

**AMITERMES AMICKI, A NEW SUBTERRANEAN TERMITE
(ISOPTERA: TERMITIDAE: TERMITINAE) FROM ARUBA**

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ABSTRACT

Amitermes amicki n. sp. is described from soldiers collected on Aruba. For comparison, the soldier of *A. beaumonti* is redescribed from specimens collected in Mexico, Belize, and Cuba. *Amitermes amicki* is the eighth congener thus far described from the Neotropical Region. A technique is reported to enhance the visual clarity of digitized scanning electron micrographs.

Key Words: *Amitermes beaumonti*, Neotropics, West Indies, Netherlands Antilles, scanning electron microscopy, digital image enhancement

RESUMEN

Se describe *Amitermes amicki* sp. n. de soldados colectados en Aruba. Para comparación, se describe de nuevo el soldado de *A. beaumonti* de ejemplares colectados en México, Belice y Cuba. *Amitermes amicki* es el octavo congénere descrito de la Región Neotropical hasta ahora. Se reporta una técnica para mejorar la claridad visual de microfografías electrónicas digitalizadas.

The genus *Amitermes* Silvestri consists of about 100 living species distributed worldwide (Scheffrahn and Su 1987, Roisin 1989, Scheffrahn et al. 1989, Constantino 1992, Sands 1992). Seven species are known from the Neotropical Region (Constantino 1998), including *A. amifer* Silvestri, *A. aporema* Constantino, *A. excellens* (Silvestri), and *A. foreli* Wasmann from South America; and *A. beaumonti* Banks, *A.*

cryptodon Light, and *A. ensifer* Light from Central America. Of these, only *A. beaumonti* has been collected from an island locality (Cuba) (Hernández 1994, Scheffrahn et al. 1994).

Samples of an undescribed *Amitermes* species were collected on two recent expeditions to the island of Aruba. Aruba is located in the southern Caribbean Sea, 26 km north of Venezuela. Herein is provided a description of the soldier caste of *A. amicki* n. sp., and a redescription of the soldier of *A. beaumonti*.

MATERIALS AND METHODS

Morphometrics of specimens preserved in 85:15 (ethanol: water) were made with a stereomicroscope fitted with a calibrated ocular micrometer. Three ratios were used to quantify the head and mandible shape of *Amitermes* soldiers, namely, the head contraction ratio (head width at antennae ÷ maximum head width), the marginal tooth ratio (length of right mandible tip to marginal tooth point ÷ length of right mandible from tip to basilateral process), and the mandible curvature ratio (arch height of right mandible, as measured by the length of a line perpendicular to the line used to measure mandible length, ÷ mandible length). The mandible curvature ratio is similar to the minimum mandible curvature index II as used by Light (1930) for *Amitermes*; however, the former is measured to the outer margin of the right mandible and therefore provides a more accurate representation of mandible curvature. Light (1930) measured minimum mandible curvature to the inner margin of the left mandible.

The holotype soldier will be deposited in the collection of the American Museum of Natural History, New York, New York. Paratype soldiers will be deposited in the National Museum of Natural History (Smithsonian Institution), 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 first author's collection at the University of Florida Research and Education Center, Ft. Lauderdale, Florida.

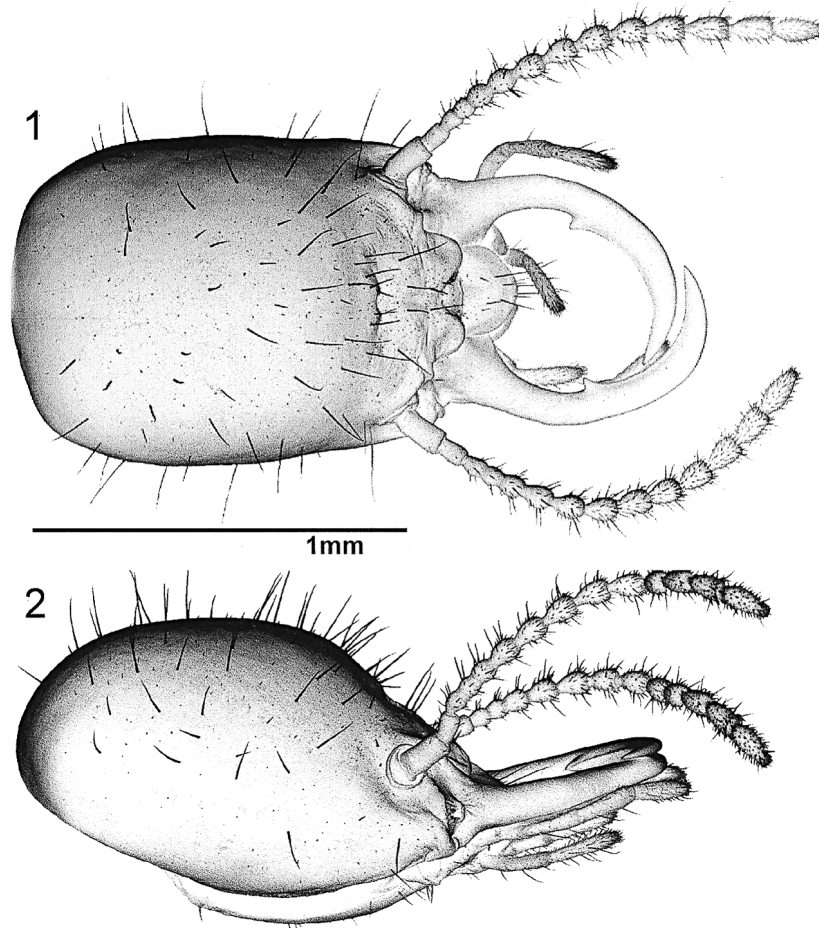
Photographic prints of scanning electron micrographs (SEMs) of *Amitermes* soldiers were scanned at 600 dots/inch and saved in .tif format. Three photo enhancement software packages were used with similar results: Corel Photo House® version 1.10.071, Logitech FotoTouch Color® version 3.0, and Micrografx Photo Magic® version 4.0a. The scanned images were 1) deskewed to best fit the monitor screen, 2) in a few cases antennal segments or whole antennae were copied using the freehand selection tool, pasted and deskewed to achieve a more aesthetic alignment, 3) the images were then processed using the unsharp mask tool, and 4) brightness and contrast tools were then used to improve photographic exposure. The entire image was outlined in black, and then the background was filled in black.

After enhancing the image and blackening the background, the image was converted to its negative. The line tool was used to superimpose a black line over the original scale bar. The original bar was removed and the new bar was moved to the desired placement and its length labeled. Individual finished images were then imported into a Microsoft PowerPoint® presentation for final layout and labeling.

Amitermes amicki Scheffrahn, new species

IMAGO. Unknown.

SOLDIER. (Figs. 1-2, Table 1). Head, in dorsal view, rectangular with slight anterior convergence of sides; head contraction ratio = 0.927. Head surface smooth. Head pale yellow with lighter interior area delineating the frontal gland; vertex con-



Figs. 1-2. Enhanced scanning electron micrographs showing the dorsal (1) and lateral (2) aspects of the soldier head capsule of *Amitermes amicki* n. sp.

vex in profile; mandibles orange-brown distally, concolorous with head proximally. Head capsule with about 65-75 long bristles, sparse near posterior, more numerous around fontanelle. Fontanelle opening on very shallow mound. Labrum roundly triangulate with 10 or more long bristles; postclypeus bilobed.

Mandible curvature asymmetrical; mandibles long and evenly slender; points of marginal teeth near middle of mandibles; marginal tooth ratio = 0.537. Posterior margin of marginal teeth projecting about 60-90° from inner surface of mandibles; anterior margins projecting 45-60°. Left mandible curving in a high arch until distal 4/5, then curving more sharply. Right mandible also highly arched and curving more sharply at tip, but with slight and abrupt inward bend at 1/3 length from base; mandible curvature ratio = 0.336. Cutting edges between mandible tips and marginal teeth showing fine optical serrations when viewed with light microscope, but serrations undetected on SEMs.

TABLE 1. MEASUREMENTS OF *AMITERMES AMICKI* SOLDIER.

Measurements in mm (n = 13 from 2 colonies)	Range	Mean \pm S.D.	Holotype
Head length with mandibles	1.77 - 1.93	1.84 \pm 0.047	1.83
Head length to dorsal condyle	1.10 - 1.20	1.15 \pm 0.032	1.16
Head width at antennae	0.86 - 0.93	0.89 \pm 0.020	0.91
Head width, maximum	0.91 - 0.98	0.97 \pm 0.023	0.98
Head height with postmentum	0.79 - 0.85	0.82 \pm 0.020	0.81
Right mandible length, tip to basilateral process	0.77 - 0.81	0.79 \pm 0.013	0.80
Right mandible length, tip to tip of marginal tooth	0.41 - 0.44	0.42 \pm 0.013	0.43
Right mandible minimum curvature	0.25 - 0.28	0.26 \pm 0.008	0.26
Pronotum, maximum width	0.57 - 0.63	0.60 \pm 0.018	0.61
Pronotum, maximum length	0.31 - 0.37	0.35 \pm 0.015	0.37
Postmentum (gula), minimum width	0.18 - 0.21	0.20 \pm 0.01	0.20
Postmentum, maximum width	0.29 - 0.33	0.31 \pm 0.01	0.31
Postmentum median length	0.65 - 0.72	0.68 \pm 0.019	0.67
Total body length	3.76 - 4.90	4.51 \pm 0.38	4.90

Antennae with 14 articles; relative length formula $2 > 3 = 4 < 5$. Postmentum strongly inflated and bulging beneath head capsule. Pronotum pale yellow; anterior margin orange-yellow. Pronotum margins with bristles, anterior lobe sloping steeply upward. Apical tibial spurs 2:2:2 with numerous stout setae located above apical spines.

Comparisons. Among Neotropical species, soldiers of *A. amifer*, *A. aporema*, *A. amicki*, and *A. foreli* have marginal teeth located near the middle of the mandibles. *Amitermes aporema* from Brazil is the smallest of the group (maximum head width 0.71-0.76 mm, Constantino 1992) and has highly reduced, almost indiscernible, marginal teeth. *Amitermes foreli* from Panama, Columbia, and Venezuela (Constantino 1998) is the largest of the group (maximum head width 1.38-1.50 mm, Light 1932) with long, slender marginal teeth and with mandibles sharply hooked beyond marginal teeth. Soldiers of *A. amifer* from northern Argentina, Paraguay, and central Brazil (Constantino 1998) are closest to *A. amicki*, but the former are larger (maximum head width 1.11-1.14 mm, Light 1932). The marginal teeth of the *A. amifer* soldier are proportionally larger and more conical than the marginal teeth of *A. amicki* soldiers. The soldier of *A. amicki* is nearest in size to that of the smaller *A. beaumonti*, but *A. amicki* has a more quadrate head capsule than *A. beaumonti* (head contraction index 0.927 and 0.881, respectively), more curved mandibles (mandible curvature ratio 0.336 and 0.282, respectively), medially thicker mandibles, and less barb-like and more medially positioned marginal teeth (marginal tooth ratio 0.537 and 0.435, respectively). The *A. amicki* soldier also lacks the fine cuticular microsculpturing found on the soldier of *A. beaumonti* (Figs. 1-4).

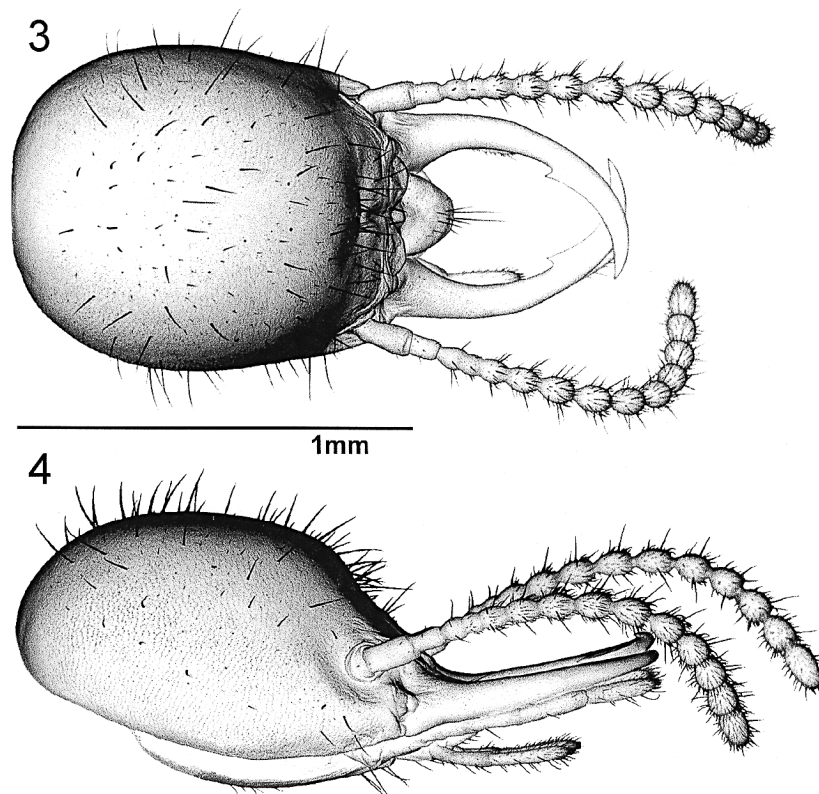
Type Material. HOLOTYPE soldier and 9 paratype soldiers from Palm Beach, Aruba, (12.58° N, 70.04° W) collected 2-IX-1995 by J. A. Chase from foraging galleries under rock (#NA003); 3 paratype soldiers from hills near Noord' (12.57° N, 70.02° W) collected 27-IV-1995 by A. van Liempt from under plywood on soil (#NA129).

Etymology. This species is named after Mr. Breck Amick of Amick & Son Termite and Pest Control, St. Petersburg, Florida. Mr. Amick, along with his parents, Philip and Toni, support basic entomological research and recognize its benefits to the pest control industry.

Amitermes beaumonti Banks 1918; redescribed by Light (1932).

IMAGO. Snyder (1924) described winged imagos from three specimens collected in Panama; however, specimens were collected in flight and may be of another species. No imagos have thus far been collected in association with foragers.

SOLDIER. (Figs. 3-4, Table 2). Head, in dorsal view, ovoid in posterior with slightly convex sides and converging moderately toward the anterior; head contraction ratio = 0.881. Head covered with fine microsculpturing visible on SEM. Head pale yellow with lighter interior area delineating the frontal gland; mandibles orange-brown distally, concolorous with head proximally. Vertex slightly convex in profile; frons flat, sloping about 40° from plane of vertex. Head capsule with about 70-80 long



Figs. 3-4. Enhanced scanning electron micrographs showing the dorsal (3) and lateral (4) aspects of the soldier head capsule of *Amitermes beaumonti*.

TABLE 2. MEASUREMENTS OF *AMITERMES BEAUMONTI* SOLDIER

Measurements in mm (n = 18 from 3 colonies)	Range	Mean \pm S.D.
Head length with mandibles	1.41 - 1.77	1.64 \pm 0.101
Head length to dorsal condyle	0.94 - 1.14	1.04 \pm 0.062
Head width at antennae	0.71 - 0.86	0.79 \pm 0.047
Head width, maximum	0.80 - 0.99	0.90 \pm 0.067
Head height with postmentum	0.71 - 0.86	0.78 \pm 0.048
Right mandible length, tip to basilateral process	0.65 - 0.78	0.73 \pm 0.042
Right mandible length, tip to tip of marginal tooth	0.28 - 0.34	0.32 \pm 0.021
Right mandible minimum curvature	0.17 - 0.22	0.20 \pm 0.015
Pronotum, maximum width	0.47 - 0.55	0.52 \pm 0.024
Pronotum, maximum length	0.26 - 0.32	0.29 \pm 0.018
Postmentum (gula), minimum width	0.16 - 0.20	0.19 \pm 0.013
Postmentum, maximum width	0.23 - 0.29	0.26 \pm 0.016
Postmentum median length	0.56 - 0.72	0.62 \pm 0.054
Total body length	3.86 - 4.75	4.22 \pm 0.20

bristles, sparse near posterior, more numerous around fontanelle. Fontanelle opening on very shallow mound. Labrum lingulate with 7-8 long bristles; postclypeus bilobed.

Mandibles long; narrowing proximal to marginal teeth, then noticeably broader until again tapering near tip; points of marginal teeth clearly distal to midpoint of mandibles; marginal tooth ratio = 0.435. Marginal tooth barb-like; posterior margin of marginal tooth projecting backward about 120° from inner surface of mandible; anterior margin forming gradually curving confluence with mandible tip. Mandible curvature symmetrical, curving evenly from base in a moderate arch, then curving more sharply midway between marginal teeth and tips; mandible curvature ratio = 0.282. Cutting edge between mandible tip and marginal tooth smooth. Soldiers from Quintana Roo having slightly shorter and more medially angulate mandibles.

Antennae usually with 14 articles, rarely 13 or 15; relative length formula variable, but 2 > 3 > 4 < 5 most common. Postmentum strongly inflated and bulging beneath head capsule. Pronotum pale yellow. Pronotum margins with bristles, anterior lobe sloping upward. Apical tibial spurs 2:2:2 with several additional stout spines near apex of middle tibia.

Comparisons. See also comparisons for *A. amicki* above. The soldier of *A. beaumonti* is closest to those of the Nearctic *A. emersoni* and *A. silvestrianus*. The mandibles of *A. emersoni* are narrower, straighter, and proportionally longer than those of *A. amicki*, while the marginal teeth on the mandibles of *A. silvestrianus* are set more basally than those of *A. beaumonti*. Measurements of a single soldier from Panama in Light's (1932) redescription of *A. beaumonti* were considerably larger than either measurements in the current or the original (Banks 1918) descriptions.

Material Measured. Soldiers (6/colony) were measured from the following three colony localities: 0.5 km S. Valladolid Nuevo, Quintana Roo, Mexico (20.93° N, 87.32° W) collected 10-XII-1997 by J. A. Chase and J. R. Mangold (#MX204); 29 km SW of Be-

lize City, Belize (17.42° N, 88.44° W) collected 4-X-1994 by J. Anderson, J. A. Chase, and J.R. Mangold (#BZ004); Bacuranao, Cuba (23.13° N, 82.24° W) collected 2-V-1974 by J. Krecek (#CU904). Additional material examined: 20 km N. Panama City, Canal Zone, Panama, collected 15-X-1979 by J. Krecek.

BIOLOGY

The type localities of *A. amicki* on Aruba are characterized by rocky soil, cacti, and small shrubs, reflecting the arid habitat of the entire island (annual rainfall about 50 cm, mostly during November and December). Foraging groups, working within darkly coated earthen tubes, attack wood near the soil surface. This species does not build mounds. The foraging habit of *A. amicki* is typical of *Amitermes*, especially of the xerically adapted species of the southwestern Nearctic Region (Light 1930).

Amitermes beaumonti occupies a wide range of mesic and wet habitats in Central America and Cuba. Foraging habits of this species are similar to those of *A. amicki* and other *Amitermes* species, and it also lacks mound nests.

DISCUSSION

The digital enhancements (Figs. 1-4) demonstrate some of the potential uses of photo enhancement software for improving the quality and esthetic appeal of SEMs. These enhancements can serve to heighten the features of interest by removing visual background noise, such as SEM stubs, adhesive materials, and shadows. Structures to be compared can be uniformly positioned and sized for easier visual interpretation. By converting SEMs to negative images, the black background can be eliminated, resulting in an image that resembles a finely stippled pen and ink drawing while retaining photographic accuracy.

On the negative side, digital manipulations may also have the potential to introduce error, especially if parts such as palpi and antennae are cut and repositioned for esthetic reasons. It is, therefore, important that the types of enhancements performed on the images be specified by authors and that digital enhancements do not alter morphological elements of the specimen.

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