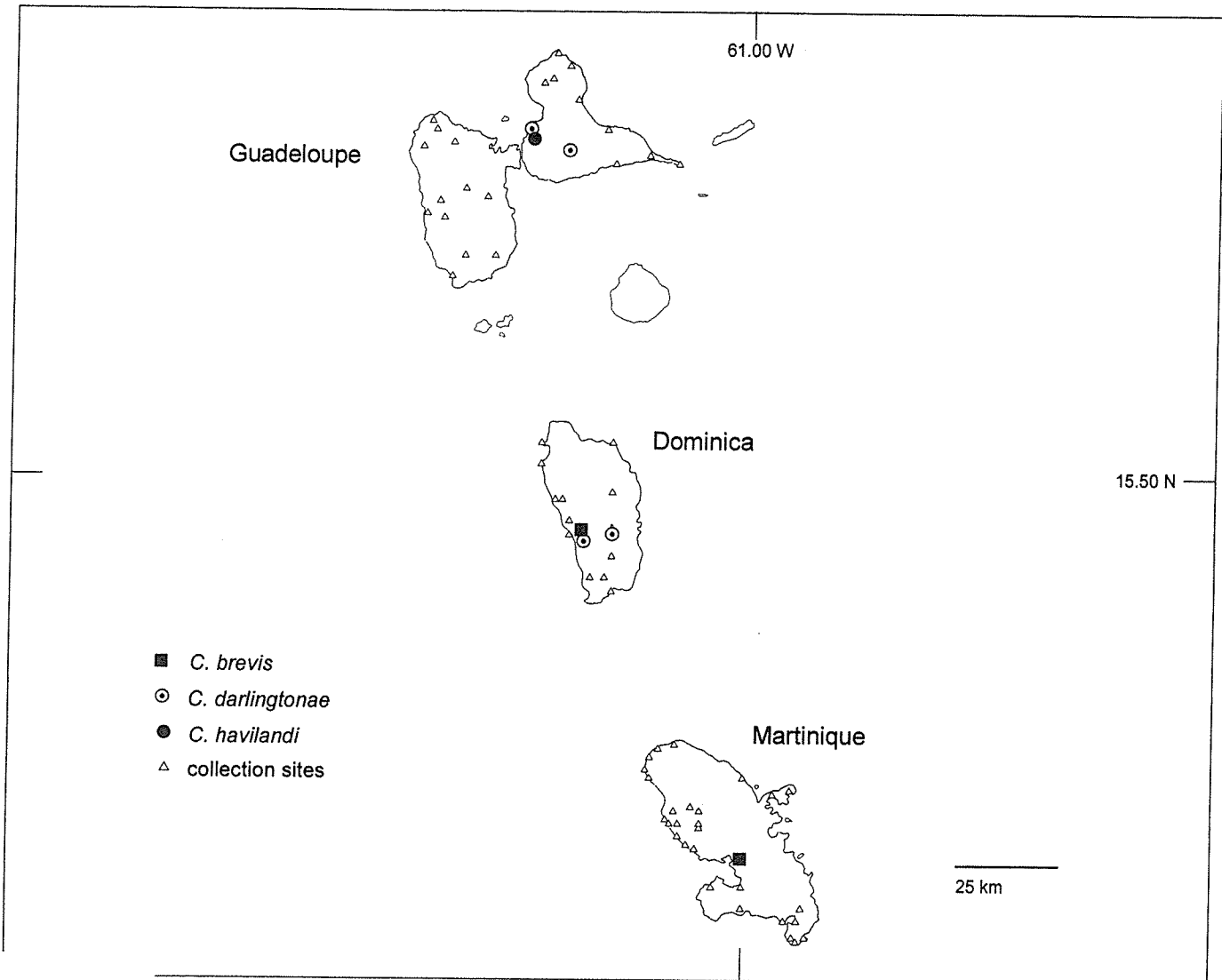


Figure 15. *Cryptotermes* distribution on the central Lesser Antilles.

to the African continent (Gay 1967). *Cryptotermes domesticus* appears to be native to Southeast Asia and Australia (Gay and Watson 1982).

Because there were few collections from structural lumber in our surveys, the distribution of non-indigenous species in the West Indies is likely to be underreported. However, several conclusions about the distribution of non-indigenous species are warranted. *Cryptotermes brevis* is undoubtedly the most abundant kalotermitid pest of the West Indies and likely occurs on all inhabited islands. Although *C. brevis* was not collected on all islands surveyed, suspected structural damage was evident almost universally. *Cryptotermes havilandi* was seldom taken from structures, however, it was always collected in woody growth near coastal human habitations

throughout the Lesser Antilles, from St. Croix to Tobago (Figs. 14-17) where it is probably a pervasive structural pest. We were unable to confirm Araujo's (1970) record of *C. havilandi* from Jamaica. The only collections of *C. dudleyi* are from Trinidad where it is rather broadly distributed and has been collected numerous times from structures (Fig. 17), and from Jamaica where *C. dudleyi* is restricted to a few coastal woodland localities (Fig. 10). *Cryptotermes domesticus* has been reported only once from the West Indies in Trinidad (Araujo 1970) and specimens from there are not available. Araujo's (1970) report may refer to an isolated occurrence, as it seems that this species has not appeared in the West Indies since.

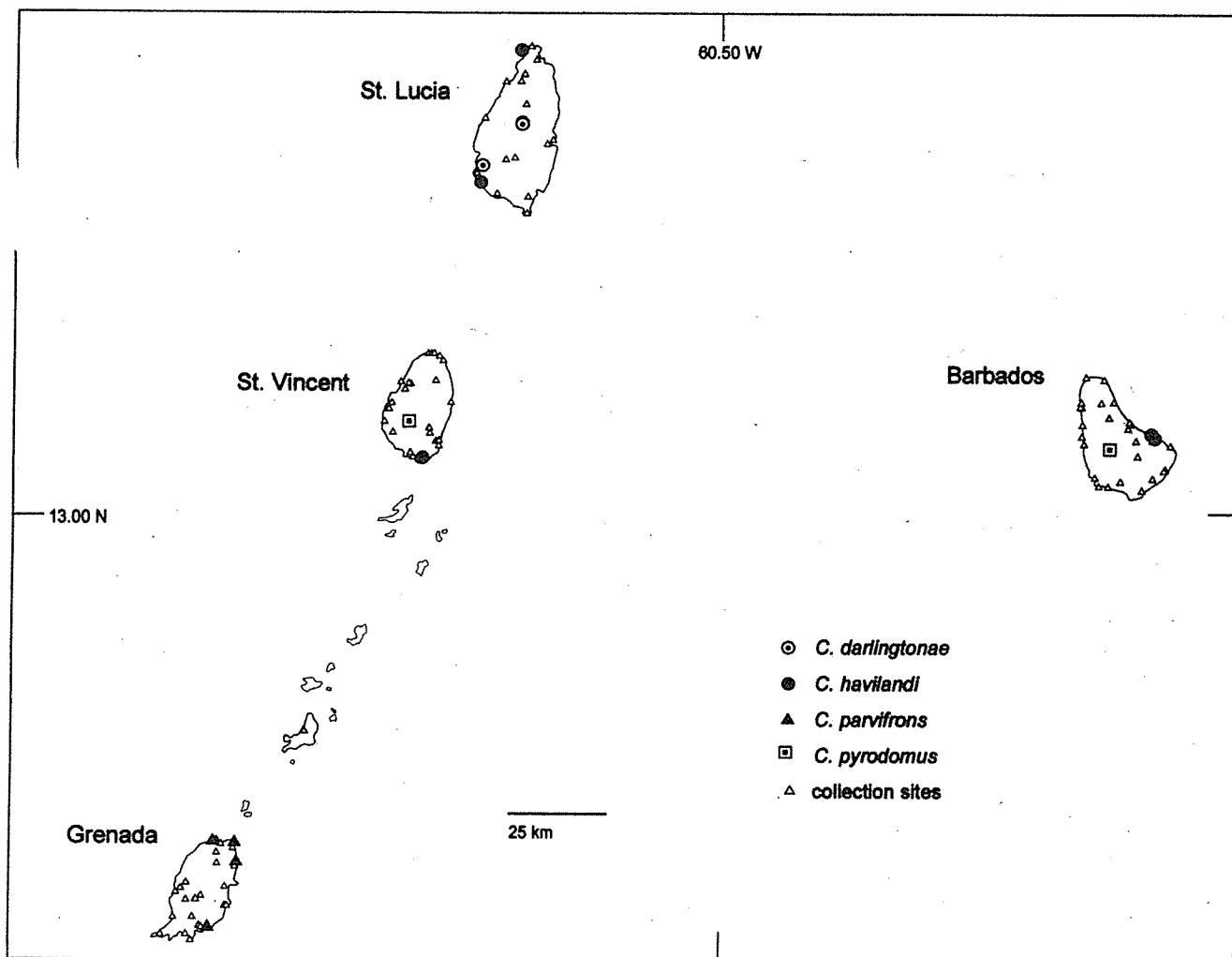


Figure 16. *Cryptotermes* distribution on the southern Lesser Antilles.

Discussion

With 17 indigenous species, the West Indian *Cryptotermes* fauna is the most diverse in the world, surpassing Australia's 14 indigenous species (Gay and Watson 1982). Although the termite fauna of the United States is fairly well established, other mainland regions allied with the Caribbean Basin, including much of Central America and northern South America, have only been sporadically surveyed. The only indigenous West Indian *Cryptotermes* to be found on the mainland is *C. caviifrons* with a range across peninsular Florida (Fig. 7, Scheffrahn and Su 1994). Recent collections in the northern and eastern Yucatan Peninsula (Scheffrahn et al. 1998, Scheffrahn et al. unpublished) and a landmark survey of Guyana (Emerson 1925) have not yielded any indigenous West Indian *Cryptotermes*,

suggesting that this genus is exceptionally well-suited for island speciation.

Cryptotermes aequicornis n. sp.

Description. Imago. Unknown.

Soldier (Figs. 19-21, Table 2). Head anterior 1/3 nearly black in dorsal view, grading to ferruginous orange in posterior 1/3; in lateral view, anterior half of head almost black, posterior half ferruginous orange. Mandibles very dark chestnut brown. Anterior pronotal margin ferruginous, remaining pronotum with wide more pale fringe.

Head in dorsal view, slightly elongated, with nearly parallel sides, faintly concave near middle, and widely rounded posteriorly; vertex with deep median concavity. Rugosity deep in anterior half including frontal flange and frons. Frons deeply concave. Frontal flange robust,

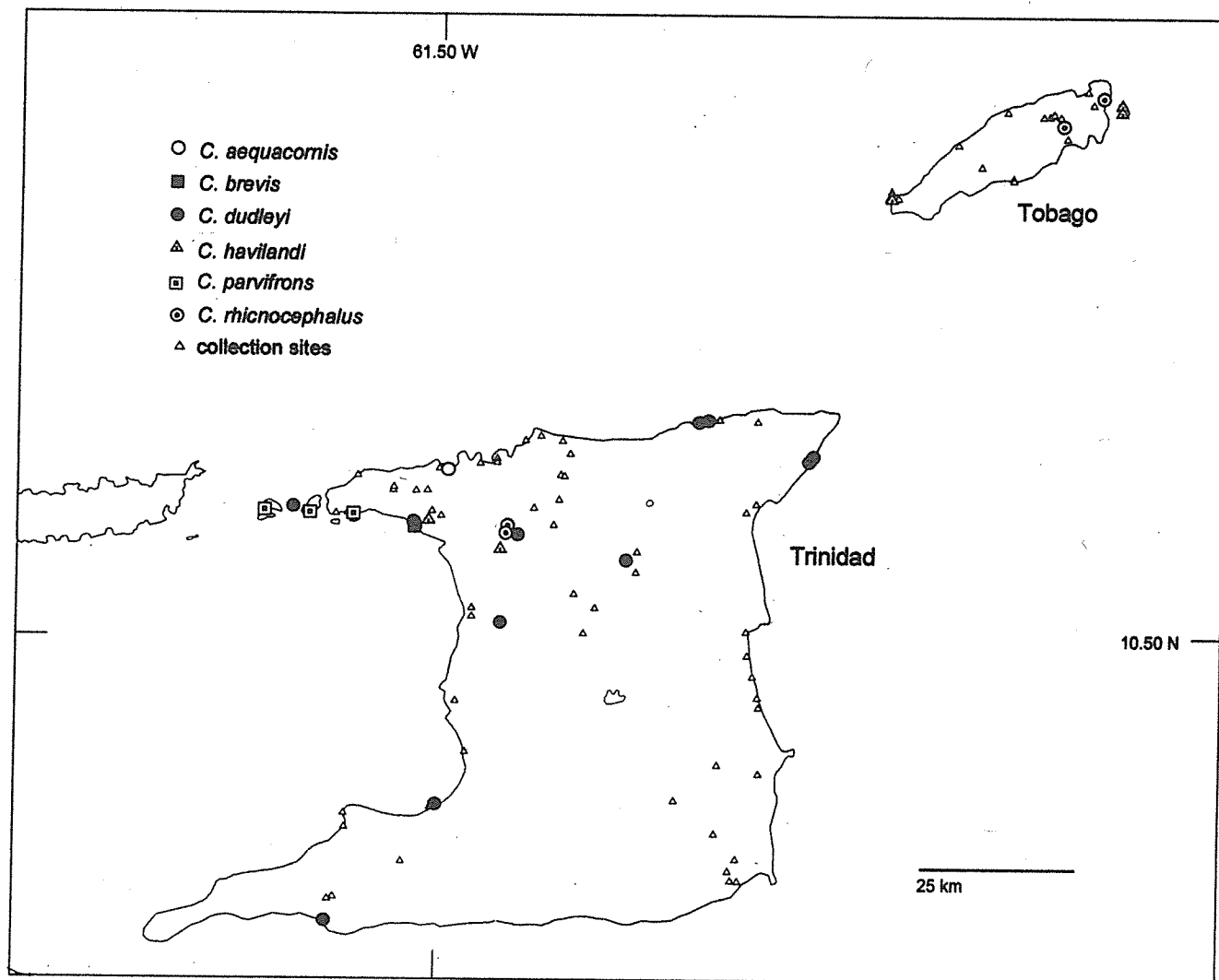


Figure 17. *Cryptotermes* distribution in Trinidad and Tobago.

elevated particularly in frontal view, with deep median notch continuous with midvertex concavity; in dorsal view, flange rectate or very shallowly incised. Vertex plane sloping to frons plane about 90° . Eye spots absent or very faint, small, and oval. Labrum short, pointed, and with faintly concave anterior sides. Frontal horns large, globular. Genal horns nearly identical in shape and size to frontal horns, slightly more conical. Genal and frontal horns abut at their bases. Mandibles very short, medially humped and angled, projecting horizontally in lateral view; dentition weakly developed. Antenna with 11 to 13 articles, usually 11 or 12; formulae $2>3=4=5$ or $2>3<4=5$. Pronotum almost quadrate, with slight lateral convexity and very faint concavity of posterior margin; anterior margin with biconvex incision or with concavity, and with weak irregular sinuosity. Meso- and metanotum sides weakly triangulate.

Comparisons. For comparisons see *C. darlingtonae* n. sp.

Remarks. *Cryptotermes aequicornis* is known only from a single montane rainforest colony.

Geographical Distribution. West Indies (Fig. 17): northwestern Trinidad. Elsewhere: unknown.

Etymology. The species is named for its nearly identical frontal and genal horns.

Material Examined. Holotype colony: Trinidad. Mountain Road S La Vache Bay; $10^\circ 44.78' N$, $61^\circ 29.27' W$; 28.v.1996; JC, JK, BM, JM, and RS; holotype soldier, 5 paratype soldiers, one for SEM, immatures (TT319).

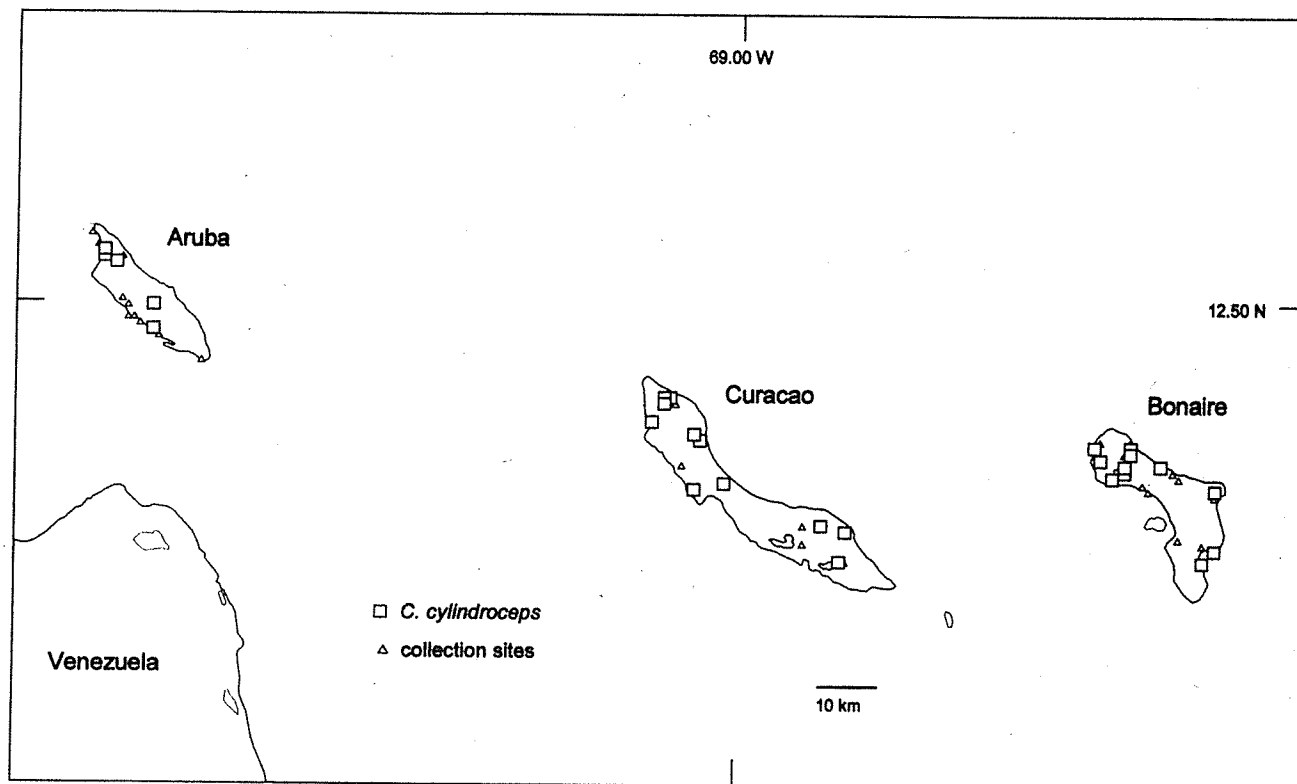


Figure 18. *Cryptotermes* distribution on the Netherlands Antilles.

Cryptotermes brevis (Walker)

Termes brevis Walker 1853: 524 [imago], Jamaica

Cryptotermes brevis: Banks 1919: 476 [records only], Cuba, Dominica, St. Thomas (USVI).

Cryptotermes brevis: Banks in Banks and Snyder 1920: 36, 78, 144 [soldier drawing; biology].

Cryptotermes pseudobrevis Fuller 1921: 30 [soldier], South Africa.

Kalotermes (Cryptotermes) brevis: Emerson 1925: 327, fig. 29 [soldier, alate], Guyana.

For extended synonymies see Araujo 1977: 11, Bacchus 1987: 40, Snyder 1949: 39, and Chhotani 1970: 9.

Description. Imago (Table 3). General color brown. Sclerotized veins of fore wing brown; membrane subhyaline with prismatic purplish iridescence. Frons pale brown, vertex brown with sepia brown band between eyes. Brown chevron pattern on fore wing scales indistinct because of concolorous mesonotum. Pronotum and abdominal tergites brown. Antennae pale brown. Labrum very pale brown. Femora whitish, legs including tibiae, pale brown distally. Abdominal sternites whitish in middle, pale brown or very pale brown laterally. Head oval; cranial sutures fine, but distinct. Eyes moderately large, protruding, and

subcircular. Ocelli moderately large, oval, and touching eyes. Antennae with 15 to 17 articles, usually 16, and with formulae variable. Pronotum wider than long, distinctly narrower than head width at eyes; anterior margin slightly concave, posterior margin rectate, sides moderately convex. Crossbar mark and midline of pronotum distinct. Fore wing radius reaching wing margin at almost half wing length from suture; radial sector with 6-7 branches. Media not always curving at mid-wing to intersect costal margin. Arolia absent.

Comparisons. Among congeners worldwide, only imagos of *C. darwini* (Light) from the Galapagos Islands, *C. kirbyi* Moszkowski from Madagascar, and *C. brevis* share the absence of arolia (Bacchus 1987). Emerson, however, synonymized *C. darwini* with *C. brevis* in his collection (unpublished observation). We consider *C. darwini* to be a good species as presented by Bacchus (1987). In addition, *C. brevis* has a characteristic contrasting darker band and sparse small pale spots between the eyes. Among West Indian congeners, *C. brevis* resembles the dark brown imago of *C. juliani* and *C. cylindroceps* the latter two possessing a more contrasting chevron pattern and

Table 1. West Indian *Cryptotermes* species and their island records.

| Species | Island(s) |
|----------------------|--|
| <i>aequacornis</i> | Trinidad |
| <i>brevis</i> | Probably all inhabited islands; introduced |
| <i>cavifrons</i> | Bahamas, Cuba and Isle of Youth, Jamaica, Caymans |
| <i>chasei</i> | Hispaniola and Saona Is. |
| <i>cryptognathus</i> | Jamaica |
| <i>cylindroceps</i> | Aruba, Bonaire, Curaçao |
| <i>cymatofrons</i> | Bahamas, Cuba and Isle of Youth |
| <i>darlingtonae</i> | Dominica, Guadeloupe, Montserrat, Nevis, St. Lucia |
| <i>domesticus</i> | Trinidad? Introduced? |
| <i>dudleyi</i> | Trinidad, Jamaica; introduced |
| <i>haviglandi</i> | Lesser Antilles; introduced |
| <i>hemicyclius</i> | Jamaica |
| <i>juliani</i> | Hispaniola |
| <i>mangoldi</i> | Hispaniola and Saona Is. |
| <i>nitens</i> | Caymans, Jamaica |
| <i>parvifrons</i> | Grenada, Trinidad |
| <i>pyrodomus</i> | Barbados, St. Vincent |
| <i>rhinocephalus</i> | Trinidad, Tobago |
| <i>rotundiceps</i> | Hispaniola, Puerto Rico |
| <i>spathifrons</i> | Caymans, Cuba, Hispaniola |
| <i>undulans</i> | Puerto Rico |

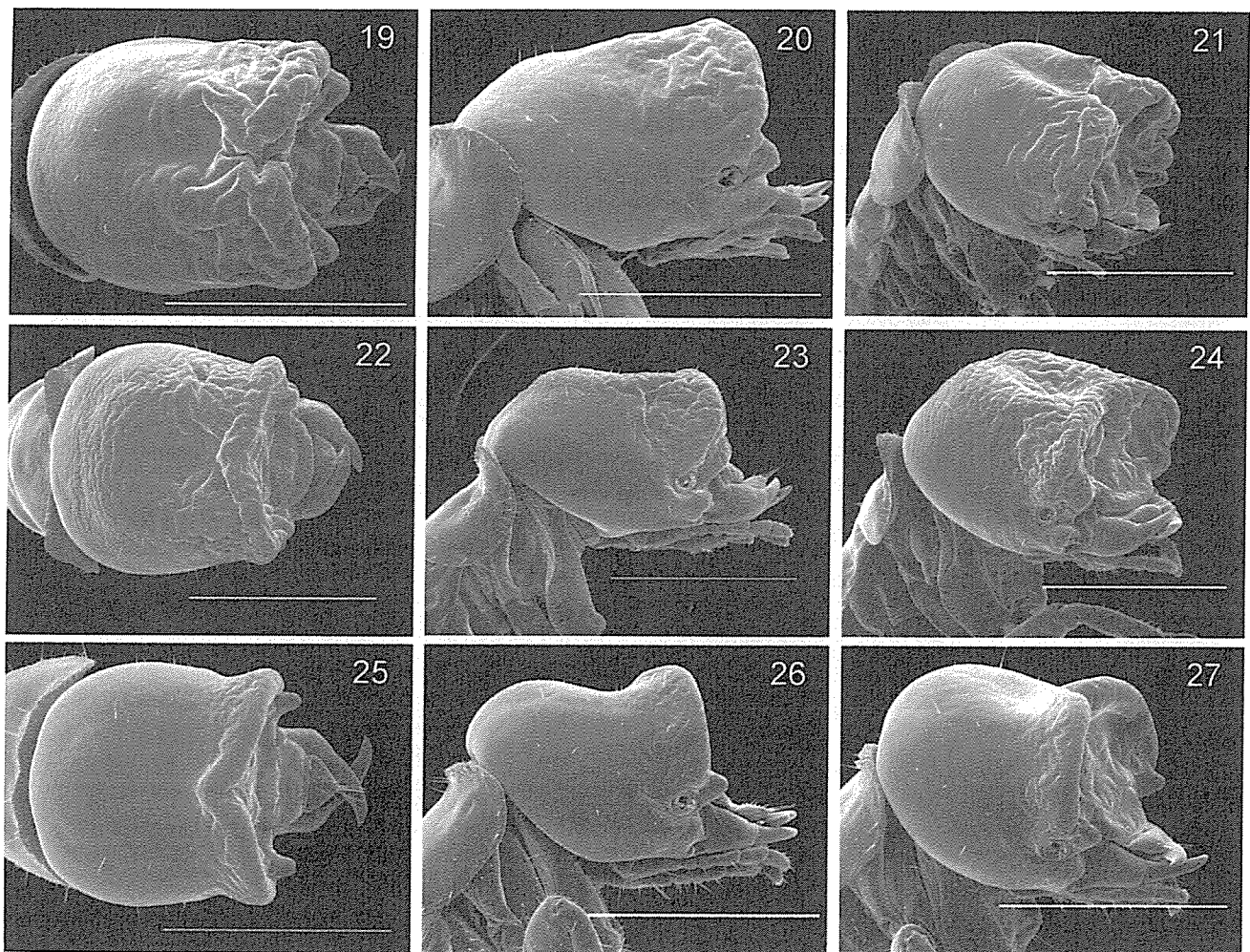
darker wing scales. The wing venation of *C. brevis* is atypical of other congeners in that, in some individuals, the media extends to the wing tip (Scheffrahn et al. 1988).

Soldier (Figs. 22-24, Table 4). Head in dorsal view, with anterior 1/3 nearly black, grading posteriorly to chestnut brown or ferruginous; in lateral view, anterior 1/3 of head almost black, genae ferruginous orange, remainder chestnut brown. Mandibles nearly black or very dark chestnut brown. Anterior margin of pronotum ferruginous, remainder yellow-white, except for pair of ferruginous subcircular spots near anterior margin.

In dorsal view, head capsule with pronounced concavity at anterior vertex; sides noticeably constricted at eye spot level; posterior bulbous. Head rugosity scabrose, covering anterodorsal and anterolateral surface to eye spots. Frontal flange robust and delineated from vertex, anterior with median notch, and dorsally flattened in frontal view. Frontal concavity flattened, rugose, and noticeably wider than high; frontal plane sloping 70° from plane of vertex. Labrum shortly linguiform, inflated apically. Frontal horns continuous with frontal flange, massive, wider than long, and rounded apically. Genal horns forming small rounded tubercles on dorsal half of anterior genae. Genal horns about 5X narrower than frontal

horns in lateral view, and attached to frontal horns. Mandibles short, massive, and rugose at bases; humped and angled at basal 1/3, and slightly curved at distal 1/4; dentition weak. Tip of right mandible resting on, but not overlapping left mandible in ethanol-preserved specimens. Eye spot small, suboval, usually indistinct. Antenna with 11-15 articles, usually 12; formulae variable, but usually 2>3>4<5, or 2>3<4=5. Pronotum much broader than long, usually biconvex anterolaterally, with deep and wide median concavity. Tips of anterior corners rounded, sometimes weakly angled. Pronotum considerably convex laterally in equal proportion to anterior concavity; posterior margin almost rectate, and anterior margin shallowly sinuous.

Comparisons. *Cryptotermes brevis* superficially resembles *C. darlingtonae* and *C. aequacornis*, because all have deep rugosity of the head capsule. However, the head capsule of *C. brevis* is noticeably wider than high in frontal view, lacks a distinct dorsal incision, and is dorsofrontally flattened. The frontal profiles of *C. aequacornis* and *C. darlingtonae* are subcircular and show a distinct dorsal incision. The *C. aequacornis* and *C. darlingtonae* head capsules are not constricted at eye spots level or are bulbous posteriorly when viewed dorsally, while in *C. brevis* the head capsule is distinctly constricted and bulbous.



Figures 19-27. Soldier heads of *Cryptotermes aequicornis* (TT319, Trinidad, Mountain Road S La Vache Bay) (19-21), *C. brevis* (DR980, Dominican Republic, Los Pinos de Jarabocoa, hotel furniture) (22-24), and *C. cavifrons* (BA320, Bahamas, N Andros Is., Nicholls Town) (25-27) each, by order, in dorsal, lateral, and oblique views. Scale bars = 1 mm.

Frontal and genal horns tips of *C. darlingtonae* are near the frons plane, while in *C. brevis* the genal horns tips are distinctly retracted posteriorly. The anterior pronotum margin of *C. brevis* is deeply concave medially and biconvex laterally (sometimes angled), but in *C. darlingtonae* it is shallowly incised, and it is not biconvex.

Remarks. All *C. brevis* samples collected in the West Indies are from buildings. This pattern of occurrence is characteristic for this species worldwide. The discovery of *C. brevis* in a woodland locality on Oahu, Hawaii, (Scheffrahn *et al.* 1998) is the lone documented non-structural occurrence of *C. brevis*. The exclusively synanthropic occurrence of *C. brevis* in the West Indies is a strong argument to consider all populations there to be non-indigenous.

Geographical Distribution. West Indies (Figs. 7-17): Bahamas [N Andros (new record), New Providence], Barbados, Bermuda, Cayman Brac, and Grand Cayman Island, Cuba, Curaçao, Dominica, Grenada, Guadeloupe (Basse- and Grande-Terre), Hispaniola (Dominican Republic and Haiti), Jamaica, Margarita Island, Martinique (new record), Montserrat, Nevis (new record), Puerto Rico, St. Kitts, St. Lucia, St. Vincent, Tobago, Trinidad, Turks & Caicos Islands (Grand Turk, Providenciales, Scheffrahn *et al.* 1990), Virgin Islands (British): certain islands; (U.S.): St. Croix, St. Thomas. Elsewhere: New World: *C. brevis* infestations have been detected over wide continental expanses from Canada (Myles 1995) to Chile and Uruguay (unpublished observations). There are a few regions where infestations remain unrecorded, for example, Nicaragua (Maes 1990) and Guyana, Para-

Table 2. Measurements of *Cryptotermes aequicornis* soldier.

| Measurement in mm (n = 6 from 1 colony) | Range | Mean ± SD | Holotype |
|--|-----------|--------------|----------|
| Head length to tip of mandibles | 1.46-1.61 | 1.54 ± 0.052 | 1.54 |
| Head length to frontal horns | 1.36-1.44 | 1.40 ± 0.029 | 1.38 |
| Frontal flange width | 1.05-1.14 | 1.11 ± 0.045 | 1.06 |
| Frontal horns, outside span | 0.82-0.92 | 0.87 ± 0.038 | 0.85 |
| Head width, maximum | 1.06-1.18 | 1.12 ± 0.045 | 1.06 |
| Head height, excluding postmentum | 0.82-0.96 | 0.91 ± 0.063 | 0.82 |
| Pronotum, maximum width | 0.93-1.06 | 1.01 ± 0.052 | 0.97 |
| Pronotum, maximum length | 0.75-0.82 | 0.80 ± 0.029 | 0.77 |
| Left mandible length, tip to ventral condyle | 0.56-0.62 | 0.60 ± 0.029 | 0.62 |
| Total length | 3.51-4.06 | 3.76 ± 0.20 | 3.81 |

guay, and Argentina (unpublished observations). Old World: tropicopolitan, and Palaearctic region.

Material Examined. All alates and soldiers measured unless stated otherwise. **Dominican Republic.** Duarte Province, San Francisco de Macoris; 19°18'N, 70°15'W; 16.vi.1991; JC, JM, JR, and RS; 1 soldier measured, 1 soldier unmeasured, 1 dealate, immatures (DR0039). Distrito Nacional, Santo Domingo; 19°27'N, 69°53'W; 15.vi.1991; JC, JM, JR, and RS; 1 alate (DR0040). La Vega Province, Los Pinos de Jarabacoa; hotel furniture; 19°06'N, 70°39'W; 22.viii.1994; JC, JK, JR, and RS; 1 of 5 soldiers measured, a few alates unmeasured, immatures (DR0980). La Vega Province, Arenosa; 1.iv.1992; JR; 1 alate, immatures (DR1087). Distrito Nacional, Santo Domingo; 19°27'N, 69°53'W; 2.v.1992; JC and RS; 1 flying alate (DR1088). **Bahamas.** N Andros Island; Green Windows Inn, Nicholls Town; 25°08'N, 77°59'W; 29.v.1995; JC, JK, JM, JR, RS; 1 indoor flying alate measured, many unmeasured (BA176). **Dominica.** Springfield Station, 15°21'N, 61°23'W; 28.v.1994; JC, JK, JM, and RS; 1 of few outdoor flying alates measured (DM058). **Martinique.** Le Lamentin, hotel Martinique Cottages; 14°59'N, 60°53'W; 3.vi.1994; JC, JK, JM, and RS; 1 indoor flying alate measured (MA217). **Jamaica.** Port Antonio; 18°10.88'N, 76°27.03'W; 27.v.1997; PB, JC, JK, BM, JM, and YR; 1 alate (JA297). **Puerto Rico.** Bayamon; 18°25'N, 66°08'W; 31.vii.1995; Torres; 1 soldier, 1 functional reproductive, immatures (PR532). **Turks & Caicos.** Providenciales Island; Turtle Cove, Europe House, in pallets; 21°28'N, 72°06'W; 8.ii.1990; B. Diehl and RS; 1 of 3 soldiers measured, 2 functional reproductives, immatures (TC34). Grand Turk Island; Front Street, old house; 21°47'N, 72°08'W; 6.ii.1990; B. Diehl and

RS; 1 soldier, 4 functional reproductives, immatures (TC35). Grand Turk, Front St., from badly infested house; 21°47'N, 72°08'W; 12.iii.1989; B. Diehl; 1 of 2 soldiers measured, immatures (TC37). Providenciales, Turtle Cove, Europe House, doors in a house; 21°28'N, 72°06'W; 7.iv.1989; B. Diehl; 1 of 3 soldiers measured, immatures (TC83). **Cuba.** Havana City, cedar wood tobacco box; 23°04'N, 82°25'W; 29.x.1971; JK; 1 of 3 soldiers measured, immatures (CU1013). Havana City, furniture; 23°04'N, 82°25'W; 10.x.1971; JK; 1 soldier, immatures (CU1014). Havana City, Alamar, in house interior; 23°09'N, 82°18'W; 2.ii.1972; JK; 1 of several alates measured (CU301). Havana City, Marianao, wooden trays; 23°04'N, 82°25'W; 1.ii.1972; JK; 1 soldier, immatures (CU302).

Additional Species Examined. *Cryptotermes darwini* (Light), **Galapagos Is.** Albermarle Is., Tagus Cove, 26.v.1932, A.E. Larsen, 1 paratype soldier (AMNH).

Cryptotermes cavifrons Banks

Cryptotermes cavifrons Banks 1906: 337 [soldier, alate], 4 figs., USA (Florida).

Cryptotermes cavifrons: Banks in Banks & Snyder 1920: 35 [soldier, alate], 3 figs.

Type species of the genus (Banks 1906: 336).

Description. Imago (Table 5). General color yellow-brown to pale brown. Sclerotized fore wing veins pale brown to brown; membrane slightly smoky, very pale brown. Head pale brown with brown band between eyes. Pale brown chevron pattern on fore wing scales distinct. Antennae and pronotum pale brown. Abdominal tergites yellow-brown to pale brown. Labrum yellow-brown. Femora whitish, legs including tibiae, very pale brown

Table 3. Measurements of *Cryptotermes brevis* imago.

| Measurement in mm (n = 4♀, 3♂ from 7 colonies) | Range | Mean ± SD |
|---|-------------|---------------|
| Head length with labrum | 1.37-1.44 | 1.40 ± 0.023 |
| Head length to postclypeus | 1.01-1.13 | 1.07 ± 0.042 |
| Head width, maximum at eyes | 1.10-1.14 | 1.12 ± 0.021 |
| Eye diameter, maximum | 0.29-0.33 | 0.31 ± 0.012 |
| Eye to head base, minimum | 0.16-0.20 | 0.18 ± 0.017 |
| Ocellus diameter, maximum | 0.11-0.14 | 0.12 ± 0.0096 |
| Pronotum, maximum length | 0.65-0.69 | 0.68 ± 0.012 |
| Pronotum, maximum width | 0.96-1.08 | 1.02 ± 0.040 |
| Total length with wings | 11.64-12.43 | 12.09 ± 0.23 |
| Total length without wings | 5.25-6.82 | 6.26 ± 0.57 |
| Fore wing length from suture | 8.66-9.80 | 9.26 ± 0.44 |
| Fore wing, maximum width | 2.34-2.51 | 2.43 ± 0.066 |

Table 4. Measurements of *Cryptotermes brevis* soldier.

| Measurement in mm (n = 11 from 11 colonies) | Range | Mean ± SD |
|--|-----------|--------------|
| Head length to tip of mandibles | 1.77-1.99 | 1.88 ± 0.078 |
| Head length to frontal horns | 1.32-1.67 | 1.54 ± 0.11 |
| Frontal flange width | 1.11-1.36 | 1.26 ± 0.080 |
| Frontal horns, outside span | 0.85-1.05 | 0.94 ± 0.067 |
| Head width, maximum | 1.19-1.44 | 1.33 ± 0.074 |
| Head height, excluding postmentum | 0.87-1.06 | 0.98 ± 0.070 |
| Pronotum, maximum width | 1.14-1.46 | 1.32 ± 0.099 |
| Pronotum, maximum length | 0.72-0.98 | 0.88 ± 0.080 |
| Left mandible length, tip to ventral condyle | 0.72-0.83 | 0.79 ± 0.039 |
| Total length | 3.32-5.84 | 4.49 ± 0.73 |

distally. Abdominal sternites whitish in middle, yellow-brown to pale brown laterally. Head oval; cranial sutures fine, but distinct. Eyes moderately large, suboval. Ocelli small, oval, and touching eyes. Antennae with 13 to 17 articles, usually 15 or 16; formulae variable. Pronotum subsquare, slightly wider than head width at eyes; anterior margin slightly concave, posterior margin faintly concave, sides subparallel. Crossbar mark and midline of pronotum distinct. Fore wing radius reaching wing margin at half wing length from suture; radial sector with 5-6 branches. Arolia present.

Comparisons. *Cryptotermes cavifrons* is biometrical-ly indistinguishable from *C. mangoldi* and *C. undulans* over a wide range of measurements, but *C. cavifrons* is distinctly the darkest of the three.

Soldier (Figs. 25-27, Table 6). Head, in dorsal view, with anterior 1/4 nearly black and glossy, grading posteriorly to ferruginous orange. Head in lateral view, with anterior 1/3 almost black; grading to ferruginous orange in posterior, with pale yellow marginal strip along foramen magnum. Mandibles

Table 5. Measurements of *Cryptotermes cavifrons* imago.

| Measurement in mm (n = 5♀, 3♂ from 8 colonies) | Range | Mean ± SD |
|---|-----------|---------------|
| Head length with labrum | 1.10-1.16 | 1.14 ± 0.021 |
| Head length to postclypeus | 0.82-0.90 | 0.86 ± 0.024 |
| Head width, maximum at eyes | 0.88-0.93 | 0.91 ± 0.020 |
| Eye diameter, maximum | 0.29-0.32 | 0.30 ± 0.013 |
| Eye to head base, minimum | 0.11-0.16 | 0.13 ± 0.022 |
| Ocellus diameter, maximum | 0.10-0.12 | 0.11 ± 0.0097 |
| Pronotum, maximum length | 0.62-0.70 | 0.66 ± 0.028 |
| Pronotum, maximum width | 0.83-0.95 | 0.87 ± 0.035 |
| Total length with wings | 8.52-9.66 | 9.05 ± 0.36 |
| Total length without wings | 4.97-5.61 | 5.26 ± 0.23 |
| Fore wing length from suture | 6.67-7.53 | 7.05 ± 0.29 |
| Fore wing, maximum width | 1.62-2.11 | 1.90 ± 0.17 |

Table 6. Measurements of *Cryptotermes cavifrons* soldier.

| Measurement in mm (n = 9 from 9 colonies) | Range | Mean ± SD |
|--|-----------|--------------|
| Head length to tip of mandibles | 1.48-1.69 | 1.60 ± 0.069 |
| Head length to frontal horns | 1.26-1.38 | 1.29 ± 0.041 |
| Frontal flange width | 1.06-1.13 | 1.10 ± 0.023 |
| Frontal horns, outside span | 0.82-0.87 | 0.84 ± 0.017 |
| Head width, maximum | 1.08-1.14 | 1.11 ± 0.020 |
| Head height, excluding postmentum | 0.77-0.87 | 0.82 ± 0.026 |
| Pronotum, maximum width | 1.00-1.14 | 1.06 ± 0.042 |
| Pronotum, maximum length | 0.75-0.88 | 0.81 ± 0.040 |
| Left mandible length, tip to ventral condyle | 0.72-0.77 | 0.75 ± 0.016 |
| Total length | 3.47-4.95 | 4.25 ± 0.46 |

dark chestnut brown. Anterior margin of pronotum ferruginous orange, rest of pronotum pale yellow.

Head shape in dorsal view subsquare, with slight to moderate concavity at level of eyes; sides slightly convex posteriorly, and posterior margin convex. Anterior outline of frontal flange in dorsal view shallowly incised. Faint rugosity on anterior 1/3 of head, including frontal flange and frons. Frontal flange continuous with vertex and frons without or with faint delineation from each; delineation from frons usually more distinct than from vertex. Frons moderately concave. Frontal plane sloping 70° from plane of

vertex; dorsal outline of vertex distinctly concave. Labrum with short, subparallel sides, triangular terminus, and tip faintly inflated. Frontal horns distinct and thumb-like and deeply separated from clypeus. Genal horns very small, bluntly pointed. Genal and frontal horns widely separated at tips; bases of horns only faintly connected; in dorsal view, frontal horns fully eclipsing much smaller frontal horns. Mandibles moderately long, distal half sickle-shaped, with elongate apical tooth of right mandible visible; usually slightly humped near base, angled in middle, and with distinct dentition. In lateral view,

mandibles nearly horizontal. Eyes oval and small. Antennae with 10 to 14 articles, usually 11 or 12, and with formulae variable, but usually $2 > 3 > 4 < 5$. Pronotum shield-shaped, only slightly wider than long. Anterior margin of pronotum shallowly incised and shallowly sinuous; sides of pronotum faintly or slightly convex; posterior corners widely rounded, and posterior margin rectate.

Comparisons. *Cryptotermes cavifrons* is most similar to *C. undulans*, from which the former differs by its much more faint rugosity, longer mandibles, and narrower frontal horns.

Remarks. *Cryptotermes cavifrons* is very common and ubiquitous species where it occurs.

Geographical Distribution. West Indies (Figs. 7-11): Bahamas and Cayman Islands; Greater Antilles including Cuba and Jamaica. Elsewhere: peninsular Florida (Scheffrahn et al. 1988, Scheffrahn and Su 1994) and Bermuda (Snyder 1956). Reported from Puerto Rico, St. Croix, and Haiti (Snyder 1956) and Central America (Snyder 1934, 1949, Araujo 1977, Bacchus 1987), but those records now appear very doubtful.

Material Examined. All alates and soldiers measured unless stated otherwise: **Bahamas.** Cat Island; 1 km NE Bain Town; 24°40'N, 75°42'W; 28.v.1995; JC, JK, JM, JR, and RS; 1 of 3 soldiers measured, immatures (BA136). N Andros Island; 3 km SE Coakley Town; 24°42'N, 78°14'W; 30.v.1995; JC, JK, JM, JR, and RS; 1 of 3 soldiers and 1 of 2 alates measured, immatures (BA288). North Andros Island; Nicholls Town; 25°08'N, 77°59'W; 31.v.1995; JC, JK, JM, JR, and RS; 1 of 4 soldiers and 1 of 2 alates measured, immatures (BA317). **Cayman Islands.** Little Cayman; South Town; 19°39.71'N, 80°04.66'W; 25.ix.1996; JK; 1 of many soldiers and alates measured, immatures (CA011). Same data as previous sample, but 1 of 5 soldiers measured, immatures (CA014). Grand Cayman; Red Bay, S Selkirk Dr.; 19°16.56'N, 81°19.04'W; 27.ix.1996; JK; 1 of many soldiers measured, immatures (CA045). **Jamaica.** Discovery Bay; 18°28.73'N, 77°26.42'W; 24.v.1997; PB, JC, JK, BM, JM, and YR; 1 of many soldiers and alates measured, immatures (JA079). 2 km E Pomfret; 17°52.12'N, 76°29.65'W; 27.v.1997; PB, JC, JK, BM, JM, and YR; 1 of 3 soldiers and 1 of many alates measured, immatures (JA368). **Cuba.** Pinar del Rio Province, Maria la Gorda, Guanahacabibes peninsula; 21°56'N, 84°33'W; 18.i.1973; JK; 1 of several soldiers and alates measured, immatures (CU634). Matanzas Province, Playa Larga; 22°18'N, 81°11'W; 25.ix.1996;

JK; 1 of several soldiers and alates measured, immatures (CU658).

Cryptotermes chasei Scheffrahn

Cryptotermes chasei Scheffrahn 1993: 501 [soldier, alate], 10 figs., 2 tables, Dominican Republic.

Description. Imago (Table 7). General color contrasting and includes yellow-white to sepia brown. Sclerotized fore wing veins brown; membrane very pale brown. Frons yellow-white, vertex pale yellow to yellow. Sepia brown chevron pattern on fore wing scales very distinct in contrast to whitish underlying mesonotum. Antennae and pronotum pale brown. Abdominal tergum brown except for pale yellow first tergite. Labrum yellow-brown. Femora very pale brown, legs including tibiae, pale brown distally. Abdominal sternites brown, usually distinctly paler in middle. Head subcircular; cranial sutures indistinct, masked by pale head coloration. Eyes large, subtriangular. Ocelli large, oval, and touching eyes. Antennae with 16 to 18 articles, usually 17, and with formulae variable. Pronotum slightly wider than long; anterior margin moderately concave, sides moderately convex, and posterior margin shallowly emarginate. Crossbar mark and midline of pronotum faint. Radius of fore wing reaching wing margin at 1/4 to 1/3 of wing length from suture; radial sector with 5-7 long branches. Arolia present.

Comparisons. *Cryptotermes chasei* differs from its West Indian congeners by the contrasting coloration of its imago. The very pale yellow-white head is in pronounced contrast to the dark brown abdominal dorsum and the prominent chevron pattern formed by the wing scales. The *C. chasei* imago is second to *C. spathifrons* in total and fore wing length. *Cryptotermes chasei* also has a truncated head length with a mean head length to width index of 1.10, compared to range a 1.16-1.32 range for this index in the other species. At 1.05 mm, the mean hind tibia length of *C. chasei* is among the longest, with only *C. spathifrons*, and *C. hemicyclius*, both at 1.02 mm, being comparable.

Soldier (Figs. 28-30, Table 8). Head, in dorsal view, with anterior 1/2 of head capsule ferruginous, including frontal flange, except for characteristic dark chestnut brown trilobed crown-like mark spanning frons; mark concolorous with both pairs of horns, and postclypeus. Posterior half of head ferruginous orange. Head in lateral view anteriorly ferruginous,

Table 7. Measurements of *Cryptotermes chasei* imago.

| Measurement in mm (n = 2♀, 3♂ from 1 colony) | Range | Mean ± SD |
|---|-------------|---------------|
| Head length with labrum | 1.26-1.36 | 1.30 ± 0.053 |
| Head length to postclypeus | 1.05-1.11 | 1.08 ± 0.033 |
| Head width, maximum at eyes | 1.16-1.19 | 1.18 ± 0.013 |
| Eye diameter, maximum | 0.37-0.38 | 0.37 ± 0.0045 |
| Eye to head base, minimum | 0.15-0.17 | 0.17 ± 0.011 |
| Ocellus diameter, maximum | 0.14-0.16 | 0.15 ± 0.0068 |
| Pronotum, maximum length | 0.78-0.82 | 0.80 ± 0.015 |
| Pronotum, maximum width | 1.01-1.10 | 1.05 ± 0.031 |
| Total length with wings | 11.50-12.50 | 12.18 ± 0.45 |
| Total length without wings | 5.68-6.53 | 6.25 ± 0.33 |
| Fore wing length from suture | 9.09-9.73 | 9.39 ± 0.25 |
| Fore wing, maximum width | 2.44-2.54 | 2.51 ± 0.040 |

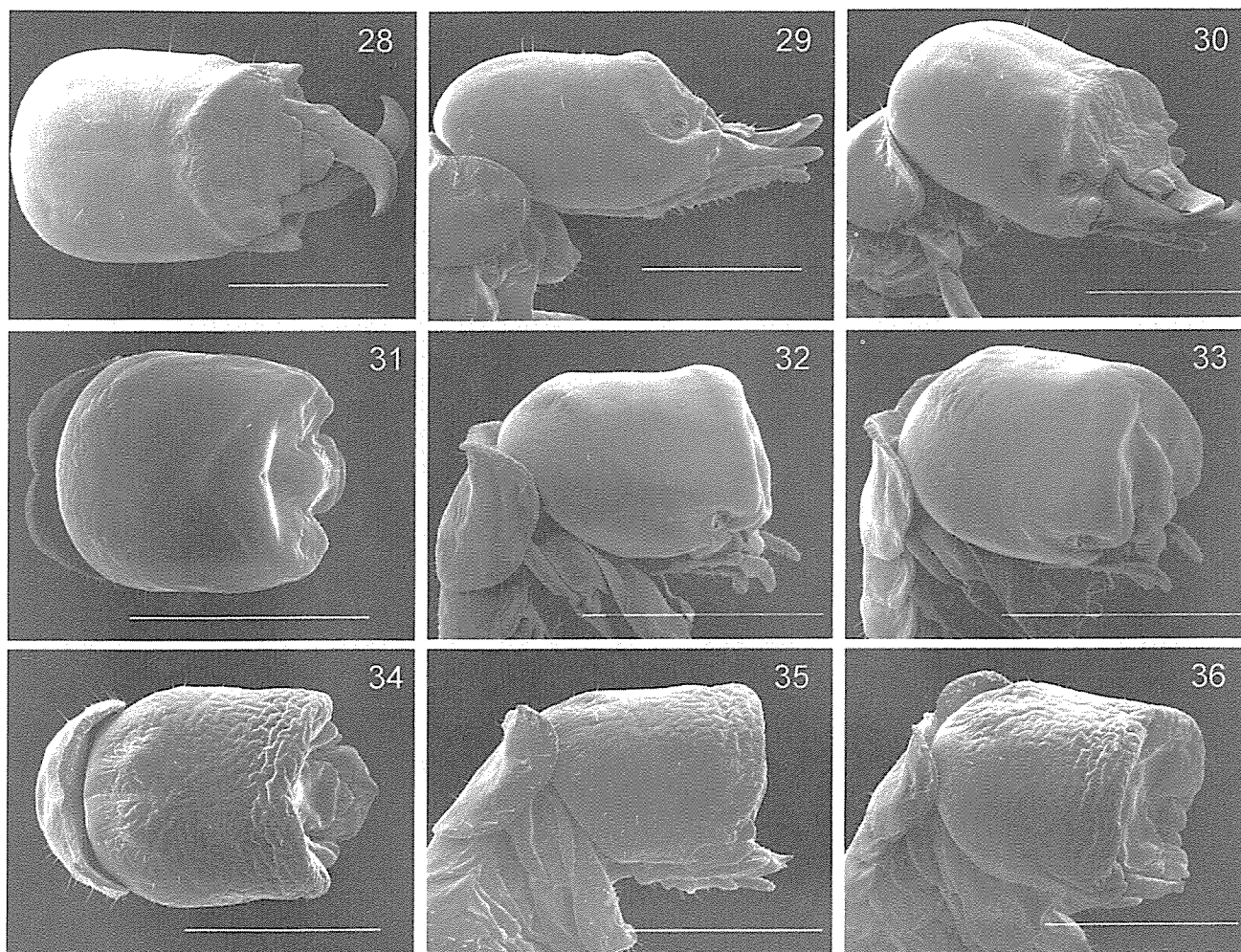
Table 8. Measurements of *Cryptotermes chasei* soldier.

| Measurement in mm (n = 16 from 6 colonies) | Range | Mean ± SD |
|---|-----------|--------------|
| Head length to tip of mandibles | 2.26-2.51 | 2.40 ± 0.083 |
| Head length to frontal horns | 1.62-1.78 | 1.68 ± 0.054 |
| Frontal flange width | 1.08-1.19 | 1.14 ± 0.034 |
| Frontal horns, outside span | 0.96-1.05 | 0.99 ± 0.026 |
| Head width, maximum | 1.34-1.42 | 1.37 ± 0.024 |
| Head height, excluding postmentum | 1.00-1.06 | 1.02 ± 0.021 |
| Pronotum, maximum width | 1.18-1.37 | 1.25 ± 0.050 |
| Pronotum, maximum length | 0.69-0.88 | 0.77 ± 0.048 |
| Left mandible length, tip to ventral condyle | 1.06-1.21 | 1.11 ± 0.039 |
| Total length | 4.77-6.09 | 5.44 ± 0.36 |

except for dark chestnut brown frontal and genal horns, grading posteriorly to ferruginous orange. Mandibles almost black distally, proximally usually paler, chestnut brown or dark chestnut brown. Narrow anterior margin of pronotum orange-yellow, rest of pronotum pale yellow.

Head capsule elongate, about 1.25X longer than wide, with sides and posterior margin faintly convex, and with rounded posterior corners. In some specimens, head sides subparallel with slight divergence backward and with posterior margin almost rectate. Eyes protruding in dorsal view. Head rugosity weak,

confined to middle of frons, frontal flange, and small lateral area behind flange. Lateral limits of frontal flange distinctly narrower than head posteriorly and flange continuous with vertex and frons. Frontal flange weakly defined, narrowing near eyes, widest in middle of head. Frons almost flat except for slightly concave area congruent with area of darker pigmentation, and slightly protruding strip formed by postclypeus and frontal horns. Frontal plane sloping 40° from plane of vertex. Labrum with short convergent sides, triangular termination, and inflated tip; anterior sides concave. Frontal horns small, with rounded



Figures 28-36. Soldier heads of *Cryptotermes chasei* (DR1425, Dominican Republic, La Altagracia Province, 0.5 km W Club Mediterraneo) (28-30), *C. cryptognathus* (JA313, Jamaica, 2 km SE of Rural Hill) (31-33), and of *Cryptotermes cylindroceps* (NA077, Curaçao, Tera Cora) (34-36), each, by order, in dorsal, lateral, and oblique views. Scale bars = 1 mm.

tip and continuous with both postclypeus and frons; horn surface granulate. Genal horns distinct, projecting anterolaterally, shortly conical, with rounded tips and granulate surfaces. Axes of genal horns divergent at almost right angle. Frontal and genal horns very widely separated, lacking contact even at bases; both pairs fully visible from above. Mandibles very long, massive, distinctly humped near bases, slight curvature proximally, then curving sharply; dentition very weak. Right mandible projecting horizontally in side view. Eyes oval and very large. Antennae with 10 to 16 articles, usually 11 to 13; usual formulae $2>3>4=5$, less often $2>3>4<5$ or $2>3<4=5$. Pronotum widely shield-shaped, 2X wider than long in middle, with anterior margin moderately concave, sides faintly or slightly convex, and posterior margin faintly concave. Anterior margin of pronotum faintly sinuous.

Comparisons. For comparisons see *C. dudleyi*.

Remarks. *Cryptotermes chasei* is littoral forest species confined to patchy localities in the eastern Dominican Republic including Saona Island.

Geographical Distribution. West Indies (Fig. 12): Greater Antilles, Hispaniola, Dominican Republic. Elsewhere: unknown.

Material Examined. For type material designation see Scheffrahn 1993 (morphotype winged imago, DR511; holotype soldier, DR569). Additional examined material, all measured unless stated otherwise: **Dominican Republic.** Saona Island; La Romana Province, Catuano-Mano Juan; $18^{\circ}12'N$, $68^{\circ}46'W$; 13.iii.1995; JC and JR; 2 soldiers, 1 functional repro-

Table 9. Measurements of *Cryptotermes cryptognathus* imago.

| Measurement in mm (n = 4♀, 6♂ from 2 colonies) | Range | Mean ± SD | Morphotype |
|---|-----------|---------------|------------|
| Head length with labrum | 1.05-1.16 | 1.10 ± 0.037 | 1.13 |
| Head length to postclypeus | 0.80-0.85 | 0.83 ± 0.014 | 0.83 |
| Head width, maximum at eyes | 0.87-0.90 | 0.88 ± 0.013 | 0.90 |
| Eye diameter, maximum | 0.28-0.31 | 0.29 ± 0.0060 | 0.30 |
| Eye to head base, minimum | 0.11-0.15 | 0.13 ± 0.011 | 0.12 |
| Ocellus diameter, maximum | 0.10-0.11 | 0.11 ± 0.006 | 0.11 |
| Pronotum, maximum length | 0.54-0.59 | 0.56 ± 0.019 | 0.57 |
| Pronotum, maximum width | 0.74-0.80 | 0.77 ± 0.026 | 0.78 |
| Total length with wings | 7.67-8.66 | 8.16 ± 0.32 | 8.52 |
| Total length without wings | 3.69-4.26 | 3.95 ± 0.23 | 4.26 |
| Fore wing length from suture | 6.25-6.96 | 6.60 ± 0.21 | 6.82 |
| Fore wing, maximum width | 1.58-1.78 | 1.66 ± 0.064 | 1.75 |

Table 10. Measurements of *Cryptotermes cryptognathus* soldier.

| Measurement in mm (n = 18 from 6 colonies) | Range | Mean ± SD | Holotype |
|---|-----------|--------------|----------|
| Head length to tip of mandibles | 1.12-1.24 | 1.19 ± 0.031 | 1.18 |
| Head length to frontal horns | 1.10-1.28 | 1.20 ± 0.037 | 1.20 |
| Frontal flange width | 0.90-0.96 | 0.94 ± 0.023 | 0.96 |
| Frontal horns, outside span | 0.69-0.75 | 0.71 ± 0.022 | 0.72 |
| Head width, maximum | 1.06-1.14 | 1.09 ± 0.022 | 1.11 |
| Head height, excluding postmentum | 0.70-0.83 | 0.78 ± 0.035 | 0.82 |
| Pronotum, maximum width | 0.97-1.06 | 1.02 ± 0.027 | 0.97 |
| Pronotum, maximum length | 0.62-0.75 | 0.70 ± 0.029 | 0.67 |

ductive, immatures (DR1115). Saona Island; La Romana Province, Catuano, 18°12'N, 68°47'W; 14.iii.1995; JC and JR; 1 soldier, 5 alates (DR1116); and 2 soldiers; (DR1117). La Altagracia Province, 0.5 km W Club Mediterraneo; 18°33.25'N, 68°21.17'W; 6.xi.1996; JC and JK; 5 of 11 soldiers measured, one for SEM, king, immatures (DR1425). Same data; 5 of 9 soldiers measured, immatures (DR1426). Same data; 1 soldier, immatures (DR1427).

Cryptotermes cryptognathus n. sp.

Cryptotermes n. sp.: Scheffrahn et al. 1998: 239 [3 photographs of soldier head], Jamaica.

Description. Imago (Table 9). General color pale yellow, abdominal tergum yellow. Head pale yellow with slightly darker band between eyes. Chevron pattern on wing scales faint; concolorous with yellow posterior corners of pronotum. Remainder of pronotum pale yellow with distinct whitish midline intersected with whitish band to form cross. Labrum, antennae, and legs yellow, except for pale yellow femora. Wing membrane almost hyaline, with faint gold iridescence; anterior sclerotized veins pale orange, fading distally. Cranial sutures poorly defined. Eyes moderately large and oval. Ocelli oval, touching eyes. Antenna with 13 to 16 articles, usually 14 or 15, and with variable formulae. Pronotum considerably