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POPULATION EXPLOSION OF THE HAIRY CRAZY ANT, *PARATRECHINA PUBENS* (HYMENOPTERA: FORMICIDAE), ON ST. CROIX, US VIRGIN ISLANDS

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ABSTRACT

The hairy crazy ant, *Paratrechina pubens* (Forel), is undergoing a population explosion on St. Croix, US Virgin Islands. Here, we evaluate the status of *P. pubens* on St. Croix. In 2002, residents of Calquohoun and surrounding areas in central St. Croix began reporting large infestations of *P. pubens*. In 2005 and 2006, we surveyed ants at >100 sites across St. Croix. We found 3 geographically discrete populations of *P. pubens* occupying ~5% of the island: a main population centered on Calquohoun spread over ~9 km^2 and 2 smaller populations occupying <1 km^2 each. Locals blamed *P. pubens* for crop damage due to high densities of plant-feeding Hemiptera that tended the ants. Surveys of trees in areas with and without *P. pubens* present indicated that *P. pubens* has a significant negative impact on arboreal-foraging ants. The distribution and chronology of *P. pubens* records on St. Croix suggest that this species is a recently arrived exotic. It is unknown whether *P. pubens* will become a more serious pest on St. Croix or whether populations will collapse to inconsequential levels.

Key Words: exotic species, *Paratrechina pubens*, pest ants, Virgin Islands

RESUMEN

La población de la hormiga peluda-loca, *Paratrechina pubens* (Forel) esta explotando en St. Croix una de las Islas Vírgines de los EEUU. Aquí, evaluamos el estado de *P. pubens* en St. Croix. En 2002, los residentes de Calquohoun y en las áreas alrededores del centro de St. Croix empezaron a reportar infestaciones grandes de *P. pubens*. En 2005 y 2006, realizamos un monitoreo de las hormigas en mas de 100 sitios por toda la isla de St. Croix. Nosotros encontramos 3 poblaciones geográficas distintas de *P. pubens* ocupando ~5% de la isla: una población principal con su centro en Calquohoun dispersada por ~9 km^2 y 2 poblaciones mas pequeñas cada una ocupando <1 km^2. La gente local culpó a *P. pubens* por el daño a los cultivos debido a la alta densidad de los hemípteros fitófagos protegidos por las hormigas. Un monitoreo de los árboles en las áreas donde *P. pubens* estuvo presente versus ausente indicó que *P. pubens* tiene un impacto negativo significativo sobre las hormigas que buscan su alimento en los árboles. La distribución y cronología de los registros de *P. pubens* en St. Croix sugieran que esta es una especie exótica recién llegada. No se sabe si *P. pubens* llegara a ser una plaga mas seria en St. Croix o si la población bajara a niveles inconsecuentes.

The hairy crazy ant, *Paratrechina pubens* (Forel), is known from sites scattered across the New World tropics and subtropics. Forel (1893) described *P. pubens* from St. Vincent, and Smith (1951) reported that *P. pubens* was known from Mexico, Central and South America, and the West Indies. Other West Indian records include Martinique (Forel 1912), Anguilla (Trager 1984), Guadeloupe (Trager 1984), Puerto Rico (Torres & Snelling 1997), and Cuba (Fontenla 1995). In 1990, Miller (1994) found *P. pubens* in a barge full of potted plants from south Florida being unloaded at Guana Island, British Virgin Islands. The earliest Florida records of *P. pubens* come from the Miami area in 1953 (Trager 1984), and *P. pubens* is now a localized exotic pest in Florida (Deyrup et al. 2000). Wetterer (2007) recently reported a previously unrecognized 1905 record of *P. pubens* from Bermuda, and proposed that this species was the most likely candidate for an unidentified ant that underwent a great population explosion for 8 years in the 19th century in Bermuda and then disappeared (also see Wetterer 2006). Here, we report a recent population explosion of *P. pubens* on St. Croix, US Virgin Islands and evaluate its status there.

METHODS AND MATERIALS

While working for the Cooperative Extension Service, JK received numerous complaints about insect pests on St. Croix, including outbreaks of *P. pubens*. JK took notes on these complaints and visited the sites. From 30 Oct to 5 Nov 2005 and 3-12 Mar 2006, JW collected ants at >100 sites on St. Croix. Collection sites included a diversity of

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disturbed and relatively natural habitats. JW sampled at 1-5 km intervals over most of the island, but at shorter intervals in accessible areas adjacent to sites where *P. pubens* was found to be present.

From 5-10 Mar 2006, JW examined the impact of *P. pubens* on arboreal-foraging ants on St. Croix. At each of 24 sites (designated sites A-X; 12 sites with *P. pubens* present and 12 with *P. pubens* absent), JW surveyed ants on 10 trees with trunk diameter >10 cm, spaced at ~10 m intervals in forested areas and at more irregular intervals in areas with fewer trees. JW tacked a folded index card holding ~1 g of canned tuna (in water) at 2 m height on the north side of the trunk between 9:00 and 14:00h and returned in 2 h (± 15 min) to collect the cards and place ants in plastic bags. The ants were frozen, counted, and placed in 95% alcohol. JW initiated a parallel study of ants coming to terrestrial baits at site A, but abandoned it because mongooses removed most of the bait cards. Roy Snelling of the Los Angeles County Museum of Natural History confirmed identification of *P. pubens*. Stefan Cover of the Museum of Comparative Zoology (MCZ) confirmed identification of all specimens.

Results

JK investigated several complaints concerning *P. pubens* from 3 contiguous Estates (i.e., townships) in central St. Croix: Calquohoun, Little Fountain, and Upper Love (geocoordinates given in °N, °W). The earliest complaint, on 24 Aug 2002, was from a resident in Calquohoun (site 1; 17.741, 64.793; see Fig. 1) whose house and property were overrun by these ants. The resident reportedly swept up a dustpan full of dead ants every day. For more than a year, all additional complaints concerning *P. pubens* came from nearby parts of Calquohoun. On 24 May 2004, a farmer in Little Fountain (site 2; 17.749, 64.790; see Fig. 1) reported that several small farm buildings as well as large areas of pasture were overrun with *P. pubens*. Less than 1 km from this farm, a physician in Little Fountain (site 3; 17.752, 64.794) reported that large numbers of *P. pubens* infested his house and the large trees near the house (date not recorded). On 21 Oct 2005, a resident of Upper Love (site 4; 17.732, 64.810) complained of an infestation on his property, and reported that he scooped up ~2 liters of dead *P. pubens* every day from his covered porch and driveway area. On 6 Dec 2005, a resident of Little Fountain (site 5; 17.755, 64.791) reported a very large number of *P. pubens* inside his house and attributed the death of several rabbits kept in cages on his property to these ants.

JW collected *P. pubens* at 12 sites on St. Croix in Oct-Nov 2005 and at 19 additional sites in Mar 2006. *Paratrechina pubens* occurred at high densities in at least part of each of these 31 sites.

We delineated 3 geographically separate populations covering ~10 km^2 (~5% of the island; Fig. 1). The main population was spread across at least 13 Estates and occupied ~9 km^2, including all sites sampled by JK plus 21 sites sampled by JW: Bethlehem Old Works; Rte 64; 1 km S of Rte 72 (17.730, 64.796), Bethlehem Old Works, Rte 64; 0.5 km NW of Rte 70 (site E; 17.729, 64.795), Body Slob; S of Rte 709; E of Rte 75 (17.739, 64.776), Calquohoun; Cruzan Gardens (site K; 17.739, 64.801), Calquohoun; NNE of Cruzan Gardens (17.745, 64.793), Canaan; Rte 73; 1.5 km NW Frangipani (17.760, 64.798), Castle Burke; Rte 78; 2 km E of Rte 69 (17.724, 64.804), Fredensborg; S of Rte 707; W of Rte 73 (17.735,

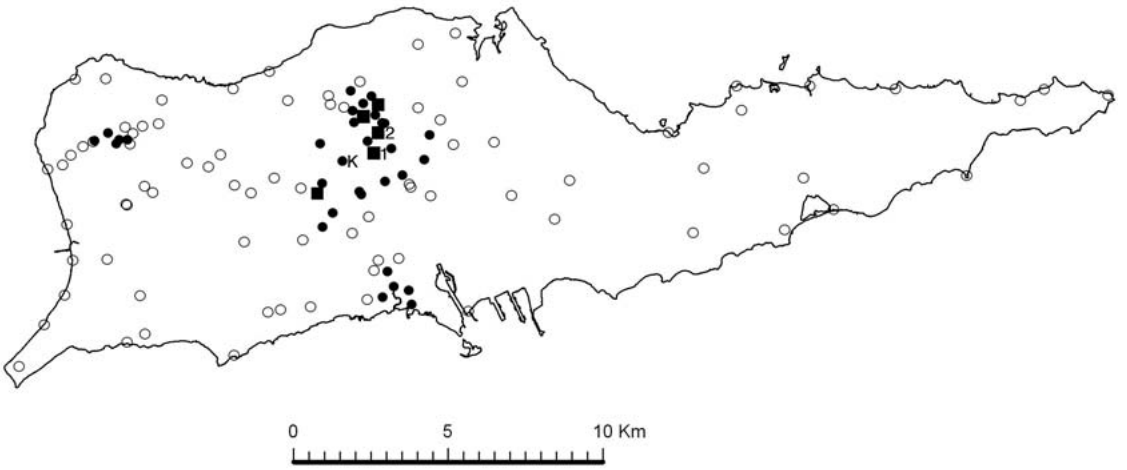


Fig. 1. Ant collection sites on St. Croix. Squares = JK records of *Paratrechina pubens* complaints. Circles = JW collection sites (filled = *P. pubens* present, open = *P. pubens* absent). The 3 earliest known *P. pubens* records are labeled: site 1 (Aug 2002), site K (early 2003), and site 2 (May 2004).

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64.783), Fredensborg; turn in Rte 707 (17.733, 64.788), Hermitage; Blue Mt; NE side (17.754, 64.798), Hermitage; Blue Mt; SE side (site Z; 17.751, 64.797), Jealousy; 1 km N of Rte 72 (17.744, 64.807), Little Fountain; NE corner (site A; 17.758, 64.792), Little Fountain; Rte 73; 0.5 km NW Frangipani (17.753, 64.791), Little Fountain; Rte 73; 1 km NW Frangipani (17.756, 64.794), Lower Love; NW of gas station (site B; 17.720, 64.807), Mon Bijou; 0.2 km W of Frangipani (site J; 17.750, 64.789), Mon Bijou; S of Rte 72; W of Rte 73 (site I; 17.743, 64.786), Mon Bijou; NW corner of Frangipani (site Y; 17.750, 64.788), The Glynn; Rte 72; 0.2 km W of Rte 75 (17.747, 64.774), and Upper Love; Holy Cross Church (site D; 17.733, 64.807).

Two smaller *P. pubens* populations occupied <1 km^2 each. The Western population, sampled at 5 sites in 3 Estates, occupied ~0.2 km^2: Mount Victory; 2.5 km up Rte 58 (site N; 17.744, 64.870), Mount Victory; 3 km up Rte 58 (site P; 17.749, 64.868), Mt. Victory; 3.5 km up Rte 58 (site Q; 17.750, 64.863), North Hall; 2 km up Rte 58 (site M; 17.745, 64.875), and Punch; 0.5 km SW of Mt. Victory Camp (site T; 17.746, 64.871). The Southern population, sampled at 5 sites in 3 Estates, occupied ~0.5 km^2: Anguilla; 0.5 km up landfill road (17.7013, 64.7809), Anguilla; 1 km up landfill road (17.697, 64.780), Bethlehem Middle Works; Rte 64; 0.5 km S of Rte 66 (17.702, 64.785), Bethlehem Middle Works; Rte 64; N of Rte 66 (17.707, 64.787), and Mannings Bay; Rte 64; 1 km from Rte 66 (17.699, 64.789).

At Cruzan Gardens (site K in Calquohoun; see Fig. 1), a private 2.0-ha botanical garden and nursery that imports plants from off-island (C. Holmes, pers. comm.), a staff member who had worked at the gardens for 30 years reported that *P. pubens* became apparent at the nursery in early 2003, and had an impact on many of the fruit trees though tending enormous numbers of mealybugs on the branches, leaves, and fruit. In Nov 2005, JW found that *P. pubens* was extremely abundant throughout most of the property, particularly in sections that were watered regularly. In these areas, every rock and log examined housed *P. pubens* colonies and the trunk of every tree examined had broad trails of *P. pubens* foragers going up and down. Nest-bound foragers were bloated with liquid, no doubt honeydew collected from tended Hemiptera. In Mar 2006, we observed much lower densities of *P. pubens* at Cruzan Garden than in Nov 2005, despite a lack of control efforts, suggesting that this species may already be in decline in some areas.

JW spoke about the outbreak of ants with residents at several other sites. At the Frangipani housing development (site Y in Mon Bijou), a resident said that the ants had arrived in early 2005. Along the perimeter of his house were piles of ants killed by a white powder pesticide, along with much-reduced trails of live *P. pubens*. In Hermitage (site Z), near the western edge of the main population, we saw large numbers of *P. pubens* on a variety of fruit trees. Residents reported that the ants appeared around Dec 2005 and that their coconut plantation produced no coconuts this year because high densities of ant-tended Hemiptera covered the flowers and young fruit and caused them to drop prematurely. At Mount Victory Camp, an ecotourism resort in western St. Croix (adjacent to site P), the owner reported that *P. pubens* first became evident around Dec 2005. In the northeast corner of Little Fountain (site A), at the northern edge of the main population, local residents first noted *P. pubens* in Mar 2006, and the ants were found only at the southern edge of their property, in the direction of the main population.

In the tree surveys, we collected *P. pubens* plus 6 ant species we considered exotic to St. Croix (*Monomorium floricola* (Jerdon), *Paratrechina longicornis* (Latreille), *Solenopsis geminata* (Fabricius), *Solenopsis invicta* Buren, *Tapinoma melanocephalum* (Fabricius), and *Technomyrmex difficilis* Forel), and 6 we considered to be native (*Brachymyrmex heeri* Forel, *Crematogaster crinosa* Mayr, *Linepithema iniquum* (Mayr), *Monomorium ebeninum* Forel, *Pheidole moerens* Wheeler, and *Solenopsis corticalis* Forel). At the 12 *P. pubens*-occupied sites (10 trees surveyed per site), we collected *P. pubens* at 60 trees and made 34 additional arboreal-foraging ant records (17 records of 3 exotic species and 17 of 3 native species; Table 1). At the 12 sites without *P. pubens* present, we made 75 arboreal-foraging ant species records (37 records of 5 exotic species and 38 of 5 native species; Table 2). Thus, there were significantly fewer records of other arboreal-foraging ants on trees in *P. pubens*-occupied sites versus in sites without *P. pubens* present ($\chi^2 = 15.4$, $df = 1$, $P < 0.001$).

The degree of dominance of *P. pubens* varied greatly among the *P. pubens*-occupied sites. At the 6 sites where *P. pubens* occurred on 6 or more of the 10 trees, there were only 2 other arboreal-foraging ant records (1 native and 1 exotic; Table 1). In contrast, at the 6 *P. pubens*-occupied sites where *P. pubens* occurred on 5 or fewer of the 10 trees, there were 32 arboreal-foraging ant records of species other than *P. pubens*. Thus, there were significantly fewer records of other arboreal-foraging ants at the 6 sites where *P. pubens* were common in the trees than at the 6 sites where *P. pubens* was present, but not common in the trees ($\chi^2 = 26.5$, $df = 1$, $P < 0.001$).

Discussion

We documented 3 geographically discrete populations of *P. pubens* on St. Croix: a main population occupying ~9 km^2 and 2 smaller populations occupying <1 km^2 each. The chronology of com-

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TABLE 1. NUMBER OF TREES WITH DIFFERENT EXOTIC AND NATIVE ANT SPECIES PRESENT AT 12 SITES (10 TREES PER SITE) WITH *PARATRECHINA PUBENS* PRESENT, IN ORDER OF DOMINANCE BY *P. PUBENS* (SEE TEXT FOR SITE LOCATIONS).

	Sites												
Exotic species	B	P	T	J	E	K	A	N	D	I	M	Q	Total
Paratrechina pubens	10	10	10	9	8	6	5	2	—	—	—	—	60
Technomyrmex difficilis	—	—	—	—	—	—	—	—	2	—	—	10	12
Monomorium floricola	—	—	1	—	—	—	—	—	3	—	—	—	4
Paratrechina longicornis	—	—	—	—	—	—	1	—	—	—	—	—	1
Native species													
Linepithema iniquum	—	—	—	—	—	—	—	5	—	—	7	—	12
Crematogaster crinosa	—	—	—	—	—	—	3	—	—	—	—	—	3
Solenopsis corticalis	—	—	1	—	—	—	—	—	—	1	—	—	2

plaints from residents and the current distribution of *P. pubens* suggest this species is an exotic that first arrived in the Calquohoun area circa late 2001 or early 2002. If the main population of *P. pubens* on St. Croix originated at the center of its current range in early 2002, then to reach peripheral areas 2.0-2.5 km from the center (e.g., sites 7 and A) by early 2006, it must have spread at an average linear rate of 0.5-0.6 km per year. The smaller populations of *P. pubens* in western and southern St. Croix may be satellite populations founded by propagules originating from the main population as recently as 2005. Cruzan Gardens, a botanical garden and nursery located near the center of the main population, may be acting as a hub for dispersal to other parts of St. Croix by *P. pubens* colonies living in potted plants.

Currently, *P. pubens* appears to be principally a house and garden pest on St. Croix. However, when occurring at extremely high densities, this species has the potential be a significant agricultural pest by enhancing populations of the phloem-feeding Hemiptera it tends. Hemiptera cause crop damage both through sapping plants of nutrients and by increasing the occurrence of diseases, including viral and fungal infections. In addition to its negative impact on arboreal-foraging ants, *P. pubens* may also have negative impacts on other animals, both invertebrates and small vertebrates.

Native Versus Exotic Range

Marlatt (1928) wrote that *P. pubens* "is believed to be a native of Brazil, but now occurs quite abundantly in Cuba and other West Indian Islands." Records of *P. pubens* from South and Central America often come from nature preserves. For example, Leponce et al. (2004) and Theunis et al. (2005) recorded *P. pubens* in Rio Pilcomayo National Park, Argentina. Fisher et al. (1990) and Fisher (1992) reported *P. pubens* inhabiting myrmecophytic orchids in Barro Colorado National Monument, Panama.

TABLE 2. NUMBER OF TREES WITH DIFFERENT EXOTIC AND NATIVE ANT SPECIES PRESENT AT 12 SITES (10 TREES PER SITE) WITH *PARATRECHINA PUBENS* NOT PRESENT, IN ORDER OF COLLECTION DATE.

	Sites												
Exotic species	C	F	G	H	L	O	R	S	U	V	W	X	Total
Paratrechina longicornis	2	1	—	—	9	—	—	—	—	—	—	—	12
Solenopsis geminata	2	—	1	3	—	—	1	2	—	—	—	—	9
Solenopsis invicta	—	5	—	—	—	—	—	—	—	—	—	—	5
Monomorium floricola	—	—	—	2	—	1	—	4	—	—	—	1	8
Tapinoma melanocephalum	1	2	—	—	—	—	—	—	—	—	—	—	3
Native species													
Monomorium ebeninum	2	—	8	—	—	—	3	3	—	1	—	8	25
Solenopsis corticalis	—	—	1	2	—	1	—	2	3	—	—	—	9
Linepithema iniquum	—	—	—	1	1	—	—	—	—	—	—	—	2
Pheidole moerens	1	—	—	—	—	—	—	—	—	—	—	—	1
Brachymyrmex heeri	—	—	—	—	—	—	—	—	—	1	—	—	1

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This pattern suggests that *P. pubens* is native to South and Central America. Unfortunately, the taxonomic status of *P. pubens* and other closely related forms remains uncertain, and records of *P. pubens* from South and Central America could represent a different species.

In the West Indies and Florida, *P. pubens* has been reported primarily in open, disturbed areas, a habitat preference often indicative of exotic species. For example, Smith (in Forel 1893) collected *P. pubens* from 5 locales on the island of St. Vincent, four at the seashore and 1 in a sugar cane field, writing that this ant "appears to be confined to the seashore, or to open land not far from the sea." Klotz et al. (1995) listed 3 records from Florida: in a Boca Raton home, in a Miami hospital, and in a commercial building near Homestead. Deyrup et al. (2000) reported that *P. pubens* "is abundant on the campus of the University of Miami . . . foraging on sidewalks and running up and down tree trunks."

Warner and Scheffrahn (2004) recently proposed the common name "Caribbean crazy ant" for *P. pubens*, but this name is misleading and inappropriate because *P. pubens* appears to be exotic to the Caribbean islands. Therefore, we prefer the common name used by Wetterer (2007), "hairy crazy ant," based on its Latin name *pubens* which means pubescent, i.e., covered with short soft hairs, a prominent characteristic of this species.

It will be interesting to track the progress of the *P. pubens* on St. Croix to see whether it continues to spread and becomes a major long-term economic and ecological pest. Alternatively, *P. pubens* may decline on St. Croix and become only a minor pest there, or disappear completely as happened in Bermuda.

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References Cited

Deyrup, M., L. Davis, and S. Cover. 2000. Exotic ants in Florida. Trans. American Entomol. Soc. 126: 293-326.

Fisher, B. L. 1992. Facultative ant association benefits a neotropical orchid. J. Trop. Ecol. 8: 109-114.

Fisher, B. L., L. da S. L. Sternberg, and D. Price. 1990. Variation in the use of orchid extrafloral nectar by ants. Oecologia 83: 263-266.

Fontenla, J. L. 1995. Un comentario sobre las "hormigas locas" (*Paratrechina*) cubanas, con énfasis en *P. fulva*. Cocuyo 2: 6-7.

Forel, A. 1893. Formicides de l'Antille St. Vincent, récoltées par Mons. H. H. Smith. Trans. Entomol. Soc. London 1893: 333-418.

Forel, A. 1912. Formicides néotropiques. Part VI. 5me sous-famille Camponotinae Forel. Mem. Soc. Entomol. Belgique 20: 59-92.

Klotz, J. H., J. R. Mangold, K. M. Vail, L. R. Davis, Jr., and R. S. Patterson. 1995. A survey of the urban pest ants (Hymenoptera: Formicidae) of peninsular Florida. Florida Entomol. 78: 109-118.

Leponce, M, L. Theunis, J. H. C. Delabie, and Y. Roisin. 2004. Scale dependence of diversity measures in a leaf-litter ant assemblage. Ecography 27: 253-267.

Marlatt, C. L. 1928. House ants, kinds and methods of control. Revised. USDA Farmers Bull. 740: 1-*12*.

Miller, S. E. 1994. Dispersal of plant pests into the Virgin Islands. Florida Entomol. 77: 520-521.

Theunis, L., M. Gilbert, Y. Roisin, and M. Leponce. 2005. Spatial structure of litter-dwelling ant distribution in a subtropical dry forest. Insect. Soc. 52: 366-377.

Torres, J. A., and R. R. Snelling. 1997. Biogeography of Puerto Rican ants: a non-equilibrium case. Biodivers. Conserv. 6: 1103-1121.

Trager, J. C. 1984. A revision of the genus *Paratrechina* (Hymenoptera: Formicidae) of the continental United States. Sociobiol. 9: 49-162.

Warner, J., and R. H. Scheffrahn. 2004. Caribbean crazy ant, *Paratrechina pubens* Forel. UF/IFAS Featured Creatures. EENY-284. http://creatures.ifas.ufl.edu/urban/ants/caribbean.crazy.ant.htm.

Wetterer, J. K. 2006. The vanished plague ants (Hymenoptera: Formicidae) of 19th century Bermuda. Myrmecol. Nachr. 8: 219-224.

Wetterer, J. K. 2007. *Paratrechina pubens* (Forel, 1893) (Hymenoptera: Formicidae), a candidate for the plague ant of 19th century Bermuda. Myrmecol. Nachr. 10: 39-40.

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