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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. cylindrocephus*, *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. rhinocephalus* Bacchus. The imagos of *C. pyrodomus* and *C. rhinocephalus* 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.

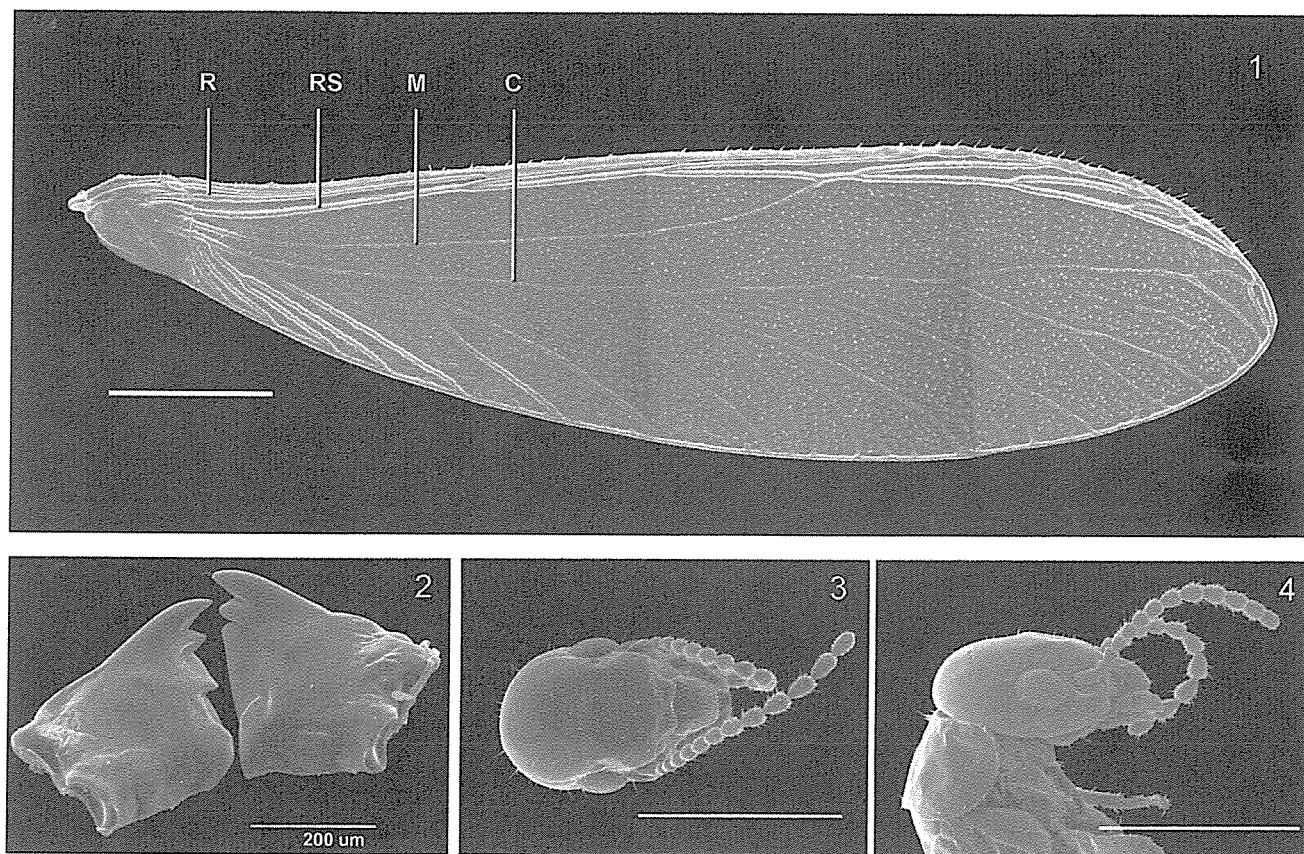
The first *Cryptotermes* species described from the West Indies was *C. brevis* (Walker 1853) from Jamaica. Adamson (1940) collected *C. dudleyi* Banks in Trinidad along with *C. brevis* and two undescribed *Cryptotermes* species. Snyder (1956) reported *Cryptotermes havilandi* (Sjöstedt) from Barbados 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. rhinocephalus*, 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

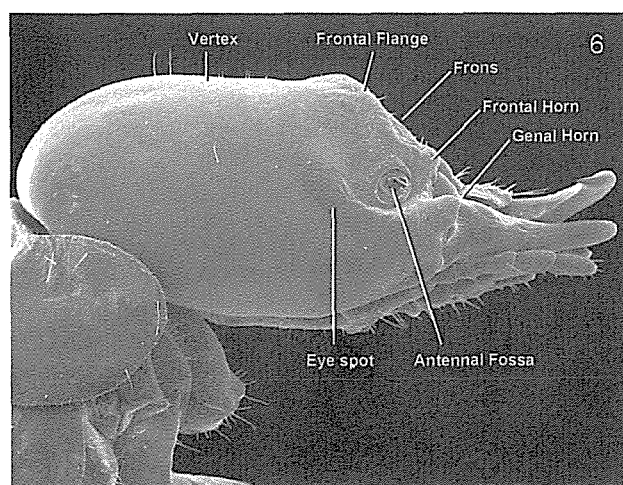
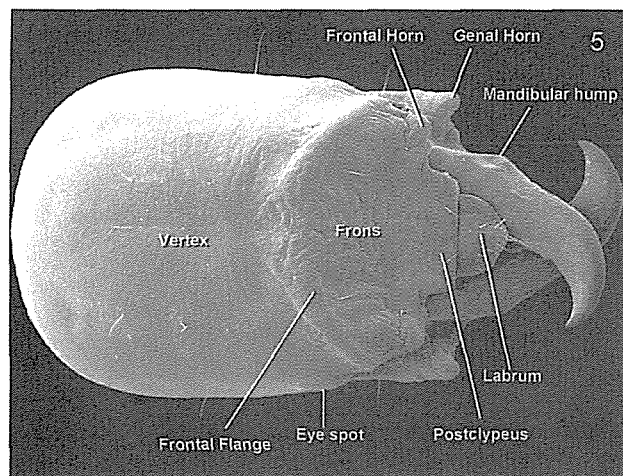
unsharp mask tool, and the subject outlined using photograph-enhancing software (Photo Magic, Micrografx, Inc., Richardson, TX). Subject backgrounds were converted to black, and scale bars digitally redrawn. Soldier antennae were removed from SEM specimens and palps were digitally deleted from dorsal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

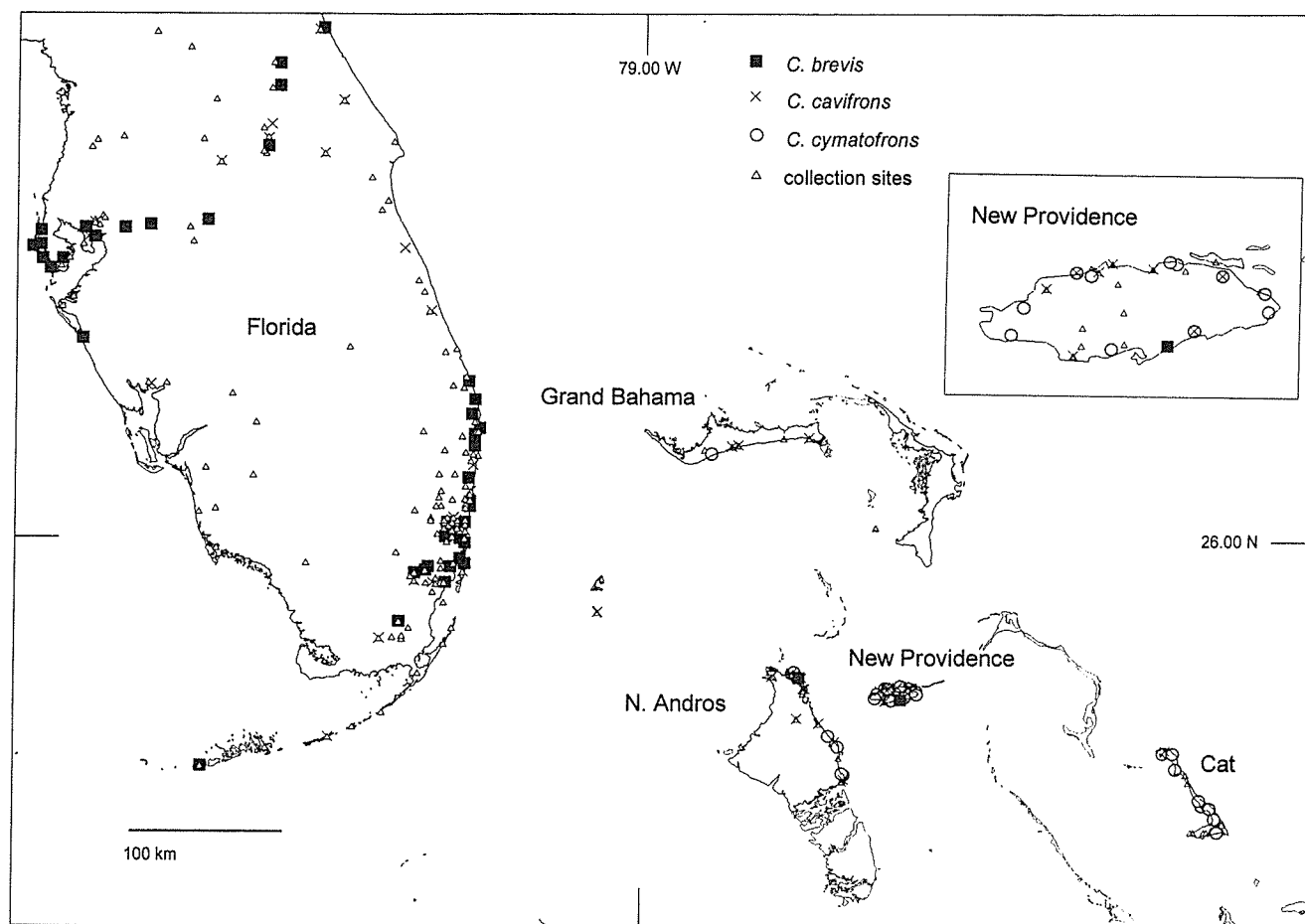


Figure 7. *Cryptotermes* distribution on the northern and central Bahamas and peninsular Florida.

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

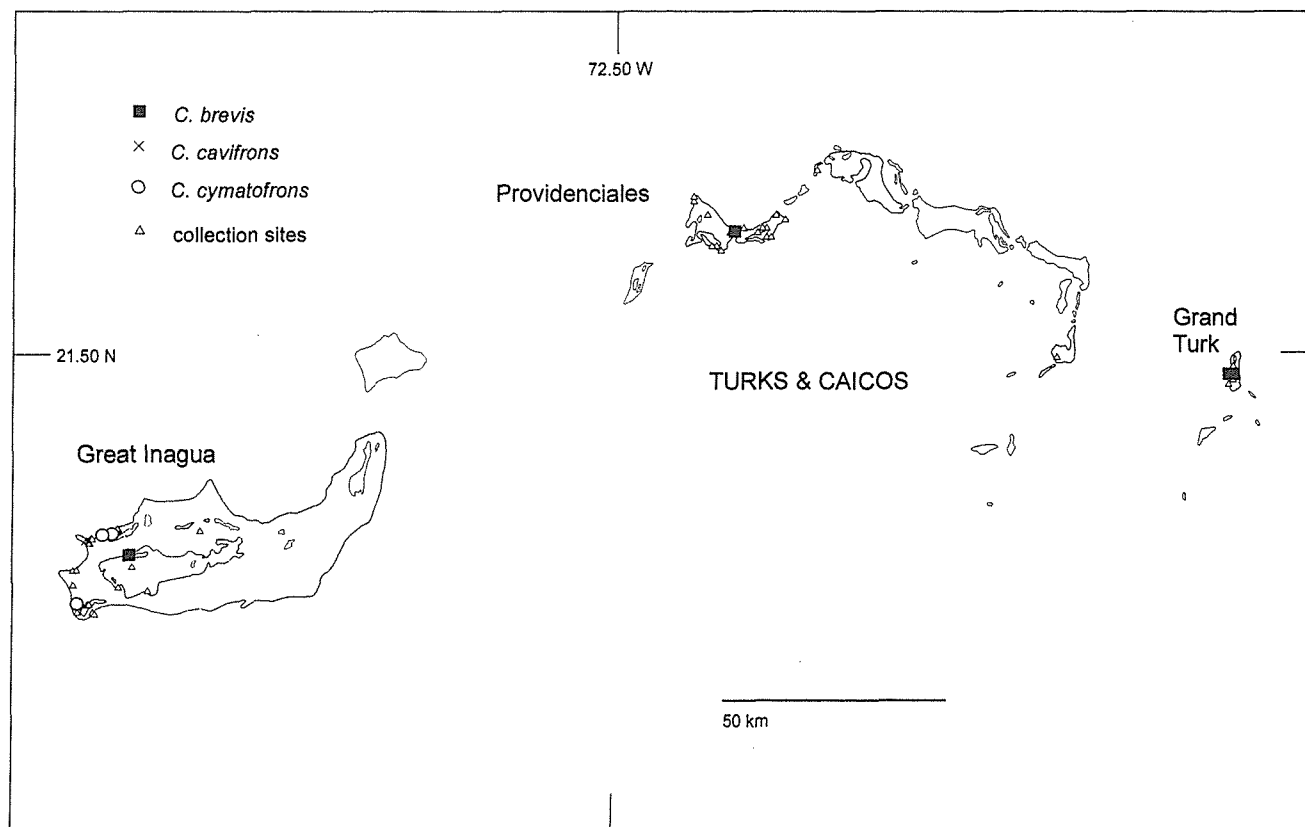


Figure 8. *Cryptotermes* distribution on Great Inagua, Bahamas, and Turks and Caicos Islands.

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

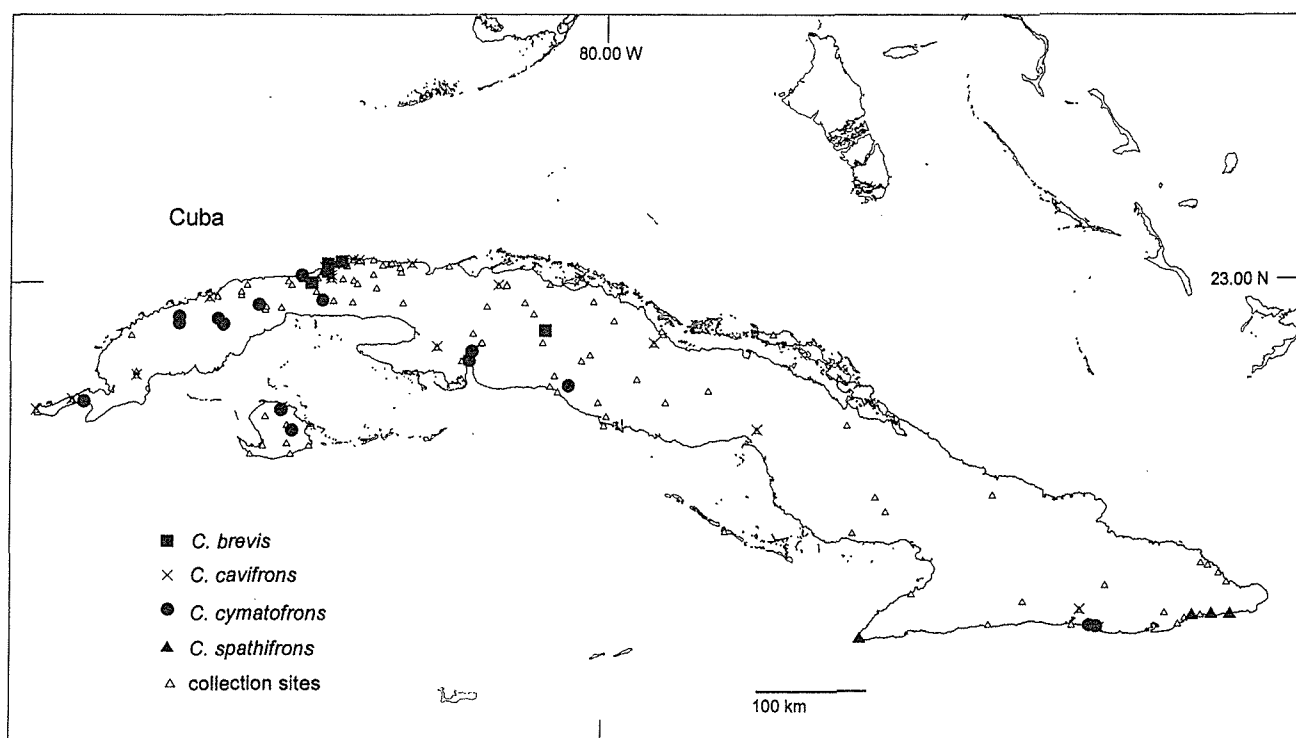


Figure 9. *Cryptotermes* distribution in Cuba.

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| or by the frontal horns (Figs. 19, 22, 25, 37, 34, 40, 55, 58, 61, 64, 67, 70, 73, 79) | 8 | 6. | Frontal flange semicircular from above, frons occupying anterior 1/3 of head capsule (Figs. 52-54) | <i>C. hemicyclius</i> | |
| 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 | 6'. | Frontal flange semi-hexagonal from above, frons occupying anterior 1/2 of head capsule (Figs. 76-78) | <i>C. spathifrons</i> n. sp. |
| 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 | 7. | Frontal flange elevated, narrow, with median notch; mandibles narrow (Figs. 46-48) | <i>C. dudleyi</i> |
| 4. | Frontal flange convex, forming characteristic frontal peak and obscuring view of frons from above; head capsule surface dull (Figs. 43-45) | | 7'. | Frontal flange shallow, broad, without median notch; mandibles broad (Figs. 28-30) | <i>C. chasei</i> |
| 4'. | Frontal flange concave, brow-like, not obscuring dorsal view of frons; head capsule glossy (Figs. 48-50) | | 8. | Head capsule coarsely rugose; vertex deeply concave (Figs. 19-24, 40-42, 67-69) | 9 |
| 5. | Mandibles with basal inflations forming robust shelf-like humps (Figs. 52, 76) | 6 | 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 |
| 5'. | Mandibles without basal inflations, humps weak, not shelf-like (Figs. 28, 46) | 7 | 9. | Head capsule not obviously constricted laterally in dorsal view, posterior not bulbous; frons, in frontal view, ovoid; (Figs. 19, 40, 67) | 10 |
| | | | 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> |
| | | | 10. | Frontal horns, in lateral view, about 3 times larger than genal horns; genal horns projecting forward | |

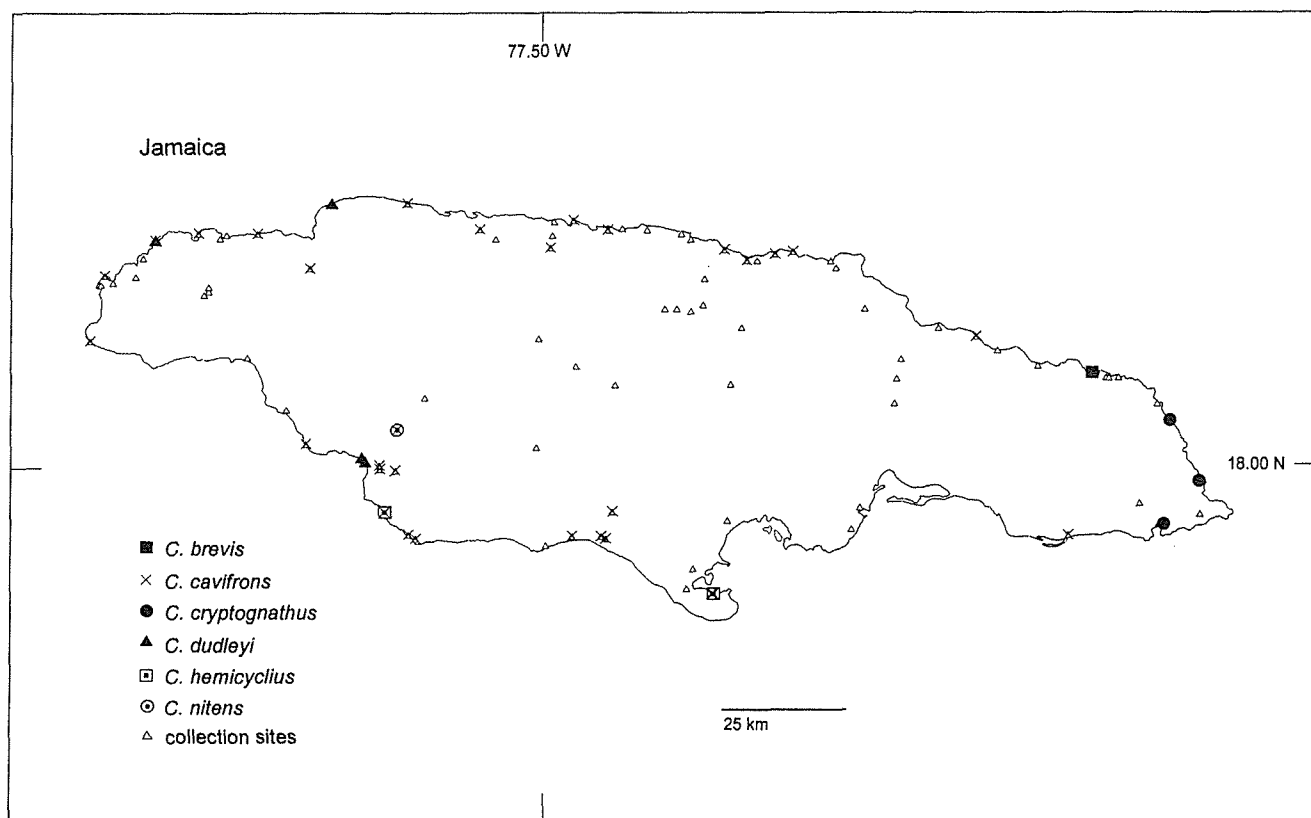


Figure 10. *Cryptotermes* distribution in Jamaica.

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| | and only slightly recessed behind frontal horns, left mandible 0.68-0.75 mm long (Figs. 40-42) <i>C. darlingtonae</i> n. sp. | 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 |
| 10 ¹ . | 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> | 13 ¹ . | 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. |
| 10 ² . | Frontal horns, in lateral view, subequal; smaller species, left mandible 0.56-0.62 mm long (Figs. 19-21) <i>C. aequicornis</i> n. sp. | | |
| 11. | Head capsule rugosity cerebraform; flange not elevated (Figs. 34-36, 70-72) 12 | | |
| 11 ¹ . | 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 | | |
| 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. cylindrocephus</i> n. sp. | 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 |
| 12 ¹ . | 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> | 14 ¹ . | 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; |

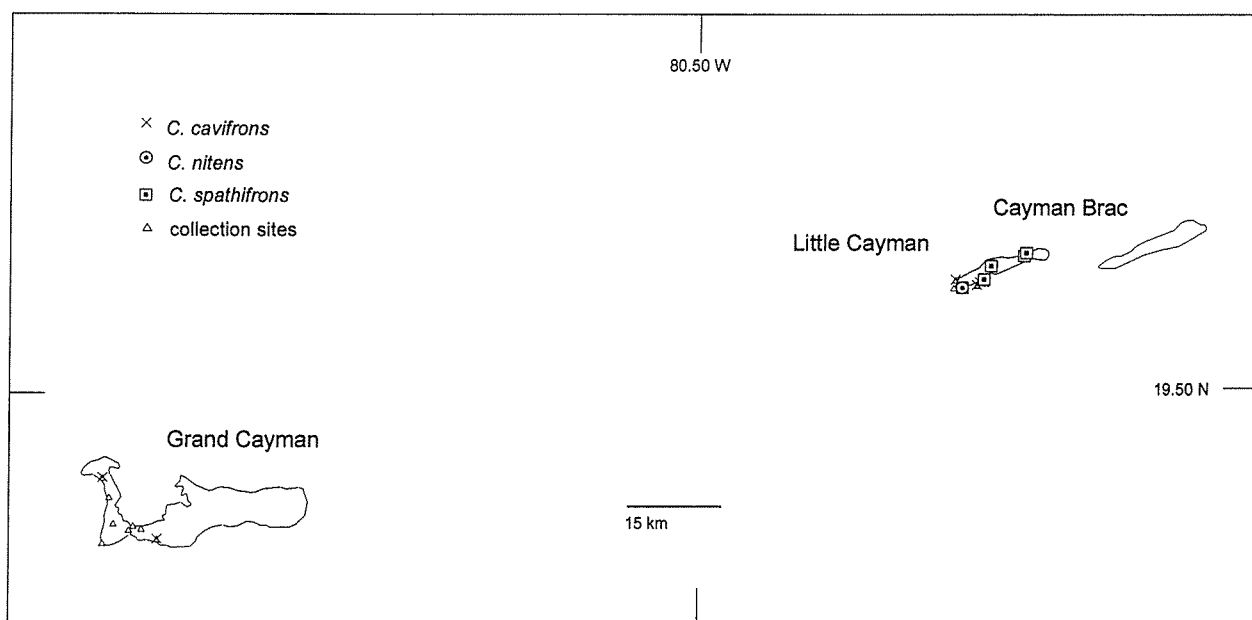


Figure 11. *Cryptotermes* distribution on the Cayman Islands.

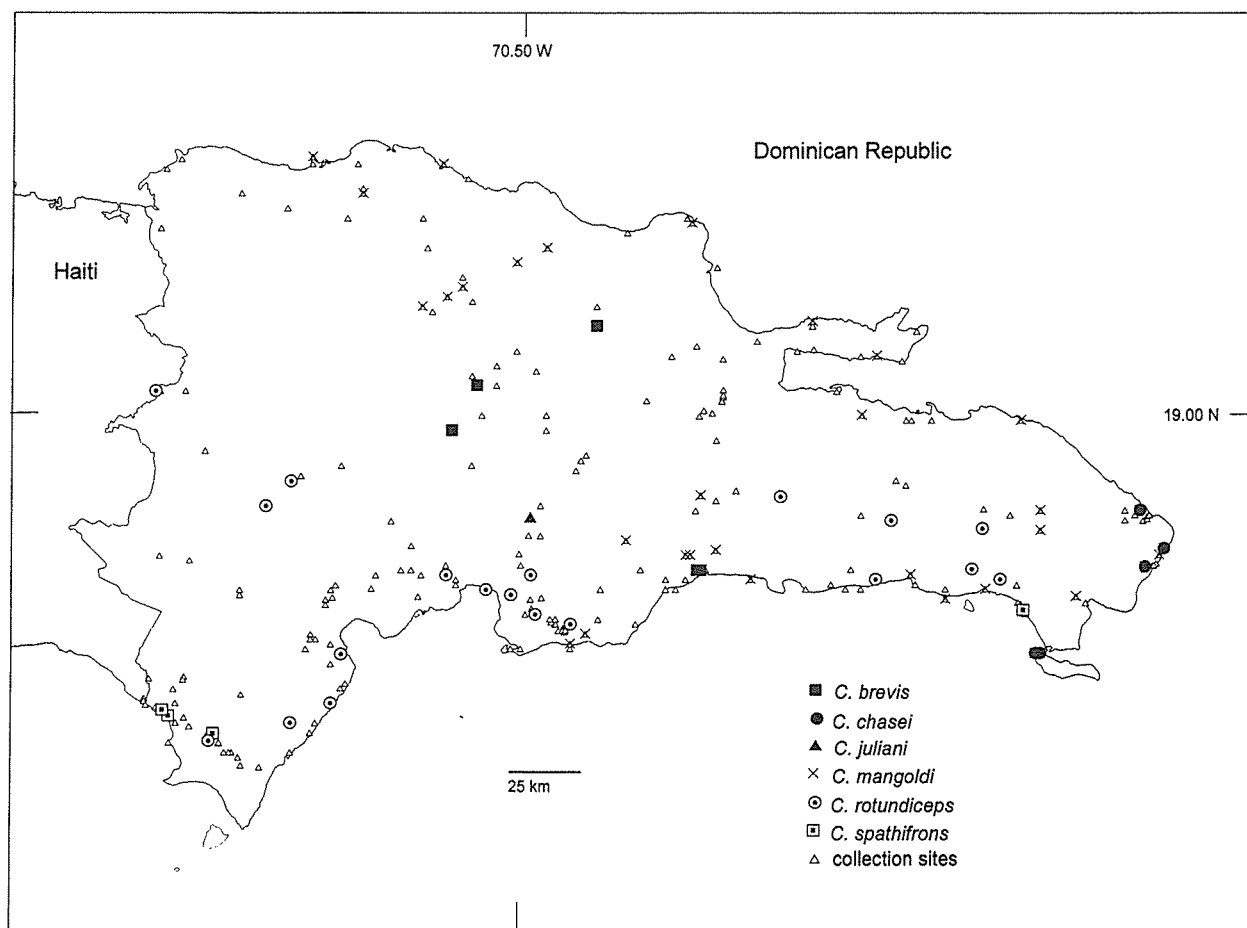


Figure 12. *Cryptotermes* distribution in the Dominican Republic.

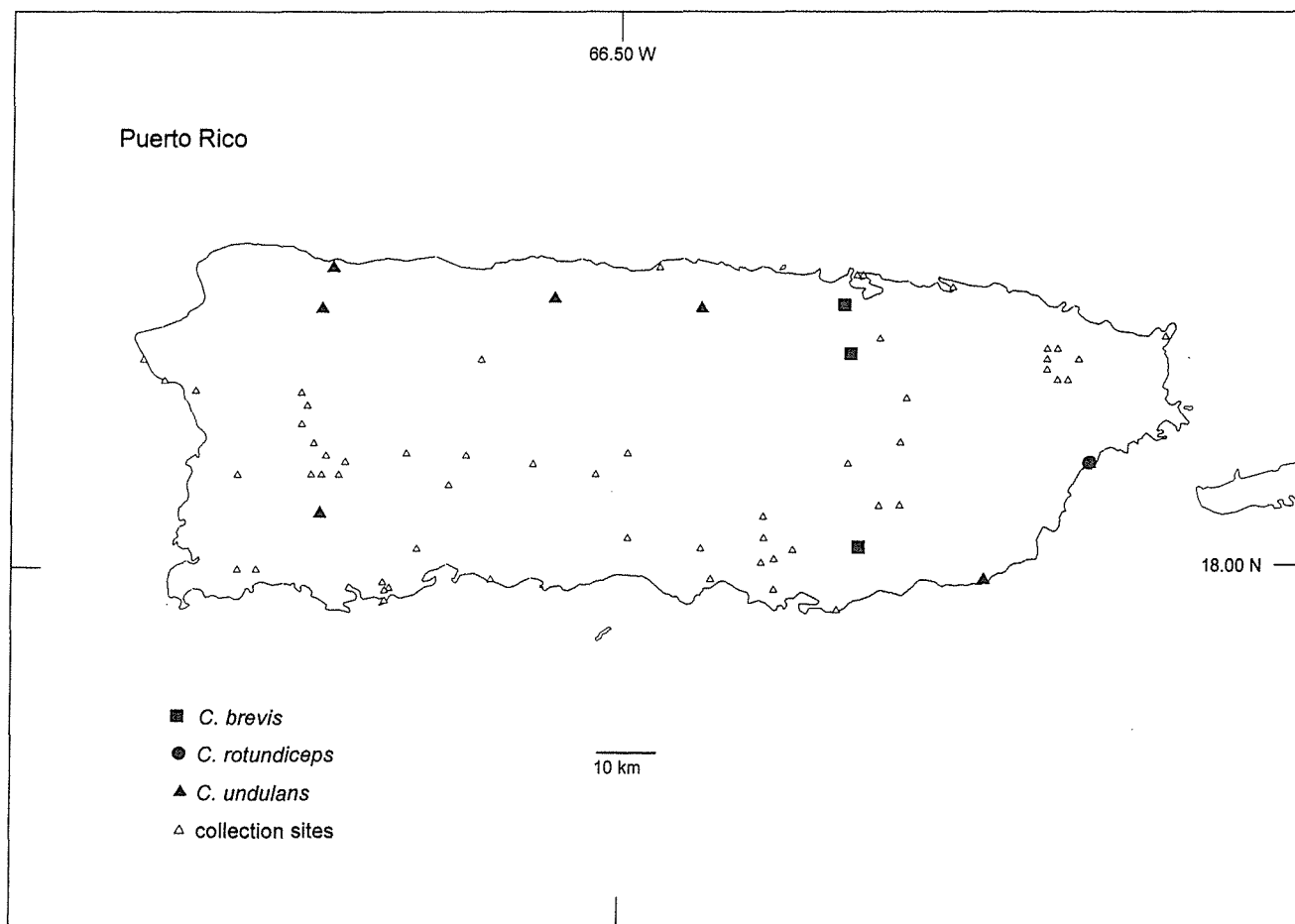


Figure 13. *Cryptotermes* distribution in Puerto Rico.

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| larger species, head width ≥ 1.26 mm, left mandible length ≥ 0.78 mm (Figs. 55-57) | |
| <i>C. juliani</i> n. sp. | |
| 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 |
| 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. |
| 16. Frontal horns, in dorsal view, divergent, projecting to sides; head capsule smooth or very faintly rugose (Figs. 37-39, 61-63) | 17 |
| 16". Frontal horns, in dorsal view, parallel, projecting forward; head capsule rugosity variable but present (Figs. 25-27, 64-66, 79-81) | 18 |
| 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. |
| 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. |
| 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. |
| 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 |
| 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> |
| 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. |

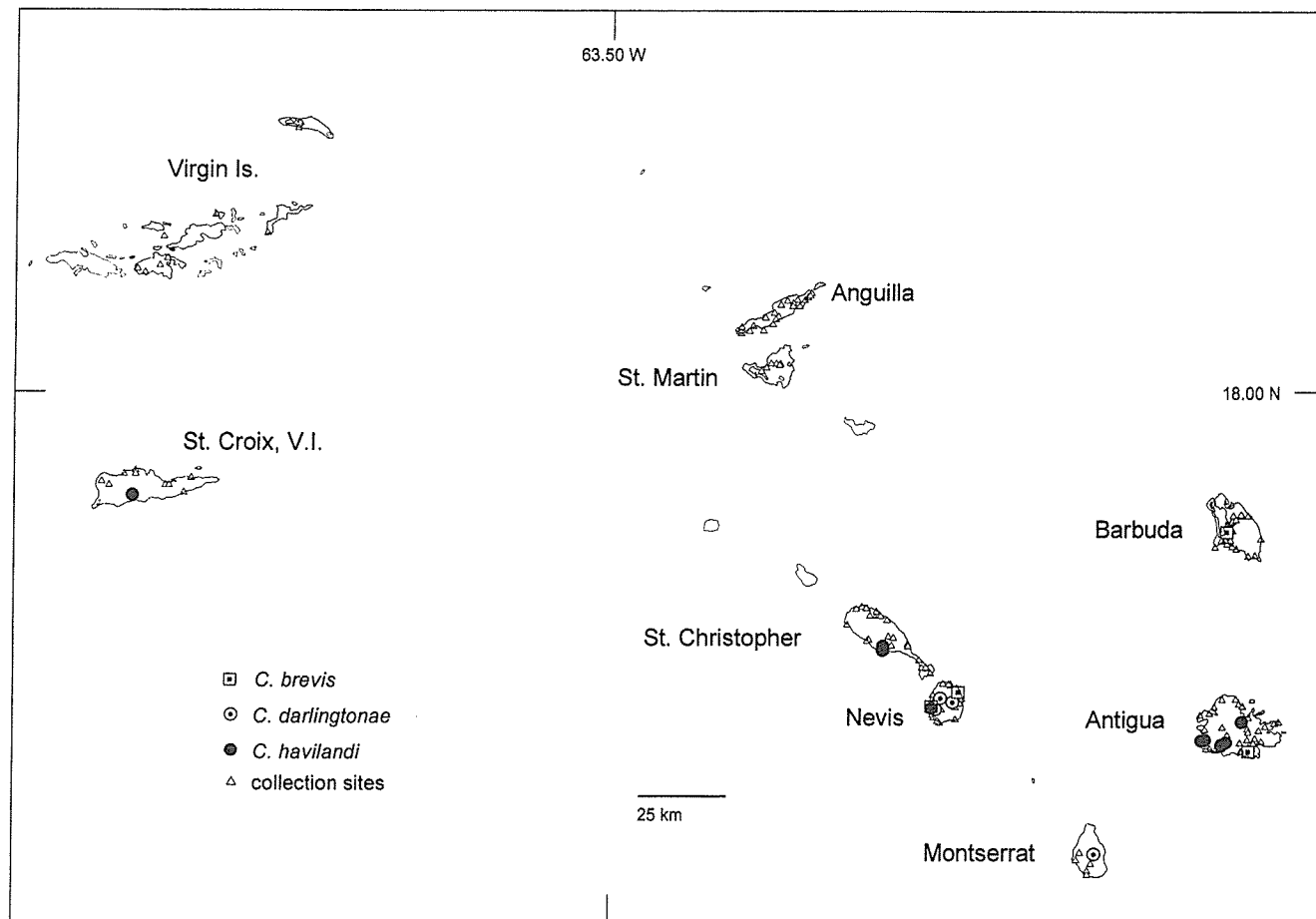


Figure 14. *Cryptotermes* distribution on the Virgin Islands and northern Lesser Antilles.

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. cylindrocephus*, 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

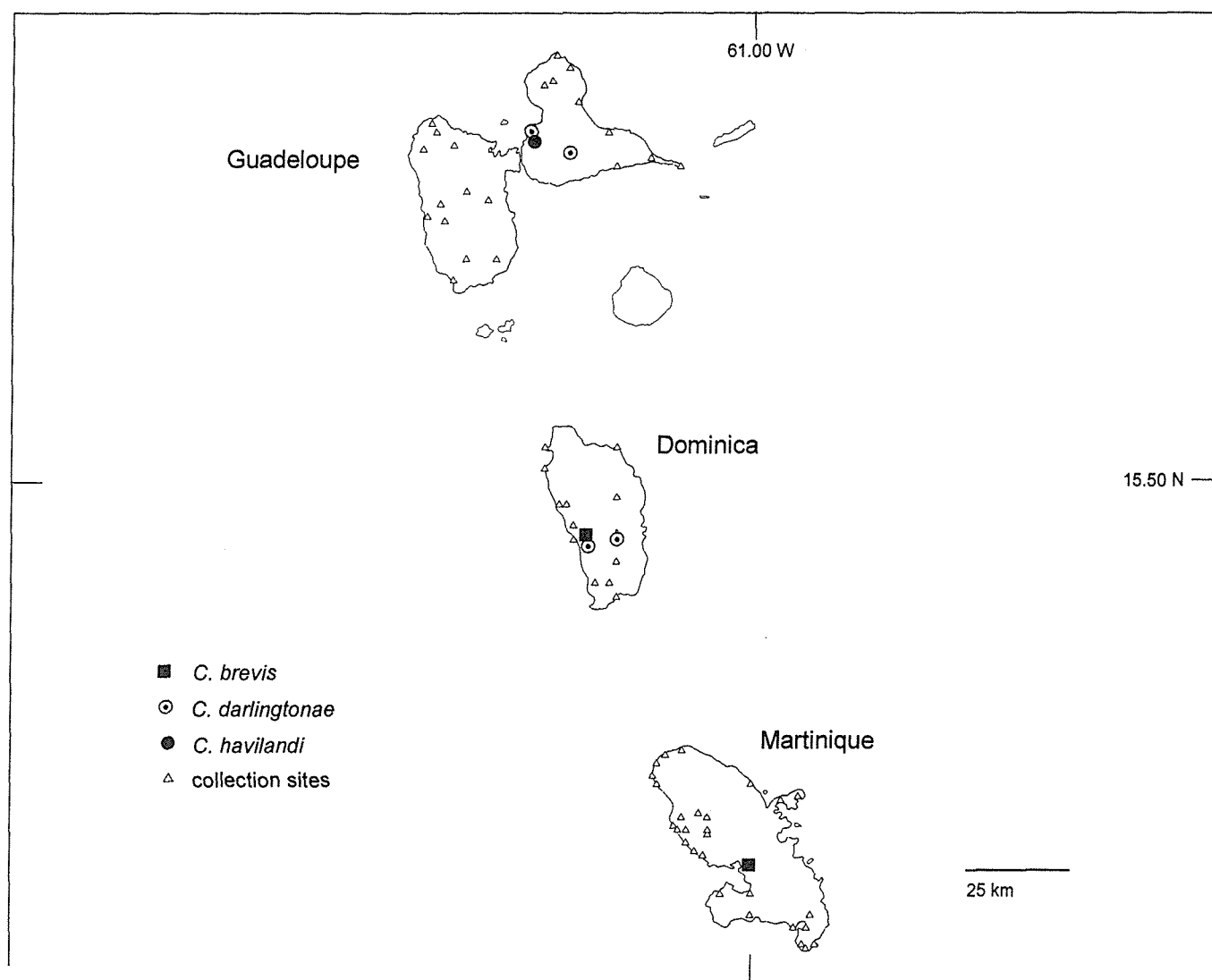


Figure 15. *Cryptotermes* distribution on the central Lesser Antilles.

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.

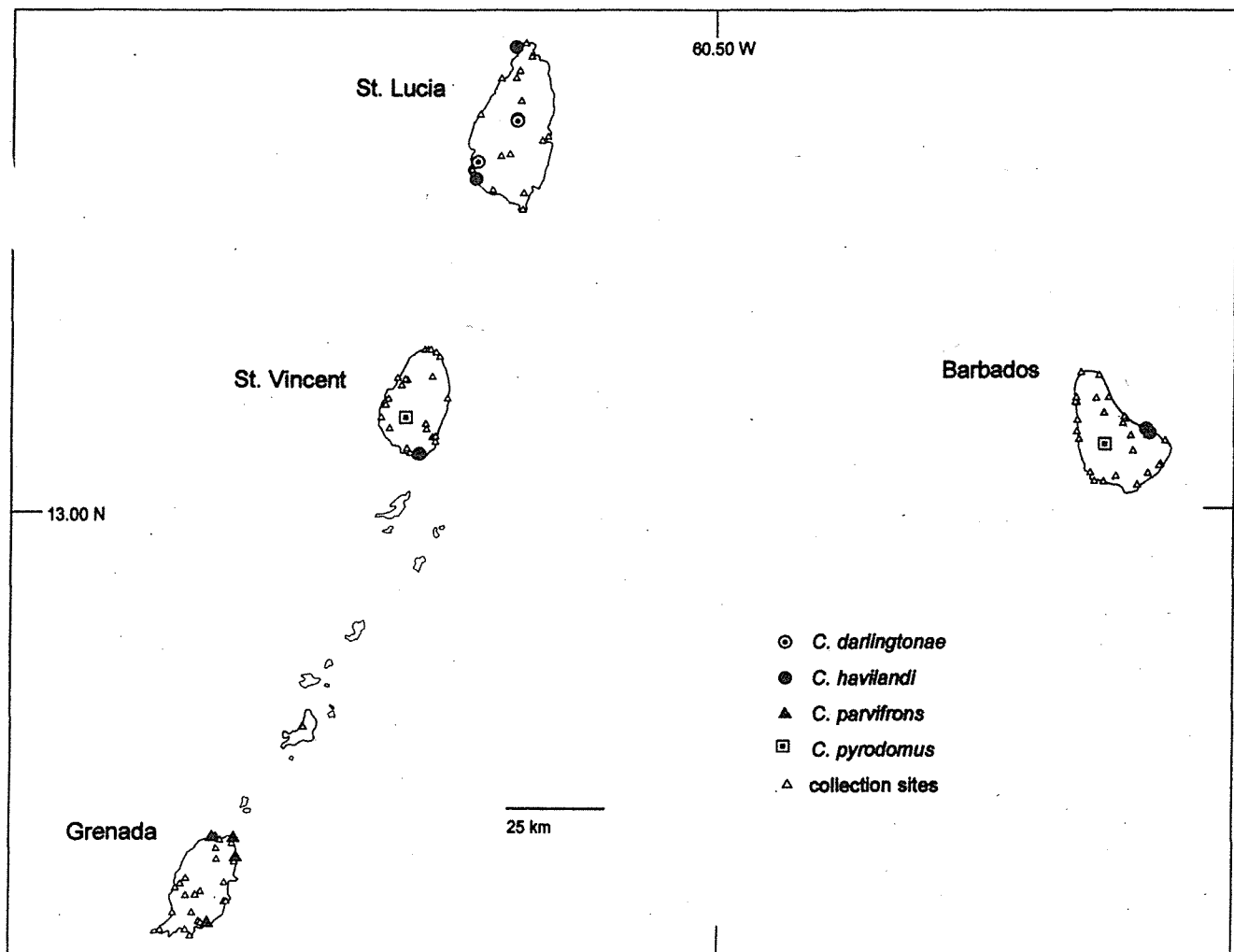


Figure 16. *Cryptotermes* distribution on the southern Lesser Antilles.

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,

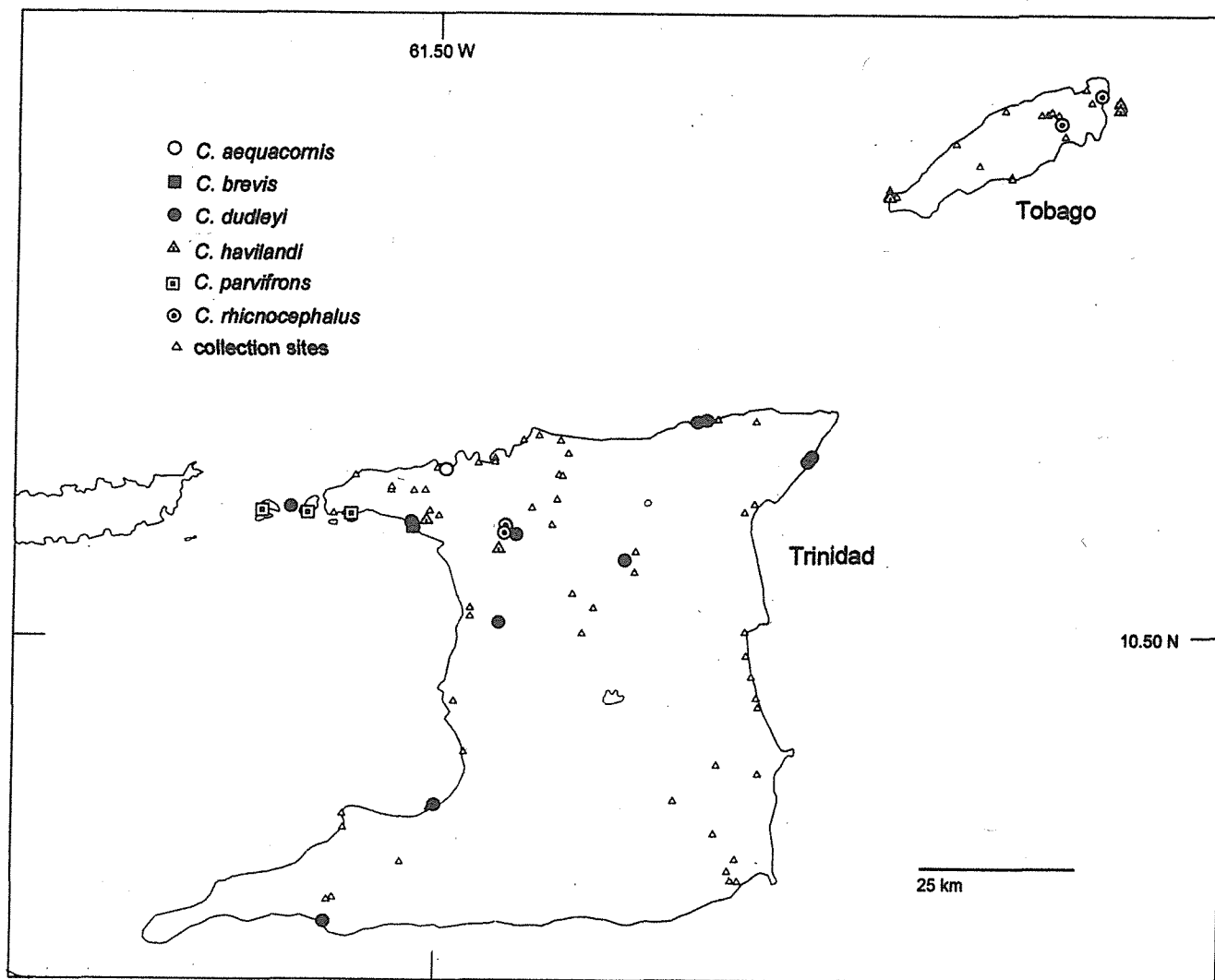


Figure 17. *Cryptotermes* distribution in Trinidad and Tobago.

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 aequacornis* 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; $10^\circ 44.78' \text{ N}$, $61^\circ 29.27' \text{ W}$; 28.v.1996; JC, JK, BM, JM, and RS; holotype soldier, 5 paratype soldiers, one for SEM, immatures (TT319).

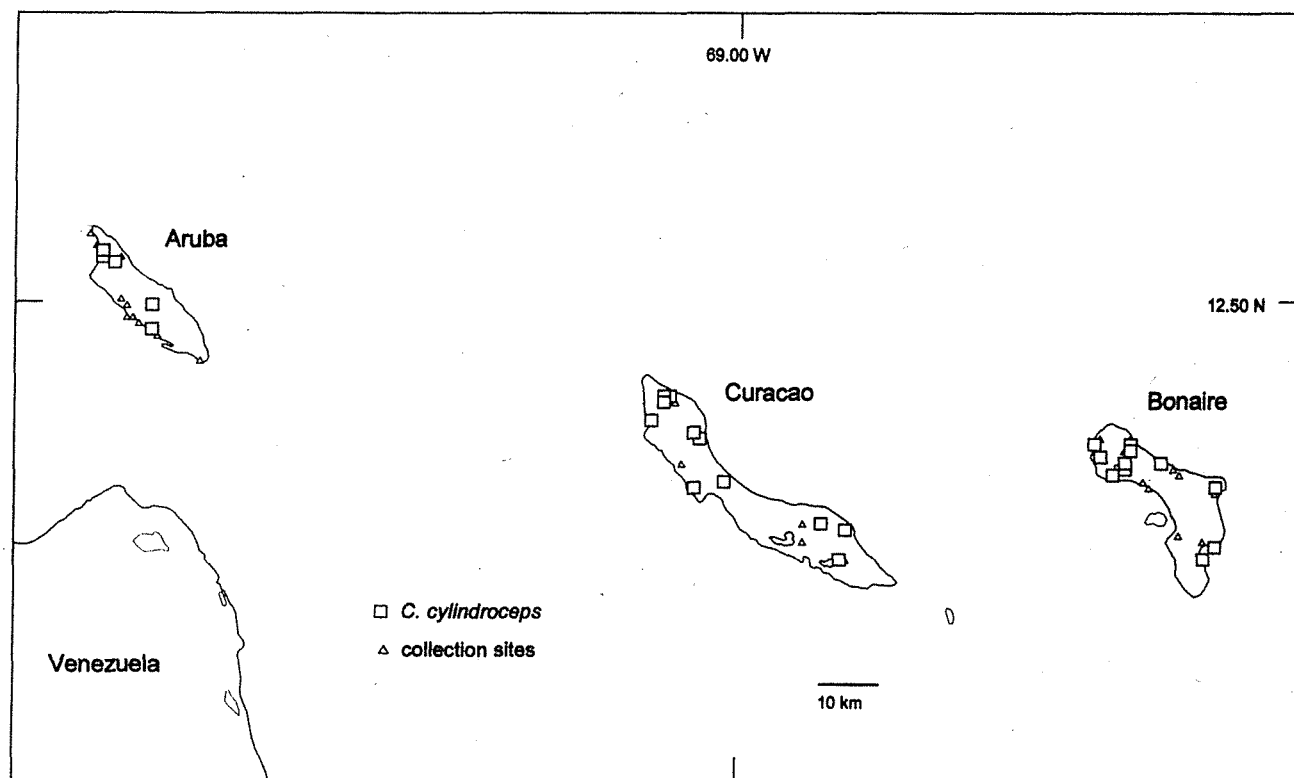


Figure 18. *Cryptotermes* distribution on the Netherlands Antilles.

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. cylindrocephus* 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>cylindrocephus</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

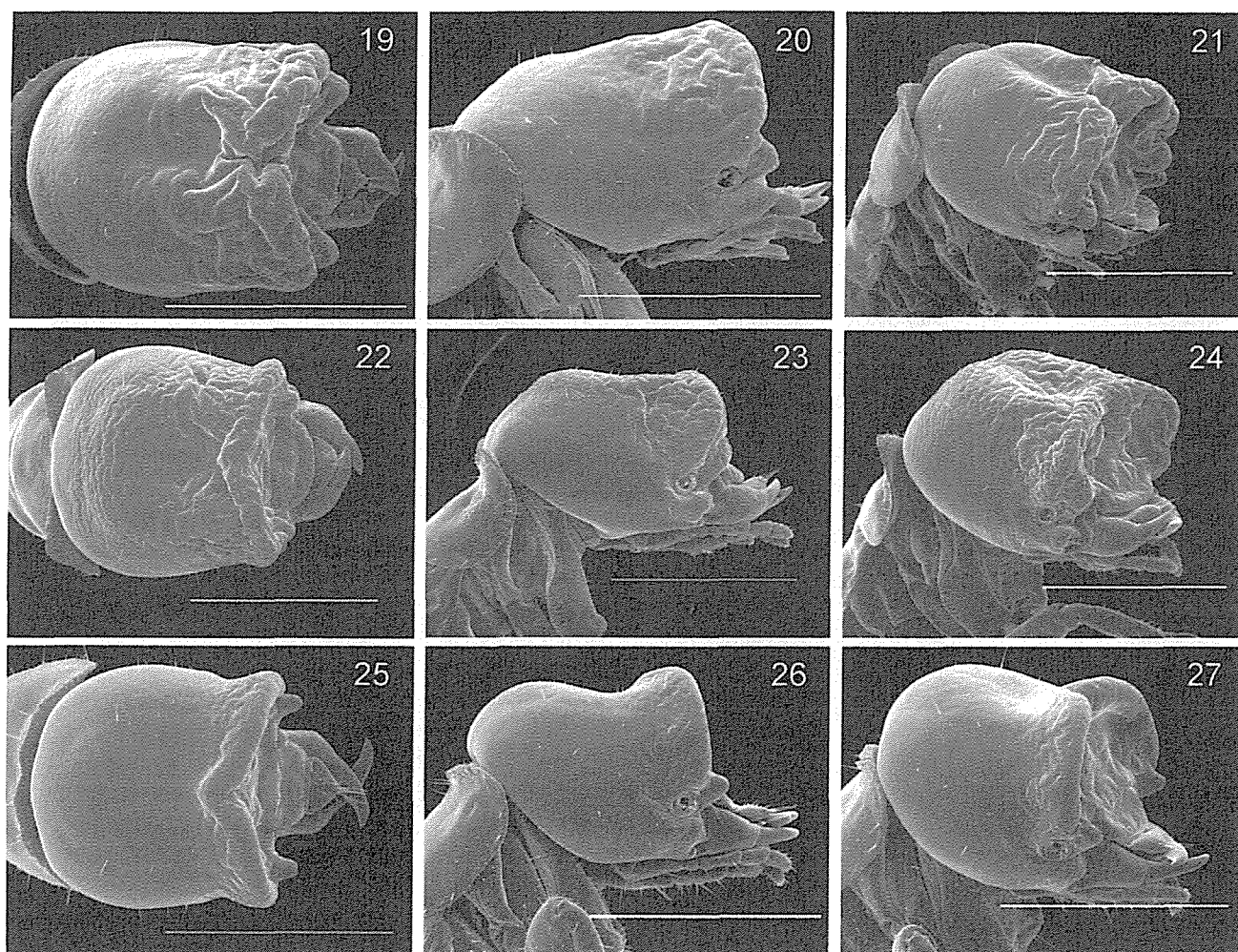
darker wing scales. The wing venation of *C. brevis* is atypical of other congeners in that, in some individuals, the media extends to the wing tip (Scheffrahn et al. 1988).

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 \pm SD	Holotype
Head length to tip of mandibles	1.46-1.61	1.54 \pm 0.052	1.54
Head length to frontal horns	1.36-1.44	1.40 \pm 0.029	1.38
Frontal flange width	1.05-1.14	1.11 \pm 0.045	1.06
Frontal horns, outside span	0.82-0.92	0.87 \pm 0.038	0.85
Head width, maximum	1.06-1.18	1.12 \pm 0.045	1.06
Head height, excluding postmentum	0.82-0.96	0.91 \pm 0.063	0.82
Pronotum, maximum width	0.93-1.06	1.01 \pm 0.052	0.97
Pronotum, maximum length	0.75-0.82	0.80 \pm 0.029	0.77
Left mandible length, tip to ventral condyle	0.56-0.62	0.60 \pm 0.029	0.62
Total length	3.51-4.06	3.76 \pm 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 biometrically 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. Arolium 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

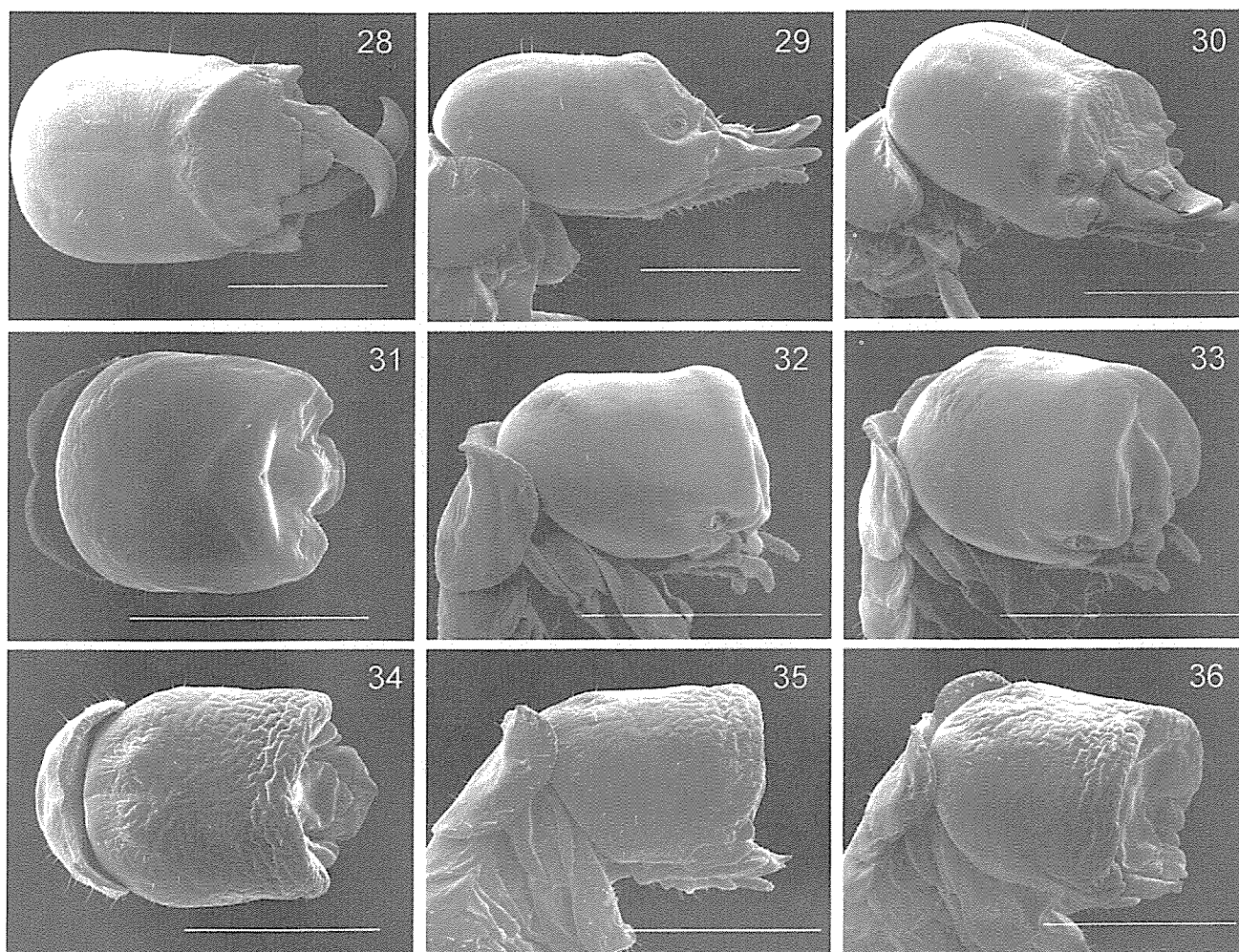
Table 8. Measurements of *Cryptotermes chasei* soldier.

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 *Cryptoterme 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 *Cryptoterme 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. *Cryptoterme 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. Fortype 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

narrower than head width at eyes; shape subsquare, sides nearly rectate, and slightly divergent backward, or weakly convex; anterior margin moderately concave, posterior margin faintly concave in middle. Fore wing radius joining costal margin at 1/3-1/2 wing length from suture. Radial sector 4-branched. Arolia present.

Comparisons. For comparisons see *Cryptotermes mangoldi*.

Soldier (Figs. 31-33, Table 10). Head, from above, with anterior 1/3-1/2 almost black, remaining posterior ferruginous to chestnut brown; in lateral view, anterior 1/3-1/2 nearly black, ferruginous or chestnut brown in posterior and very narrow orange-yellow marginal strip along foramen magnum. Mandibles with variable pigmentation from ferruginous orange to chestnut brown, with iridescence in some darker individuals. Anterior margin of pronotum with ferruginous orange bow tie-shaped mark; rest of pronotum pale yellow.

Head, in dorsal view, ovoid, with only antennae and palps protruding; sides nearly parallel with slight convergence to anterior, and with faint constriction in middle; anterior and posterior corners rounded. Head surface prevalently smooth and reflective, including frons and frontal flange; faint and slightly elongated rugosity in posterior 1/4 and laterally. Frontal flange stout both in dorsal and frontal view, median width twice lateral width; anterior margin almost straight near middle, then protruding forward laterally; frontal flange weakly, but clearly rising above vertex and conspicuously rounded in lateral view. Frons distinctly convex in middle, flanked on each side by a lateral concavity; convexity continuous with postclypeus below and tapering above into a point separated from the frontal flange. Frontal plane sloping 70° from plane of vertex. Labrum very short and widely rounded. Frontal horns very short but wide, almost continuous with frontal flange. Genal horns minute. Mandibles extremely short; in dorsal view completely eclipsed by postclypeus and frons in half of individuals; often undetectable even in frontal view, except for angled bases; remainder covered by labrum. In remaining individuals, extreme tip of one mandible visible. Mandibles with basal hump, angled, and in lateral view turned distinctly downward; first marginal tooth on both mandibles short, but distinct. Eyes oval and small or large and slightly pigmented in soldier-nymph intercaste. Antennae with 10 to 14 articles, usually 11 or 12; formulae variable. Pronotum widely shield-shaped and with shallowly incised anterior

margin, posterior margin almost straight, sides slightly convex; anterior corners of pronotum curve almost at right angles. Anterior margin of pronotum densely and bluntly sinuous.

Comparisons. *Cryptotermes cryptognathus* is dissimilar to all congeners worldwide due to the cryptic positioning of its diminutive mandibles, which reside, when closed, under the labrum. Head phragmosis is extraordinarily compact and rounded, including the frontal convexity. Consequently, the dorsal silhouette of the head is generally very rounded, and the frontal outline is ovoid. The head morphology of *C. cryptognathus* is unique among all taxa of mandibulate soldiers in the Isoptera, including all Kalotermitidae, in having extremely altered mandibles which do not project beyond the frontogenal boundaries of the head capsule (Scheffrahn *et al.* 1998).

Remarks. The range of *C. cryptognathus* is limited, but the species is not rare where it does occur.

Geographical Distribution. West Indies (Fig. 10): Greater Antilles: northeastern coast of Jamaica. Elsewhere: unknown.

Etymology. The name assigned to this species relates the obscured and recessed condition of the soldier mandibles.

Material Examined. Holotype colony: **Jamaica.** Booby South Point; 17°58.38'N, 76°14.76'W; 27 v. 1997; PB, JC, JK, BM, JM, and YR; Holotype soldier, 5 paratype soldiers, 1 non-type functional reproductive, immatures (JA323). Morphotype colony: Bowden; 18°05.37'N, 76°18.20'W; 27 v. 1997 PB, JC, JK, BM, JM, and YR; Morphotype winged imago, 7 paramorphotype winged imagos, few non-type imagos, 1 paratype soldier, immatures (JA345). Paratype colonies: 2 km SE Rural Hill; 17°53.36'N, 76°18.85'W; 27 v. 1997; PB, JC, JK, BM, JM, and YR; 4 paratype soldiers, one for SEM, immatures (JA313). Same data; 2 paratype soldiers, immatures (JA314). Same data; 3 soldiers, immatures (JA315). Bowden; 18°05.37'N, 76°18.20'W; 27 v. 1997; PB, JC, JK, BM, JM, and YR; 2 paratype soldiers, 2 paramorphotype alates, immatures (JA344).

Cryptotermes cylindroceps n. sp.

Description. Imago (Table 11). General color variable, brown to yellow-brown. Frons pale brown, vertex brown or yellow-brown. Darker narrow strip between eyes and occiput. Chevron pattern on fore wing scales

Table 11. Measurements of *Cryptotermes cylindroceps* imago.

Measurement in mm (n = 5♀, 13♂ from 9 colonies)	Range	Mean ± SD	Morphotype
Head length with labrum	1.10-1.26	1.19 ± 0.035	1.19
Head length to postclypeus	0.77-0.87	0.82 ± 0.021	0.83
Head width, maximum at eyes	0.93-1.00	0.96 ± 0.021	0.96
Eye diameter, maximum	0.27-0.30	0.29 ± 0.0096	0.30
Eye to head base, minimum	0.15-0.18	0.16 ± 0.0097	0.15
Ocellus diameter, maximum	0.13-0.16	0.14 ± 0.0075	0.15
Pronotum, maximum length	0.61-0.69	0.65 ± 0.023	0.67
Pronotum, maximum width	0.75-0.92	0.85 ± 0.040	0.83
Total length with wings	8.02-8.80	8.41 ± 0.22	8.66
Total length without wings	3.69-4.97	4.30 ± 0.38	3.83
Fore wing length from suture	6.53-7.10	6.75 ± 0.15	6.96
Fore wing, maximum width	1.75-2.04	1.87 ± 0.080	1.86

Table 12. Measurements of *Cryptotermes cylindroceps* soldier.

Measurement in mm (n = 18 from 12 colonies)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	1.40-1.60	1.52 ± 0.046	1.48
Head length to frontal horns	1.18-1.32	1.27 ± 0.037	1.22
Frontal flange width	1.02-1.18	1.10 ± 0.047	1.06
Frontal horns, outside span	0.77-0.88	0.84 ± 0.027	0.85
Head width, maximum	1.06-1.23	1.15 ± 0.051	1.11
Head height, excluding postmentum	0.90-1.06	0.98 ± 0.050	1.00
Pronotum, maximum width	1.05-1.23	1.11 ± 0.051	1.09
Pronotum, maximum length	0.72-0.87	0.78 ± 0.043	0.74
Left mandible length, tip to ventral condyle	0.51-0.60	0.55 ± 0.025	0.56
Total length	3.07-4.90	3.70 ± 0.44	3.22

distinct and brown or less distinct and yellow-brown. Sclerotized fore wing veins brown or yellow-brown, membrane subhyaline. Antennae, pronotum and abdominal tergites brown to yellow-brown. Labrum pale brown. Femora yellow-white, legs including tibiae distally slightly darker, pale yellow-brown. Abdominal sternites pale brown or yellow-brown. Head suboval, cranial sutures distinct. Eyes moderately large, non-protruding and subcircular. Ocelli large, oval, touching eyes. Antennae with 14 to 17 articles, usually 15 or 16; usual formula 2=3=4=5, less often 2<3=4=5 or 2<3>4=5. Pronotum subsquare, with anterior margin moderately concave, sides faintly convex and posterior margin faintly concave. Pronotum usually with distinct midline

and weak crossbar mark. Fore wing radius converging with costal margin at 1/5 or 1/4 wing length from suture; radial sector with 7-9 branches. Arolia present.

Comparisons. The general color pattern of *Cryptotermes cylindroceps* resembles that of *C. brevis* with the former being slightly darker brown and possessing arolia. *Cryptotermes cylindroceps* has smaller measurements than *C. brevis* including head with labrum, width of head in eyes, width of pronotum, total length with wings, total length without wings, fore wing length, and fore wing width.

Soldier (Figs. 34-36, Table 12). Head in dorsal view, with anterior 1/5-1/2 almost black, grading posteriorly to chestnut brown or dark chestnut brown and orange-yellow in posterior 1/5. Head in lateral view, with anterior 1/5 nearly black; grading to chestnut brown in posterior with orange-yellow marginal strip along foramen magnum. Mandibles very dark chestnut brown. Anterior margin of pronotum ferruginous orange, rest of pronotum pale yellow.

Head shape in dorsal view, subsquare with nearly parallel sides; anterior margin faintly concave, and posterior margin faintly convex; in some specimens slight constriction in anterior 1/3 and slightly bulbous posteriorly, in others with sides slightly divergent forward. Head rugosity reticulate, fine, shallow, more distinct near frontal flange, becoming to faint posteriorly; rugosity extending to genal horns and anterior genae. Frontal flange delineated from frons, but continuous with vertex; in frontal view, with orbicular profile. Frons shallowly concave, with flattened glossy central area, periphery densely rugose; frontal plane sloping 70-90° from plane of vertex. Labrum short, tongue-shaped, inflated distally, and with rather short terminal pilosity. Frontal horns rounded, wide, and short, almost continuous with frontal flange; oriented forward; separated from clypeus by deep indentation. Genal horns conspicuous, twice as long than wide, cylindrical with conical apex, often faintly constricted near bases and with granulate surfaces. Genal horns adjacent to base of frontal horns in lateral view; frontal horns not eclipsing genal horns in dorsal view. Mandibles very short, slightly humped at base in some specimens, angled about 65°; apical tooth of both mandibles rudimentary, skewed; in lateral view slightly bent downward. In closed position, right mandible tip eclipsed by tip of left mandible. Dentition very short, but distinct. Eyes small, narrowly oval, and submerged or absent. Antennae with 11 to 14 articles, usually 11 or 12; formulae very variable. Pronotum shallowly and widely incised anteriorly or bilobed, sides distinctly convex, posteriorly almost straight with rounded corners; overall widely shield-shaped. Anterior margin of pronotum faintly sinuous.

Comparisons. For comparison see *C. rhicnocephalus*.

Remarks. *Cryptotermes cylindroceps* is a dominant species. Samples of this species represent over a half of the kalotermitids collected within its range.

Geographical Distribution. West Indies (Fig. 18): Lesser Antilles: Aruba, Curaçao, Bonaire. Elsewhere: unknown, but suspected on Venezuelan mainland.

Etymology. Name refers to the cylindrical shape of the soldier head capsule.

Material Examined. Holotype colony: **Curaçao**. Santa Barbara; 12°35'N, 68°50'W; 7.ix.1995; JC; holotype soldier, 5 paratype soldiers, few non-type soldiers, morphotype winged imago with 6 paramorphotype winged imagos, more non-type alates, immatures (NA074). Paratype colonies: **Aruba**. Palm Beach; 12°05'N, 70°03'W; 7.ix.1995; JC; 1 paratype, 1 non-type soldier, immatures (NA1). San Fuego; 12°30'N, 69°58'W; 2.ix.1995; JC; 1 paratype soldier, 2 paramorphotype winged imagos, more non-type alates, immatures (NA010). Pos Chiquito; 12°27'N, 69°58'W; 3.ix.1995; JC; 1 paratype, 1 non-type soldier, 1 paramorphotype alate, many non-type alates, immatures (NA028). Hills near Noord; 12°34'N, 70°01'W; 27.iv.1995; A. van Liempt; 1 paratype soldier, immatures (NA130). **Bonaire**. Karpata; 12°13'N, 68°23'W; 5.ix.1995; JC; 1 paratype, 3 non-type soldiers, immatures (NA49). Flamingo Sanctuary; 12°15'N, 68°24'W; 5.ix.1995; JC; 1 paratype, 2 non-type soldiers, immatures (NA057). Bakuna; 12°06'N, 68°12'W; 5.ix.1995; JC; 1 paratype soldier, 2 paramorphotype winged imagos, many non-type alates, immatures (NA060). Boven Bolivia; 12°12'N, 68°12'W; 6.ix.1995; JC; 1 paratype soldier, 2 non-type soldiers, 2 paramorphotype winged imagos, many non-type alates, immatures (NA067). **Curaçao**. Tera Cora; 12°13'N, 69°01'W; 8.ix.1995; JC; 1 paratype soldier, many non-type soldiers, one for SEM, 1 paramorphotype winged imago, 2 non-type alates, immatures (NA077). Bron van San Pedro; 12°17'N, 69°04'W; 8.ix.1995; JC; 1 paratype soldier, many non-type soldiers, 1 paramorphotype winged imago, 5 non-type alates, immatures (NA081). Ascencion; 12°18'N, 69°04'W; 8.ix.1995; JC; 7 non-type soldiers, 1 paramorphotype winged imago, 5 non-type alates, immatures (NA082). Short Cut; 12°21'N, 69°07'W; 8.ix.1995; JC; 1 paratype soldier, 4 non-type soldiers, 1 paramorphotype winged imago, 3 non-type alates, immatures (NA087).

Cryptotermes cymatofrons n. sp.

Description. Imago (Table 13). General color yellow-brown. Sclerotized fore wing veins pale brown; membrane subhyaline. Head including labrum yellow-brown, except for pale brown band between eyes.

Table 13. Measurements of *Cryptotermes cymatofrons* imago.

Measurement in mm (n = 7♀, 7♂ from 5 colonies)	Range	Mean ± SD	Morphotype
Head length with labrum	1.18-1.28	1.21 ± 0.033	1.24
Head length to postclypeus	0.88-0.96	0.92 ± 0.023	0.92
Head width, maximum at eyes	0.95-1.01	0.97 ± 0.027	0.95
Eye diameter, maximum	0.33-0.37	0.34 ± 0.014	0.34
Eye to head base, minimum	0.11-0.14	0.12 ± 0.0093	0.12
Ocellus diameter, maximum	0.09-0.14	0.11 ± 0.016	0.09
Pronotum, maximum length	0.65-0.77	0.69 ± 0.036	0.67
Pronotum, maximum width	0.85-0.98	0.91 ± 0.045	0.90
Total length with wings	9.09-10.22	9.68 ± 0.34	9.66
Total length without wings	4.54-5.68	5.11 ± 0.33	4.97
Fore wing length from suture	7.38-8.24	7.84 ± 0.27	7.81
Fore wing, maximum width	2.04-2.24	2.13 ± 0.052	2.14

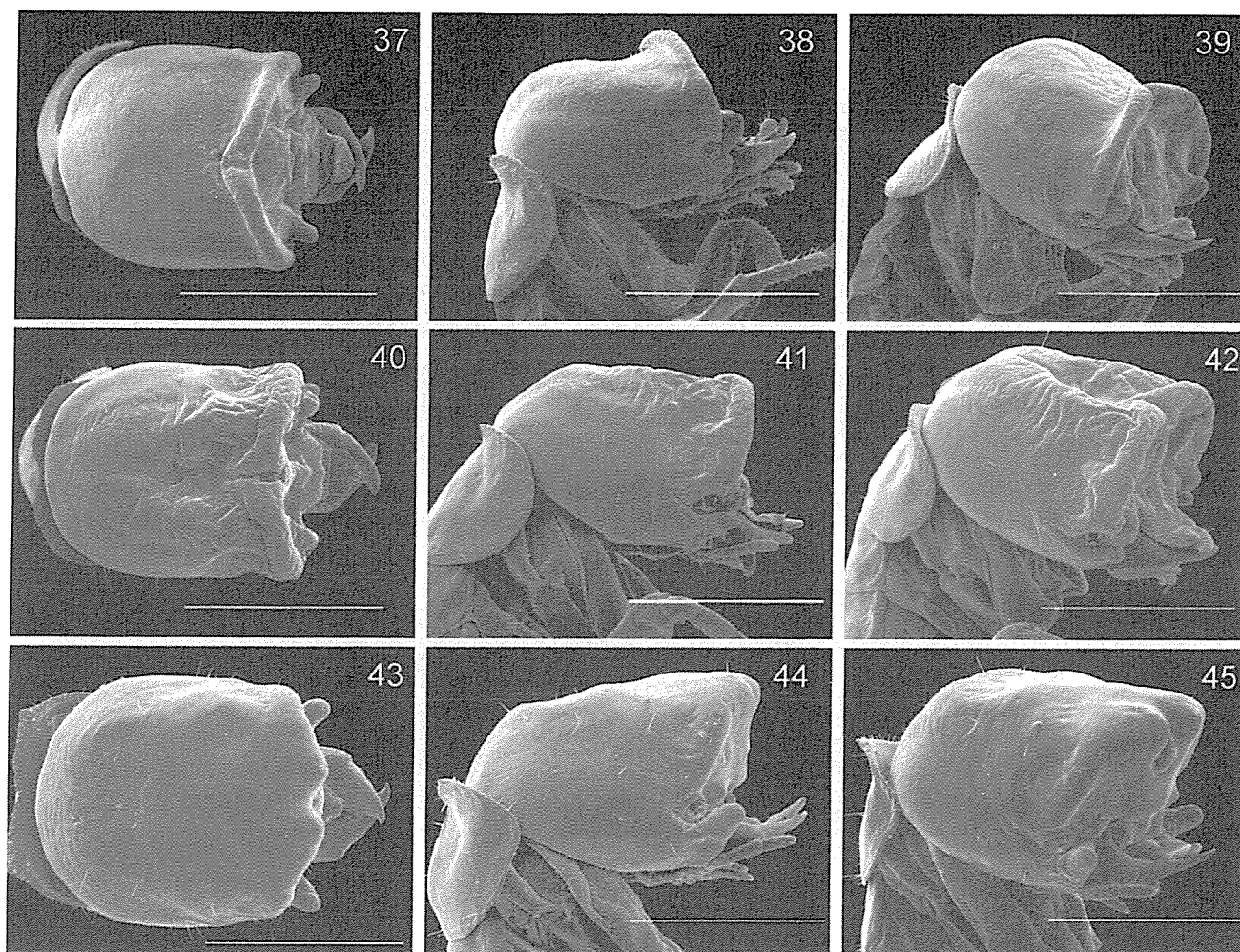
Table 14. Measurements of *Cryptotermes cymatofrons* soldier.

Measurement in mm (n = 17 from 14 colonies)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	1.48-1.63	1.57 ± 0.047	1.61
Head length to frontal horns	1.28-1.42	1.34 ± 0.047	1.42
Frontal flange width	1.11-1.26	1.18 ± 0.038	1.19
Frontal horns, outside span	0.83-0.95	0.90 ± 0.027	0.90
Head width, maximum	1.14-1.26	1.19 ± 0.033	1.23
Head height, excluding postmentum	0.77-0.87	0.81 ± 0.028	0.83
Pronotum, maximum width	1.08-1.28	1.15 ± 0.059	1.15
Pronotum, maximum length	0.72-0.92	0.82 ± 0.045	0.80
Left mandible length, tip to ventral condyle	0.69-0.74	0.71 ± 0.017	0.69
Total length	3.42-4.80	3.98 ± 0.37	4.31

Pale brown chevron pattern on fore wing scales moderately distinct. Pronotum pale yellow-brown with golden fringe. Abdominal tergites and sternites pale yellow. Antennae very pale brown. Femora whitish, legs very pale brown distally. Head oval, cranial sutures faint. Eyes large, protruding, suboval with rectate margins along antennal fossae. Ocelli small, oval, and touching eyes. Antennae with 15 to 18 articles, usually 16 or 17; formulae variable, but usually 2>3=4=5. Pronotum subsquare, distinctly narrower than head at eyes; anterior margin moderately concave, sides moderately convex, and posterior margin shallowly concave. Crossbar mark and midline of pronotum faint. Media of fore wing running

atypically long through 3/4 wing length from suture; radius reaching 2/5 of wing length from suture; radial sector with 5-7 branches. Arolia present.

Comparisons. The imago of *C. cymatofrons* is very similar, and difficult to distinguish from *C. nitens*. The first species is generally larger in many measurements, but some ranges overlap. The wings of *C. cymatofrons* are proportionally longer than body length compared to *C. nitens* with the indices of wing length to body length without wings ranging between 1.40-1.72 and 1.18-1.33, respectively.



Figures 37-45. Soldier heads of *Cryptotermes cymatofrons* (BA130, Bahamas, Cat Is., Hermitage) (37-39), *C. darlingtonae* (DM007, Dominica, St. Paul Parish, Springfield Station) (40-42), and *C. domesticus* (Australia, Thursday Is.) (43-45), each, by order, in dorsal, lateral, and oblique views. Scale bars = 1 mm.

Soldier (Figs. 37-39, Table 14). Head in dorsal view, with anterior 1/3 almost black shading posteriorly to ferruginous or chestnut brown; in lateral view ferruginous pigmentation expanding anteriorly to eye spots and genae. Mandibles dark chestnut brown. Pronotum pale yellow to pale orange-yellow, with ferruginous anterior margin.

Head capsule, in dorsal view subsquare, widely rounded posteriorly; surface glossy, with shallow rugosity on anterior half. Frontal flange narrow, conspicuously elevated and cresting toward vertex; flange shallowly incised, medially notched, usually bilobed in frontal view, and distinctly delineated from vertex. Frons evenly concave, with glossy rugosity; frontal plane sloping 70° from plane of vertex. Labrum bluntly linguiform or terminated by broad

triangulate tip. Frontal horns, in dorsal view, diverging laterally as short finger-like projections; in lateral view, forming large hemiglobular projections. Genal horns form small blunt points, much smaller than frontal horns, to which they abut basally. Mandibles short, in dorsal view, angled in basal 1/3 and curving gradually to points; in lateral view, projecting parallel with head axis; dentition short, dull. Eye spot distinct, oval. Antennae with 10 to 14 articles, most commonly 12 or 13; formulae very variable, most frequently 2>3<4=5. Pronotum shield-shaped, comparatively wide; broadly rounded posteriorly, shallow anterior incision with fine marginal sinuosity.

Comparisons. *Cryptotermes cymatofrons* differs from the apparent sibling species *C. nitens* by the conspicuously crested frontal flange of the former. In *C. nitens*, the flange is elevated without recurvature toward the vertex, and, therefore, the flange is not clearly delineated from the vertex as with *C. cymatofrons*. The head capsule and frons of *C. cymatofrons* is shallowly rugose, while in *C. nitens* these are almost smooth, and glossy. Mandibles of *C. cymatofrons* are shorter and curved more gradually in their distal ½ than those of *C. nitens*.

Remarks. *Cryptotermes cymatofrons* tends to be a sublittoral or inland forest species. On the Bahamas, it is somewhat less common overall than *C. cavifrons* (54 and 73 colony series, respectively). However, on the southern and eastern Bahamas, *C. cymatofrons* is more common than *C. cavifrons*. In Cuba, *C. cymatofrons* is unevenly distributed, but widespread, and is known from coastal and lower mountain localities over the length of the island.

Geographical Distribution. West Indies (Figs. 7,8,9): Bahamas: Cat and N Andros Islands; Greater Antilles: Cuba and Isle of Youth. Elsewhere: unknown.

Geographical Variability. Soldiers from Playa Juraguá, Cuba, exhibit slightly more elevated frontal flanges compared to all other known populations.

Etymology. The species is named for the Greek kyma = wave, referring to the crested wave-like elevation of the soldier's frontal flange.

Material Examined. All type material was collected on the Bahamas by JC, JK, JM, JR, and RS. Holotype colony: Cat Island; Hermitage; 24°18'N, 75°25'W; 28.v.1995; holotype soldier, 3 paratype soldiers, one for SEM, morphotype winged imago, 3 paramorphotype winged imagos, with more non-type alates, immatures (BA130). Paratype colonies: Cat Island; Fernandez Bay; 24°19'N, 75°28'W; 26.v.1995; 1 paratype, 1 non-type soldier, immatures (BA003). Cat Island; Smith Bay; 24°21'N, 75°29'W; 26.v.1995; 1 paratype soldier, 7 paramorphotype winged imagos, immatures (BA011). Same data; 1 paratype soldier, many non-type alates, immatures (BA013). Cat Island; Lake shore near Thurston Hill; 24°33'N, 75°38'W; 26.v.1995; 1 paratype, 3 non-type soldiers, 1 non-type alate, immatures (BA32). Cat Island; Zonicles; 24°09'N, 75°22'W; 27.v.1995; 1 paratype, 4 non-type soldiers, 8 non-type alates, immatures (BA089). Cat Island; 1

km NW Old Bight; 24°09'N, 75°22'W; 27.v.1995; 1 paratype soldier, 1 paramorphotype winged imago, many non-type alates, immatures (BA120). Same data as holotype colony; 1 paratype, 10 non-type soldiers, immatures (BA131). Cat Island; Bridge Inn hotel, New Bight; 24°18'N, 75°25'W; 29.v.1995; 1 paratype, 1 non-type soldier, 1 paramorphotype winged imago, 1 non-type alate, immatures (BA175). North Andros Island; 1 km SW Morgan's Bluff; 25°10'N, 77°57'W; 29.v.1995; 1 paratype, 2 non-type soldiers, immatures (BA205). North Andros Island; 1 km N Behring Point; 24°29'N, 78°16'W; 30.v.1995; 1 paratype soldier, 1 paramorphotype winged imago, 8 non-type alates, immatures (BA258). North Andros Island; 4 km N Bowen Sound; 24°29'N, 78°16'W; 30.v.1995; 1 paratype, 2 non-type soldiers, immatures (BA280). North Andros Island; 3 km NW Calabash Bay; 24°46'N, 78°11'W; 30.v.1995; 1 paratype soldier, 1 non-type alate, immatures (BA299). North Andros Island; Morgan's Bluff; 25°10'N, 77°57'W; 31.v.1995; 1 paratype, 2 non-type soldiers, immatures (BA376).

Cryptotermes darlingtonae n. sp.

Cryptotermes longicollis Banks 1918: Darlington (Scheffrahn et al. 1994: 222), Montserrat only.

Cryptotermes n. sp.: Darlington (1992) Guadeloupe (Grande-Terre).

Cryptotermes n. sp.: Darlington (Scheffrahn et al. 1994: 222) Montserrat.

Cryptotermes n. sp.: Darlington (Scheffrahn et al. 1994: 219) Guadeloupe (Grande-Terre).

Cryptotermes n. sp.: Scheffrahn & Krecke (Scheffrahn et al. 1994: 218) Dominica.

Description. Imago (Table 15). General color pale brown. Sclerotized fore wing veins brown; membrane subhyaline, very pale smoky brown. Head, labrum and pronotum pale brown. Pale brown chevron pattern on fore wing scales distinct. Antennae brown. Abdominal tergites yellow-brown. Abdominal sternites very pale yellow-brown. Femora whitish, legs distally, including tibiae, pale yellow-brown. Head oval; cranial sutures distinct. Eyes moderately large, faintly rectate along antennal fossae. Ocelli moderately large, oval, almost touching eyes. Antennae with 14 to 17 articles, usually 15, less often 16; formulae variable, but usually 2=3=4=5. Pronotum slightly wider than long; anterior and posterior margins slightly concave, sides moderately convex. Cross-bar mark and midline of pronotum distinct. Fore wing radius fusing with costal margin at half wing length from suture; radial sector with 6-8 branches. Arolia present.

Table 15. Measurements of *Cryptotermes darlingtonae* imago.

Measurement in mm (n = 24♀, 9♂ from 4 colonies)	Range	Mean ± SD	Morphotype
Head length with labrum	1.06-1.35	1.16 ± 0.058	1.14
Head length to postclypeus	0.84-0.90	0.87 ± 0.016	0.88
Head width, maximum at eyes	0.90-0.97	0.94 ± 0.017	0.93
Eye diameter, maximum	0.30-0.33	0.32 ± 0.011	0.33
Eye to head base, minimum	0.12-0.17	0.14 ± 0.013	0.17
Ocellus diameter, maximum	0.11-0.12	0.12 ± 0.0076	0.12
Pronotum, maximum length	0.59-0.69	0.65 ± 0.025	0.65
Pronotum, maximum width	0.84-1.02	0.91 ± 0.051	0.96
Total length with wings	8.06-10.14	9.32 ± 0.514	9.23
Total length without wings	4.10-5.25	4.63 ± 0.310	4.95
Fore wing length from suture	6.63-7.80	7.31 ± 0.362	7.28
Fore wing, maximum width	1.88-2.23	2.07 ± 0.095	2.10

Table 16. Measurements of *Cryptotermes darlingtonae* soldier.

Measurement in mm (n = 22 from 5 colonies)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	1.58-1.76	1.67 ± 0.043	1.66
Head length to frontal horns	1.28-1.49	1.39 ± 0.052	1.40
Frontal flange width	1.11-1.25	1.18 ± 0.033	1.20
Frontal horns, outside span	0.79-0.91	0.89 ± 0.033	0.91
Head width, maximum	1.14-1.26	1.19 ± 0.029	1.20
Head height, excluding postmentum	0.91-0.97	0.94 ± 0.019	0.94
Pronotum, maximum width	1.09-1.25	1.16 ± 0.040	1.20
Pronotum, maximum length	0.78-0.92	0.85 ± 0.040	0.88
Left mandible length, tip to ventral condyle	0.68-0.75	0.72 ± 0.023	0.73
Total length	3.42-4.85	3.99 ± 0.41	3.66

Comparisons. The *C. darlingtonae* imago is unique among West Indian congeners by the contrasting colors of its ochraceous pronotum and brown proximal portion of wing.

Soldier (Figs. 40-42, Table 16). Head capsule, in dorsal view, with anterior 1/3 nearly black, grading to dark or very dark chestnut brown in median 1/3, and ferruginous or ferruginous orange in posterior 1/3; in lateral view, anterior 1/2 almost black, posterior 1/2

ferruginous or ferruginous orange. Mandibles very dark chestnut brown. Anterior margin of pronotum ferruginous.

Head, in dorsal view, subrectangular, with rounded posterior corners, and slightly constricted laterally behind frontal flange. Head with distinct concavities in each anterolateral corner. Vertex concave in middle. Rugosity deep and elongated. Frontal flange distinct, rugose, anterior margin very shallowly incised or almost rectate in dorsal view; deeply notched medially and continuous with vertex concavity; slight-

ly, but distinctly raised. Frontal plane sloping 90° from plane of vertex. Frons rugose and bilaterally concave along noticeable median vertical carina. Labrum short, roundly pointed. Frontal horns bluntly hemispherical, and smooth. Genal horns bluntly conical and finely grained. Frontal and genal horns both project forward and abut at bases in lateral view; frontal horns about 3X larger than genal horns. Mandibles humped at basal 1/3, angled at 2/3, and sickle-like in distal 1/3; dentition short. Eye spots oval, pigmentation distinct. Antennae with 11-14 articles, usually 12 or 13; formulae usually $2>3=4=5$ or $2>3<4=5$. Pronotum broadly shield-shaped, biconvexly incised anteriorly, posterolaterally rounded, and with faint median concavity of posterior margin.

Comparisons. Soldiers of this species are somewhat variable in size and head capsule rugosity. *Cryptotermes darlingtonae* is very similar to *C. pyrodomus*, but the latter is distinguishable by much smaller and more posteriorly recessed genal horns. The frontal horns of *C. pyrodomus* eclipse the view of the genal horns in frontodorsal view, whereas, in *C. darlingtonae*, the genal horns are visible. *Cryptotermes darlingtonae* is similar to *C. aequacornis*, but the former has anterolateral head capsule concavities and its frontal horns that are 3 time more voluminous than its genal horns. In *C. aequacornis*, the frontal and genal horns are similar in size.

Remarks. *Cryptotermes darlingtonae* is a relatively uncommon, montane forest species of the Lesser Antilles.

Geographical Distribution. West Indies (Figs. 14-16): Lesser Antilles: Dominica, Guadeloupe (Grande-Terre), Montserrat, Nevis, and St. Lucia. Elsewhere: unknown.

Geographical Variability. Soldiers from Montserrat, Guadeloupe, and St. Lucia exhibit slightly smaller genal horns in comparison with populations from Dominica.

Etymology. This species is named for its first collector, Dr. Johanna P. E. C. Darlington, who has collected termites throughout much of the Lesser Antilles.

Material Examined. Holotype colony: **Dominica**. Springfield Station; 15°21'N, 61°23'W; 28.v.1994; JC, JK, JM, and RS; holotype soldier, 9 paratype soldiers, one for SEM, morphotype winged imago, 17 paramor-

photype winged imagos, additional non-type alates, immatures (DM007). Paratype colonies: **Dominica**. 2 km S Pond Casse Forest Division Nursery; 15°22'N, 61°19'W; 29.v.1994 JC, JK, JM, and RS; 5 paratype soldiers, 7 paramorphotype winged imagos, immatures (DM103). Same data; 1 paratype soldier, 4 paramorphotype winged imagos, immatures (DM107). **Guadeloupe**. Grande-Terre, 1 km N Les Grands Fonds; 16°16'N, 61°25'W; 17.viii.1989; J. Darlington; 2 paratype soldiers, 5 paramorphotype winged imagos, immatures (JD353). **Montserrat**. Paradise Yard, 400 m; 16°44'N, 62°11'W; 1.iv.1991; JD; 4 paratype soldiers, immatures (JD670).

Cryptotermes domesticus (Haviland)

Calotermes domesticus: Haviland and Sharp 1896: [nomen nudum; biology only], Singapore.

Calotermes domesticus: Haviland 1898: 374 [soldier, imago], 4 figs., Singapore and Sarawak (Borneo).

Cryptotermes domesticus: Oshima 1923: 5 [imago], Sumatra.

Cryptotermes breviararticulatus Snyder 1926: 11[soldier, alate], Taboga Island, Panama. Referred to by Harris 1961 as *C. domesticus*, according to Araujo 1970 (p. 540) based on Emerson's unpublished synonymy.

For extended synonymies see Araujo 1977: 12, Bacchus 1987: 50, Snyder 1949: 40, and Chhotani 1970: 24.

Description. Imago (Table 17). General color pale brownish yellow-white. Sclerotized fore wing veins pale brown; membrane subhyaline with faint violet prismatic iridescence. Head anteriorly yellow-white, posteriorly pale yellow. Pale yellow-brown chevron pattern on fore wing scales weak. Pronotum yellow-white to pale yellow. Abdominal tergites and sternites yellow-white to pale yellow. Antennae whitish. Labrum yellow-white, opalescent. Legs yellow-white, almost concolorous, from tibiae very faintly darker. Head subrectangular and posteriorly rounded; complete cranial sutures very faint. Eyes variable in size, large to moderately large, suboval; margin along antennal fossae rectate. Ocelli small, oval, and touching eyes. Antenna 15 (only one complete antenna); formulae $2<3>4=5$ or $2=3<4=5$. Pronotum slightly wider than long; its width equal to or slightly inferior than head width at eyes; anterior margin shallowly concave; sides slightly convex, and posterior margin faintly emarginate. Crossbar mark and midline of pronotum very faint or absent. Fore wing radius reaching wing margin at 1/3 wing length from suture; radial sector with 5-7 branches. Arolia present.

Table 17. Measurements of *Cryptotermes domesticus* imago.

Measurement in mm (n = 7♀, 2♂ from 2 colonies)	Range	Mean ± SD
Head length with labrum	1.23-1.35	1.29 ± 0.039
Head length to postclypeus	0.93-1.01	0.98 ± 0.026
Head width, maximum at eyes	0.93-1.00	0.98 ± 0.021
Eye diameter, maximum	0.29-0.37	0.32 ± 0.023
Eye to head base, minimum	0.14-0.17	0.15 ± 0.012
Ocellus diameter, maximum	0.09-0.11	0.10 ± 0.0079
Pronotum, maximum length	0.62-0.69	0.65 ± 0.025
Pronotum, maximum width	0.88-0.98	0.93 ± 0.038
Total length with wings	9.09-9.44	9.30 ± 0.14
Total length without wings	3.83-5.82	5.04 ± 0.62
Fore wing length from suture	6.39-7.38	6.99 ± 0.34
Fore wing, maximum width	1.75-1.98	1.89 ± 0.089

Table 18. Measurements of *Cryptotermes domesticus* soldier.

Measurement in mm (n = 9 from 3 colonies)	Range	Mean ± SD
Head length to tip of mandibles	1.59-1.91	1.72 ± 0.12
Head length to frontal horns	1.28-1.44	1.35 ± 0.063
Frontal flange width	1.08-1.21	1.16 ± 0.048
Frontal horns, outside span	0.74-0.85	0.80 ± 0.042
Head width, maximum	1.15-1.32	1.25 ± 0.061
Head height, excluding postmentum	0.82-1.03	0.92 ± 0.068
Pronotum, maximum width	1.15-1.26	1.19 ± 0.044
Pronotum, maximum length	0.83-0.93	0.89 ± 0.040
Left mandible length, tip to ventral condyle	0.72-0.82	0.75 ± 0.041
Total length	3.86-4.65	4.31 ± 0.41

Comparisons. The head coloration of *C. domesticus* is characteristically contrasted by the whitish frons and yellowish vertex, and very pale antennae. The imago head of *C. domesticus* is proportionally longer than all compared congeners with a mean head length to width index of 1.32. The head length to ocular diameter ratio of *C. domesticus* is also proportionally large at 12.9 and nearest to *C. brevis* at 11.7. The general color of *C. brevis* is brown, while that of *C. domesticus* is yellowish.

Soldier (Figs. 43-45, Table 18). Head in lateral view, with anterior 1/2 - 2/3 almost black; grading to posteriorly to a little paler tinge. The original color description of this specimen by Snyder (1926) describes a castaneous-brown head with a reddish tinge.

Head in dorsal view, with anterior angulate projection, or frontal peak, of about 140°, having distinct median rounded incision; laterally slightly convex; posterior margin distinctly convex. Head rugosity on frons and posterior 1/2 of head very faint,

otherwise absent. Frontal flange indistinct and not delineated from either vertex or frons. Frons carinate and noticeably convex along vertical plane; frontal plane sloping 90° or more from plane of vertex. Labrum shortly linguiform and inflated apically. Frontal horns, small, short, and rounded tubercle, 2X shorter than wide at base and discontinuous with frontal flange. Genal horns very conspicuous, cylindrical with rounded tip, 2X longer than wide, with axes diverging anterodorsally. Frontal horns indistinct in both dorsal and lateral views. Both pairs of horns separated by cleft equaling their width. Eyes moderately large, oval, and distinct.

Comparisons. Some specimens of *C. domesticus*, a considerably variable species (Gay and Watson 1982), resemble *C. abruptus* described from the Yucatan and Cozumel (Scheffrahn et al. 1998). However, the frontal peak of *C. abruptus* is larger, and eclipses view of the mandibles and genal horns in dorsal view in contrast with *C. domesticus* in which mandibles and genal horns are visible from above. The frontal peak of *C. domesticus* has a median notch which is absent in *C. abruptus*. The genal horns of *C. domesticus* are much larger than its frontal horns, while in *C. abruptus* horn size is reversed. *Cryptotermes domesticus* possesses longer mandibles than *C. abruptus*.

Remarks. *Cryptotermes domesticus* is the least documented of all four non-indigenous congeners introduced into the West Indies and its establishment in the New World is very doubtful. This species was reported from West Indies only once (Trinidad; Araujo 1970, 1977), but its occurrence is not reliably documented. Only one Panamanian sample is available from New World collections described originally as *Kalotermes (Cryptotermes) breviararticulatus* Snyder 1926, but synonymized by Emerson in Araujo (1970) with *C. domesticus*. Some New World reports of this *C. domesticus* (Araujo 1977) may be attributed to misidentifications of *C. abruptus*.

Geographical Distribution. West Indies: Trinidad (?). Elsewhere: New World: Panama, Costa Rica (?), Mexico (?). Old World: Indomalayan, Papuan, and Australian regions.

Material Examined. All alates, dealates, and soldiers were measured unless stated otherwise. **Panama.** Taboga Island; 11.ix.1925; H. Kirby Jr.; 1 paratype soldier of *Kalotermes (Cryptotermes) breviararticulatus* Snyder 1926 examined at the American Museum of Natural History, New York (AMNH). **Papua**

New Guinea. Potsdam Plantation; 24.vii.1984; YR; 1 soldier, 1 dealate, immatures (PNGT756). Same data, 26.vii.1984; 1 soldier, 2 dealates; immatures (PNGT766). **Australia.** Thursday Island; 25.x.?. G. Hill; 5 of many soldiers measured, one for SEM, 6 of many alates measured from a sample loaned by AMNH; immatures (CC227).

Cryptotermes dudleyi Banks

Cryptotermes dudleyi Banks 1918: 660 [soldier, alate], 1 fig., Panama.

Cryptotermes thompsonae Snyder 1922: 16 [alate, soldier], 6 figs., Panama.

For extended synonymies see Araujo 1977: 13, Bacchus 1987: 53, Snyder 1949: 41, and Chhotani 1970: 34.

Description. Imago (Table 19). General color pale brown. Sclerotized fore wing veins brown; membrane slightly smoky, very pale brown. Frons yellow-brown, vertex pale brown with brown band between eyes. Pale brown chevron pattern on fore wing scales moderately distinct. Antennae, pronotum and abdominal tergites pale brown. Labrum yellow-brown. Femora whitish, legs including tibiae, very pale brown distally. Abdominal sternites very pale brown. Head oval; cranial sutures fine, but distinct. Eyes rather small, suboval, margin along antennal fossae rectate. Ocelli small, oval, and almost touching eyes. Antennae with 14 to 18 articles, usually 15, 16, or 17, and with formulae variable. Pronotum slightly wider than long, and slightly narrower than head width at eyes; anterior margin slightly concave, sides slightly convex, and posterior margin faintly concave. Crossbar mark and midline of pronotum moderately distinct. Fore wing radius reaching costal margin at half wing length from suture; radial sector with 4-6 branches. Arolia present.

Comparisons. Among West Indian *Cryptotermes*, the imago of *C. dudleyi* is closest to *C. havilandi*. *Cryptotermes dudleyi* is generally larger in all measurements, except maximum fore wing width. Some measurements of both species overlap, but tibia length, head capsule length do not. *Cryptotermes dudleyi* has a distinct chevron pattern with paler median triangle that is nearly concolorous with pronotum and darker head, while, in *C. havilandi*, these structures are almost concolorous.

Soldier (Figs. 46-48, Table 20). Head, in dorsal and oblique views, with frons, both pairs of horns, ante-

Table 19. Measurements of *Cryptotermes dudleyi* imago.

Measurement in mm (n = 7♀, 7♂ from 8 colonies)	Range	Mean ± SD
Head length with labrum	1.23-1.47	1.35 ± 0.062
Head length to postclypeus	0.96-1.11	1.03 ± 0.039
Head width, maximum at eyes	0.96-1.08	1.04 ± 0.030
Eye diameter, maximum	0.30-0.36	0.33 ± 0.014
Eye to head base, minimum	0.12-0.18	0.15 ± 0.018
Ocellus diameter, maximum	0.11-0.15	0.13 ± 0.014
Pronotum, maximum length	0.61-0.80	0.68 ± 0.044
Pronotum, maximum width	0.88-1.03	0.98 ± 0.042
Total length with wings	8.80-10.51	9.73 ± 0.47
Total length without wings	5.40-6.39	5.95 ± 0.34
Fore wing length from suture	6.53-7.67	7.25 ± 0.28
Fore wing, maximum width	1.81-2.11	1.91 ± 0.075

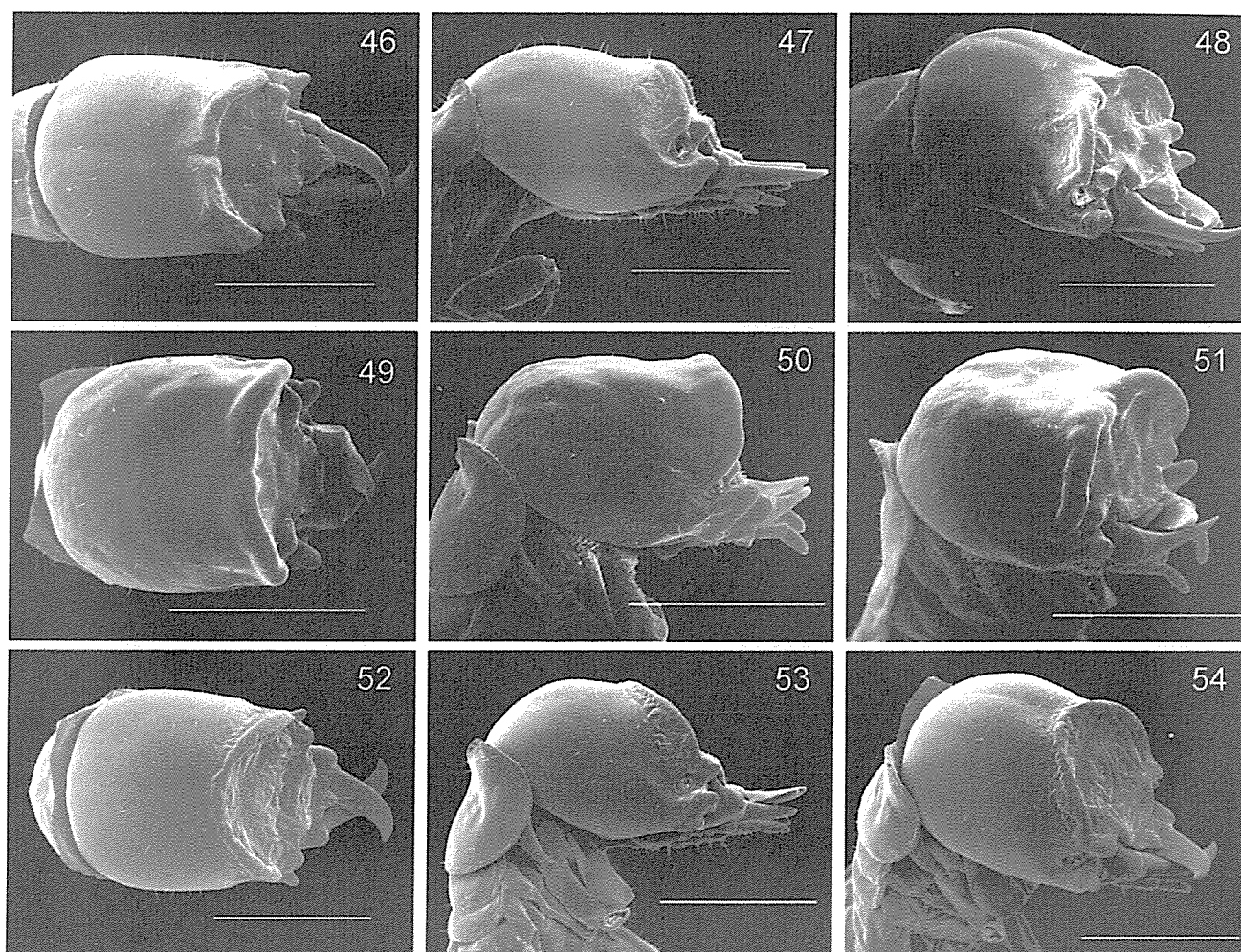
Table 20. Measurements of *Cryptotermes dudleyi* soldier.

Measurement in mm (n = 10 from 4 colonies)	Range	Mean ± SD
Head length to tip of mandibles	2.14-2.52	2.30 ± 0.11
Head length to frontal horns	1.55-1.88	1.69 ± 0.079
Frontal flange width	1.10-1.32	1.21 ± 0.066
Frontal horns, outside span	0.88-1.05	0.96 ± 0.052
Head width, maximum	1.14-1.44	1.31 ± 0.071
Head height, excluding postmentum	0.93-1.13	1.00 ± 0.058
Pronotum, maximum width	1.05-1.37	1.20 ± 0.077
Pronotum, maximum length	0.77-1.01	0.88 ± 0.050
Left mandible length, tip to ventral condyle	0.92-1.00	0.95 ± 0.027
Total length	5.30-8.08	6.58 ± 0.67

rior genae, and frontal flange nearly black; anterior 1/3-1/2 of head capsule ferruginous orange to very dark chestnut brown, posteriorly, grading to pale yellow or pale orange. Mandibles dark or very dark chestnut brown. Anterior margin of pronotum ferruginous orange, remainder of pronotum pale yellow.

Head capsule elongate, about 1.2X longer than wide, with sides almost straight, converging slightly anteriorly; posterior margin widely rounded. Weak rugosity and finely granulate surface on frons, frontal

flange, and vertex. Anterior margin of frontal flange considerably concave in dorsal view, distinct, and delineated from frons; flange with deep incision in middle continuous with vertex. Frons shallowly concave. Frontal plane sloping 70° from plane of vertex. Labrum usually retracted, shortly linguiform without terminal inflation, sides parallel when visible. Frontal horns moderately large, rounded tubercles, continuous or shallowly separated from both clypeus and vertex; horn surface finely granulate. Genal horns distinct, short, and conical, with rounded tips and



Figures 46-54. Soldier heads of *Cryptotermes dudleyi* (TT082, Trinidad, Mt. St. Benedict foothills, forest trail) (46-48), *C. havilandi* (TT550, Tobago, Pigeon Point mangroves) (49-51), and *C. hemicyclius* (JA457, Jamaica, Portland Ridge foothills) (52-54) each, by order, in dorsal, lateral, and oblique views. Scale bars = 1 mm.

finely granulate surfaces; horns form distinct antero-lateral extremities of head capsule. Axes of genal and frontal horns almost parallel. Frontal and genal horns very widely separated, without contact at bases; frontal horns not eclipsing dorsal view of genal horns. Eye spots variable from moderately large to very small, but always distinct. Mandibles long, distinctly humped near bases, rather slender, about 3X longer than wide posterior to hump; outer margins almost rectate in proximal 1/2, curvate in distal 1/2. Prominent dentition on both mandibles. Mandibles project horizontally in side view. Antennae with 11 to 15 articles, usually 12 and 13; formulae very variable, but usually $2>3>4<5$. Pronotum widely shield-shaped; with anterior margin deeply and widely incised or concave, and with distinct paired dull anterolateral projections. Pronotum slightly convex laterally, posterior corners rounded, and

posterior margin faintly concave. Anterior margin of pronotum faintly sinuous.

Comparisons. *Cryptotermes dudleyi* is closest to *C. chasei* from which the former is easily distinguishable by its slender and distinctly toothed mandibles. The mandibles of *C. chasei* are massive and faintly toothed. The frontal flange of *C. dudleyi* is elevated, brow-like and medially incised, while in *C. chasei*, the frontal flange is indistinct and without median incision. The frons pigmentation of *C. dudleyi* is almost black, while in *C. chasei*, it is mottled with ferruginous and dark chestnut brown coloration.

Remarks. *Cryptotermes dudleyi* was described from Panama, although it undoubtedly originated from the Old World (see below) but has been introduced

Table 21. Measurements of *Cryptotermes havilandi* imago.

Measurement in mm (n = 8♀, 4♂ from 3 colonies)	Range	Mean ± SD
Head length with labrum	1.18-1.32	1.26 ± 0.036
Head length to postclypeus	0.92-0.96	0.95 ± 0.016
Head width, maximum at eyes	0.95-1.00	0.97 ± 0.018
Eye diameter, maximum	0.30-0.33	0.31 ± 0.074
Eye to head base, minimum	1.14-0.17	0.16 ± 0.0095
Ocellus diameter, maximum	0.10-0.12	0.11 ± 0.0073
Pronotum, maximum length	0.67-0.74	0.70 ± 0.021
Pronotum, maximum width	0.88-0.97	0.93 ± 0.029
Total length with wings	8.95-9.66	9.28 ± 0.21
Total length without wings	4.83-5.25	5.05 ± 0.13
Fore wing length from suture	6.89-7.81	7.31 ± 0.24
Fore wing, maximum width	1.78-1.95	1.89 ± 0.043

Table 22. Measurements of *Cryptotermes havilandi* soldier.

Measurement in mm (n = 16 from 6 colonies)	Range	Mean ± SD
Head length to tip of mandibles	1.59-1.83	1.73 ± 0.078
Head length to frontal horns	1.26-1.46	1.38 ± 0.065
Frontal flange width	1.13-1.31	1.23 ± 0.052
Frontal horns, outside span	0.78-0.95	0.89 ± 0.047
Head width, maximum	1.14-1.34	1.25 ± 0.070
Head height, excluding postmentum	0.82-0.98	0.90 ± 0.053
Pronotum, maximum width	1.06-1.31	1.21 ± 0.068
Pronotum, maximum length	0.70-0.96	0.87 ± 0.072
Left mandible length, tip to ventral condyle	0.72-0.80	0.76 ± 0.028
Total length	3.56-4.90	4.30 ± 0.35

elsewhere by humans (Gay 1967). After introduction, *C. dudleyi* often appears in disturbed outdoor habitats (Bachus 1987; Scheffrahn and Krecek, unpublished).

Geographical Distribution. West Indies (Figs. 10 and 17): Greater Antilles: Jamaica (new record). Lesser Antilles: Trinidad. Elsewhere: native distribution includes Indomalayan region between Ceylon and the Philippines (Gay 1967); introduced to Costa Rica, Colom-

bia, Brazil and West Indies in the Neotropical Region, and to the Australian (Australia, Darwin, Thursday Island), Papuan (Papua New Guinea, Marshall Islands), Ethiopian (Somalia, Kenya, Uganda, Tanzania), and Malagasy Regions (Madagascar, Mauritius and Seychelles). With occurrence in 6 of 8 zoogeographical regions, *C. dudleyi* is the second most widespread *Cryptotermes* species after *C. brevis*, which is found in all regions.

Material Examined. All alates and soldiers measured unless stated otherwise. **Trinidad.** Balandra Beach; 10°46.07'N, 60°56.91'W; 26.v.1996; JC, JM, BM, RS, and C. Starr; 1 of 4 soldiers measured, 2 of many alates measured, immatures (TT062). Same data; 1 of 7 soldiers measured, 2 of many alates measured, immatures (TT063). Same data; 1 of 7 soldiers measured, immatures (TT064). Guayamara Point; 10°45.62'N, 60°57.25'W; 26.v.1996; JC, JM, RS, and C. Starr; 1 soldier, immatures (TT080). Mt. Tabor, St. Benedict Monastery area; 10°39.83'N, 61°23.93'W; 26.v.1996; JK; 1 of 9 soldiers measured, 1 for SEM, immatures (TT082). SW San Fernando, Mosquito Creek (mangrove); 10°45.62'N, 60°57.25'W; 26.v.1996; JC, JK, JM, BM, RS, and C. Starr; 1 soldier measured, 2 of many alates measured, immatures (TT162). Same data; 1 of 3 soldiers measured, 2 of many alates measured, immatures (TT163). Same data; 1 soldier measured, 2 of 9 alates measured, immatures (TT164). Same data; 1 soldier measured, 2 of many alates measured, immatures (TT165). Same data; 1 of 2 soldiers measured, many unmeasured alates, immatures (TT166). Erin Beach, San Francique; 10°04.25'N, 61°39.59'W; 27.v.1996; JC, JK, JM, BM, RS, and C. Starr; 1 soldier, immatures (TT187). Same data; 1 of 3 soldiers measured, immatures (TT188). Tunapuna; 10°39'N, 61°23'W; 31.v.1996; BM; 1 of 2 soldiers measured, immatures (TT742). **Jamaica.** Mahoe Bay area; 18°30.69'N, 77°53.99'W; 24.v.1997; PB, JC, JK, JM, BM, and YR; 1 of 3 soldiers measured, 1 of many alates measured, immatures (JA2). Same data; none of 3 soldiers measured, 1 of 5 alates unmeasured, immatures (JA3). Cousin Cove; 18°26.45'N, 78°14.08'W; 31.v.1997; PB, JC, JK, JM, BM, and YR; 1 of 2 soldiers measured, immatures (JA758).

Cryptotermes havilandi (Sjöstedt)

Calotermes domesticus Sjöstedt 1897: 212 [alate], Fernando Po, Cameroon (name preoccupied by Haviland 1896, see *C. domesticus*).

Calotermes havilandi Sjöstedt 1900: 37, 43-45, 218, 220 (new designation).

For more extended synonymy see Araujo 1977: 14, Bacchus 1987: 56, Snyder 1949: 42, and Chhotani 1970: 42.

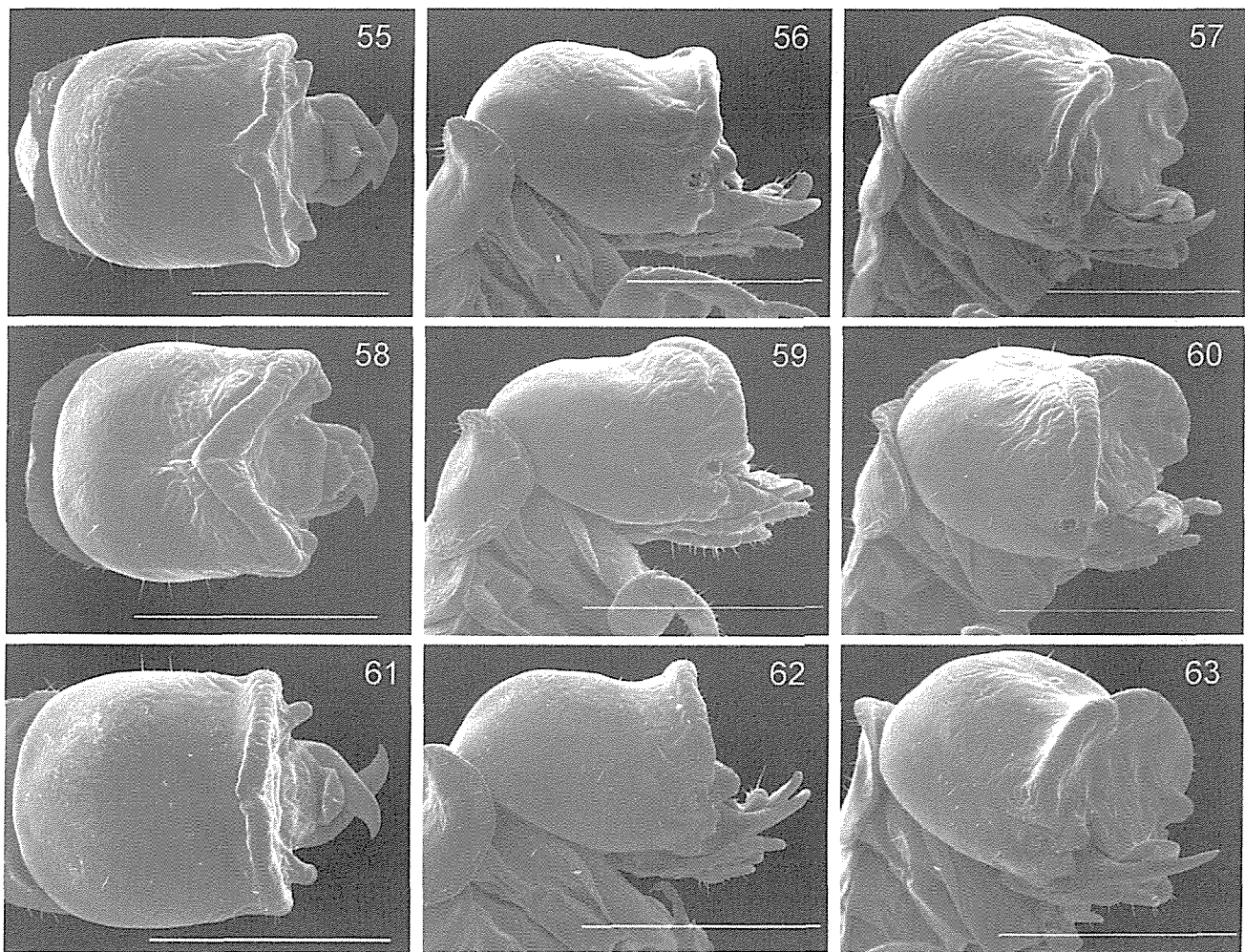
Description. Imago (Table 21). General color brown. Sclerotized fore wing veins brown; membrane subhyaline with faint prismatic iridescence. Head pale brown with brown band between eyes. Brown chevron pattern on fore wing scales weak, almost concolorous with underlying mesonotum. Pronotum pale brown to

brown. Abdominal tergites brown. Antennae pale brown. Labrum yellow-brown. Femora whitish, legs including tibiae, very pale brown distally. Abdominal sternites pale brown laterally, pale yellow-brown in middle. Head oval; cranial suture traces consisting of a little more than half of median posterior branch. Eyes moderately large, suboval; margins along antennal fossae rectate. Ocelli smaller, oval, and touching eyes. Antennae with 15 to 17 articles, usually 16; formulae usually 2<3>4=5 or less frequently 2=3>4=5. Pronotum moderately wider than long; width subequal or slightly narrower than head width at eyes; anterior margin considerably concave, sides moderately convex, and posterior margin slightly emarginate. Crossbar mark and midline of pronotum moderately distinct. Fore wing radius reaching wing margin at half wing length from suture; radial sector with 4-6 branches. Arolia present.

Comparisons. For comparisons see *Cryptotermes dudleyi*.

Soldier (Figs. 49-51, Table 22). Head in dorsal view, with anterior 1/2-2/3 glossy black, shading posteriorly to chestnut brown or dark chestnut brown. Head in lateral view, with anterior 1/3 almost black, including both pairs of horns and anterior genae; grading in posterior to ferruginous or chestnut brown. Mandibles very dark chestnut brown. Anterior margin of pronotum ferruginous to chestnut brown, rest of pronotum yellow-white or pale yellow; large T-shaped ferruginous mark in middle of pronotum.

Head in dorsal view subsquare, with sides slightly convergent posteriorly, and widely rounded posterior margin. Head capsule surface smooth, rugosity absent, except for faint posterior, lateral, and frontal remnants present in some individuals; with two minute pointed tubercles on anterolateral vertex. Frontal flange distinct, prominent, usually rather narrow, not delineated from vertex in dorsal view, but delineated from vertex in lateral view, and delineated from frons in frontal view; frontal flange concave in dorsal view. Frons noticeably concave, wider than high; frontal plane sloping near 80° from plane of vertex. Labrum equilaterally trianguliform, rounded apically. Frontal horns squat, smooth, apically rounded tubercles, and discontinuous with flange; horns about 2X shorter than wide at their bases; horn axes divergent. Genal horns prominent, conical, finger-like projections, with finely granulate surface, 2X longer than wide at their bases; genal horn axes laterally divergent. Frontal horns separated from, and much smaller than, genal horns. Eye spots



Figures 55-63. Soldier heads of *Cryptoterme juliani* (DR1557, Dominican Republic, Peravia Province, Las Avispas) (55-57), *C. mangoldi* (DR1428, Dominican Republic, La Altagracia Province, 0.5 km W Club Mediterraneo) (58-60), and *C. nitens* (CA108, Cayman Islands, Little Cayman, Pirates Point Resort) (61-63) each, by order, in dorsal, lateral, and oblique views. Scale bars = 1 mm.

moderately large, oval, and distinct. Mandibles wide, angled, and slightly curvate apically; dentition weakly developed. Mandibles, in lateral view, project horizontally. Antennae with 11 to 15 articles, usually 12 or 13; formulae slightly variable, but usually $2>3>4=5$. Pronotum somewhat wider than long, with widely and deeply concave or incised anterior margin; concavity laterally terminated at tips; sides of pronotum below tips strongly convex; comparatively short posterior margin almost rectate.

Comparisons. *Cryptoterme havilandi* is dissimilar to any New World congener. This species has a characteristically polished and reflective head capsule surface, and a pair of minute pointed tubercles on

the anterolateral vertex. *Cryptoterme domesticus* is nearest to *C. havilandi*, but the head surface of the former is dull and minute tubercles on the vertex are absent. In dorsal view, the frontal flange of *C. domesticus* is peaked, in *C. havilandi* it is concave and eyebrow-like.

Remarks. All but one (35/36) of our West Indian collections of *C. havilandi* were taken from natural growth; one was taken from a house in Trinidad. This species is generally reported as a structural pest in the New World (Adamson 1940, Moszkowski 1955).

Geographical Distribution. West Indies (Figs. 14-17): Greater Antilles: Jamaica? (Araujo 1970), Lesser Antilles: St. Croix (new record), Antigua, St.

Table 23. Measurements of *Cryptotermes hemicyclius* dealate imago.

Measurement in mm (n = 1♀, 1♂ from 1 colony)	Range	Mean ± SD
Head length with labrum	1.42-1.47	1.45 ± 0.035
Head length to postclypeus	1.13-1.16	1.14 ± 0.023
Head width, maximum at eyes	1.16-1.19	1.18 ± 0.023
Eye diameter, maximum	0.37-0.38	0.38 ± 0.012
Eye to head base, minimum	0.12-0.14	0.13 ± 0.012
Ocellus diameter, maximum	0.12-0.13	0.13 ± 0.0058
Pronotum, maximum length	0.85-0.87	0.86 ± 0.012
Pronotum, maximum width	1.19-1.19	1.19 ± 0
Total length without wings	5.75-5.96	5.86 ± 0.15

Table 24. Measurements of *Cryptotermes hemicyclius* soldier.

Measurement in mm (n = 2 from 2 colonies)	Range	Mean ± SD
Head length to tip of mandibles	2.04-2.31	2.18 ± 0.19
Head length to frontal horns	1.65-1.68	1.66 ± 0.023
Frontal flange width	1.19-1.26	1.23 ± 0.046
Frontal horns, outside span	1.00-1.06	1.03 ± 0.046
Head width, maximum	1.39-1.46	1.42 ± 0.046
Head height, excluding postmentum	1.06-1.14	1.10 ± 0.058
Pronotum, maximum width	1.31-1.32	1.32 ± 0.012
Pronotum, maximum length	0.95-0.98	0.96 ± 0.023
Left mandible length, tip to ventral condyle	1.00-1.01	1.01 ± 0.012
Total length	3.76-4.95	4.36 ± 0.84

Kitts (new record), Nevis (new record), Guadeloupe (Grande-Terre), St. Lucia (new record), St. Vincent (new record), Barbados, Trinidad, Tobago, Little Tobago (new record). Elsewhere: New World: Surinam, Guyana, Brazil. Old World: a probable origin of distribution is tropical Africa, the species was introduced to the Neotropical, Malagasy, and Indomalayan regions (Gay 1967).

Material Examined. All alates and soldiers measured unless stated otherwise. **Trinidad.** Mt. Tabor, St. Benedict Monastery area; 10°39.83'N, 61°23.93'W; 26.v.1996; JK; 2 of 4 soldiers measured, immatures (TT083). Same data, 1 soldier, 4 of many alates measured, immatures (TT084). **Tobago.** Pigeon Point, mangroves, 11°09.78'N, 60°50.38'W; 30.v.1996; JC, JK, JM, and RS; 1 soldier, immatures (TT546). Same data; 1 of 8 soldiers measured, 1 for SEM, 4 of many alates measured, immatures (TT550).

Tobago, Little Tobago Island; N peninsula; 11°18'N, 60°30'W; 1.vi.1996; JC, JK, JM, and RS; 2 of 4 soldiers measured, immatures (TT718). Same data; 2 soldiers, immatures (TT719). Same data; 2 of 5 soldiers measured, immatures (TT720). Same data; 1 soldier, 4 of 5 alates measured, immatures (TT721). Same data; 1 soldier, immatures (TT722). **U.S. Virgin Islands.** St. Croix Island; University of the Virgin Islands campus; 24.i.1995; PB; 2 of 3 soldiers measured, immatures (VI029).

Cryptotermes hemicyclius Bacchus

Cryptotermes hemicyclius Bacchus 1987: 58 [1 dealate imago, 5 soldiers] from one colony, 4 figs., 2 tables, Jamaica.

Description. Imago (dealate, Table 23). General color pale yellow. Darkest pigmentation on head and wing scales; median chevron pattern on wing scales ferruginous orange. Pronotum and abdominal tergites and sternites pale yellow. Antennae orange-yellow. Labrum pale orange. Legs with yellow-white femora; orange-yellow distally. Cranial sutures absent. Eyes moderately large, subcircular, margins confronting antennal fossae rectate; posteroventral margins nearly rectate. Ocelli moderately large and oval in horizontal axis, nearly touching eyes. Antennae of examined specimens broken distally, formula $2<3>4=5$. Pronotum width equal to or slightly wider than head with eyes, wider than longer; anterior margin moderately concave, sides moderately convex and posterior margin incised medially and biconvex laterally. Arolia present.

Comparisons. For comparisons see *C. spathifrons*.

Soldier (Figs. 52-54, Table 24). Head in dorsal view, with frontal flange and frontal and genal horns almost black; anterior half of frons very dark chestnut brown, posterior half of frons chestnut brown; vertex ferruginous orange except for very dark chestnut brown anterior corners and orange-yellow posterior margin. Head capsule in lateral view, ferruginous orange with slight fading posteriorly. Mandibles dark chestnut brown. Anterior border of pronotum ferruginous, remaining margin ferruginous orange; interior pale yellow.

Head in dorsal view, with distinctly recessed frons, invading vertex and occupying 1/3 of head capsule length. Head from above slightly constricted before, and becoming bulbous behind faintly protruded eyes. Vertex not concave. Head capsule modestly

rugose on frons and narrow rugose band behind frontal flange; remaining head capsule almost smooth. Frontal flange semicircular in outline, callos, unusually narrow, and elevated above frons; sides faintly concave near base of flange. Frons widely, evenly, and shallowly concave. Frontal plane sloping 50° from plane of vertex. Labrum large, linguiform, pointed terminally slightly inflated tip with lateral concavities. Frontal horns short, stout, rounded, and flaring at base; continuous with frontal flange, but delineated conspicuously from frons, and separated by deep concavity from clypeus; axes of frontal horns subparallel. Genal horns form short, small, finger-like anterior extensions of genae, axes diverge 90°. Frontal horns broadly separated from and about twice as voluminous as genal horns. Mandibles long, with distinct humps near bases; dentition blunt. Eyes small and oval. Antenna with 11 to 12 articles; formula $2<3>4=5$. Pronotum almost circular, except for deep and wide anterior incision and short and rectate posterior margin. Anterior margin of pronotum densely and bluntly sinuous.

Comparisons. *Cryptotermes hemicyclius* is closest to *C. spathifrons* but their head capsules differ in an unusual manner. In lateral view, the planes formed by the foramen magnum and the frons diverge posteriorly in *C. hemicyclius*, while these planes are parallel in *C. spathifrons*. For additional characters see *C. spathifrons*.

Remarks. *Cryptotermes hemicyclius* is a rare species known only from the area near the type locality.

Geographical Distribution. West Indies (Fig. 10): Greater Antilles: southern coast of Jamaica. Elsewhere: unknown.

Material Examined. For type material data see Bacchus 1987. Additional material: **Jamaica.** Portland Ridge foothills; 17°45.33'N, 77°10.29'W; 29.v.1997; 1 soldier measured and used for SEM, immatures (JA457). 5 km N Frenchman; 17°54.93'N, 77°47.84'W; 29.v.1997; PB, JC, JK, BM, JM, and YR; 1 soldiers and 2 primary reproductives measured, immatures (JA545).

Cryptotermes juliani n. sp.

Description. Imago (Table 25). General color brown. Frons pale brown, vertex brown. Darkest pigmentation on sepia brown wing scales and sepia brown

Table 25. Measurements of *Cryptotermes juliani* imago.

Measurement in mm (n = 14♀, 7♂ from 1 colony)	Range	Mean ± SD	Morphotype
Head length with labrum	1.23-1.32	1.28 ± 0.027	1.26
Head length to postclypeus	0.98-1.01	1.00 ± 0.012	1.26
Head width, maximum at eyes	1.00-1.03	1.01 ± 0.010	1.00
Eye diameter, maximum	0.34-0.36	0.35 ± 0.0060	0.34
Eye to head base, minimum	0.13-0.16	0.15 ± 0.0080	0.15
Ocellus diameter, maximum	0.11-0.13	0.12 ± 0.0088	0.11
Pronotum, maximum length	0.65-0.70	0.69 ± 0.015	0.69
Pronotum, maximum width	0.87-0.95	0.89 ± 0.027	0.87
Total length with wings	10.93-11.64	11.25 ± 0.21	11.50
Total length without wings	5.11-6.11	5.56 ± 0.28	5.54
Fore wing length from suture	8.95-9.51	9.26 ± 0.20	9.37
Fore wing, maximum width	2.18-2.31	2.25 ± 0.042	2.24

Table 26. Measurements of *Cryptotermes juliani* soldier.

Measurement in mm (n = 6 from 1 colony)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	1.77-1.87	1.83 ± 0.039	1.81
Head length to frontal horns	1.44-1.52	1.47 ± 0.029	1.46
Frontal flange width	1.24-1.32	1.29 ± 0.030	1.32
Frontal horns, outside span	0.95-1.03	1.00 ± 0.030	1.03
Head width, maximum	1.26-1.32	1.28 ± 0.027	1.28
Head height, excluding postmentum	0.92-1.01	0.98 ± 0.035	1.00
Pronotum, maximum width	1.18-1.21	1.20 ± 0.012	1.21
Pronotum, maximum length	0.82-0.87	0.84 ± 0.022	0.87
Left mandible length, tip to ventral condyle	0.78-0.85	0.82 ± 0.024	0.85
Total length	3.81-5.54	4.87 ± 0.64	4.70

sclerotized wing venation. Antennae, abdominal tergites, and pronotum brown, except sepia brown posterior corners of pronotum. Labrum very pale brown. Femora whitish; tibia and abdominal sternites yellow-brown. Head suboval. Cranial sutures distinct. Eyes large, suboval, except subrectate borders against antennal fossae and along ventral margins. Ocelli small, oval, almost abutting against eyes. Antennae with 14 to 16 articles, usually 15 and with formulae variable. Pronotum subsquare, considerably narrower than head width at eyes; anteri-

or margin distinctly concave, sides weakly convex or subparallel, posterior margin almost straight. Radius running to near mid wing from suture. Radial sector with 6 to 8 branches. Arolia present.

Comparisons. For comparisons see *Cryptotermes brevis*.

Soldier (Figs. 55-57, Table 26). Anterior 2/3 of head in dorsal view nearly black, with glossy iridescence, purple chestnut brown in posterior; in lateral view,

anterior half of head almost black, posterior half ferruginous. Mandibles very dark chestnut brown. Anterior margin of pronotum ferruginous with paler extensions on interior, perimeter fringed with ferruginous orange.

Head subsquare from above, posteriorly widely rounded; with slight constriction near frontal flange. Anterior 2/3 of head capsule weakly and sinuously rugose, but with polished surface texture. Frontal flange elevated, relatively narrow, with median notch; flange finely delineated from vertex. Frons shallowly concave, median area almost smooth, and carinate laterally. Frontal plane sloping near 90° from plane of vertex. Labrum bluntly pointed. Frontal horns obtusely triangular, bases 2X wider than length, and flaring to sides in dorsal view; more pronounced and hemispherical in lateral view. Genal horns small, rounded knob-like projections. Genal horns much smaller and completely eclipsed from above by frontal horns; abut to frontal horns at their bases. Mandibles massive, distinctly humped basally, widely sickle-shaped distally of hump; moderately short, recurvate in terminal 1/4, abruptly narrowed and pointed very near tips; eclipsing labrum and anteclypeus in frontal view; first marginal tooth short and pointed on each mandible. Eye spots relatively conspicuous; large and subcircular. Antennae with 11 to 14 articles, usually 14; formulae $2>3<4<5$ or $2>3>4<5$. Pronotum widely shield-shaped, widely incised anteriorly, broadly rounded posterolaterally, and with faint emargination of posterior margin. Anterior margin of pronotum irregularly and dully serrated.

Comparisons. *Cryptotermes juliani* is most similar to *C. cymatofrons* and *C. nitens*, of which *C. juliani* is the largest. The mandibles of *C. juliani* are much more robust, angled, and broad, and tips more abruptly pointed. The mandibles of both *C. cymatofrons* and *C. nitens* are elongated, less angled, and gradually narrowing.

Remarks. *Cryptotermes juliani* is a rare montane forest species known only from one colony at the type locality.

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

Etymology. The species is named for Ing. Julián de la Rosa Guzmán, an enthusiastic termite collector,

survey collaborator, and pest control consultant from Santo Domingo, Dominican Republic.

Material Examined. Holotype colony: **Dominican Republic.** Peravia Province, Las Avispas, ca. 1000m; 18°39.72'N, 70°28.16'W; 10.xi.1996; JC and JK; holotype soldier, 5 paratype soldiers, one for SEM, morphotype winged imago, 20 paramorphotype winged imagos, and additional non-type alates, immatures (DR1557).

Cryptotermes mangoldi n. sp.

Cryptotermes cavifrons: ?Snyder 1956: 193 (Haiti only).

Cryptotermes cavifrons: Scheffrahn & Su in Scheffrahn et al. 1994: 219 (Dominican Republic only).

Description. Imago (Table 27). General color dull pale yellow-brown. Head yellow-brown except for pale brown band between eyes. Chevron pattern on wing scales indistinct. Fore wing radius, radial sector including first branch, and proximal half of costal margin pale brown; radial sector with distal branching, and costal margin very pale brown to whitish; membrane hyaline. Pronotum yellow-brown; faint whitish midline and cross-band present or absent. Abdominal tergites pale yellow-brown to pale brown. Antennae pale brown. Labrum pale yellow brown. Femora yellow-white, legs distally pale yellow-brown. Abdominal tergites pale yellow. Head subquadrate, cranial sutures hardly developed. Eyes moderately large, suboval. Ocelli moderately large, oval, almost touching eyes. Antennae with 13 to 16 articles, usually 15 or 16, with formulae variable, but usually $2>3<4=5$. Pronotum subsquare, width noticeably narrower than head width at eyes; anterior margin shallowly concave, sides moderately convex, and posterior margin almost rectate. Fore wing radius converging with costal margin at 1/3 wing length from suture; radial sector with 6 branches. Arolia present.

Comparisons. *Cryptotermes mangoldi* is very similar to *C. cryptognathus*, but the latter is rather smaller. Both species, however, overlap in most measurements with the exception of hind tibia length, which in *C. mangoldi* is ≥ 0.69 mm, and in *C. cryptognathus* is ≤ 0.69 mm.

Soldier (Figs. 58-60, Table 28). Head, in dorsal view, nearly black in anterior 1/3, grading to ferruginous orange in posterior 2/3; laterally, anterior 1/2 blackish, grading to ferruginous orange posteriorly. Mandibles dark chestnut brown. Anterior pronotal intru-

sions and margin ferruginous to chestnut brown; remainder of pronotum whitish in contrast.

Head capsule, in dorsal view, characterized by conspicuous incisions of the anterior and posterior margins of the frontal flange. Head short, sides almost parallel, but usually slightly constricted behind frontal flange and convex behind middle; posterior corners rounded, and posterior margin straight or nearly so; small shallow concavity at midvertex. Frontal flange robust, broadest in middle, and with median notch; very distinctly delineated from vertex posteriorly, and squarely pointed behind in middle. Overall rugosity faint, but dense, including frontal flange; rugosity suppressed on concavity of frons. Frons about 1.5X wider than high; in lateral view; frontal plane sloping 90° from plane of vertex. Labrum short, proximally subsquare, apically faintly inflated and blunt, sometimes with faintly concave sides. Frontal horns variable in size, most often blunt, continuous with frontal flange; inner sides deeply and widely separated from clypeus; horns oriented forward. Genal horns weakly tuberculate and poorly demarcated from genae. Frontal horns widely separated from genal horns. Mandibles moderately long, faintly humped near base and distinctly angled; short and sickle-shaped apically, and almost horizontal in lateral view; first marginal tooth distinct on both mandibles. Mandibles in Figs. 58-60 shorter than most. Eyes small or very small, but usually distinct. Antennae with 11-13 articles, usually 12, formulae very variable. Pronotum wide, shield-shaped; lateral sides subparallel, or slightly convex; anterior margin shallowly concave; biconvex laterally, and weakly sinuous. Posterior margin of pronotum nearly straight.

Comparisons. *Cryptotermes mangoldi* is closest to *C. undulans* but the latter differs in having deeper and finer rugosity of the head capsule. The frontal flange of *C. undulans* is narrower and more rugose than that of *C. mangoldi*.

Remarks. *Cryptotermes mangoldi* is the most common indigenous *Cryptotermes* in the Dominican Republic (75 of 118 indigenous *Cryptotermes* samples) and has a broad northern and eastern coastal distribution. This species is allopatric with *C. rotundiceps*, which has a more southwestern and inland distribution.

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

Etymology. This species is named in honor of Dr. John R. Mangold, an urban entomologist with an enduring dedication to the collection and study of termites.

Material Examined. Holotype colony: **Dominican Republic.** La Altagracia Province, 0.5 km W Club Mediterraneo; 18°33.25'N, 68°21.17'W; 6.xi.1996; JC, JK; holotype soldier, 5 paratype soldiers, many non-type soldiers, one for SEM, morphotype winged imago, 7 paramorphotype winged imagos, additional non-type alates, immatures (DR1428). Paratype colonies: Maria Trinidad Province, Abreu; 19°39'N, 69°56'W; 18.vi.1991; JC, JM, JR, and RS; 1 paratype soldier, immatures (DR0035). Espaillat Province, Jamao River; 19°34'N, 70°25'W; 18.vi.1991 JC, JM, JR, and RS; 1 paratype soldier, 1 paramorphotype winged imago, immatures (DR0036). Puerto Plata Province, Maimon; 19°51'N, 70°46'W; 19.vi.1991; JC, JM, JR, and RS; 1 non-type soldier, 1 paramorphotype winged imago, 4 non-type alates, immatures (DR0041). Distrito Nacional, Santo Domingo, La Isabel Duchesa; 18°27'N, 69°57'W; 24.ii.1992; JC and JR; 1 paratype, 2 non-type soldiers, 1 paramorphotype winged imago, some non-type alates, immatures (DR0183). Peravia Province, Canasta; 18°14'N, 70°20'W; 24.ii.1992; JC and JR; 2 non-type soldiers, 1 paramorphotype winged imago, some non-type alates, immatures (DR0188). Same data; 1 paratype soldier, immatures (DR0211). Samana Province, Las Terrenas beach; 19°19'N, 69°32'W; 7.vi.1992; JC, JM, JR, and RS; 1 paratype, 1 non-type soldier, 1 paramorphotype winged imago, some non-type alates, immatures (DR0415). Puerto Plata Province, Cruce de los Hidalgos; 19°45'N, 71°02'W; 8.vi.1992; JC, JM, JR, and RS; 1 paratype, 3 non-type soldiers, 1 non-type alate, immatures (DR0447). Hato Mayor Province, 3 km S Sabana de la Mar; 19°00'N, 69°22'W; 9.vi.1992; JC, JM, JR, and RS; 1 paratype, 1 non-type soldier, immatures (DR0481). Santiago Province, Janico Arriba; 19°22'N, 70°50'W; 21.viii.1994; JC, JK, JR, and RS; 1 paratype, 2 non-type soldiers, 1 paramorphotype winged imago, many non-type alates, immatures (DR0936). La Plata Province, Punta Rucia; 19°52'N, 71°12'W; 21.viii.1994; JC, JK, JR, and RS; 1 paratype, 3 non-type soldiers, immatures (DR948). San Pedro de Macoris Province, Boca de Cumayasa, coast; 18°23'N, 69°05'W; 23.x.1994; JK and JR; 1 paratype, 2 non-type soldiers, immatures (DR1016). Saona Island; La Romana Province, Punta Catuano; 18°12'N, 68°47'W; 23.x.1994; JC and JR; 1 non-type soldier, 1 paramorphotype winged imago, immatures (DR1144). Same data; 1 paratype, 1 non-

Table 27. Measurements of *Cryptotermes mangoldi* imago.

Measurement in mm (n = 12♀, 3♂ from 8 colonies)	Range	Mean ± SD	Morphotype
Head length with labrum	1.00-1.24	1.14 ± 0.065	1.16
Head length to postclypeus	0.82-0.95	0.88 ± 0.031	0.87
Head width, maximum at eyes	0.85-0.98	0.92 ± 0.036	0.92
Eye diameter, maximum	0.28-0.31	0.29 ± 0.010	0.28
Eye to head base, minimum	0.11-0.16	0.14 ± 0.013	0.15
Ocellus diameter, maximum	0.11-0.12	0.11 ± 0.0059	0.32
Pronotum, maximum length	0.56-0.65	0.63 ± 0.030	0.64
Pronotum, maximum width	0.77-0.90	0.84 ± 0.038	0.85
Total length with wings	8.09-9.66	8.69 ± 0.35	8.52
Total length without wings	3.98-4.97	4.60 ± 0.42	3.98
Fore wing length from suture	6.53-7.24	6.84 ± 0.20	6.82
Fore wing, maximum width	1.68-2.01	1.86 ± 0.079	1.88

Table 28. Measurements of *Cryptotermes mangoldi* soldier.

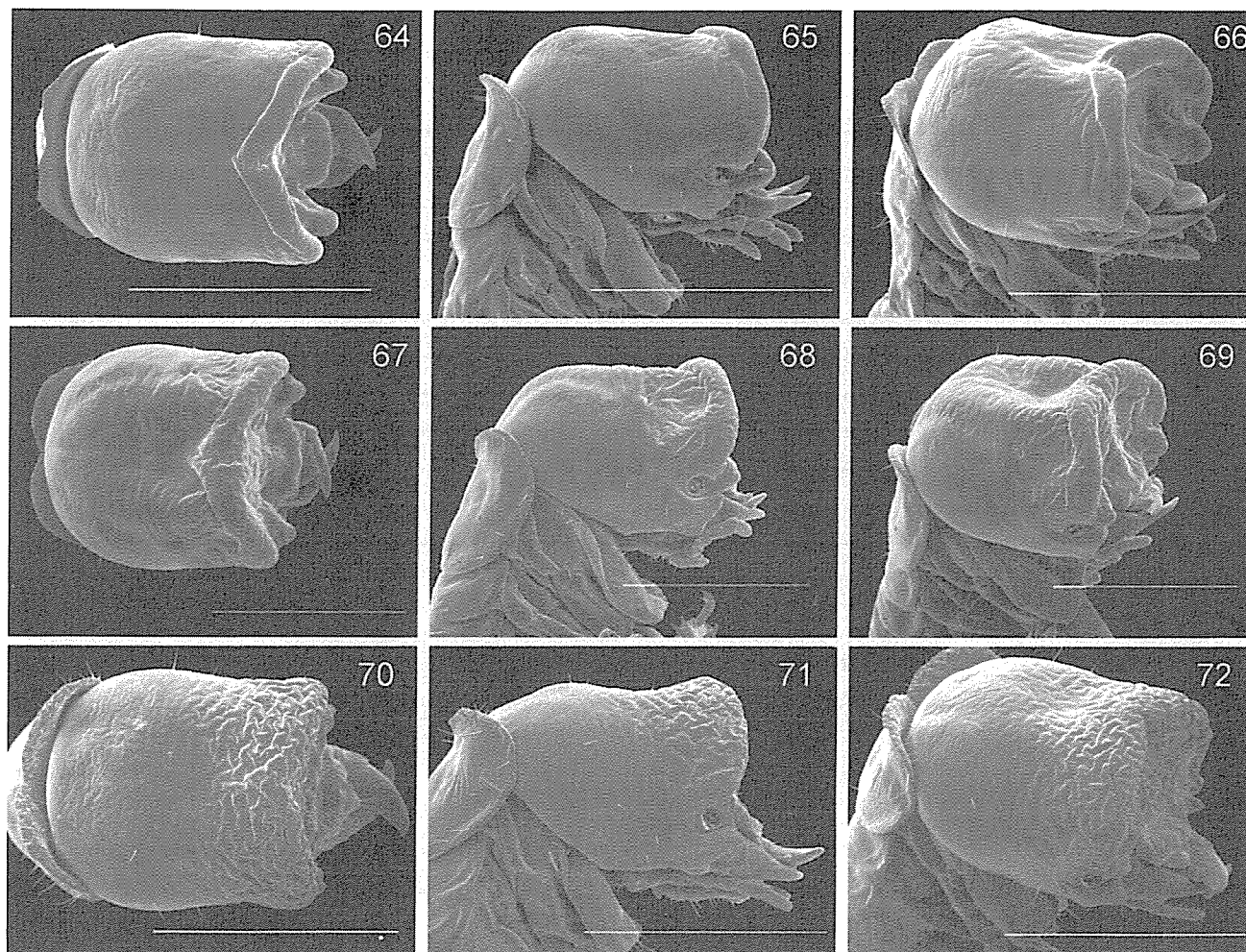
Measurement in mm (n = 18 from 13 colonies)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	1.34-1.50	1.40 ± 0.037	1.44
Head length to frontal horns	1.12-1.26	1.20 ± 0.034	1.20
Frontal flange width	0.96-1.13	1.05 ± 0.044	1.06
Frontal horns, outside span	0.75-0.85	0.82 ± 0.028	0.82
Head width, maximum	1.01-1.13	1.06 ± 0.036	1.10
Head height, excluding postmentum	0.74-0.82	0.77 ± 0.022	0.77
Pronotum, maximum width	0.90-1.05	0.99 ± 0.046	1.03
Pronotum, maximum length	0.70-0.80	0.74 ± 0.033	0.75
Left mandible length, tip to ventral condyle	0.62-0.69	0.65 ± 0.016	0.65
Total length	2.97-4.26	3.76 ± 0.36	3.96

type soldier, 5 non-type alates, immatures (DR1145). El Seibo Province, Playa Laguna Limon; 18°59'N, 68°50'W; 16.iii.1995; JC; 1 paratype, 1 non-type soldier, immatures (DR1154).

Cryptotermes nitens n. sp.

Description. Imago (Table 29). General color yellow-brown. Sclerotized fore wing veins pale brown;

membrane very pale smoky brown. Head yellow-brown, except for pale brown band between eyes. Yellow-brown chevron pattern on fore wing scales only slightly developed. Antennae and pronotum pale yellow-brown. Labrum and abdominal tergites yellow-brown. Femora whitish, rest of legs, including tibiae, yellow-brown. Abdominal sternites pale yellow. Head oval; cranial sutures poorly defined. Eyes large, protruding, oval except for rectate margins along antennal fossae. Ocelli moderately large,



Figures 64-72. Soldier heads of *Cryptotermes parvifrons* (GR001, Grenada, La Sagesse) (64-66), *C. pyrodomus* (STV109, St. Vincent, Vermont Falls Trail) (67-69), and *C. rhinocephalus* (TT086, Trinidad, Mt. St. Benedict foothills, forest trail) (70-72) each, by order, in dorsal, lateral, and oblique views. Scale bars = 1 mm.

oval, and touching eyes. Antennae with 15 to 18 articles, usually 17; formulae usually $2=3>4=5$, less often $2=3=4=5$ or $2>3=4=5$. Pronotum subsquare, width subequal with head at eyes; anterior margin shallowly concave, sides moderately convex, and posterior margin slightly concave. Crossbar mark and midline of pronotum absent. Fore wing radius reaching half of wing length from suture; radial sector with 6-7 branches. Arolia present.

Comparisons. For comparison see *Cryptotermes cymatofrons*.

Soldier (Figs. 61-63, Table 30). In dorsal view, frons, and frontal flange glossy black; in many specimens anterior 1/3 to 1/2 of vertex also glossy black with grading into chestnut brown and ferruginous in

posterior 1/3. Some specimens have vertex shaded from dark chestnut brown just behind frontal flange to ferruginous orange or orange in back. In lateral view, frontal flange nearly black, posterior pigmentation ferruginous orange or ferruginous. Mandibles dark chestnut brown. Anterior margin of pronotum ferruginous, remaining thorax, including legs, and abdomen yellow to orange-yellow.

Head capsule in dorsal view with subparallel sides slightly constricted near of frontal flange, usually with very slightly protruding eyes. Head, including frontal flange, frons, and postclypeus almost uniformly glossy smooth with only very faint rugosity. Anterior margin of frontal flange straight except for narrow median notch; notch continuous with vertex. Frontal concavity very shallow, flattened. Frontal flange elevated especially in lateral view, but

Table 29. Measurements of *Cryptotermes nitens* imago.

Measurement in mm (n = 8♀, 8♂ from 1 colony)	Range	Mean ± SD	Morphotype
Head length with labrum	1.14-1.20	1.16 ± 0.019	1.14
Head length to postclypeus	0.85-0.92	0.87 ± 0.021	0.85
Head width, maximum at eyes	0.89-0.99	0.91 ± 0.027	0.89
Eye diameter, maximum	0.32-0.34	0.33 ± 0.0086	0.32
Eye to head base, minimum	0.09-0.14	0.11 ± 0.016	0.13
Ocellus diameter, maximum	0.10-0.14	0.12 ± 0.011	0.12
Pronotum, maximum length	0.64-0.69	0.67 ± 0.015	0.67
Pronotum, maximum width	0.91-0.96	0.94 ± 0.020	0.92
Total length with wings	8.95-9.94	9.30 ± 0.26	9.09
Total length without wings	4.83-6.25	5.68 ± 0.34	5.47
Fore wing length from suture	6.96-7.53	7.26 ± 0.14	7.10
Fore wing, maximum width	1.91-2.08	2.00 ± 0.043	1.98

Table 30. Measurements of *Cryptotermes nitens* soldier.

Measurement in mm (n = 14 from 7 colonies)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	1.52-1.69	1.62 ± 0.048	1.63
Head length to frontal horns	1.20-1.40	1.33 ± 0.058	1.34
Frontal flange width	1.06-1.14	1.12 ± 0.025	1.14
Frontal horns, outside span	0.80-0.90	0.85 ± 0.028	0.85
Head width, maximum	1.06-1.19	1.15 ± 0.041	1.16
Head height, excluding postmentum	0.77-0.83	0.80 ± 0.022	0.78
Pronotum, maximum width	0.93-1.10	1.03 ± 0.050	1.06
Pronotum, maximum length	0.60-0.82	0.76 ± 0.058	0.78
Left mandible length, tip to ventral condyle	0.74-0.78	0.76 ± 0.014	0.75
Total length	3.37-4.70	3.95 ± 0.44	4.16

not projecting. Frontal plane sloping 80° from plane of vertex. Labrum broadly pointed at apex with small terminal inflation. Frontal horns conspicuous, semi-globular in lateral view, oval in frontal view, and finger tip-like in dorsal aspect; laterally divergent. Genal horns small rounded knob-like projections on dorsal tips of genae, abutted to bases of frontal horns. Mandibles sickle-shaped, moderately long, with basal inflations; tips turned up to eclipse labrum and anteclypeus in frontal view. First margin-

al tooth on each mandible short and pointed. Eyes conspicuous, large and oval. Antennae with 11-16 articles, usually 13 or 14; usual formulae 2>3>4<5 or 2>3<4=5. Pronotum relatively long and narrow.

Comparisons. For comparison see *C. cymatofrons*.
Geographical Distribution. West Indies (Figs. 10-11): Little Cayman Island, western Jamaica. Elsewhere: unknown.

Geographic Variability. Soldiers of the Jamaican phenotype exhibit a more concave frons and frontal flange (dorsal view) compared to those from Little Cayman. The Jamaican specimens are also larger in almost all measurements. Collection of *C. nitens* at only the type locality and only two samples from one locality in Jamaica (one with a single teneral soldier) prevent more precise conclusions about variability and require that both forms remain conspecific for now.

Remarks. Apparently a shrubby forest (Jamaica) and coastal seagrape (Little Cayman) species.

Etymology. This species is named for the Latin "nitido" meaning glossy or polished, referring to the texture and appearance of the soldier head capsule surface.

Material Examined. Holotype colony: **Cayman Islands.** Little Cayman; Pirates' Point Resort; 19°39.49'N, 80°06.01'W; 19.v.1996; JK; holotype soldier, 6 paratype soldiers, one for SEM, morphotype winged imago, 15 paramorphotype winged imagos, additional non-type alates, immatures (CA106). Paratype colonies: same data; 25.ix.1996; 1 paratype soldier, immatures (CA007). Same data (CA009). Same data (CA10). Same data; 10.i.1996; Ban; 2 paratype soldiers, 2 non-type alates, immatures (CA85). Same data; M. Collins; 1996; 1 paratype soldier, immatures (CA099). Same data; 20.v.1996; JK; (CA127). **Jamaica.** 1.5 km W of East Lacovia; 18°04.39'N, 77°46.50'W; 30.v.1997; PB, JC, JK, BM, JM, and YR; all castes (JA580).

Cryptotermes parvifrons n. sp.

Cryptotermes longicollis Banks 1918: Scheffrahn et al. 1994: 224, Trinidad only.

Description. Imago (Table 31). General color pale brown. Frons pale yellow-brown, vertex pale brown. Darkest pigmentation on wing scales forming median brown chevron pattern; wing membrane pale brownish, sclerotized veins brown. Labrum very pale yellow-brown. Pronotum and antennae pale brown. Pronotum with cross-shaped pattern formed by very pale brown band over whitish median line. Abdominal tergites pale brown, sternites very pale brown. Legs very pale brown to pale brown. Head subsquare. Cranial sutures hardly visible. Eyes oval and moderately large. Ocelli oval and touching eyes. Antennae with 15 to 17 articles, usually 16; formula 2>3=4=5.

Pronotum subequal to width of head with eyes; pronotum wider than long, with sides slightly convex; anterior margin slightly concave and posterior margin slightly emarginate. Fore wing radius running to 1/4 length of wing from suture. Radial sector with 6-8 branches. Arolia present.

Comparisons. For comparisons see *C. rhinocephalus*.

Soldier (Figs. 64-66, Table 32). Head from above with anterior 2/3 almost black, posterior 1/3 ferruginous; in lateral view, anterior 2/3 nearly black, posterior 1/3 around foramen magnum ferruginous orange. Mandibles chestnut brown. Anterior margin of pronotum marked with ferruginous orange bow tie-shaped pattern; remainder of pronotum pale yellow.

Head, in dorsal view, with sides parallel or with faint anterior divergence; widely rounded at posterior corners, posterior margin almost straight; anterior outline somewhat bracket-like. Vertex slightly concave in middle. Cephalic rugosity widespread, dense, faint, and almost homogenous, smoother on midvertex in some individuals. Frontal flange most conspicuous in frontal view; broadly incised, and clearly delineated from vertex; median notch with alternating, zipper-like creases; flange almost smooth, but dull; conspicuously rounded in cross section. Frons deeply concave; with small flattened median area continuous at nearly right angle with clypeus; frons textured, but glossy. Frontal plane sloping 70° from plane of vertex. Labrum blunt, inflated distally with very faint lateral truncation. Frontal horns stout, vertical, slightly narrower than long, separated from frontal flange and clypeus; oriented forward or slightly outward. Genal horns almost absent. Mandibles very short, without hump, angled; horizontal in lateral view; first marginal tooth on both mandibles very short and blunt. Eyes small, oval, if at all visible. Antennae with 11 to 13 articles, usually 12, with formulae 2>3=4=5 or 2>3>4=5. Pronotum subsquare with shallowly incised anterior margin, posterior margin almost straight, sides convex. Pronotum with anterior margin densely and bluntly sinuous.

Comparisons. For comparisons see *C. rotundiceps*.

Remarks. *Cryptotermes parvifrons* is an uncommon species in Trinidad proper, with apparent greater abundance on Grenada and islands of northwest Trinidad.

Table 31. Measurements of *Cryptotermes parvifrons* imago.

Measurement in mm (n = 6♀, 6♂ from 1 colony)	Range	Mean ± SD	Morphotype
Head length with labrum	0.98-1.19	1.08 ± 0.065	1.03
Head length to postclypeus	0.83-0.90	0.87 ± 0.021	0.87
Head width, maximum at eyes	0.88-0.92	0.89 ± 0.011	0.88
Eye diameter, maximum	0.26-0.29	0.28 ± 0.011	0.28
Eye to head base, minimum	0.13-0.17	0.15 ± 0.012	0.16
Ocellus diameter, maximum	0.09-0.11	0.10 ± 0.0073	0.11
Pronotum, maximum length	0.57-0.62	0.60 ± 0.014	0.62
Pronotum, maximum width	0.85-0.92	0.88 ± 0.024	0.88
Total length with wings	8.38-8.95	8.63 ± 0.24	8.95
Total length without wings	4.12-5.11	4.75 ± 0.33	4.83
Fore wing length from suture	6.25-6.82	6.53 ± 0.17	6.67
Fore wing, maximum width	1.62-1.68	1.66 ± 0.023	1.62

Table 32. Measurements of *Cryptotermes parvifrons* soldier.

Measurement in mm (n = 15 from 6 colonies)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	1.32-1.50	1.40 ± 0.044	1.42
Head length to frontal horns	1.20-1.34	1.27 ± 0.044	1.28
Frontal flange width	1.01-1.14	1.07 ± 0.042	1.08
Frontal horns, outside span	0.74-0.82	0.78 ± 0.030	0.74
Head width, maximum	1.03-1.14	1.10 ± 0.033	1.08
Head height, excluding postmentum	0.75-0.90	0.83 ± 0.037	0.85
Pronotum, maximum width	0.92-1.05	0.99 ± 0.038	0.97
Pronotum, maximum length	0.69-0.82	0.74 ± 0.037	0.72
Left mandible length, tip to ventral condyle	0.49-0.62	0.57 ± 0.035	0.57
Total length	3.22-4.11	3.62 ± 0.31	3.22

Geographical Distribution. West Indies (Figs. 16-17): Lesser Antilles: mainland Trinidad incl. Chacachacare and Monos islands, and Grenada. Elsewhere: unknown.

Geographical Variability. Soldiers from Grenada possess a more shallow concavity of the frons.

Etymology. The species name reflects the diminutive frons of the soldier.

Material Examined. Holotype colony: **Trinidad.** Williams Bay E of Chaguaramas; 10°40.79'N, 61°37.52'W; 28.v.1996; JC, JK, BM, JM, and RS; holotype soldier, 6 paratype soldiers, immatures (TT0278). morphotype colony: Trinidad; Chacachacare Island; 30.iii.1990; J. Darlington; morphotype winged imagos, 11 paramorphotype winged imagos, few non-type dealates, 2 paratype soldiers, immatures (JD518). paratype colonies: **Grenada.** La Sagesse; 12°01.63'N, 61°40.29'W; 17.viii.1997; JC and BM; 2 paratype, 1 non-type soldier, one for SEM, immatures

Table 33. Measurements of *Cryptotermes pyrodomus* imago.

Measurement in mm (n = 3♀, 7♂ from 1 colony)	Range	Mean ± SD	Morphotype
Head length with labrum	1.10-1.16	1.14 ± 0.018	1.16
Head length to postclypeus	0.82-0.87	0.83 ± 0.016	0.82
Head width, maximum at eyes	0.88-0.93	0.91 ± 0.015	0.88
Eye diameter, maximum	0.29-0.33	0.31 ± 0.012	0.30
Eye to head base, minimum	0.13-0.18	0.16 ± 0.014	0.17
Ocellus diameter, maximum	0.10-0.13	0.12 ± 0.011	0.10
Pronotum, maximum length	0.59-0.65	0.61 ± 0.018	0.61
Pronotum, maximum width	0.83-0.92	0.88 ± 0.027	0.89
Total length with wings	8.80-9.51	9.18 ± 0.25	9.23
Total length without wings	3.98-5.54	4.57 ± 0.50	5.25
Fore wing length from suture	6.82-7.53	7.20 ± 0.20	7.17
Fore wing, maximum width	1.88-2.13	2.00 ± 0.065	1.99
Hind tibia length	0.75-0.82	0.78 ± 0.020	0.78

Table 34. Measurements of *Cryptotermes pyrodomus* soldier.

Measurement in mm (n = 7 from 1 colony)	Range	Mean ± SD	Neotype
Head length with frontal flange	1.28-1.38	1.33 ± 0.037	1.38
Head length to tip of mandibles	1.59-1.65	1.63 ± 0.025	1.64
Head length to frontal horns	1.32-1.42	1.38 ± 0.043	1.42
Frontal flange width	1.13-1.21	1.17 ± 0.026	1.17
Frontal horns, outside span	0.87-0.92	0.90 ± 0.020	0.88
Head width, maximum	1.16-1.23	1.19 ± 0.023	1.21
Head height, excluding postmentum	0.95-1.05	0.98 ± 0.030	0.98
Pronotum, maximum width	1.03-1.21	1.14 ± 0.063	1.19
Pronotum, maximum length	0.74-0.83	0.79 ± 0.039	0.82
Left mandible length, tip to ventral condyle	0.63-0.72	0.67 ± 0.029	0.67
Total length	3.56-4.90	4.20 ± 0.54	4.46

(GR001). Antoine Bay; 12°10.76'N, 61°36.29'W; 17.viii.1997; JC and BM; 1 paratype soldier, immatures (GR019). Same data, 2 paratype soldiers, immatures (GR020). David Point; 12°13.67'N, 61°39.62'W; 18.viii.1997; JC and BM; 1 paratype soldier, immatures (GR075).

Cryptotermes pyrodomus Bacchus

Cryptotermes pyrodomus Bacchus 1987: 72 [2 soldiers] from one colony, 2 figs., 1 table, Barbados.

Description. Imago (Table 33). Caste previously undescribed. General color pale brown. Sclerotized fore wing veins brown; membrane subhyaline, very pale smoky brown. Head, labrum and pronotum pale brown. Pale brown chevron pattern on fore wing scales barely visible. Antennae pale brown. Abdominal tergites yellow-brown. Abdominal sternites very pale yellow-brown. Femora whitish, legs distally, including tibiae, pale yellow-brown. Head oval; cranial sutures distinct. Eyes moderately large, faintly rectate along antennal fossae. Ocelli moderately large,

oval, almost touching eyes. Antennae with 15 to 17 articles, usually 16; formulae variable, but usually 2=3=4=5. Pronotum wider than long; anterior and posterior margins slightly concave, sides moderately convex. Crossbar mark and midline of pronotum visible. Fore wing radius fusing with costal margin beyond half wing length from suture; radial sector with 5 or more branches. Arolia present.

Comparisons. The imago of *C. pyrodomus* is indistinguishable from that of *C. darlingtonae*, however, measurements of the former are rather smaller in range.

Soldier (Figs. 67-69, Table 34). Head capsule, in dorsal view, with anterior 2/3 nearly black, grading to ferruginous or ferruginous orange in posterior 1/3; in lateral view, anterodorsal region black, posteroventral region behind eyes ferruginous orange. Mandibles very dark chestnut brown. Anterior margin of pronotum ferruginous, remainder very pale yellow save brownish patches in anterior half.

Head, in dorsal view, subsquare, with rounded posterior margin; very slightly constricted laterally behind frontal flange. Head with weak, rugose concavities in each anterolateral corner behind frontal flange. Vertex with circular median concavity. Rugosity deep and elongated. Frontal flange slightly elevated, rugose, very shallowly concave in dorsal view; medially notched and notch discontinuous with vertex concavity. Frontal plane sloping 90° from plane of vertex. Frons rugose and bilaterally concave along noticeable median vertical carina. Labrum short, with slightly inflated median point. Frontal horns prominent in dorsal view, thumb-like and rugose. Genal horns very small, conical, projecting anterodorsally, and not visible in dorsal view. Frontal and genal horns abut at bases in lateral view; frontal horns about 5X more voluminous than genal horns; genal horns clearly recessed posteriorly relative to dominant frontal horns. Mandibles with rugose hump at basal 1/3; dentition short. Eye spots oval, pigmentation distinct. Antennae with 12-14 articles, usually 13 or 14; formulae variable, usually 2>3>4<5 or 2>3<4=5. Pronotum broadly shield-shaped, bluntly incised anteriorly, posterolaterally rounded.

Comparisons. *Cryptotermes pyrodomus* is very similar to *C. darlingtonae*, but the former is distinguishable by much smaller and more posteriorly recessed genal horns. The frontal horns of *C. pyrodomus* eclipse the view of the genal horns in frontodor-

sal view, whereas, in *C. darlingtonae*, the genal horns are visible

Remarks. *Cryptotermes pyrodomus* is an extremely rare, moist forest species and may now be absent from Barbados.

Geographical Distribution. West Indies (Fig. 16): Lesser Antilles: Barbados, Saint Vincent. Elsewhere: unknown.

Material Examined. The holotype soldier from Barbados could not be located in the AMNH collection and the only paratype was lost by RS during preparation for SEM. A neotype soldier is designated herein along with a neoparatype soldier series. The imago is described for the first time from the same colony. Neotype colony: **St. Vincent.** Vermont Falls Trail; 13°13.00'N, 61°12.90'W; 25.v.1998; JK, BM, and JM; neotype soldier, 6 neoparatype soldiers and one SEM specimen, morphotype imago and 9 paratype imagos, immatures (STV109).

Cryptotermes rhinocephalus Bacchus

Cryptotermes rhinocephalus Bacchus 1987:72 [1 soldier] from one colony, 2 figs, 1 table, Trinidad.

Description. Imago (Table 35). Caste previously undescribed. General color pale brown. Sclerotized fore wing veins brown; membrane smoky, pale brown. Head pale brown to brown with darker band between eyes. Brown chevron pattern on fore wing scales distinct. Pronotum pale brown to brown. Abdominal tergites brown. Abdominal sternites, labrum and antennae pale brown. Femora whitish, legs including tibiae, pale brown distally. Head oval with cranial sutures weakly defined. Eyes moderately large, sub-oval, with rectate margins along ocelli and antennal fossae. Ocelli moderately large, oval and touching eyes. Antennae with 14 or 15 articles equally frequent; formulae variable, but usually 2=3=4=5. Pronotum subsquare, distinctly narrower than head width at eyes; anterior margin slightly concave, posterior margin very slightly concave, sides slightly convex. Fore wing radius reaching wing margin at 1/3 wing length from suture; radial sector with 5-7 branches. Arolia present.

Comparisons. *Cryptotermes rhinocephalus* has the most pigmented wings among West Indian congeners. The wing bases are dark, especially when

Table 35. Measurements of *Cryptotermes rhinocephalus* imago.

Measurement in mm (n = 9♀, 6♂ from 2 colonies)	Range	Mean ± SD
Head length with labrum	1.03-1.18	1.10 ± 0.039
Head length to postclypeus	0.80-0.92	0.86 ± 0.032
Head width, maximum at eyes	0.85-0.93	0.90 ± 0.020
Eye diameter, maximum	0.28-0.32	0.30 ± 0.011
Eye to head base, minimum	0.08-0.12	0.11 ± 0.011
Ocellus diameter, maximum	0.10-0.11	0.11 ± 0.0052
Pronotum, maximum length	0.52-0.60	0.58 ± 0.027
Pronotum, maximum width	0.75-0.83	0.81 ± 0.027
Total length with wings	7.95-9.23	8.64 ± 0.36
Total length without wings	4.12-4.97	4.50 ± 0.26
Fore wing length from suture	6.25-7.24	6.67 ± 0.35
Fore wing, maximum width	1.58-1.81	1.70 ± 0.091

Table 36. Measurements of *Cryptotermes rhinocephalus* soldier.

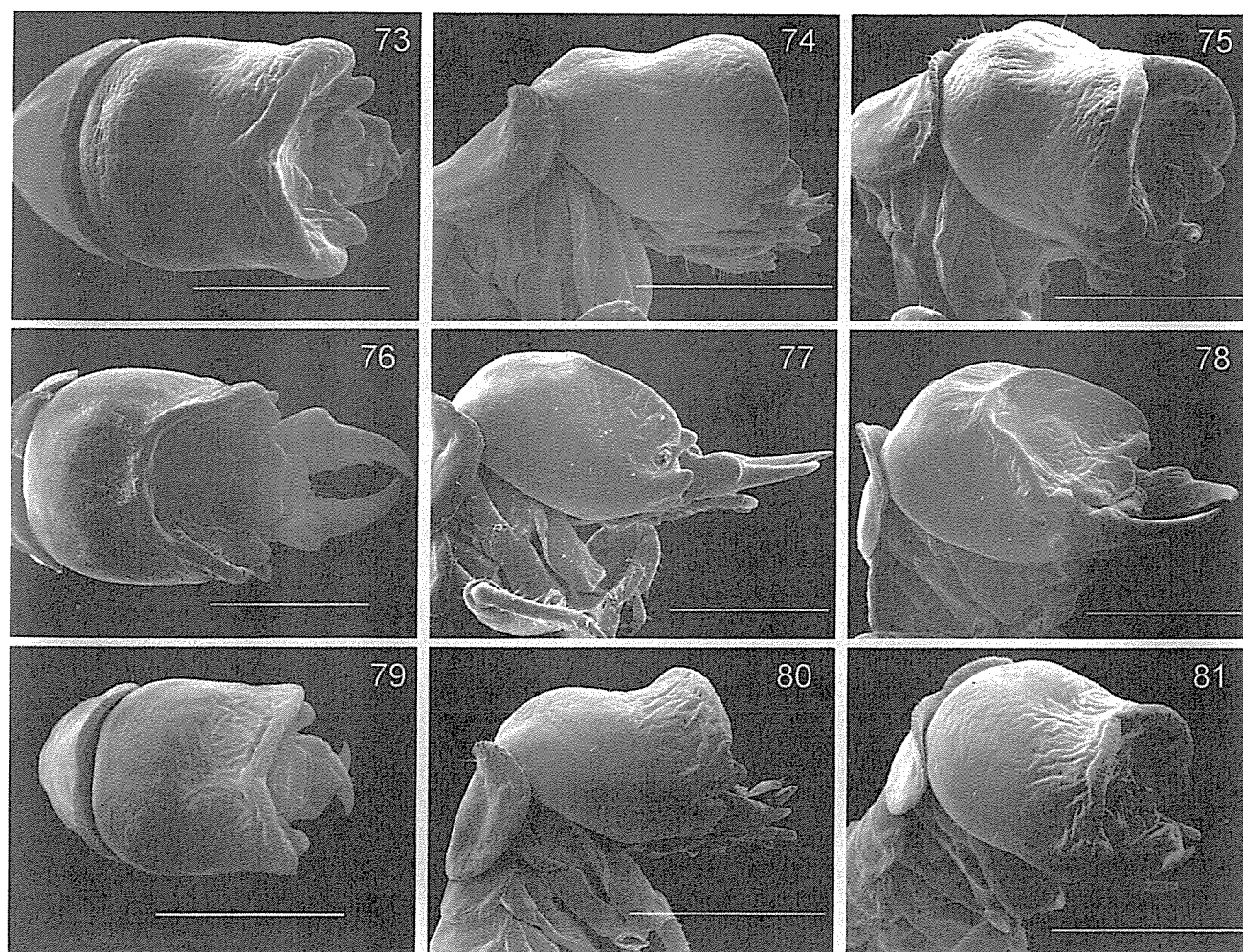
Measurement in mm (n = 15 from 4 colonies)	Range	Mean ± SD
Head length to tip of mandibles	1.46-1.59	1.53 ± 0.042
Head length to frontal horns	1.18-1.30	1.25 ± 0.034
Frontal flange width	1.00-1.10	1.07 ± 0.024
Frontal horns, outside span	0.78-0.85	0.82 ± 0.019
Head width, maximum	1.03-1.11	1.07 ± 0.020
Head height, excluding postmentum	0.82-0.92	0.87 ± 0.030
Pronotum, maximum width	0.90-1.03	0.98 ± 0.033
Pronotum, maximum length	0.64-0.80	0.73 ± 0.041
Left mandible length, tip to ventral condyle	0.64-0.69	0.67 ± 0.017
Total length	2.97-3.86	3.46 ± 0.24

stacked over abdomen. Wings of this species are also very short and narrow (mean 6.67 mm, range 6.25 - 7.24). *Cryptotermes parvifrons* and *C. cryptognathus* both have comparable sized wings, but wings are less pigmented than *C. rhinocephalus*.

Soldier (Figs. 70-72, Table 36). Head in dorsal view, with anterior 1/3-1/2 nearly black, grading posteriorly to ferruginous. Head in lateral view, with anterior 1/3 almost black; grading to ferruginous in posterior, with pale yellow marginal strip along foramen mag-

num. Mandibles very dark chestnut brown. Anterior margin of pronotum chestnut brown, rest of pronotum orange-yellow.

Head shape in dorsal view subsquare, with slight, but distinct constriction at eye spots; sides slightly convex, posterior margin faintly convex, or in some specimens, almost rectate. Rugosity on anterior 1/3-1/2 of head characteristically cerebri-form. Anterior outline of frontal flange shallowly incised and biconvex; flange continuous without delineation from vertex and frons. Frons with vari-



Figures 73-81. Soldier heads of *Cryptotermes rotundiceps* (DR1290, Pedernales Province, 15 km NW Los Tres Chacos) (73-75), *C. spanthifrons* (CA029, Cayman Islands, Little Cayman, Crawl Bay) (76-78), and *C. undulans* (PR204, Puerto Rico, 2 km E Recio on Hwy 3) (79-81) each, by order, in dorsal, lateral, and oblique views. Scale bars = 1 mm.

able degree of concavity, slight to faint, and with rugosity of complete frontal surface congruous with anterior head capsule; frontal plane sloping 90° from plane of vertex; dorsal outline of vertex distinctly concave. Labrum small, triangular, and with faintly inflated tip. Frontal horns very short, rounded, continuous with flange, and with congruous frontal rugosity. Genal horns short, conical, and with granulate surfaces; axes divergent. Genal and frontal horns narrowly separated; in dorsal view genal horns not completely eclipsed by frontal horns. Mandibles moderately long, somewhat sickle-shaped, usually slightly humped near bases, and with very short dentition. In lateral view, mandibles project almost horizontally. Eye spots oval and small, or very small and poorly delineated. Antennae with 11 to 13

articles, usually 11 or 13; formulae variable, but usually $2>3<4=5$. Pronotum widely shield-shaped. Anterior margin of pronotum shallowly incised with additional small and slightly deeper median indentation; sides of pronotum slightly convex, or subparallel with slight backward convergence and with posterior corners widely rounded; posterior margin rectate. Anterior margin of pronotum shallowly, but distinctly sinuous.

Comparisons. *Cryptotermes rhinocephalus* is most similar to *C. cylindrocephus* from which the former differs by its longer mandibles and less cylindrical head capsule. *Cryptotermes rhinocephalus* also has much deeper rugosity on the head capsule and frons than *C. cylindrocephus*.

Remarks. *Cryptotermes rhinocephalus* is a rare forest species.

Geographical Distribution. West Indies (Fig. 17): Lesser Antilles: Trinidad, Tobago (new record). Elsewhere: unknown.

Material Examined. For type material data see Bacchus 1987. For additional material, all soldiers and alates measured unless stated otherwise. **Trinidad.** Mt. Tabor, St. Benedict Monastery foothills area; 10°39.83'N, 61°23.93'W; 26.v.1996; JK; 4 soldiers, immatures (TT 85). Same data, 7 of 9 soldiers measured, 1 for SEM, 5 of many alates measured, immatures (TT86). **Tobago.** Anse Brisant Bay trail; 11°18.55'N, 60°31.64'W; 31.v.1996; JC, JK, JM, and RS; 2 soldiers, 10 of many alates measured (TT0557), Roxborough Road, NNW Roxborough; 11°16.02'N, 60°35.15'W; 31.v.1996; JC, JK, JM, and RS; 2 soldiers, immatures (TT577).

***Cryptotermes rotundiceps* n. sp.**

Cryptotermes longicollis Banks 1918: Scheffrahn et al. 1994: 219,220,223; Dominican Republic, Haiti, and Puerto Rico.

Description. Imago (Table 37). General color pale yellow-brown and nearly monochromatic. Sclerotized fore wing venation yellow-brown, membrane subhyaline. Chevron pattern on fore wing scales very faint. Frons, labrum, pronotum, and abdominal sternites pale yellow-brown. Vertex, antennae, and abdominal tergites yellow-brown. Femora yellow-white, legs including tibiae, pale yellow-brown distally. Head oval and elongated with cranial sutures distinct, and often masked by pale background. Eyes moderately large and oval except for rectate margin along antennal fossae. Ocelli smaller, oval, and touching eyes. Antennae with 16 to 18 articles, usually 17, and with formulae variable, but usually 2>3=4=5. Pronotum usually distinctly wider than or occasionally equal to head width at eyes, with anterior margin moderately concave, sides slightly convex, and posterior margin weakly concave. Pronotal midline and crossbar mark almost absent. Fore wing subcosta long, reaching 1/4 of wing length from suture, radius reaching near midwing, and radial sector with 5-7 branches. Arolia present.

Comparisons. For comparisons see *Cryptotermes undulans*.

Soldier (Figs. 73-75, Table 38). Head in dorsal view, with variable degree of pigmentation, usually nearly black in anterior 2/3, occasionally only in anterior 1/3, posterior ferruginous, chestnut brown or dark chestnut brown. One pair of small, much paler, orange-yellow spots on very posterior. Head in lateral view, anterior 1/2 almost black, posterior half variable, usually tinged with chestnut brown, and with characteristic, noticeably paler, orange-yellow inferior margin of genae. Mandibles chestnut brown. Anterior margin of pronotum ferruginous orange, remainder of pronotum pale yellow.

Head outline in dorsal view, variable; some specimens with parallel sides, others more or less bulbous behind constriction in anterior 1/5. Anterior profile of head in dorsal view shallowly concave with additional small concavity in middle. Head with faint concavity in middle of vertex. Vertex profile in lateral view with distinct concavity accentuated by hump on the posterior vertex. Rugosity faint, but dense and covering major surfaces of head capsule, including frontal flange and frons, except for smooth central area of frons. Frontal flange distinct, and rounded in cross section; often directly continuous with vertex; in some individuals faintly delineated from vertex in middle; in frontal view, outline orbicular. Frontal plane sloping 70-80° from plane of vertex. Labrum short, widely rounded, inflated distally, and with rather short terminal setae. Frontal horns rounded and massive, especially wide in lateral view, projecting divergently; discontinuous with frontal flange in dorsal view, and separated from clypeus by deep groove. Genal horns form small rounded protuberances. Genal horns adjacent to frontal horns. Mandibles very short, angled, in some specimens faintly humped; curved up in lateral view; tips do not extend beyond lateral margins of labrum when closed; dentition weak. Eyes absent or small and slit-like; in soldier-nymph intercaste large and oval. Antennae with 11 to 14 articles, usually 12 or 14; formula usually 2>3>4=5. Pronotum very shallowly incised anteriorly, sides almost parallel, or convergent to back in anterior half, widely rounded in posterior half; anterior margin faintly sinuous, posterior margin straight.

Comparisons. *Cryptotermes rotundiceps* is closest to *C. parvifrons*, with the former being a much larger species. The frontal flange of *C. parvifrons* has a median notch consisting of characteristic zipper-like alternating undulations while the notch of *C. rotundiceps* is weak or absent and is without undulations. The mandibles of *C. rotundiceps* are shorter

Table 37. Measurements of *Cryptotermes rotundiceps* imago.

Measurement in mm (n = 9♀, 6 ♂ from 7 colonies)	Range	Mean ± SD	Morphotype
Head length with labrum	1.28-1.41	1.33 ± 0.044	1.41
Head length to postclypeus	1.01-1.05	1.03 ± 0.013	1.01
Head width, maximum at eyes	1.01-1.08	1.05 ± 0.020	1.06
Eye diameter, maximum	0.33-0.36	0.35 ± 0.0086	0.34
Eye to head base, minimum	0.12-0.16	0.14 ± 0.013	0.16
Ocellus diameter, maximum	0.11-0.14	0.12 ± 0.0087	0.13
Pronotum, maximum length	0.74-0.87	0.80 ± 0.038	0.80
Pronotum, maximum width	0.98-1.16	1.07 ± 0.053	1.10
Total length with wings	10.65-11.50	11.00 ± 0.26	10.93
Total length without wings	4.83-6.82	5.81 ± 0.61	5.82
Fore wing length from suture	8.38-9.09	8.73 ± 0.23	8.66
Fore wing, maximum width	2.27-2.41	2.33 ± 0.043	2.37

Table 38. Measurements of *Cryptotermes rotundiceps* soldier.

Measurement in mm (n = 19 from 12 colonies)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	1.50-1.71	1.59 ± 0.061	1.61
Head length to frontal horns	1.38-1.57	1.47 ± 0.061	1.52
Frontal flange width	1.16-1.39	1.28 ± 0.067	1.26
Frontal horns, outside span	0.83-1.01	0.92 ± 0.045	0.92
Head width, maximum	1.19-1.42	1.30 ± 0.066	1.34
Head height, excluding postmentum	0.85-1.06	0.98 ± 0.066	1.01
Pronotum, maximum width	1.08-1.37	1.24 ± 0.093	1.29
Pronotum, maximum length	0.77-1.01	0.90 ± 0.074	0.95
Left mandible length, tip to ventral condyle	0.65-0.74	0.70 ± 0.021	0.70
Total length	3.61-5.35	4.53 ± 0.46	4.85

beyond basal hump than preceding the hump, while the *C. parvifrons*, the mandibles are longer distal to the hump than before it.

Remarks. *Cryptotermes rotundiceps* is confined to the xeric regions of the southern and western coast of the Dominican Republic with one deep inland extension into eastern Haiti. This species is less common and more restricted in distribution than *C. mangoldi*.

In Puerto Rico the species is represented by a single sample. See also *C. mangoldi*.

Geographical Distribution. West Indies (Figs. 12-13): Greater Antilles: Hispaniola, Dominican Republic and Haiti, and Puerto Rico. Elsewhere: unknown.

Etymology. This species is named for the conspicuous rounded features of the soldier head including the

frons, clypeus, posterior head margin, frontal flange, labrum, posterior half of pronotum, and the lateral profile of the frontal horns.

Material Examined. Holotype colony: **Dominican Republic.** La Romana Province, 4 km N Guyamate; 18°37.31'N, 68°57.63'W; 5.xi.1996; JC and JK; holotype soldier, 6 paratype soldiers, one for SEM, a pair of primary reproductives, immatures (DR1370). Morphotype colony: Dominican Republic, Azua Province, 37 km W Bani; 18°25'N, 70°37'W; 5.v.1992; JC, JR, and RS; Morphotype winged imago, 6 paramorphotype winged imagos, and non-type alates, 1 paratype soldier, immatures (DR0313). Paratype colonies: all reference samples except for PR217 (see below) originate from the Dominican Republic. Peravia Province, 11 km S San José de Ocoa; 18°28'N, 70°28'W; 27.ii.1992; JC and JR; 1 paratype, 2 non-type soldiers, immatures (DR0175). San Pedro de Macoris Province, La Punta; 18°27'N, 69°19'W; 25.ii.1992; JC and JR; 1 paratype soldier, immatures (DR0177). Hato Mayor Province, 12 km S Hato Mayor; 18°27'N, 69°19'W; 9.vi.1992; JC, JM, JR, and RS; 1 paratype soldier, 1 paramorphotype winged imago, non-type alates, immatures (DR0475). La Altagracia Province, 4 km E Bayehibe Int. La Romana Hwy; 18°27'N, 68°54'W; 12.vi.1992; JC, JM, JR, and RS; 1 paratype soldier, immatures (DR0584). Barahona Province, 5 km NE Enriquillo; 17°58'N, 71°16'W; 28.iii.1993; JC and JR; 1 paramorphotype winged imago (DR0719). San Juan Province, 15 km E San Juan; 18°42'N, 71°21'W; 29.x.1993; JC and JR; 1 paratype soldier, immatures (DR0879). Barahona Province, Jaquimeyes; 18°18'N, 70°20'W; 4.viii.1996; JC; 2 paratype soldiers, 1 paramorphotype winged imago, more non-type alates, immatures (DR1210). Pedernales Province, 15 km NW Los Tres Chacos, 17°55.66'N, 71°31.22'W; 3.xi.1996; JC and JK; 1 paratype, 3 non-type soldiers, immatures (DR1290). La Romana Province, Higuerá; 18°29.09'N, 68°59.74'W; 5.xi.1996; JC and JK; 1 paramorphotype winged imago, 3 non-type soldiers, immatures (DR1366). Monte Plata Province, Juana Lorenza; 18°43.74'N, 69°38.26'W; 8.xi.1996; JC, JK, and JR; 1 paratype, one non-type soldier, immatures (DR1487). Same data; 1 paramorphotype winged imago, non-type alates, 1 non-type soldier, immatures (DR1488). **Puerto Rico,** Wildlife Station on Hwy 3 NE Humacao; 18°10'N, 65°45'W; 1.vi.1993; JC, JM, JR, and RS; 2 paratype soldiers, 3 paramorphotype winged imagos, immatures (PR217).

Additional Species Examined. *Cryptotermes longicollis* Banks, **Mexico,** Leona Vicario, Hwy 180,

270 km marker, 21°00.39'N, 87°09.82'W; 10.xii.1997; JC and JM; 2 soldiers, immatures (MX209).

Cryptotermes spathifrons n. sp.

Cryptotermes nr. *hemicyclius*: Scheffrahn et al. 1994: 216, Cuba; 219, Dominican Republic.

Description. Imago (Table 39). General color yellow-white to pale yellow. Head posterior orange-yellow, abruptly separated from yellow anterior. Darkest pigmentation in wing scales, forming median chevron pattern; membrane yellow-white, sclerotized veins pale orange. Pronotum and abdominal tergites pale yellow. Antennae and sternites yellow-white. Labrum orange-yellow. Legs with yellow-white femora, distally orange-yellow. Posterior remnant of cranial suture faint. Eyes large, protruding, subcircular; margins confronting ocelli, antennal fossae, and posteroventral region often nearly rectate. Ocelli large, oval in horizontal axis, nearly touching eyes. Antennae with 15 to 19 articles, usually 18 or 17, and with formulae $2=3>4=5$ or $2<3>4=5$. Pronotum narrower or conspicuously narrower than head with eyes; shape subsquare, sides nearly parallel, and anterior with posterior margins slightly and almost equally concave. Fore wing radius fusing with costal margin at proximal 1/3 of wing. Radial sector with 4 branches. Arolia present.

Comparisons. *Cryptotermes spathifrons* is closest to *C. hemicyclius*, but the former has larger eyes and a shorter head (with postclypeus) compared to *C. hemicyclius*. The pronotum of *C. spathifrons* has slightly and almost equally concave anterior and posterior margins, while in *C. hemicyclius*, the pronotum is asymmetrical along its transverse axis.

Geographical Variation. The eyes of the Little Cayman phenotype are larger compared with Cuban colony samples. The pronotum of Cuban imagoes is wider than long, while those from Little Cayman have a subquadrate pronotum.

Soldier (Figs. 76-78, Table 40). Head in dorsal view, with variable coloration; frontal flange, anterior half of frons, and frontal and genal horns almost black; in some specimens posterior half of frontal flange chestnut brown to very dark chestnut brown. Anterior half of frons nearly black in lateral view, abruptly grading posteriorly to ferruginous or chestnut brown and framed by darker flange. Vertex and head capsule in lateral view ferruginous orange or ferruginous. Man-

Table 39. Measurements of *Cryptotermes spathifrons* imago.

Measurement in mm (n = 11♀, 5♂ from 3 colonies)	Range	Mean ± SD	Morphotype
Head length with labrum	1.31-1.49	1.39 ± 0.046	1.39
Head length to postclypeus	1.01-1.11	1.06 ± 0.031	1.05
Head width, maximum at eyes	1.17-1.24	1.20 ± 0.020	1.19
Eye diameter, maximum	0.37-0.46	0.42 ± 0.028	0.43
Eye to head base, minimum	0.08-0.17	0.12 ± 0.023	0.14
Ocellus diameter, maximum	0.14-0.18	0.16 ± 0.012	0.16
Pronotum, maximum length	0.78-0.88	0.84 ± 0.025	0.85
Pronotum, maximum width	1.05-1.18	1.11 ± 0.041	1.14
Total length with wings	11.50-13.49	12.70 ± 0.58	12.92
Total length without wings	5.54-7.38	6.58 ± 0.58	7.38
Fore wing length from suture	9.02-10.51	10.02 ± 0.44	9.94
Fore wing, maximum width	2.60-2.82	2.73 ± 0.050	2.74

Table 40. Measurements of *Cryptotermes spathifrons* soldier.

Measurement in mm (n = 21 from 18 colonies)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	2.10-2.42	2.26 ± 0.090	2.27
Head length to frontal horns	1.53-1.75	1.61 ± 0.067	1.60
Frontal flange width	1.21-1.47	1.33 ± 0.063	1.31
Frontal horns, outside span	1.00-1.23	1.06 ± 0.051	1.05
Head width, maximum	1.34-1.54	1.41 ± 0.059	1.39
Head height, excluding postmentum	0.92-1.03	0.98 ± 0.035	0.95
Pronotum, maximum width	1.18-1.47	1.32 ± 0.078	1.34
Pronotum, maximum length	0.93-1.06	1.00 ± 0.042	1.01
Left mandible length, tip to ventral condyle	1.00-1.16	1.07 ± 0.042	1.10
Total length	4.50-6.75	5.46 ± 0.63	6.62

dibles dark chestnut brown or very dark chestnut brown. Anterior margin of pronotum ferruginous, remaining margin ferruginous orange; interior pale yellow.

Head in dorsal view, dominated by conspicuously recessed hemihexagonal frons, displacing vertex to posterior 1/2 of head. Head, from above, slightly constricted before, and becoming bulbous behind faintly protruded eyes. Vertex concave in median anterior area coinciding with faint incision of frontal flange. Rugosity of head developed bilaterally along frontal flange and central area of frons; remaining head

capsule almost smooth. Frontal flange hemihexagonal in outline, callose, unusually narrow, and elevated above frons with sides very slightly concave laterally; posterior margin nearly rectate. Frons widely and shallowly concave; each anterolateral corner adorned with circular rugosity. Frontal plane reclinate, sloping 30° from vertex plane, and parallel with head margin along foramen magnum. Labrum large, linguiform, and terminated with small inflated protrusion. Frontal horns stout, rounded, broadened at base; continuous with frontal flange, but delineated conspicuously from frons; separated deeply, and

almost perpendicularly, from clypeus; axes of frontal horns parallel. Genal horns form small finger-like extensions of dorsal tip of genae; axes diverge 90°. Frontal horns broadly separated from, and about twice as voluminous as genal horns. Mandibles very long, with corpulent humps well beyond base; dentition distinct. Eyes small, oval, or in soldier-nymph intercaste large, almost circular. Antennae with 12 to 16 articles, usually 12 or 14; formulae variable, but usually $2 > 3 < 4 = 5$. Pronotum widely shield-shaped, anterior margin deeply and widely incised medially, incision sharply angled laterally to form sharp corners with slight terminal constrictions. Sides of pronotum rounded anteriorly, posteriorly rectate, and converging behind; posterior margin faintly concave. Anterior margin of pronotum densely and bluntly sinuous.

Comparisons. *Cryptotermes spathifrons* is closest to *C. hemicyclius*, however, the former has a distinctly more recessed frons, and consequently, a more posteriorly displaced and diminished vertex. The frontal flange of *C. spathifrons* intrudes into the middle of the head, while in *C. hemicyclius* the flange occupies the anterior 1/3. The mandibles of *C. spathifrons* are longer, more massively humped, and adorned with more distinct dentition than *C. hemicyclius*. The frontal flange of *C. hemicyclius* is rounded posteriorly, while in *C. spathifrons* it is hemihexagonal. For additional characters see also *C. hemicyclius*.

Remarks. *Cryptotermes spathifrons* appears xerically adapted. In the Dominican Republic its distribution is very restricted, but occurs sympatrically with *C. rotundiceps*.

Geographical Distribution. West Indies (Figs. 9, 11-12): Greater Antilles: southeastern coast of Cuba and southwestern Dominican Republic, and Little Cayman Island. Elsewhere: unknown.

Etymology. This species is named for the Latin "spatha" meaning a broad blade such as a spoon to describe the excavated appearance of the soldier frons.

Material Examined. Holotype colony: Cayman Islands. Little Cayman Island, Jackson's Point; 19°41.48'N, 80°03.41'W; 22.v.1996; JK; holotype soldier, 3 paratype, 5 non-type soldiers, morphotype winged imago, 10 paramorphotype winged imagos, other non-type alates, immatures (CA141). Paratype colonies: same data; 1 paratype soldier, several non-type dealates, including functional, immatures

(CA142). Mary's Bay, "Michigan"; 19°42.64'N, 80°00.17'W; 26.ix.1996; JK; 1 paratype, 3 non-type soldiers, immatures (CA025). Crawl Bay; 19°42.39'N, 80°00.39'W; 26.ix.1996; JK; 1 paratype soldier, immatures (CA028). Same data; 1 paratype, 5 non-type soldiers, one for SEM, immatures (CA029). Same data; 1 paratype, 13 non-type soldiers, immatures (CA032). Pirates' Point Resort (across road); 19°39.49'N, 80°06.01'W; 10.i.1996; PB; 1 paratype, 1 non-type soldier, immatures (CA086). Same data; 20.v.1996; JK; 1 paratype, 2 non-type soldiers, 1 functional dealate, immatures (CA118). Pirates' Point Resort; 19°39.49'N, 80°06.01'W; 20.v.1996; JK; 1 paratype, 2 non-type soldiers, 3 functional dealates, immatures (CA149). Dominican Republic. Pedernales Province, 7 km E Pedernales; 18°00'N, 71°40'W; 29.iii.1993; JC and JR; 1 paratype soldier, 1 functional dealate, immatures (DR0782). Pedernales Province, 3 km W Cabo Rojo Int.; 18°00'N, 71°40'W; 28.x.1993; JC and JR; 1 paratype, 1 non-type soldier, immatures (DR0869). Pedernales Province, 15 km NW Los Tres Chacos; 17°55.66'N, 71°31.22'W; 3.xi.1996; JC and JK; 1 paratype, 1 non-type soldier, 1 functional dealate, immatures (DR1289). La Altagracia Province, 0.5 km E Playa Dominicus; 18°20.72'N, 68°49.42'W; 6.xi.1996; JC and JK; 1 paratype, 5 non-type soldiers, immatures (DR1395). Same data; 1 non-type soldier, 1 functional dealate, immatures (DR1396). Same data; 2 non-type soldier, immatures (DR1397). Cuba. Santiago de Cuba Province, Siboney, El Caney; 19°57'N, 75°43'W; 19.v.1972; de Armas; 1 paratype, 3 non-type soldiers, 2 paramorphotypes winged imagos, and others non-type alates, immatures (C0457). Guantánamo Province, Cajobabo, coast; 20°04'N, 74°28'W; 14.xi.1964; I. Hrdý; 1 paratype, 1 non-type soldier, 1 functional dealate, immatures (CU1008). Granma Province, Cabo Cruz, Niquero; 19°51'N, 77°44'W; 22.vi.1966; I. Hrdý; 1 paratype, 7 non-type soldiers, 1 functional dealate, immatures (CU1009). Guantánamo Province, San Antonio del Sur; 20°03'N, 74°48'W; 14.v.1967; JK; 3 paramorphotype winged imagos, 1 non-type soldier, immatures (CU1010). Same data; 1 paratype, 2 non-type soldiers, 1 functional dealate, immatures (CU1011). Guantánamo Province, Imias; 20°04'N, 74°38'W; viii.1978; de Armas; 1 paratype, 2 non-type soldiers, 1 functional dealate, immatures (CU1012).

Cryptotermes undulans n. sp.

Cryptotermes cavifrons: Snyder in Wolcott 1948 (1950): 63, Puerto Rico (record doubtful).

Table 41. Measurements of *Cryptotermes undulans* imago.

Measurement in mm (n = 3♀, 5♂ from 2 colonies)	Range	Mean ± SD	Morphotype
Head length with labrum	1.08-1.14	1.11 ± 0.024	1.13
Head length to postclypeus	0.78-0.85	0.81 ± 0.021	0.85
Head width, maximum at eyes	0.85	eyes collapsed in all but one	
Eye diameter, maximum	0.28-0.35	0.30 ± 0.022	0.29
Eye to head base, minimum	0.11-0.17	0.15 ± 0.017	0.15
Ocellus diameter, maximum	0.11-0.12	0.12 ± 0.0052	0.12
Pronotum, maximum length	0.57-0.59	0.58 ± 0.0076	0.82
Pronotum, maximum width	0.78-0.82	0.80 ± 0.011	1.08
Total length with wings	8.80-9.37	9.07 ± 0.23	4.83
Total length without wings	4.26-5.11	4.79 ± 0.25	7.53
Fore wing length from suture	6.82-7.53	7.28 ± 0.24	7.53
Fore wing, maximum width	1.65-2.01	1.88 ± 0.12	1.95

Table 42. Measurements of *Cryptotermes undulans* soldier.

Measurement in mm (n = 22 from 9 colonies)	Range	Mean ± SD	Holotype
Head length to tip of mandibles	1.40-1.52	1.46 ± 0.038	1.46
Head length to frontal horns	1.20-1.32	1.27 ± 0.033	1.24
Frontal flange width	1.05-1.14	1.09 ± 0.030	1.06
Frontal horns, outside span	0.77-0.87	0.82 ± 0.023	0.80
Head width, maximum	1.05-1.16	1.10 ± 0.025	1.10
Head height, excluding postmentum	0.72-0.87	0.81 ± 0.031	0.72
Pronotum, maximum width	0.98-1.06	1.01 ± 0.024	1.01
Pronotum, maximum length	0.67-0.77	0.71 ± 0.030	0.70
Left mandible length, tip to ventral condyle	0.67-0.72	0.69 ± 0.015	0.70
Total length	3.51-4.90	4.11 ± 0.34	4.90

Cryptotermes cavifrons: Snyder 1956: 194 (Puerto Rico and St. Croix only, records doubtful).

Description. Imago (Table 41). General color pale brown. Sclerotized fore wing veins pale brown; membrane faintly smoky brown. Chevron pattern on fore wing scales pale brown, weakly defined. Labrum, frons, antennae, and pronotum very pale brown. Vertex and abdominal tergites pale brown. Abdominal sternites pale yellow-brown. Femora whitish, legs, including tibiae, distally faintly dark-

er, very pale brown. Head oval, with distinct cranial sutures. Eyes moderately large, oval. Ocelli smaller, oval, and touching eyes. Antennae with 14 to 16 articles, usually 14 or 15; formulae very variable. Pronotum subsquare, narrower than head width at eyes, with anterior margin shallowly concave, sides slightly convex, and posterior margin slightly concave. Crossbar mark and midline of pronotum distinct. Fore wing media running to 1/3 wing length; radial sector 5 to 6-branched. Arolia distinct.

Comparisons. *Cryptotermes undulans* is similar to *C. rotundiceps* in pigmentation; however, the latter has larger eyes, ocelli, and total body length with wings. The imago head of *C. undulans* is elongated in dorsal view; in *C. rotundiceps* it is subcircular.

Soldier (Figs. 79-81, Table 42). Head in dorsal view, anterior 1/3 of vertex nearly black or dark chestnut brown, frontal flange darkest structure, posterior 2/3 ferruginous orange; in lateral view, anterior 1/3 of head black or dark chestnut brown, grading to ferruginous orange in posterior 2/3. Mandibles dark chestnut brown. Anterior margin of pronotum ferruginous with pocket-like intrusions, rest of pronotum yellow-white.

In dorsal view, anterior profile of frontal flange bracket-like, lateral outline of head slightly constricted behind frontal flange, bulbous posteriorly. Conspicuous rugosity in anterior half of head in dorsal view. Rugosity dense, fine, and undulating. Vertex with small median concavity in anterior 1/3. Frontal flange narrow, rugose, with median notch; well delineated from vertex by median elevation. Frons deeply and evenly concave. In frontal view, lateral extension of frons near 90° to plane of vertex. Labrum pointed, noticeably inflated apically. Frontal horns fused to flange, bluntly conical, and rugose. Genal horns hump-like, small; eclipsed in dorsal view by frontal horns. Genal horns about 10 times smaller in volume than frontal horns. Genal and frontal horns separated. Mandibles humped and conspicuously angled near base, sickle-shaped beyond hump, moderately long. First marginal tooth distinct on both mandibles. Eyes small, but distinct, and oval. Antennae with 11-14 articles, usually 11 or 14; formulae very variable, most often $2>3=4=5$ or $2>3<4=5$. Pronotum shield-shaped, subsquare, incised and biconvex anteriorly, laterally subparallel with slight convergence to back; anterior margin with faint dense sinuosity; posterior margin with slight concavity.

Comparisons. For comparisons see *C. mangoldi*.

Remarks. Widely distributed from coastal to inland forest habitats, but an uncommon species. Collections of *C. undulans* represent only 7% of Puerto Rican kalotermitids.

Geographical Distribution. West Indies (Fig. 13): Greater Antilles: Puerto Rico. Elsewhere: unknown.

Etymology. This species is named for undulating texture of the soldier head capsule rugosity.

Material Examined. Holotype colony: **Puerto Rico.** 2 km E Recio on Hwy 3; 17°59'N, 65°55'W; 1.vi.1993; JC, JM, JR, and RS; Holotype soldier, 5 paratype soldiers, one for SEM, morphotype winged imago, 6 paramorphotype winged imagos, immatures (PR204). Paratype colonies: all nest series are from Puerto Rico, same collectors as holotype colony except for PR380 (see below). Guajataca State Park; 18°25'N, 66°58'W; 3.vi.1993; 9 paratype soldiers, immatures (PR280). Quebradillas beach; 18°29'N, 66°57'W; 3.vi.1993; 1 paratype soldier, 1 paramorphotype winged alates; (PR287). Same data; 2 paratype soldiers, immatures (PR291). Wildlife Station on Hwy. 3 NE Humacao; 18°10'N, 65°45'W; 1.vi.1993; 1 paratype soldier, 4 non-type soldiers, immatures (PR207). Same data; 1 paratype, 1 non-type soldier, immatures (PR209). Campaleche State Forest; 18°26'N, 66°36'W; 4.vi.1993; 1 paratype, 1 non-type soldier, immatures (PR315). Same data; 1 paratype soldier; immatures (PR316). NW Sabana Grande, Rd. 3363; 18°05'N, 66°58'W; 20.v.1992; S. Jones; 1 paratype soldier, immatures (PR380).

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