Coptotermes vastator Light (Isoptera: Rhinotermitidae) in Guam

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ABSTRACT: A termite survey conducted in 11 locations of central Guam yielded six termite species; four of which, *Coptotermes vastator* Light, *Cryptotermes dudleyi* Bank, a *Microcerotermes* sp. and a *Nasutitermes* sp., have not been previously reported from Guam. *Coptotermes vastator* was collected from six structural infestations that were previously assumed to be caused by the Formosan subterranean termite, *Coptotermes formosanus* Shiraki. No *C. formosanus* was collected during this survey. Based on the results, we believe that *C. vastator* imported from the Philippines, not *C. formosanus*, has been the historical cause of much structural damage in Guam.

The termites of Guam were first treated by Light (1946) who listed three species including *Cryptotermes domesticus* (Haviland), *Neotermes connexus* Snyder, and *Prorhinotermes inopinatus* Silvestri. Later, Hromada (1970) reported a massive control effort for the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, at Andersen Air Force Base in northern Guam. Apparently, the presence of *C. formosanus* was widely accepted by military personnel in Guam by the early 1970s. Lai (1977) cited a personal communication from D. Yoshioka, a Navy civil engineer, that *C. formosanus* was established in Guam. Since then, it has been assumed that Guam is one of the exotic locations where *C. formosanus* has been introduced (Su & Tamashiro 1987).

In August 1993, central Guam was briefly surveyed for termites (Fig. 1). Special attention was given to structural infestations believed to be caused by *C. formosanus*. This paper reports the findings from the survey.

MATERIALS AND METHODS

Live specimens of *Coptotermes* sp. were collected from foraging tubes on building foundations, door frames and telephone poles (Table 1 and Fig. 1, sites 1–4). Most samples yielded only the soldier caste because workers quickly retreated when tubes were disturbed. Creosote-treated telephone poles were typically filled with carton material that extruded from cracks in the poles. *Coptotermes* workers and soldiers were collected by L. Yudin (University of Guam) from foraging tubes on the wall of the newly-built Entomology Department building of the University of Guam (site 8). Desiccated specimens of *Coptotermes* imagoes and soldiers were collected from a bathroom of a condominium unit that has been heavily infested since 1991 (site 7) and where, according to residents, imagoes swarmed in May 1993. Termites collected from 11 sites (Table 1 and Fig. 1) were preserved in 85% ethanol and transported to the Ft. Lauderdale Research and Education Center, University of Florida. Three *Coptotermes* soldiers were selected from each of the five collected sites (site 1–4, and 8) and measured using a zoom stereo compound microscope (Olympus, Model SZH). Desiccated specimens collected from site 7 were not measured.

RESULTS AND DISCUSSION

Head and abdominal tergites of *Coptotermes* imagoes from Guam are dark brown. Ventral surfaces of the heads and abdomens are light yellowish-brown. The dark brown dorsal and light brown ventral coloration is distinctively different from the *C. formosanus* imago which is entirely light yellowish brown. The presence of distinct, white, crescentic "antennal spots" of the Guam *Coptotermes* imagoes implies that this species is *Coptotermes vastator* Light originally described by Light (1929) from the nearby Philippines (Fig. 2). Imagoes of *C. formosanus* lack such antennal spots.

Soldiers of Guam *Coptotermes* are distinguishable from *C. formosanus* by the single pair of setae projecting dorsolaterally from the base of the fontanelle. Soldiers of *C. formosanus* have two pairs of such setae (Scheffrahn *et al.* 1990). Measurements of *Coptotermes* soldiers from Guam fell within the overall range of morphometric characteristics of *C. vastator* soldiers provided by Light (1929) (Table 2). Soldiers of Guam *Coptotermes* have long tongue-shaped labrum extending beyond the middle of the mandibles; a diagnostic characteristic for *C. vastator* according to Light (1929).

Major characteristics of imagoes and soldiers of *Coptotermes* from Guam matched well with those of *C. vastator* collected from Los Banos Laguna, Philippines, by F. F. Sanchez (University of the Philippines; on loan from M. Tamashiro, University of Hawaii). Paratype specimens (National Museum of Natural History) were apparently faded and were smaller than either our specimens or those reported by Light (1929), but cuticular characteristics such as a single pair of setae at the base of fontanelle were similar to our specimens.

There is a strong resemblance between *C. vastator* and *Coptotermes havilandi* Holmgren, although soldiers of *C. havilandi* are slightly larger than those of *C. vastator*. Imago bodies of both species are dark brown dorsally and light yellowish-brown on the ventral surfaces of the heads and abdomens. Soldiers of both species have the single pair of setae at the base of the fontanelle. The only reliable characteristic that differentiates these two species is the shape of the antennal spot in front of each ocellus. As shown in Fig. 2, antennal spots of *C. vastator* are distinctively "crescentic" (Light 1929), whereas those of *C. havilandi* are more or less half-moon shaped (Ahmad 1965).

Arboreal nests and foraging tubes of *Microcerotermes* sp. and *Nasutitermes* sp. (Termitidae) are commonly seen on trees such as Koa Haole, *Leucaena glauca* (L.), or Betel nut, *Areca catechu* (L.), in Guam (Table 1). Both *Microtermes* sp. and one *Cryptotermes* sp. (possibly *Cr. domesticus*) were collected in Ordot (Table 1) from a tree branch outside a church building that was heavily infested by *C. vastator*. Soldiers and workers of *Cryptotermes dudleyi* Bank were collected from a wood panel of a building that was abandoned because of heavy infestation by *C. vastator*. Dense carton nests, foraging tubes and damaged wood were found in this abandoned building in Barrigada (Table 1) with no sign of live *C. vastator*. Only desiccated heads of *C. vastator* soldiers were found. Signs of *C. vastator* infestations were found in many telephone poles in Barrigada area (site 1). A single swarming imago of *Prorhinotermes* sp. (possibly *P. inopinatus*) was also collected from a room in a high rise hotel in Tumon (Table 1). *Cryptotermes dudleyi* and the two termitids (*Microtermes* sp. and *Nasutitermes* sp.) have not been reported previously from Guam.

Damage caused by *C. vastator* is similar to that of *C. formosanus*. Both species form carton nests and foraging tubes, can cause serious damage to structures in a relatively short time, and recruit many soldiers when disturbed. Soldiers of these two species are indistinguishable without the aid of a microscope. Because of their similarities, military personnel in Guam during the late 1960s (including those from Hawai'i who were familiar with *C. formosanus* infestations) probably confused *C. vastator* with *C. formosanus*.

Table 1. Termite collections from central Guam.

Site	Location	Source	Caste[1]	Identification
1	Barrigada	Telephone pole	S	*C. vastator*
2	Agana	Door frame		
		Building foundation	S	*C. vastator*
3	Ordot	Building foundation	S	*C. vastator*
		Tree (unknown sp.)	I	*Micocerotermes* sp.
		Tree (unknown sp.)	W, I	*Cryptotermes* sp.
4	Maite	Telephone pole	S	*C. vastator*
5	Barrigada	Wood panel	S, W	*Cr. dudleyi*
6	Agana	Tree (unknown sp.)	S, W, I	*Microcerotermes* sp.
7	Tamuning	Bathroom	S, I	*C. vastator*
8	Mangilao	Building wall	S, W	*C. vastator*
9	Mongmong	Koa Haole tree	S, W, I	*Nasutitermes* sp.
10	Maite	Betel nut tree	S, W	*Nasutitermes* sp.
11	Tumon	Building interior	I	*Prorhinotermes* sp. (?)

1. I = imago, S = soldier, W = worker

Table 2. Measurements of soldiers (n = 15) of *Coptotermes* sp. collected from 5 sites in central Guam, and those of the original description of *C. vastator* reported by Light (1929) from Philippine

Measurement	*Coptotermes* Mean ± SE (mm)	*C. vastator* (Light 1929)
Total length	4.62 ± 0.32	5.0–6.0 mm
Length without head	3.02 ± 0.38	3.3–4.0
Head length (without mandibles)	1.21 ± 0.30	1.2
Head width	1.14 ± 0.08	1.05–1.13
Pronotum length	0.41 ± 0.05	0.46
Pronotum width	0.77 ± 0.12	0.8
Antenna length	1.49 ± 0.09	1.5
Left mandible length	0.84 ± 0.06	0.82
Right mandible length	0.85 ± 0.04	0.76
Gula length	0.84 ± 0.05	0.74
Gula minimum width	0.38 ± 0.03	0.35

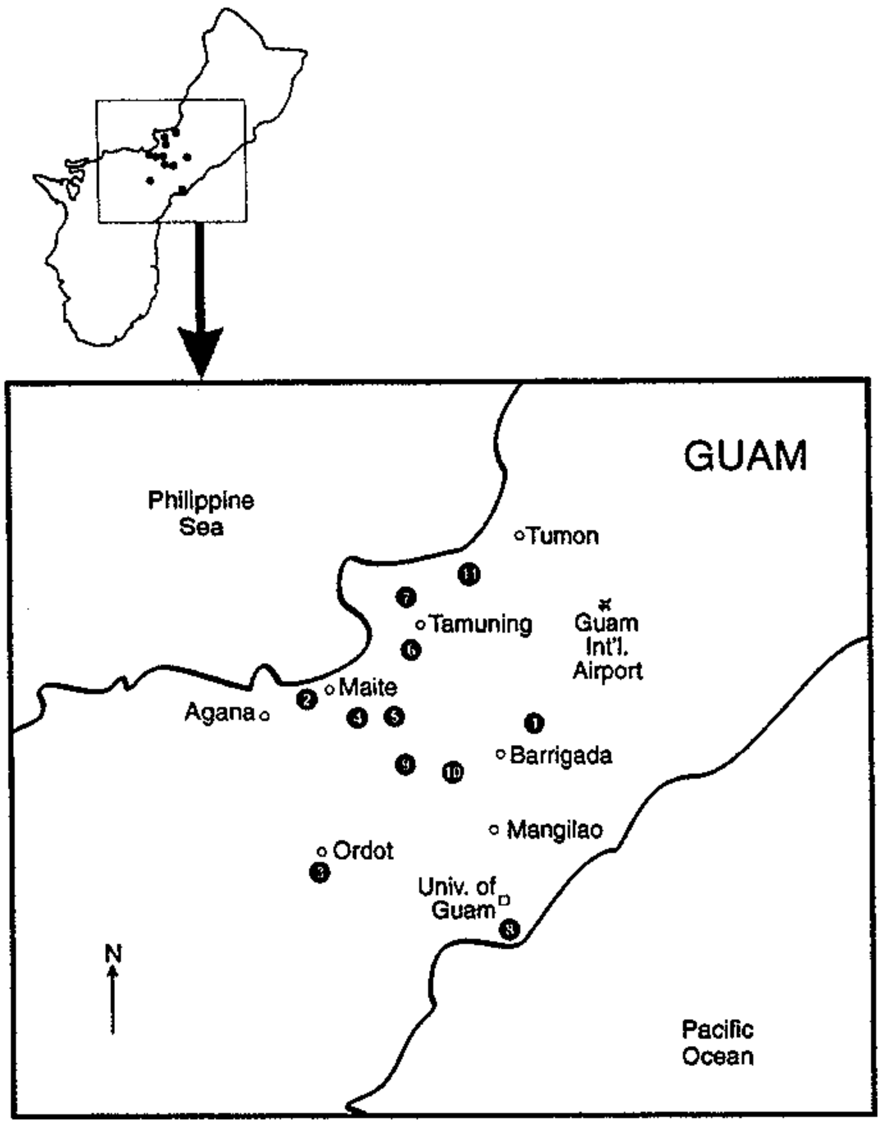

Fig. 1. Locations in central Guam from which termites were collected.

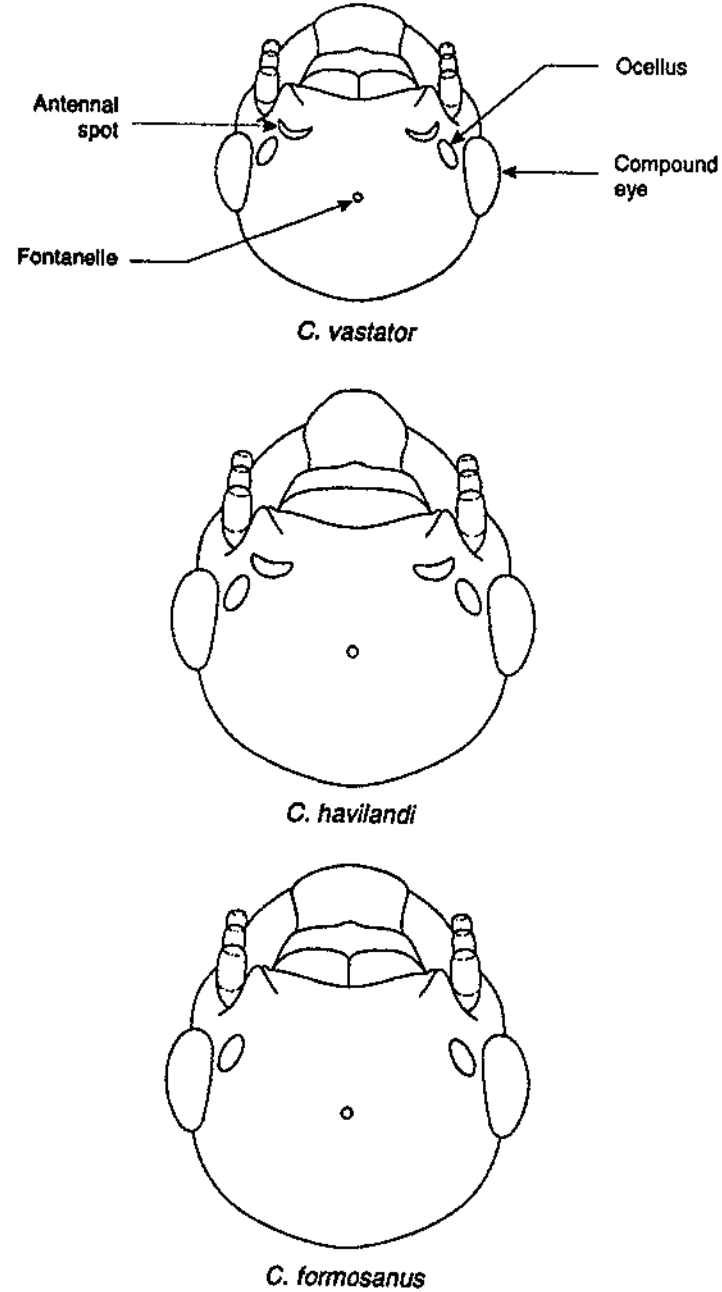

Fig. 2. Antennal spots of *Coptotermes vastator* imagoes are distinctively "crescentic" (top), whereas those of *C. havilandi* are more or less half-moon shaped (middle). Imagoes of *C. formosanus* lack such antennal spots (bottom).

Earlier reports (Hromada 1970, Lai 1977) on *C. formosanus* in Guam were typically based solely on information passed on by military personnel in Guam (C. Hromada, Terminix, Memphis, TN; personal communication). Because our survey was conducted in limited locations in central Guam, there is a possibility that *C. formosanus* may still exits in northern or southern Guam. However, due to the close proximity of Guam with the Philippines, and heavy traffic of civilian and military goods between these two locations, it is most likely that *C. vastator* imported from the Philippines, not *C. formosanus*, has been the historical cause of much structural damage in Guam.

Coptotermes formosanus has been transported to many locations worldwide and has caused serious problem in established areas (Su & Tamashiro 1987). *Coptotermes havilandi* is found in Southeast Asia and the West Indies (Ahmad 1965, Scheffrahn et al. 1990). In addition to the Philippines and Guam, *C. vastator* was collected once from Hawai'i (Weesner 1965), but apparently did not establish there. Continued and expanding commerce will probably encourage the exotic introductions of these and other *Coptotermes* sp. as potential pests of structural wood. Because of the similarity in their damage and difficulty in differentiation of some *Coptotermes* sp., a positive identification of termite pest species should be done by a careful examination of at least the soldier or imago caste.

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Chalcid Wasps (Hymenoptera: Chalcidoidea) Associated with Fruit of *Ficus microcarpa* in Hawai'i[1]

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ABSTRACT: The tropical banyan tree, *Ficus microcarpa* L., is pollinated by *Eupristina verticillata* Waterston (Agaonidae), which was purposely introduced into Hawai'i in 1938. Seeds of this tree are commonly spread by birds and germinate readily on rock faces and masonry, often creating a nuisance problem. Since 1971, eight additional species of Chalcidoidea that develop in the fruit of *F. microcarpa* have been found to be established in Hawai'i. These include two species of Otitisellinae (Agaonidae), two Epichrysomallinae (Agaonidae), two Sycoryctinae (Agaonidae), and two Eurytomidae (Eurytominae). An historical review of introductions of fig wasps associated with *F. microcarpa* into Hawai'i is presented, nomenclatural problems are discussed, and the species known to be present are identified, insofar as is possible without reference to presently unavailable types. Taxonomic information, and a key to the chalcidoid species associated with *F. microcarpa* fruit in Hawai'i, are provided.

Ficus microcarpa L., commonly called Chinese banyan or Cuban laurel, is a widely planted ornamental shade tree native to the Asiatic tropics. It occurs naturally from India and Sri Lanka eastward through south Asia to Indonesia, New Guinea, northern Australia, Bismarck Archipelago, Solomon Islands, New Caledonia, Philippines, Ryukyus and Taiwan (Hill 1967a, Wagner *et al.* 1990).

In the past, references to insects associated with Chinese banyan often cited the tree as *Ficus retusa* L. or *F. nitida* Thunb., apparently misidentifications of *F. microcarpa* (Wagner *et al.* 1990).

Eupristina verticillata and the *Ficus microcarpa* Weed Problem

Before 1938, when its agaonid pollinator, *Eupristina verticillata* Waterston, was purposely introduced into Hawai'i from the Philippines (Pemberton 1939), *F. microcarpa* produced neither mature fruit nor fertile seed in Hawai'i. *Eupristina verticillata* was introduced to facilitate propagation of the tree for reforestation. However, the ripe fruit are eaten by birds, such as the barred dove, *Geopelia striata* L., which distribute the seeds in their feces. Seeds that lodge in rock faces or masonry germinate readily, and the resultant seedlings are often a nuisance. *Ficus microcarpa* is now a well established naturalized element of the Hawaiian flora, and trees are increasing wherever conditions favor their development. More recently, *E. verticillata* has been spread accidentally to California, Florida, Bermuda, Mexico, Honduras, San Salvador and Brazil. As in Hawai'i, the resultant *F. microcarpa* seedlings have caused problems in many of these areas (Ramirez & Montero 1988).

Other Sycophilous Chalcidoidea Associated with *Ficus microcarpa*

In addition to their obligate agaonid pollinators, the fruit of *Ficus* species (known botanically as syconia) furnish habitat for numerous other chalcid wasps, many of which are highly specialized to live in this environment. These belong to several distinct groups (families or subfamilies) within the Chalcidoidea. A provisional world catalog of Chalcidoidea associated with syconia of *Ficus* species was published by Wiebes (1966), who