

A REVIEW OF THE ANTS OF THE FLORIDA KEYS

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ABSTRACT

A new survey of the ants of the Florida Keys increases the known fauna from 30 to 83 species. An annotated list provides data on habitats, collection sites, and location of vouchers. *Solenopsis corticalis* Forel, *Leptothorax torrei* (Aguayo) and *Monomorium ebeninum* Forel are new records for the U.S. The fauna includes 27 exotics and 31 species native to the southeastern Coastal Plain; most of the remaining species are Antillean. There are 2 possibly endemic species. The proportion of known exotics (33%) in the fauna is the highest for any area in the U.S. There is evidence that populations of certain exotics are increasing with increasing disturbance of remaining native habitats. Species diversity in the Keys is probably limited by 1) limited habitat diversity, 2) lack of easy access to the rich ant fauna of the Neotropics, and 3) unsuitability of the climate and habitats for many species found farther north.

RESUMEN

Un muestreo nuevo de las hormigas de los Cayos de la Florida, aumentó el conocimiento de la fauna de 30 a 83 especies. Una anotada lista provee datos sobre la habitación, lugares de colecta, y la localidad de los testigos. *Solenopsis corticalis* Forel, *Leptothorax torrei* (Aguayo), y *Monomorium ebeninum* Forel, son nuevos records para los Estados Unidos. La fauna incluye 27 especies exóticas y 31 nativas a los Llanos Costales del sudeste; la mayoría del resto de las especies son Antillanas. Posiblemente 2 especies sean endémicas. La proporción de especies exóticas conocidas (33%) de la fauna, es la más alta que la de cualquier área de los Estados Unidos. Hay evidencia que poblaciones de ciertas especies exóticas están aumentado con el aumento de disturbios de la habitación nativa que queda. Las diversidad de especies en los Cayos está probablemente limitada por: 1) diversidad limitada de la habitación, 2) falta de acceso fácil a la rica fauna de hormigas del Neotrópico, y 3) lo poco conveniente del clima y habitación para muchas especies que se encuentran más al norte.

In 1958 E. O. Wilson surveyed the ants of the Florida Keys; the resulting list was published in 1964, along with notes on the geographic origin and distribution of the species. In the ensuing 30 years there have been extensive changes in the habitats of southern Florida, probably affecting the ant fauna. There have also been modifications in our taxonomic concepts of some species. Additionally, more intensive collecting methods, as well as possible influxes of additional species, have more than doubled the number of species known from the Keys. A current survey of the ants of the entire state now provides a better perspective on the biogeography of the ants of the Keys. For these reasons, it seems useful to review the ant fauna.

One purpose of this paper, therefore, is to provide an annotated list of species that can be compared with the earlier study, and that will be a baseline for future documentation of the accelerating disruptions of the ecosystems of tropical Florida. From an ecological standpoint the ants are an excellent group to monitor because they are so dominant in terrestrial tropical ecosystems (Brues 1952). One may say that, as go the ants, so go the arthropods.

A second goal is to examine the biogeography of the ants of the Florida Keys. The diversity and derivation of the fauna is now open to new interpretations. The distribution of exotics and the proportion of exotics in the fauna can be reviewed. The presence or absence of species can often be correlated with habitat and climate, now that we know more about the ecology of Florida ants. We should even be able to make a few predictions about the findings of the next survey, which we might consider scheduling for the year 2018.

METHODS

Ants were collected on numerous trips to the Florida Keys during 1982-87, and on trips made by our colleagues listed below. Specimens were collected by simple searching techniques and by extracting ants from litter samples by standard modified Berlese funnels. A few species were collected in Malaise traps. Voucher specimens are deposited in the following collections, abbreviated in the species list: Archbold Biological Station, Lake Placid, FL (ABS), Museum of Comparative Zoology, Harvard, Cambridge, MA (MCZ), collections of Norman Carlin (NC), Gary Umphrey (GU), James Trager (JT). The additional collectors whose initials are in the annotated list are Dr. Edward Wilson (Harvard Museum of Comparative Zoology, Cambridge, MA), Dr. James Wolfe and David Smith (Archbold Biological Station), Alan Herndon (Everglades National Park, Homestead, FL), Marc Minno (University of Florida, Gainesville), Chester Winegarner (DeFuniak Springs, FL), Dr. Stewart Peck and Dr. Jarmila Kukalova-Peck (Carleton University, Ottawa, ONT), Dr. Stewart Peck and Dr. Jan Klimaszewski (the latter collector from Petawawa, ONT). Some records of species of *Pseudomyrmex* are taken from Ward, 1985, abbreviated (PW). Specimens were identified by the authors.

Since some of the biogeographical discussion is dependent on the geographic origin of the ant populations in the Keys, we explain our presumptions on the provenance of each species in the annotated list. Statements about the presence of a species in other parts of Florida are based on our own unpublished collecting records unless otherwise attributed. Our understanding of the taxonomy of the ants of the Keys also depends to some extent on unpublished work. We briefly mention taxonomic ambiguities, but avoid taxonomic innovations in this paper.

The small size and great dispersion of the islands of the Florida Keys prevents preparation of a compact map of our collecting sites. We refer the reader to the Florida Atlas and Gazetteer, available from the DeLorme Publishing Co., P. O. Box 298, Freeport, Maine 04032.

ALPHABETICAL LIST OF SPECIES

Amblyopone pallipes (Haldeman). Males of this native species were collected in Malaise traps on Big Pine (S&JP), Sugarloaf (S&JP), Cudjoe Key (NC). This species is usually found in upland forested areas. Vouchers: NC, GU.

Aphaenogaster flemingi Smith. This species is widely distributed in upland habitats throughout the southeastern U.S. There are only a few records from southern Florida, probably because in south Florida upland habitats are widely scattered and much of their native vegetation eradicated. This species is native to Florida. The Keys population is probably strongly isolated. Habitat in the Keys is dry open pineland, now found only on Big Pine. Big Pine (GU). Vouchers: GU

Aphaenogaster miamiana Wheeler. This form is a member of a complex of several named species and subspecies that require further study (Carroll 1975). The form known as *A. miamiana* occurs throughout southern and central Florida. This species is native. The habitat in the Keys is tropical hammocks; nests are usually in rotten wood on the ground. Elliott (MD), Largo (EW, MD), Upper Matecumbe (MD), Big Pine (MD, GU, S&JP), Big Torch (S&JP), Middle Torch (S&JP). Vouchers: ABS, GU.

Brachymyrmex, sp. nr. *depilis* Emery. It is probable that two species of yellow *Brachymyrmex* have been combined under the name *depilis* in Florida; the genus is in urgent need of revision. The Keys form occurs throughout southern and central Florida, and is almost certainly native. Habitat in the Keys is rotten wood and deep leaf mold in shaded situations. Elliott (MM, MD), Adams (MM), Totten (MM), Largo (JT, MD), Plantation (DS, MD), Grassy (JT, MD) Long (MD), Big Pine (GU, JT, MD), No Name (JT, MD, S&JP), Middle Torch (S&JP), Big Torch (S&JP). Vouchers: ABS, GU, JT.

Brachymyrmex, sp. nr. *obscurior* Forel. It is probable that two or more species have been combined under the name *obscurior* in Florida. The Keys form occurs throughout Florida. It has a strong preference for open, grassy, disturbed areas such as roadsides and sparse lawns, but is also found in naturally disturbed areas, particularly beaches. We have no good reason to consider this species exotic, though its populations, if not its geographic range, must have increased with the recent increase in disturbed habitats. Nests are in soil. Largo (MD), Bahia Honda (JT, MD), Big Pine (MD), Middle Torch (S&JP), Stock Island (MD), Key West (NC, JW, MD). Vouchers: ABS, JT, GU.

Brachymyrmex sp. Three microgyne queens were collected on No Name (S&JP), 4-5 June 1986, by car netting. These queens show characteristics of social parasites (E. O. Wilson, personal communication), though no social parasites are known in the genus *Brachymyrmex*. Large numbers of males and queens of *Brachymyrmex* sp. nr. *depilis* were taken in the same samples. Vouchers: GU.

Camponotus abdominalis floridanus (Buckley). Some myrmecologists consider this form a distinct species, *C. floridanus*, others do not consider it merits subspecific status. This native species occurs throughout Florida. The habitat in the Keys is dead wood and trash piles found along the beach, in the margins of hammocks, and in rocky pineland. Elliott (MD, NC), Largo (EW, NC, MD), Plantation (EW, MD), Upper Matecumbe (NC, MD), Indian Key Fill (GU), Grassy (JT, MD), Bahia Honda (MD, S&JP), No Name (JT, MD), Big Pine (NC, EW, JT, GU, MD), Ramrod (NC), Sugarloaf (NC, GU), Shark (NC), Saddlebunch 1 (NC), Saddlebunch 2 (JW), Saddlebunch 5 (NC), Big Coppitt (JW), Boca Chica (JW), Stock Island (MD), Key West (NC, MD). Vouchers: ABS, JT, NC, GU.

Camponotus decipiens Emery. This native arboreal species has usually gone under the names *C. rasilis* Wheeler or *C. sayi* Emery. We follow Snelling (in press) in the use of the name *C. decipiens*. It is widely distributed in Florida, but generally absent in the extreme south, possibly because its habitat is dominated by *C. planatus*. It occurs on Key West, where *C. planatus* is uncommon. Vouchers: ABS.

Camponotus impressus (Roger). This species is native to Florida and occurs throughout the state. Habitat is hollow twigs and weed stems. This species appears to be rather scarce in the Keys, and is found primarily in large red mangroves (Cole 1983). Big Pine (EW). Vouchers: MCZ.

Camponotus inaequalis Roger. We have two collections that appear to represent this Caribbean species. This species is rather similar to *C. tortuganus*, and the entire southern *C. maculatus* complex could use revision. Accordingly, we do not formally add this species to the U.S. fauna. One colony was found in a rotten sea grape branch about 1.5 m above the ground. Bahia Honda (GU), Key West (NC). Vouchers: GU, NC.

Camponotus planatus Roger. In Florida this tropical Caribbean species is restricted to the extreme southern portion of the state. We consider this is probably a native species. The habitat is hollow twigs, old termite galleries in dead wood, and occasionally in grass culms. This is the dominant ant of Florida's tropical hammocks. Elliott (MD), Largo (EW, MD), Upper Matecumbe (MD), Long (CU), Grassy (JT, MD), Big Pine (NC, JT, GU, MD), No Name (MD, S&JP), Middle Torch (S&JP), Sugarloaf (S&JP), Stock Island (MD), Key West (EW). Vouchers: ABS, NC, JT, GU.

Camponotus tortuganus Emery. This native species is found through the southern third of inland Florida, and further north along the coasts. The natural habitat is dead wood or trash piles in open areas. Nests are often in wall voids of houses. Elliott (MD), Plantation (EW, MD), Bahia Honda (GU), Big Pine (EW, GU, MD), No Name (JT, MD, S&JP), Middle Torch (GU), Sugarloaf (NC), Shark (NC), Saddlebunch 5 (NC), Big Coppitt (JW), Key West (NC, JW, MD). Vouchers: ABS, JT, NC, GU.

Cardiocondyla emeryi Forel. An exotic species found throughout Florida. Nests are in soil in open grassy areas. Elliott (MD), Largo (MD), Plantation (EW), Upper Matecumbe (MD), Bahia Honda (MD), Big Pine (MD, S&JP), Sugarloaf (MD), Key West (EW, MD), Dry Tortugas (CW). Vouchers: ABS, GU.

Cardiocondyla nuda (Mayr). An exotic species found throughout Florida. Nests are in soil in open grassy areas. Elliott (MD), Largo (MD), Upper Matecumbe (MD), Vaca (K&P), Big Pine (MD, K&P), Sugarloaf (MD), Key West (MD). Vouchers: ABS, GU.

Cardiocondyla venustula Wheeler. An exotic species occurring sporadically throughout Florida. Nests are in soil in open grassy areas. Upper Matecumbe (MD), Bahia Honda (JT, MD). Vouchers: ABS, JT.

Cardiocondyla wroughtonii (Forel). An exotic species found throughout Florida. Nests are in hollow twigs and branches. Key West (MD). Vouchers: ABS.

Conomyrma bureni Trager. A native species found throughout Florida. Nests are in open grassy areas, including beach dunes. Elliott (MD, NC), Largo (MD), Bahia Honda (MD), Big Pine (EW, JT, NC, GU, MD), Stock Island (MD), Key West (EW, NC, MD). Vouchers: ABS, JT, NC, GU.

Crematogaster ashmeadi Mayr. This native southeastern species occurs throughout Florida. Nests are in dead tree limbs, hollow twigs and in weed stems. Elliott (MD), Largo (EW, MD), Plantation (EW), Lower Matecumbe (MD), Grassy (JT, MD), Fat Deer (GU), Ohio (GU), Bahia Honda (MD), Big Pine (EW, JT, GU, MD), No Name (JT), Key West (EW, JW). Vouchers: ABS, JT, GU.

Crematogaster atkinsoni Wheeler. A widespread native southeastern species found in coastal areas. The carton nests are usually in grass tussocks. Big Pine (NC, MD), Saddlebunch 2 (JW). Vouchers: ABS, NC.

Crematogaster minutissima Mayr. This native southeastern species occurs throughout Florida, but appears to be scarcer in the southern part of the state. Nests are in deep humus. Elliott (MD), Big Pine (K&P). Vouchers: ABS, GU.

Cyphomyrmex minutus Mayr. There are two species of *Cyphomyrmex* in Florida, *C. minutus* in southern and central Florida, and *C. rimosus* Forel, in northern Florida and adjoining states. The distributions of the two species overlap in central Florida.

According to Snelling (personal communication), the species found in south Florida and the Keys is the West Indian species *C. minutus*. *C. rimosus* is probably recently introduced, as there is no northern *Cyphomyrmex* mentioned by Creighton (1950). As far as we know, *C. minutus* is native in the Keys. Nests are in the soil, usually under rocks or logs. Elliott (MD, NC), Largo (EW, MD), Plantation (EW, MD), Upper Matecumbe (MD), Bahia Honda (MD, GU, K&P), Big Pine (JT, NC, K&P, MD), No Name (JT, MD), Big Torch (S&JP), Summerland (K&P), Sugarloaf (MD, S&JP), Saddlebunch 2 (JW), Saddlebunch 5 (NC), Boca Chica (JW), Stock Island (MD, K&P), Key West (MD). Vouchers: ABS, NC, JT, GU.

Discothyrea testacea Roger. This native southeastern species occurs throughout Florida. Nests are in humus in wooded areas. A single specimen was collected from No Name (MD). Voucher: ABS.

Eurhopalothrix floridana Brown and Kempf. The distribution of this species extends from the Keys into northern Florida. All other *Eurhopalothrix* are neotropical, and *E. floridana* itself has been collected in Mexico (W. L. Brown, 1965, personal communication). This species was not discovered until 1960 (Brown & Kempf), and was not known to be widely distributed until we began our survey of Florida ants, but it is sufficiently cryptic to have avoided notice for a long time. This is shown by a damaged specimen, discovered by Dr. David R. Smith, in the Pergande collection (USNM); the specimen was collected in Key West in 1887. *E. floridana* is one of a number of species that we will treat as native even though its relationships and habits make an exotic origin plausible. Largo (MD), Upper Matecumbe (MD), Big Pine (K&P), No Name (MD), Key West (Pergande). Vouchers: ABS, GU, U.S. National Museum.

Forelius pruinus (Roger). This species has been recently transferred from the Genus *Iridomyrmex* (Snelling & Wheeler 1979). The species known as *F. pruinus* shows considerable variation and may be a species complex. *F. pruinus* is native in south Florida. The habitat of this species is beaches and dry rocky or sandy open areas. Elliott (MD, NC), Largo (MD), Lower Matecumbe (GU), Grassy (MD), Bahia Honda (MD), Big Pine (NC, JT, GU, MD), No Name (JT), Saddlebunch 2 (JW), Boca Chica (JW), Key West (NC). Vouchers: ABS, JT, NC, GU.

Hypoponera inexorata (Wheeler). This species has a general austral distribution in North America, and is probably native. Its habitat in the Keys is tropical hammocks. Largo (MD), Bahia Honda (MD), Big Pine (GU), Big Torch (P&K), Sugarloaf (MD), West Summerland (K&P). Vouchers: ABS, GU.

Hypoponera opaciceps (Mayr). This species has an austral general distribution in North America and occurs through South America (Smith 1979). This species generally occurs in moist disturbed habitats, including accumulations of beach wrack. Largo (MD), Long (GU), Big Pine (MD), No Name (MD), West Summerland (GU), Stock Island (K&P), Dry Tortugas (CW). Vouchers: ABS, GU.

Hypoponera opacior (Forel). A widespread species native in the southern United States. Nests are in soil and rotten wood in mesic and xeric forests. Elliott (MD), Totten (MM), Largo (JT, MD), Plantation (MD), Upper Matecumbe (MD), Grassy (JT, MD), Big Pine (MD, K&P), Sugarloaf (S&JP). Vouchers: ABS, JT, GU.

Hypoponera punctatissima (Roger). An exotic species found throughout Florida. Its habitat is accumulations of organic matter in moist places. Largo (MD), Big Pine (MD, K&P), Saddlebunch 2 (JW), Stock Island (MD), Key West (JW). Vouchers: ABS, GU.

Leptothorax allardycei (Mann). This species was known as *Macromischa floridana* (Wheeler) until Baroni Urbani (1978) revised the subgenus *Macromischa*. It is also known from the Bahamas. We consider this as probably a native species. The habitat is dead vines in dense tropical hammock. This species may be nocturnal. Elliott (MD), Largo (MD), Big Pine (S&JP), Big Torch (S&JP), Sugarloaf (S&JP). Vouchers: ABS, GU.

Leptothorax torrei (Aguayo). This species is known only from Cuba (Baroni Urbani 1978) and from the Florida Keys (new U.S. record). It is a small inconspicuous ant, not likely to be collected except by Berlese extraction, and its recent discovery in the Keys need not indicate this species was recently introduced. Largo (MD), Big Pine (GU, MD, K&P), No Name (MD), Key West (GU). Vouchers: ABS, GU, MCZ.

Leptothorax (Dichothorax) sp. nr. *pergandei*. This species appears closely related to *L. pergandei* Emery, but differs from south Florida populations in color and in the shape of the postpetiole. The habitat, a salt marsh, is also unlike that of *pergandei*, which inhabits dry, sparse woodlands. We provisionally consider this a native undescribed species. The habitat of this species, as far as it is known, is a salt marsh with tussocks of *Sporabilis* grass. Largo (MD) and Big Pine (GU). Vouchers: ABS, GU.

Monomorium destructor (Jerdon). This exotic species is not common in Florida, and may be on the decline in the Keys, except for Key West, where it is a dominant urban ant. The habitat is disturbed areas around buildings. Largo (EW), Plantation (EW), Key West (NC, GU, MD). Vouchers: ABS, GU.

Monomorium ebeninum Forel. This West Indian species has been collected only once in the Keys (new U.S. record). We consider this species a poorly established exotic. The habitat was the edge of a tropical hammock. Upper Matecumbe (MD). Vouchers: ABS.

Monomorium floricola (Jerdon). An exotic species found throughout southern Florida. Nests are in dead twigs and vines, usually in disturbed areas. Elliott (MD), Largo (EW, MD), Plantation (EW), Indian Key Fill (GU), Grassy (MD), Bahia Honda (MD), Big Pine (MD, GU), No Name (MD), Middle Torch (S&JP), Big Torch (GU), Sugarloaf (MD, GU), Stock Island (MD), Key West (MD), Dry Tortugas (CW). Vouchers: ABS, GU.

Monomorium pharaonis (Linnaeus). An exotic species found in and around buildings in urban areas throughout Florida. Elliott (NC), Plantation (EW), Big Pine (MD). Vouchers: ABS.

Myrmecina americana Emery. This native species is found through much of North America, usually in wooded areas. In the Keys specimens have been collected in hammocks adjacent to the beach. Elliott (MD), Plantation (MD), Big Pine (S&JP), No Name (S&JP), Middle Torch (S&JP), Big Torch (S&JP), Sugarloaf (S&JP). Vouchers: ABS, GU.

Neivamyrmex opacithorax (Emery). This native species is widely distributed in the southern U.S. It usually occurs in upland wooded areas. Bahia Honda (Phillip Ward collector) Big Pine (S&JP), Middle Torch (S&JP), Cudjoe (S&JP), Key West (J. Bunch collector). Vouchers: GU, JT.

Odontomachus brunneus (Patton). This appears to be a native southeastern species. Nests are under rocks and in rotten wood in moist wooded areas. Largo (MD), No Name (MD, GU, S&JP). Vouchers: ABS, GU.

Odontomachus ruginodis Wheeler. This species is found through southern Florida, but is more common in coastal areas. *O. ruginodis* appears to be a West Indian species which we tentatively consider native in the Keys. Nests occur in soil and under stones, usually in moderately open areas. Elliott (NC, MD), Largo (EW, JT, MD), Plantation (MD), Upper Matecumbe (MD), Lower Matecumbe (MD), Grassy (JT, MD), Fat Deer (GU), Bahia Honda (MD, GU), Big Pine (EW, JT, NC, GU, S&JP, MD), No Name (S&JP, MD), Middle Torch (S&JP), Big Torch (S&JP), Sugarloaf (MD), Saddlebunch 1 (NC), Saddlebunch 2 (JW), Saddlebunch 5 (ND), Boca Chica (JW), Stock Island (S&JP), Key West (JW, NC, MD). Vouchers: ABS, JT, NC, GU.

Pachycondyla stigma (Fabricius). This pantropical species seems to be extraordinarily mobile, using either natural or man-assisted methods, or both. Until we have a clearer idea of how *P. stigma* moves about, we are treating it as a Florida native. The

principle habitat appears to be the rotten bark of dead trees, usually in relatively open sites. A single collection has been made in the Keys, on Elliott Key (MD). Vouchers: ABS.

Paratrechina bourbonica (Forel). This exotic species occurs throughout Florida, usually in disturbed habitats around buildings. Beach and mangrove areas, which are naturally disturbed habitats, are also highly suitable. Elliott (MD), Largo (MD), Upper Matecumbe (MD), Grassy (MD), Big Pine (MD), No Name (JT, MD), Saddlebunch 5 (NC), Shark (NC), Boca Clca (JW), Key West (EW, JW, MD), Dry Tortugas (CW). Vouchers: ABS, NC, JT.

Paratrechina concinna Trager. This native species occurs throughout Florida, usually in rotten wood in or near swamps or near swamps or marshes. A single collection was made from a rotten palm stump in a rocky brackish swamp on Key Largo (MD). Vouchers: ABS.

Paratrechina guatemalensis (Forel). This apparently exotic species seems to be expanding its range in southern Florida. *P. guatemalensis*, unlike the other exotic *Paratrechina* of the Keys, is at home in densely wooded areas, and is a dominant ant of some tropical hammocks. Largo (MD), Plantation (MD), Bahia Honda (MD), Big Pine (JT, MD), No Name (MD), Sugarloaf (MD), Stock Island (MD), Dry Tortugas (NC). Vouchers: ABS, JT, NC.

Paratrechina longicornis (Latreille). An exotic species found throughout Florida around buildings, in disturbed areas and on beaches. On Big Pine this species occurs in open pinelands. Elliott (MD), Largo (EW, JT, MD), Plantation (EW, MD), Upper Matecumbe (MD), Indian Key Fill (GU), Grassy (MD), Bahia Honda (JT, MD), Big Pine (NC, JT, GU, MD), No Name (JT, S&JP, MD), Sugarloaf (S&JP), Saddlebunch 2 (JW), Big Coppitt (JW), Stock Island (MD), Key West (NC, JT, MD), Dry Tortugas (CW, NC). Vouchers: ABS, JT, NC, GU.

Paratrechina wojciki Trager. This native species inhabits upland forests throughout Florida. Elliott (MD) and No Name (MD). Vouchers: ABS.

Pheidole dentata Mayr. This native species occurs in many habitats throughout Florida. Nests are in soil or in rotten wood. Elliott (MD), Largo (MD), Bahia Honda (MD), Big Pine (MD, GU, JT), No Name (JT, MD), Sugarloaf (S&JP), Saddlebunch 2 (JW), Shark (NC), Stock Island (MD), Dry Tortugas (CW). Vouchers: ABS, JT, NC, GU.

Pheidole dentigula M. R. Snth. This native species is found in mesic sites throughout Florida. Nests are in moist soil or rotten wood. Largo (MD), Grassy (MD), No Name (MD). Vouchers: ABS.

Pheidole floridana Emery. There is some confusion about the application of the names *P. floridana*, *P. flavens* Roger, and *P. anastasioi* Emery. A publication on the *Pheidole* of Florida (Naves 1985) has done little to correct this situation. Traditionally (Creighton 1950, Smith 1979) the name *P. floridana* has been applied to a widespread upland species that has a distinctive matte area on the base of the first gastral tergite and very evenly rugose head. This is the species that we report from the Keys. Its habitat is dry partially shaded areas; nests are usually in soil. Elliott (MD, NC), Largo (MD), Plantation (DS), Grassy (MD, JT), Big Pine (EW, GU, MD), No Name (MD), Sugarloaf (MD, S&JP), Middle Torch (S&JP), Big Torch (S&JP), Saddlebunch 2 (JW), Boca Chica (JW), Stock Island (K&P). Vouchers: ABS, GU.

Pheidole megacephala (Fabricius). In Florida this exotic species is usually found in disturbed areas near buildings. Nests are in the soil and under objects on the ground. Largo (MD), Big Pine (JT), Key West (NC, MD), Dry Tortugas (NC). Vouchers: ABS, NC, JT.

Pheidole moerens Wheeler. This exotic species nests in moist sites in disturbed areas and in mesic woodlands. Plantation (DS, MD), Bahia Honda (MD), Big Pine (JT, MD), Stock Island (MD), Key West (MD). Vouchers: ABS, JT.

Platythyrea punctata (Smith). This neotropical species is widely distributed in the southern third of Florida, but is seldom abundant. We consider this a native species. Nests are usually in dead wood in forested areas. Largo (EW), Vaca (GU), Big Pine (JT, GU, S&JP), No Name (JT, S&JP), Middle Torch (S&JP), Sugarloaf (S&JP), Stock Island (MD). Vouchers: ABS, JT, GU.

Pogonomyrmex badius (Latreille). This native harvester ant has been collected only once on the Keys and may not be established there. *P. badius* is a common beach species in both the east and west coast of Florida, and it would not be surprising if there were a resident coastal population in the Keys. The collection site, Saddlebunch 5 (NC), is a very long way from the mainland. Voucher: NC.

Pseudomyrmex cubaensis Forel. All the south Florida *Pseudomyrmex*, with the exception of *P. seminole*, are neotropical species and potentially exotics, although *P. mexicanus* is the only documented exotic. All species, including *P. mexicanus*, can be found in natural habitats. In the absence of any clear evidence, we are considering all these (except *P. mexicanus*) as Florida natives. Nests of *P. cubaensis* are in hollow twigs and plant stalks. Elliott (MD), Largo (PW), Lower Matecumbe (PW), Big Pine (JT, GU, S&JP, MD), No Name (PW), Saddlebunch 5 (NC), Key West (NC, PW, MD). Vouchers: ABS, JT, NC, GU.

Pseudomyrmex ejectus (F. Smith). Nests are in hollow twigs and plant stalks. Elliott (MD), Largo (MD, PW). Vouchers: ABS.

Pseudomyrmex elongatus (Mayr). Nests are in hollow twigs and plant stalks. Elliott (MD), Largo (EW, JT, PW, MD), Plantation (EW), Upper Matecumbe (MD), Bahia Honda (MD), Big Pine (EW, GU, S&JP, JT, PW, MD), No Name (JT, MD), Sugarloaf (S&JP), Saddlebunch 5 (NC), Boca Chica (JW), Key West (EW, NC, MD), Dry Tortugas (CW). Vouchers: ABS, JT, NC, GU.

Pseudomyrmex mexicanus (Roger). Nests are in hollow twigs or large plant stalks. Elliott (MD), Largo (JT, PW, MD), Lower Matecumbe (MD, GU), Big Pine (MD, GU, JT). Vouchers: ABS, JT, GU.

Pseudomyrmex pallidus (F. Smith). Nests are usually in plant stalks. Elliott (MD), Largo (JT, PW, MD), Plantation (MD), Lower Matecumbe (PW), Grassy (MD), Bahia Honda (PW), Big Pine (EW, GU, PW, MD), No Name (PW), Middle Torch (S&JP), Cudjoe (GU, PW), Saddlebunch 5 (NC), Key West (PW). Vouchers: ABS, NC, JT, GU.

Pseudomyrmex seminole Ward. Nests are in plant stalks. Largo (PW), Bahia Honda (MD). Vouchers: ABS.

Pseudomyrmex simplex (F. Smith). Nests are usually in hollow twigs. Elliott (MD), Largo (MD, PW), Plantation (MD), Grassy (MD), Big Pine (MD, PW), No Name (MD, JT), Big Torch (S&JP), Sugarloaf (S&JP). Vouchers: ABS, JT, GU.

Quadristruma emmae (Emery). This exotic species is abundant throughout southern Florida. Nests are in leaf litter, often in disturbed sites. Elliott (MD), Largo (MD), Plantation (MD), Lower Matecumbe (MD), Long (S&JP), Bahia Honda (K&P), Big Pine (JT, GU, K&P, MD), Big Torch (K&P), No Name (MD), Sugarloaf (JW, S&JP), Boca Chica (JW), Stock Island (K&P). Vouchers: ABS, JT, GU.

Smithistruma dietrichi (M. R. Smith). This widespread native species is found in deep leaf litter and rotten wood in wooded areas. Grassy (MD), Bahia Honda (K&P), Big Pine (K&P), No Name (MD). Vouchers: ABS, GU.

Solenopsis corticalis Forel. This tropical species might be native in extreme south Florida; there are no published U.S. records of this species, though Florida specimens have been available for several years. Nests are in hollow twigs and plant stems. Big Pine (MD), No Name (JT, MD). Vouchers: ABS, JT.

Solenopsis geminata (Fabricius). This widespread neotropical species is probably native to the Keys. *S. geminata* usually nests in sandy soil in open areas, especially beaches. Elliott (MM, MD, NC), Largo (JT, MD), Plantation (MD), Upper Matecumbe

(NC), Bahia Honda (GU, MD), Big Pine (EW, NC, JT, GU, MD), No Name (JT, MD), Sugarloaf (MD), Shark (NC), Stock Island (MD), Dry Tortugas (CW, NC). Vouchers: ABS, NC, JT, GU.

Solenopsis gubularia littoralis Creighton. This native southeastern species lives in open sandy areas and can also be found in tussocks in salt marshes. Elliott (MD), Largo (MD), Plantation (EW), Ohio (S&JP), Big Pine (EW, JT, GU, MD), Saddlebunch 2 (JW), Geiger (JW). Vouchers: ABS, JT, GU.

Solenopsis invicta Buren. This exotic species is not nearly as dominant in the Keys as elsewhere in Florida, possibly because *S. geminata* is better adapted to coastal areas. Nests are in soil, usually in moist unshaded sites. Elliott (MD), Saddlebunch 5 (NC), Key West (NC). Vouchers: ABS, NC.

Solenopsis picta Emery. This native southeastern species nests in twigs, holes in the bark of live pine trees, and plant stems. Elliott (MD), Plantation (EW), Upper Matecumbe (EW), Bahia Honda (MD), Key West (MD). Vouchers: ABS.

Solenopsis tennesseensis M. R. Smith. This native southeastern species occurs in soil or leaf litter in wooded areas. Elliott (MD), Largo (EW, MD), Plantation (MD), Grassy (JT, MD), Long (MD), Bahia Honda (MD), No Name (JT, MD), Boca Chica (JW), Stock Island (MD). Vouchers: ABS, JT.

Solenopsis sp. This small yellow species in the subgenus *Diphorhoptum* is found throughout Florida. It has not been formally described. This species is probably native to the Keys. Nests are in leaf litter, usually in shaded habitats. Elliott (MD), Largo (MD), Plantation (DS, MD), Lower Matecumbe (MD), Grassy (JT, MD), Bahia Honda (JT, MD), Big Pine (JT, MD), No Name (MD), Sugarloaf (MD), Boca Chica (JW), Stock Island (MD), Key West (JW, MD). Vouchers: ABS, JT.

Strumigenys eggersi Emery. This neotropical species is probably exotic in Florida; it is currently found through the southern two-thirds of the state. Nests are in leaf litter in shaded or partially shaded areas. Largo (MD), Plantation (DS, MD), Upper Matecumbe (MD), Big Pine (MD, K&P), Sugarloaf (JW), Stock Island (K&P, MD), Key West (JW). Vouchers: ABS, GU.

Strumigenys gundlachi (Roger). This neotropical species is probably exotic in Florida; it is found only in the extreme southern part of the state. Nests are in leaf litter in shaded sites. Elliott (MD), Largo (EW, MD), Upper Matecumbe (MD), Grassy (MD), Long (MD), Vaca (K&P), Big Pine (MD, K&P), No Name (JT, MD), Sugarloaf (MD, K&P). Vouchers: ABS, JT, GU.

Strumigenys louisianae Roger. The range of this species extends from the southern U.S. to southern South America. It is presumably native in Florida. Nests are in leaf litter in moist shaded areas. Largo (JT), Plantation (MD), Big Pine (K&P), No Name (MD, GU), Big Torch (S&JP). Vouchers: ABS, JT, GU.

Strumigenys silvestrii Emery. This neotropical species is probably exotic in Florida. It is known from a few widely scattered localities in the state. Nests are in leaf litter. Plantation (DS), Big Pine (MD), West Summerland (K&P). Vouchers: ABS, GU.

Tapinoma litorale Wheeler. This species occurs in the West Indies and the southern third of Florida. We consider this a native species. Nests are in twigs and vines, usually in exposed or partially exposed sites. Elliott (MD), Largo (EW), Plantation (EW), Windley (EW), Big Pine (EW, GU, MD), Long (MD), Bush (NC). Vouchers: ABS, NC, GU.

Tapinoma melanocephalum (Fabricius). This exotic species is common in disturbed habitats through southern Florida. Nests are under bark, at the bases of palm leaves, and other similar cavities. Elliott (MD), Largo (MD), Plantation (DS), Upper Matecumbe (MD), Grassy (MD), Long (MD), Vaca (GU), Big Pine (MD, GU), Saddlebunch 2 (JW), Stock Island (MD), Key West (JW, MD), Dry Tortugas (CW, NC). Vouchers: ABS, NC, GU.

Tapinoma sp. This species appears related to *T. sessile* (Say), but differs in a number of morphological characters and its preference for marshes as nesting sites. Colonies have been found in salt marshes and in Everglades sawgrass prairies. The colonies are usually in tussocks or at the base of shrubs. Specimens found tending a lycaenid larva in a coastal marsh on Sugarloaf by D. Harvey. Vouchers: ABS, Los Angeles Co. Museum. Record courtesy of J. Longino, University of California, Santa Barbara.

Tetramorium bicarinatum (Nylander). Widely known in the literature as *T. guineense* (Fabricius), this exotic species is widely dispersed in Florida, though seldom very abundant. It is usually found in rather moist disturbed areas. Largo (EW), Bahia Honda (MD). Vouchers: ABS.

Tetramorium caldarium (Roger). Records of this species were generally confused with those of *T. simillimum* until Bolton's revision of the genus in 1979. This exotic species occurs throughout southern Florida, usually in open disturbed areas. Upper Matecumbe (MD), Stock Island (MD), Key West (MD), Dry Tortugas (CW). Vouchers: ABS.

Tetramorium simillimum (F. Smith). This exotic species occurs throughout Florida, usually in disturbed open areas such as lawns and foundation plantings. Elliott (MD), Upper Matecumbe (MD), Bala Honda (MD), Big Pine (MD), Key West (EW). Vouchers: ABS.

Trachymyrmex septentrionalis (McCook). This native species, occurs throughout Florida in dry, open, sandy areas. Several colonies were found on Long Key (MD). Vouchers: ABS.

Trachymyrmex sp. nr. *jamaicensis* (Andre). The name *jamaicensis* has been applied to a large dark brown species found in extreme southern Florida and in the Keys. There appear to be differences, particularly a conspicuous carina on the antennal scape, between the Florida populations and those of the West Indies. This species occurs in tropical hammocks, and its nests are marked by a conspicuous thatched turret. Elliott (MD, NC), Largo (MD), Grassy (MD, JT), Indian (GU), Long (MD), Bahia Honda (MD), Big Pine (GU, S&JP, MD), Shark (NC). Vouchers: ABS, JT, NC, GU.

Wasmannia auropunctata (Roger). We have found this exotic ant a dominant species at some collection sites in southern Florida, including a *Coccoloba* stand on Bahia Honda. This species has eliminated all native ants from parts of the Galapagos Islands (Clark et al. 1982, Lubin 1984), but has not had a similar effect during its long history in southern Florida. It was not reported by Wilson in his 1964 paper, and has evidently become much more abundant since then. Populations may still be on the increase in the Keys. Largo (MD), Plantation (MD), Upper Matecumbe (MD), Bahia Honda (MD, JT), Big Pine (NC, GU, MD), Sugarloaf (S&JP), Middle Torch (S&JP), Key West (JW, NC, MD). Vouchers: ABS, NC, GU.

Xenomyrmex floridanus Emery. This native species nests in hollow twigs. Elliott (MD), Largo (EW, MD), Plantation (EW, MD), Grassy (MD), Long, (GU), Ohio (GU), Big Pine (GU, MD), No Name (MD), Ramrod (NC), Key West (EW, MD). Vouchers: ABS, NC, GU.

Zacryptocerus varians (F. Smith). This native species nests in hollow twigs, branches hollowed by termites, and, occasionally, weed stems. Elliott (MD), Largo (EW), Plantation (EW), Ohio (GU), Big Pine (EW, GU, MD), No Name (MD, S&JP), Big Torch (S&JP), Upper Matecumbe (MD), Stock Island (K&P), Key West (EW). Vouchers: ABS, GU.

DISCUSSION

Diversity. The known diversity of the ant fauna has increased from 30 species to 83 species. The fauna no longer seems particularly depauperate, especially by Antillean

standards. Even some larger islands of the West Indies have produced shorter lists of ants. M. R. Smith, who studied the ants of Puerto Rico for about a year, found 66 species (Smith 1936). Wheeler, drawing on the studies of a number of workers, lists 72 species from Trinidad (Wheeler 1916). Cuba has a more impressive fauna of about 137 species (Alayo 1974). Longer lists could undoubtedly be compiled from large West Indian islands today, but their fauna may still be depauperate compared with the Florida Keys when the respective sizes of these islands are taken into account. The fauna of the Florida Keys is, in turn, rather small when compared to that of the mainland. From one site in southern Florida 102 species of ants have been reported (Deyrup & Trager 1986), to which we recently added 2 additional species. In one sense, therefore, the ant fauna of the Florida Keys seems rather rich, but in another sense it seems rather depauperate.

The richness of the Keys fauna is derived in part from its close association with the mainland. This has allowed migration of about 31 widely distributed species of the southeastern coastal plain. This immigration must have been facilitated by broad land bridges that extended through the Keys in the past (Hoffmeister & Multer 1968). It seems likely, however, that the Keys fauna would be richer still if the Keys were attached to a large land mass with a tropical rather than a temperate climate.

The depauperate nature of the fauna relative to the mainland is probably due to the habitats and climate of the Keys. A number of species that are associated with well-drained sandy areas of the mainland seem to be missing from the Keys. The tropical hammocks have a deep humus layer that would seem ideal for soil-dwelling species such as dacetines, but the extreme dryness of this humus during much of the year appears inimical to ants. Rotten wood, which harbors many specialized ants in wetter climates, contains only a few generalists in south Florida in general and the Keys in particular. Flooding during tropical storms may also take its toll of the ants, as suggested by Wilson (1964), but the effects of the prolonged dry season are probably more important.

Exotic Species. The proportion of species introduced by man into the ant fauna of the Keys is higher than in any other known area of the U.S. There are 27 recognized exotics, 33% of the fauna, without counting any of the West Indian species that could easily be unrecognized exotics. The proportion of exotic ants seems to decrease from south to north in Florida. At the Archbold Biological Station in Highlands Co. there are 20 species, or 19.6% of the total (Deyrup & Trager 1986), and in Alachua Co. there are 17 species, or 15% of the total (Johnson 1987). The increase in exotics to the south is partly due to heavy trade between the ports of tropical Florida and the rich faunas of mainland tropical areas. It may also be partly due to an ecological vacuum caused by the unsuitability of the climate and habitats of the Keys for many mainland species to the north.

There has clearly been an increase in the populations of exotic ants since the 1958 survey. It would have been difficult to overlook such species as *Paratrechina guatemalensis*, *Pheidole megacephala*, *P. moerens*, *Tapinoma melanocephalum*, and *Wasmannia auropunctata* if these species had been as abundant as they are presently. There is no clear indication, however, that the exotic species are displacing native species. There are a few native species that are so scarce that it is difficult to avoid the impression that they are being affected by the influx of exotics, or by other forms of habitat modification. Such species include *Crematogaster minutissima*, *Discothyrea testacea*, *Myrmecina americana*, *Pachycondyla stigma*, *Smithistruma dietrichi*, *Paratrechina concionna*, and *P. wojciki*. The exotic species themselves may not have reached an equilibrium: *Tetramorium bicarinatum*, which was abundant 20 years ago (D. S. Simberloff, personal communication), is now extremely scarce.

Endemic Species. One would not expect that an archipelago of recent origin closely associated with the mainland would be home to many autochthonous species or sub-

species. There are endemic subspecies of mammals and reptiles in the Keys (Auffenberg 1982), as well as the butterfly, *Papilio aristodemus ponceanus* Schaus. The mammals and reptiles, however, are even more strongly affected by barriers than the ants, and both reptiles and butterflies are likely to show rather conspicuous geographic distinctions in coloration caused by minimal genetic differences, which are eagerly seized upon by avid collectors. Only two species of ants seem possible endemics. One is the unidentified *Leptothorax* (*Dichothorax*), which is almost certainly derived from a more northern *Dichothorax*. This species has not been found anywhere on the mainland. The second species is the ambiguous *Trachymyrmex* sp., which seems to show at least subspecific differences from West Indian populations of *T. jamaicensis*. This form has also been found on the mainland in Dade County.

Unexpected Absences in the Fauna. There are a few additional species of south Florida ants that we expected to find in the Keys. These include the exotics *Strumigenys rogeri* Emery and *Trichoscapa membranifera* (Emery), which are widespread, but rather localized, south Florida exotics. A native species, *Leptogenys elongata manni* Wheeler should also occur in the Keys. Enclaves of sand-inhabiting ants might well occur in relatively well-drained sandy sites in the Keys. An apparently isolated population of *Trachymyrmex septentrionalis* has already been found on Long Key; other species with similar edaphic requirements are *Pheidole metallescens* Emery, *Monomorium viridum* Brown, *Solenopsis pergandei* Forel, and *Paratrechina arenivaga* (Wheeler). We had a general expectation of finding more previously unreported West Indian species, but succeeded in adding only two species to the fauna, *Monomorium ebeninum* and *Leptothorax torrei*.

General Comments on the Fauna. In a biogeographical sense, the Florida Peninsula resembles a mountain, whose peak is formed by the Keys. The apex of the mountain is 375 miles south of its origin and, like the peak of a mountain, projects into a climatic zone unsuitable for most of the inhabitants of its base. A peculiar biota results from the mingling of the more climatically adaptable of the species that have easy access from the base, with a selection of species preadapted to the climate and habitat, and somehow transported to the isolated, climatically appropriate zone. The young age of this isolated zone in the Keys precludes the presence of many endemic or relict species. The age, size, and isolation of the zone determines the establishment of species from other areas of similar climate and habitat. The Keys are relatively young, but they offer ample land masses for ant populations, and their isolation from other tropical areas is reduced by human commerce.

In his earlier survey Wilson (1964) was most likely to collect the more abundant species, which led to a view of the ant fauna as a depauperate Antillean fauna with a strong component of recent tropical exotics. Our work strongly supports this view of the dominant ants, so our ecological conception of the ants of the Keys has changed little. From a biogeographical standpoint, the Keys now appear somewhat different, as they clearly have an extensive fauna derived from the north.

The distribution of ant species among the Keys shows few, if any, effects of "equilibrium island biogeography." Most species apparently occur wherever their preferred habitat is available. Relationships between island size and species diversity have been applied to scarab beetles of the Florida Keys (Peck & Howden 1985), but in the case of ants the larger number of species on the larger islands is most easily attributed to a greater diversity of habitats on the larger islands. What evidence we have of species turnover resembles that of mainland south Florida, caused by habitat changes and recent invasions of exotics. Elliott Key, which is isolated, largely undeveloped, and free from spraying for mosquitos, appears to lack 2 dominating exotics, *Wasmannia auropunctata* and *Paratrechina guatemalensis*. *Trachymyrmex* sp. nr. *jamaicensis* is the only native ant that appears unusually abundant. Elliott Key, insulated as much by

National Parks Service management as by its distance from the mainland, will probably continue to diverge faunistically from most of the Florida Keys. We note that the key with the richest ant fauna is Big Pine, from which 61 species have been collected. This key has had large portions of natural habitat protected and maintained as part of the National Key Deer Wildlife Refuge. We believe that this has been a major factor in conserving the diversity of ant species on this island. Island biogeography is unfortunately supplied with ever more examples from ever smaller fragments of natural habitat.

It seems inevitable that the known ant fauna of the Keys will continue to change. We expect that exotic species will continue their trend toward ecological domination, except in protected areas such as Elliott Key, Lignum Vitae Key, and parts of Largo, Long, Bahia Honda, Big Pine, and No Name Keys. We also assume that the list of species known from the Keys will increase to at least 90 species, including some native species. A number of species on the present list are known only from one or a few pockets of suitable habitat, and it seems unlikely that we have sampled the full diversity of such sites. For example, a number of the islands are composed of porous rock and underlain by a whole series of miniature caves and grottos that could have a cavernicolous fauna. It is virtually certain that further myrmecological surprises await in the Florida Keys.

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BIBLIOGRAPHY OF THE
NEOTROPICAL CORNSTALK BORER,
DIATRAEA LINEOLATA (LEPIDOPTERA: PYRALIDAE)

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ABSTRACT

A bibliographic revision of the neotropical cornstalk borer (NCB), *Diatraea lineolata* (Walker) is presented. The bibliographical entries include information on distribution, taxonomy, host plants, biology, damage, and control of the NCB. However, only a few references cited include substantial and complete information on the NCB. Most of the citations include brief local observations and preliminary information on this species.