

Geographic distribution of *Cephalotes varians* (Hymenoptera: Formicidae)

James K. Wetterer*

Abstract

Cephalotes varians (Smith) (Hymenoptera: Formicidae) recently was included on a list of adventive ants established in North America. Published and unpublished records of *C. varians* from >100 sites reveal that it has an apparently continuous distribution through the Bahamas, Cuba, and southern Florida. Records of *C. varians* from South America, Central America, and Trinidad appear to be based on misidentifications, and there is therefore no justification for regarding *C. varians* as adventive in Florida.

Key Words: biogeography; exotic range; native range; conservation

Resumen

Cephalotes varians (Smith) (Hymenoptera: Formicidae) recientemente fue incluido en una lista de hormigas adventicias establecidas en América del Norte. Registros de *C. varians* publicados y no publicados de > 100 sitios revelan que esta especie tiene una distribución aparentemente continua por las Bahamas, Cuba y el sur de la Florida. Registros de *C. varians* de América del Sur, América Central y Trinidad parecen estar basadas en identificaciones erróneas, y por lo tanto no existe justificación para considerar *C. varians* como adventiva en Florida.

Palabras Clave: biogeografía; gama exótica; área de distribución natural; conservación

Turtle ants, genus *Cephalotes* (Hymenoptera: Formicidae), are a group of New World arboreal ants with heavily armored workers. When disturbed, workers typically tuck their antennae and legs beneath flanges on their head and body, crouch down, and freeze, thus passively resisting attacks.

Only 1 of the 119 described species of extant *Cephalotes* is known in the United States: *Cephalotes varians* (Smith) (Bolton 2016). Recently, Wittenborn & Jeschke (2011) included *C. varians* on their list of 93 exotic ant species established in North America. The present analysis was aimed primarily at documenting the range of *C. varians* and assessing where this species is native and where it may have arrived through human commerce.

Cephalotes varians is notable for having specialized major workers with large disc-shaped heads they use to plug the nest entrance holes and prevent enemies from gaining access to the nest. Several studies have examined behavior and ecology of *C. varians* in the Florida Keys (e.g., Wilson 1976; Cole 1980, 1983). Wilson (1976) wrote that *C. varians* "has been found nesting in dead branches of various trees, including *Bauhinia*, the sea grape *Coccoloba*, and (especially in the Florida Keys) the red mangrove *Rhizophora mangle*. Colonies have also been found in stems of tall grasses and sedges, including sea oat (*Uniola paniculata*) and saw grass (*Cladium jamaicensis*)." Mature colonies of *C. varians* have up to several hundred workers (Wilson 1976).

TAXONOMY

Smith (1876) described *Cryptocerus varians* (= *C. varians*) from Cuba. Kempf (1958) designated *Cephalotes jamaicensis* (Forel) a junior

synonym of *C. varians*, but de Andrade & Baroni Urbani (1999) revived *C. jamaicensis* from synonymy and raised it to a full species.

De Andrade & Baroni Urbani (1999) placed *C. varians* in the "*pallens* clade" with 9 other species: *Cephalotes decolor* de Andrade (of Colombia and Venezuela), *Cephalotes decoloratus* de Andrade (of the Dominican Republic and Haiti), *Cephalotes jamaicensis* (Forel) (of Jamaica), *Cephalotes pallens* (Klug) (widespread in the Caribbean region), *Cephalotes pallidoides* de Andrade (of South America, Trinidad, and Tobago), *Cephalotes pallidus* de Andrade (of South America), *Cephalotes patellaris* (Mayr) (of Brazil), *Cephalotes pellans* de Andrade (of South America), and *Cephalotes porراسi* (Wheeler) (of Central and South America). De Andrade & Baroni Urbani (1999) wrote: "The species we recognise as belonging to the *pallens* clade represent a very homogeneous set and are often difficult to distinguish from each other, particularly in the worker caste. This situation is worsened by the fact that these ants appear to exhibit the greatest variability within *Cephalotes* in sculpturation and in body size."

Wheeler (1905) wrote that compared with *C. pallens*, "the petiole and postpetiole of the worker and the soldier of *variens* [. . .] are narrower and of a different shape, and the thorax of the soldier is not so broad behind." De Andrade & Baroni Urbani (1999) wrote that diagnostic characters of *C. varians* included "in the worker propodeal sides unarmed or with a narrow membranaceous margin medially denticulate, in the soldier and in the gyne by the combination of head disc with foveae contiguous each other, in the soldier by the outer face of the hind femora superficially carinate, by the head longer than broad, and, in the gyne, by the petiole and postpetiole without or with reduced lateral expansions." De Andrade & Baroni Urbani (1999) reported *C.*

Wilkes Honors College, Florida Atlantic University, 5353 Parkside Drive, Jupiter, Florida 33458, USA

*E-mail: wetterer@fau.edu

varians as the only member of the *pallens* clade known in the Bahamas, Cuba, or Florida, and all their records of this species came from these three areas.

Previous taxonomic revisions have classified *C. varians* and its closest relatives in the following genera: *Cyathocephalus*, *Cryptocerus*, *Paracryptocerus*, and *Zacryptocerus* (de Andrade & Baroni Urbani 1999).

Materials and Methods

I compiled collection location data taken from published records and unpublished records of museum specimens in the collections of the Archbold Biological Station (ABS), the Museum of Comparative Zoology (MCZ), and the Smithsonian Institution (USNM). In addition, I used online databases that host specimen collection information (Antweb; www.antweb.org) and obtained geo-coordinates for collection sites from published references, specimen labels, maps, or geography web sites (e.g., earth.google.com and www.tageo.com).

To refine the geographic range of *C. varians*, I collected ants nesting inside dead twigs of red mangrove (*Rhizophora mangle* L.; Rhizopho-

raceae) at sites along the east coast of Florida (Miami-Dade, Broward, Palm Beach, Martin, St Lucie, Indian River, Brevard, and Volusia counties) and on islands of the Bahamas (Grand Bahama, North Bimini, New Providence, and Half Moon Cay) and the Turks and Caicos Islands (Providenciales, North Caicos, Middle Caicos, and Grand Turk).

Results

I mapped published and unpublished specimen records of *C. varians* from >100 sites (Fig. 1). I documented the earliest known *C. varians* records for Bahamas, Cuba, Dominican Republic, and Florida (Table 1).

I collected *C. varians* nesting inside red mangrove twigs in Florida and in the Bahamas in the following Florida and Bahamas locations: FLORIDA: Miami-Dade County: Oleta River State Park (25.916°N, 80.128°W; 20 Feb 2016), No Name Harbor in Bill Baggs State Park (25.676°N, 80.161°W; 21 Feb 2016), and Homestead Bayfront Park (25.463°N, 80.346°W; 20 Feb 2016); BAHAMAS: Grand Bahama, North Riding Point (26.729°N, 78.161°W; 2 Jun 2015); North Bimini, marsh at north end of the main road (25.774°N, 79.263°W; 8 Jun 2015); Bimini Bay, northeastern Bimini Bay (25.774°N, 79.258°W; 9 Jun 2015), north-



Fig. 1. Geographic distribution of *Cephalotes varians* records.

Table 1. Earliest known records for *Cephalotes varians*. MNHN = Museo Nacional de Historia Natural in Santo Domingo, Dominican Republic.

Location	Earliest record
Cuba	≤1876 (Smith 1876)
Florida	1887 (Emery 1895)
Bahamas	1904 (Wheeler 1905)
Dominican Republic*	2010 (G. de los Santos; MNHN): Galván

*Species may be misidentified as *Cephalotes decoloratus* (see text).

ern Bimini Bay (25.773°N, 79.261°W; 8 Jun 2015); and the east side of Bimini Bay (25.771°N, 79.257°W; 9 Jun 2015). I did not find *C. varians* nesting inside red mangrove in Florida north of Miami-Dade County or in the Turks and Caicos Islands.

David Lubertazzi (personal communication) recorded a specimen identified as *C. varians* in the Dominican Republic in the Museo Nacional de Historia Natural in Santo Domingo (Table 1), but it may be a misidentification of *C. decoloratus*, a species known only from Haiti and the Dominican Republic. In fact, one of the type specimens of *C. decoloratus* (Petionville: Hotel Montana; 1972-04-05) is currently listed on antweb.org as *C. varians*.

EXCLUDED RECORDS

Kempf (1958) wrote: “Previously published records for the species [*C. varians*] from Honduras (Mann 1922), and in Trinidad, Venezuela and Colombia (Weber 1938, 1948), are obviously based on misidentification and have been referred to *pallens*.” De Andrade & Baroni Urbani (1999), however, identified Mann’s (1922) specimens from Honduras as *Cephalotes biguttatus* (Emery).

Kempf (1958) wrote: “The species occurs in southern Florida, south of Miami, in the Bahamas (Andros, New Providence, Bimini), in Cuba and Jamaica.” De Andrade & Baroni Urbani (1999), however, considered all Jamaican records of *C. varians* as a separate species, *C. jamaicensis*.

In addition to the records of *C. varians* that Kempf (1958) dismissed as misidentifications (Mann 1922; Weber 1938, 1948), there are 3 records of *C. varians* from sites located far from any other confirmed records: Colombia (Fernández et al. 1996), Mexico (Abud 1987, in Vásquez-Bolaños & Navarrete-Heredia 2004), and Trinidad (Dutra & Wetterer 2007). Fernández & Sendoya (2004) and Vásquez-Bolaños (2014), however, do not list *C. varians* as occurring in Colombia or Mexico, evidently concluding that the earlier listings were misidentifications. Dutra & Wetterer (2007) recorded *C. varians* in Trinidad (identified by Roy Snelling) based on a specimen collected from inside an epiphytic orchid; however, upon re-examination, I found that this specimen does not match *C. varians* in several respects.

Discussion

Cephalotes varians records have an apparently continuous distribution through the Bahamas, Cuba, and southern Florida, and a single record in the Dominican Republic that needs confirmation. *Cephalotes varians* appears to be widespread across Cuba, Florida, and the Bahamas south of 26°N, and quite rare above this latitude; there are only 2 records of *C. varians* north of 26°N: Long Point Park, Brevard County, Florida (27.873°N, 80.469°W; 2000, ABS) and Grand Bahama (see results).

Wittenborn & Jeschke (2011) are the only authors who considered *C. varians* to be adventive in any part of its range, whereas other researchers consistently treat *C. varians* as native in Florida, the Baha-

mas, and Cuba (e.g., Deyrup et al. 1988; Deyrup 1994, 2003; Fontenla Rizo 1997; Fisher & Cover 2007; Moreau et al. 2014). Wittenborn & Jeschke (2011) appear to also have misclassified as adventive at least 10 other ant species that are actually native to North America (see Wetterer 2014, 2015a,b, 2016; Wetterer & Snelling 2015). Wittenborn & Jeschke (2011) aimed to compare characteristics of native versus exotic ant species in North America, but misclassification undermines the validity of their conclusions. Furthermore, if native species are erroneously considered to be exotic, these species may be treated as targets for eradication rather than valued and considered worthy of protection.

Acknowledgments

I thank M. Wetterer for comments on this manuscript; S. Cover (MCZ) and T. Schultz (USNM) for help with their respective ant collections; D. Lubertazzi for an unpublished record; D. P. Wojcik and S. D. Porter for compiling their valuable FORMIS bibliography; and Florida Atlantic University for financial support.

References Cited

- Bolton B. 2016. AntCat: an online catalog of the ants of the world, www.antcat.org (last accessed 20 Jan 2016).
- Cole BJ. 1980. Repertoire convergence in two mangrove ants, *Zacryptocerus varians* and *Camponotus (Colobopsis)* sp. *Insectes Sociaux* 27: 265–275.
- Cole BJ. 1983. Assembly of mangrove ant communities: colonization abilities. *Journal of Animal Ecology* 52: 349–355.
- de Andrade ML, Baroni Urbani C. 1999. Diversity and adaptation in the ant genus *Cephalotes*, past and present. *Stuttgarter Beiträge zur Naturkunde Serie B (Geologie und Paläontologie)* 271: 1–889.
- Deyrup M. 1994. Biogeographical survey of the ants of the island of San Salvador, Bahamas, pp. 21–28 *In* Kass LB. [ed.] *Proceedings of the 5th Symposium on the Natural History of the Bahamas, Bahamian Field Station, San Salvador, Bahamas*.
- Deyrup M. 2003. An updated list of Florida ants (Hymenoptera: Formicidae). *Florida Entomologist* 86: 43–48.
- Deyrup MA, Carlin N, Trager J, Umphrey G. 1988. A review of the ants of the Florida Keys. *Florida Entomologist* 71: 165–166.
- Dutra D, Wetterer JK. 2007. Ants in myrmecophytic orchids of Trinidad (Hymenoptera: Formicidae). *Sociobiology* 51: 249–254.
- Emery C. 1895. Beiträge zur Kenntniss der nordamerikanischen Ameisenfauna. (Schluss). *Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Tiere* 8: 257–360.
- Fernández F, Sendoya S. 2004. Synonymic list of Neotropical ants (Hymenoptera: Formicidae). *Biota Colombiana* 5: 3–105.
- Fernández F, Palacio EE, MacKay WP, MacKay ES. 1996. Introducción al estudio de las hormigas (Hymenoptera: Formicidae) de Colombia, pp. 349–412 *In* Andrade MG, Amat García G, Fernández F [eds.], *Insectos de Colombia. Estudios escogidos. Academia Colombiana de Ciencias Exactas, Físicas y Naturales, Bogotá, Colombia*.
- Fisher BL, Cover SP. 2007. *Ants of North America: A Guide to the Genera*. University of California Press, Berkeley, California.
- Fontenla Rizo JL. 1997. Lista preliminar de las hormigas de Cuba (Hymenoptera: Formicidae). *Cocuyo* 6: 18–21.
- Kempf WW. 1958. Synonymic note on ants of the genus *Paracryptocerus* Emery (Hymenoptera: Formicidae). *Entomological News* 69: 108–110.
- Mann WM. 1922. Ants from Honduras and Guatemala. *Proceedings of the United States National Museum* 61: 1–54.
- Moreau CS, Deyrup MA, Davis Jr LR. 2014. Ants of the Florida Keys: species accounts, biogeography, and conservation (Hymenoptera: Formicidae). *Journal of Insect Science* 14(295): 2014; DOI: 10.1093/jisesa/ieu157.
- Smith F. 1876. Descriptions of new species of Cryptoceridae, belonging to the genera *Cryptocerus*, *Meranoplus*, and *Cataulacus*. *Transactions of the Entomological Society of London* 1876: 603–612.
- Vásquez Bolaños M. 2014. Lista de especies de hormigas (Hymenoptera: Formicidae) para México. *Dugesiana* 18: 95–133.
- Vásquez Bolaños M, Navarrete-Heredia JL. 2004. Checklist of the ants (Hymenoptera: Formicidae) from Jalisco State, Mexico. *Sociobiology* 43: 351–365.

- Weber NA. 1938. The food of the giant toad, *Bufo marinus* (L.), in Trinidad and British Guiana with special reference to the ants. *Annals of the Entomological Society of America* 31: 499–503.
- Weber NA. 1948. Studies on the fauna of Curaçao, Aruba, Bonaire and the Venezuelan islands: No. 14. Ants from the Leeward Group and some other Caribbean localities. *Natuurwetenschappelijke Studiekring voor Suriname en de Nederlandse Antillen* 5: 78–86.
- Wetterer JK. 2014. Geographic distribution of *Gnamptogenys hartmani* (Hymenoptera: Formicidae), an “agro-predator” that attacks fungus-growing ants. *Terrestrial Arthropod Reviews* 7: 147–157.
- Wetterer JK. 2015a. Geographic distribution of *Trachymyrmex jamaicensis* (Hymenoptera: Formicidae). *Florida Entomologist* 98: 1175–1178.
- Wetterer JK. 2015b. Geographic distribution of *Leptogenys elongata* (Buckley) and *Leptogenys manni* Wheeler (Hymenoptera, Formicidae, Ponerinae). *Journal of Hymenoptera Research* 46: 127–136.
- Wetterer JK. 2016. Geographic distribution of *Pachycondyla harpax* (Hymenoptera, Formicidae). *Sociobiology*, in press.
- Wetterer JK, Snelling GC. 2015. Geographic distribution of *Labidus coecus* (Latr.) (Hymenoptera, Formicidae), a subterranean army ant. *Journal of Hymenoptera Research* 44: 31–38.
- Wheeler WM. 1905. The ants of the Bahamas, with a list of the known West Indian species. *Bulletin of the American Museum of Natural History* 21: 79–135.
- Wilson EO. 1976. A social ethogram of the Neotropical arboreal ant, *Zacryptocerus varians* (Fr. Smith). *Animal Behavior* 24: 354–363.
- Wittenborn D, Jeschke JM. 2011. Characteristics of exotic ants in North America. *Neobiota* 10: 47–64 (in Appendix 1).