INTRASPECIFIC AGGRESSION IN THE BROWN ROVER ANT, *BRACHYMYRMEX OBSCURIOR*

By

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ABSTRACT

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Invasive ant species often show unicoloniality, forming networks of connected colonies (i.e. supercolonies), which may extend hundreds or even thousands of kilometers. These "supercolonies" lack intraspecific aggression, thus fighting between colonies is absent. Unicoloniality may be an adaptive mechanism that allows for invasive ant species to reach higher population density and achieve ecological dominance. We used aggression assays to study unicoloniality within and between colonies of the invasive brown rover ant, *Brachymyrmex obscurior* on the Florida Atlantic University campus in Jupiter, FL. We found that the four *B. obscurior* colonies could be behaviorally divided into two areas: workers from both colonies in either region never showed intraspecific aggression while workers from colonies in opposing areas always showed intraspecific aggression, often fighting to the death. Thus, *B. obscurior* appears to show very localized unicoloniality, with neighboring colonies forming small supercolonies.

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Introduction

Invasive species, primarily introduced through commerce, are responsible for increased ecological damage and economic cost in the United States (OTA 1993, Jenkins 1996). Ants are among the most widespread and harmful of all invasive species, damaging agricultural systems, natural communities, and large geographical areas while incurring large control costs (Holway *et al* 2008). For example, the imported red fire ant (*Solenopsis invicta*) preys upon poultry chicks, lizards, snakes, groundnesting birds (Vinson 1994), swallows and northern bobwhite quail (Allen *et al* 1995). The United States spends an estimated $1 billion annually due to losses, damages and control costs suffered by *S. invicta* (Pimentel 2000).

Invasive ants form expansive groups of interconnected colonies called "supercolonies," which lack intraspecific aggression, thus fighting between colonies is absent (Wetterer & Wetterer 2006). Unicoloniality reduces the costs of territoriality and may be an adaptive mechanism that allows for invasive ant species to reach higher population density and achieve ecological dominance (Holway *et al* 1998). Native colonies of the Argentine ant (*Linepithema humile*) are single-queen colonies that span for hundreds of meters; in non-native areas, the multi-queen colonies may spread for thousands of kilometers (Giraud 2002). Invasive ants exhibiting relaxed intraspecific aggression, and removed from natural predators and parasites, may exterminate or outcompete native species (McGlynn 1999), skewing the native species' density. On Christmas Island, the long-legged ant (*Anoplolepsis gracilipes*) is devastating the red land crab (*Gecarcoidea natalis*) population, which is essential to litter breakdown and rainforest composition. *Anoplolepsis gracilipes* also hinders the reproduction of

arthropods, reptiles, birds and mammals through prey or interference and threatens populations of endangered animals such as the Abbott's booby (*Sula abbotti*), which is exclusive to the Christmas Islands (Lowe 2000).

The brown rover ant (*Brachymyrmex obscurior*) is an invasive neotropical ant species that has spread throughout the West Indies and had been introduced to the southeast United States and spread out through other areas, from Hawaii (Wheeler 1934) and Bermuda (Wheeler 1906), to Colombia (Kempf 1972) and New Caledonia (Delsinne et al 2001). In some areas, *B. obscurior* nests on the floor of wooded areas (Tschinkel & Hess 1999); in others, *B. obscurior* inhabits disturbed areas, e.g. sidewalks, buildings, etc (Ipser *et al* 2005). Little has been studied about the intraspecific and interspecific relationships of *B. obscurior*, perhaps due to the common misidentification of *B. obscurior* under the species *Paratrechina* (Wetterer and Wetterer 2004) or under *Brachymyrmex* genera *cordemoyi* and *patagonicus* (J.K. Wetterer, unpublished; MacGown et al 2007.) However, Morrison 2002 highlighted interspecific competition and coexistence among *B. obscurior*, the land hermit crab (*Coenobita clypeatus*), and the pyramid ant (*Dorymyrmex pyramicus*) in the Bahamas. On Bermuda, *B. obscurior* is the second most common ant species and it often coexists with dense populations of major invasive pest ants *L. humile* and *Pheidole megacephala* (Wetterer and Wetterer 2004).

To test for unicoloniality in *Brachymyrmex obscurior*, Dr. James Wetterer and I collected worker ants from four *B. obscurior* colonies from the Florida Atlantic University campus in Jupiter, FL, two colonies from the north and northeast sections of the campus. We then used aggression assays between same-site workers and mixed-site workers to test for intraspecific aggression within and between colonies of *B. obscurior*.

Methods

Collecting Ant Specimen

We collected *Brachymyrmex obscurior* workers from colonies underneath two concrete cigarette receptacles on the northwest side of the campus (colonies 1 & 2) and at two scrub oak trees (colonies 3 & 4) on the north side of the campus (Fig. 1). The distance between colonies is as follows: 1-2 (~32 m), 1-3 (~182 m), 1-4 (189 m), 2-3 (~164 m), 2-4 (~172m), and 3-4 (~9 m).

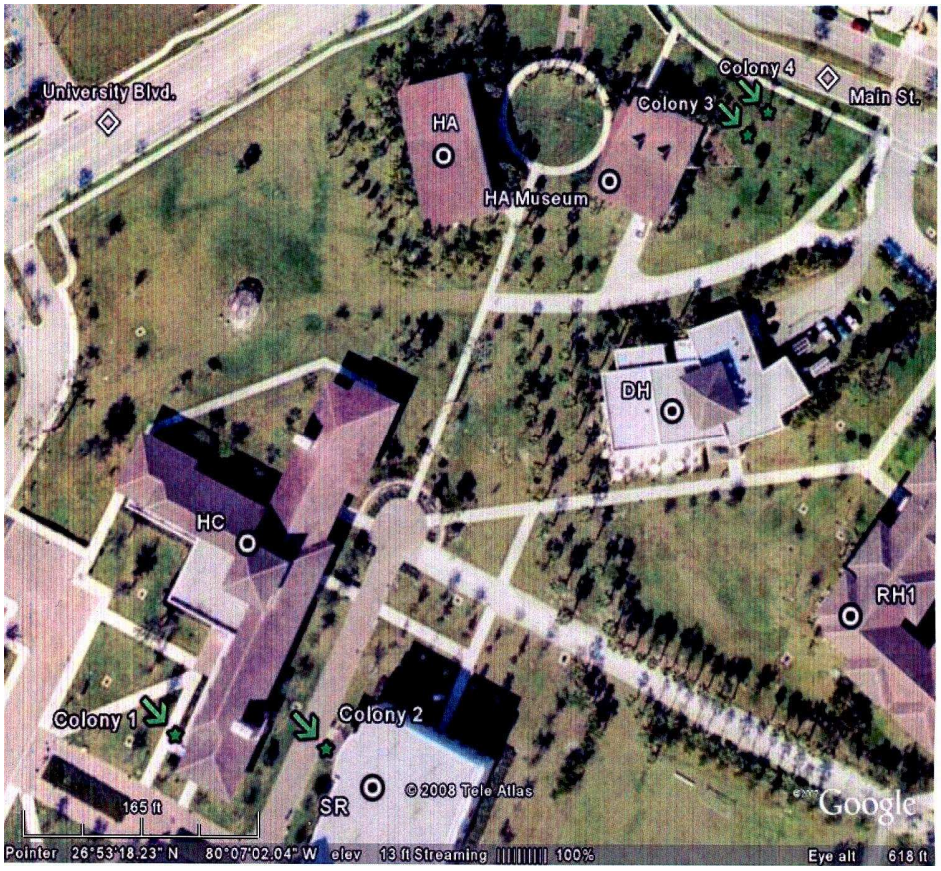

Figure 1. Colonies found in the northern section of FAU campus, Jupiter, FL. Photo courtesy of *Google Earth*.

Aggression Assays

JW placed three workers from one colony into a capped 9-dram styrene vial with three workers from either a new colony or from the same colony, and then inserted a damp sponge to maintain a humid environment. To eliminate observer bias, WR did not know the origin(s) of the workers in any vial.

WR watched six vials per 30-minute trial and rated the ants' behavior on an aggression scale described by Holway *et al* (1998) and Wetterer (2006): 0= no apparent worker interaction, 1= anntenation between workers, 2= contact between ants, resulting in the retreat of one or more workers, 3= brief aggression between workers (biting, lunging), 4= prolonged aggression between workers, resulting in the death of one or both workers. We considered behaviors marked 2 or lower to be nonaggressive and behaviors marked 3 or higher to be aggressive. We performed two replicates of each possible combination, after which, we discarded workers from mixed trials and preserved same-site workers in ethanol.

Results

We found that the four *Brachymyrmex obscurior* colonies could be divided behaviorally into two groups: area A (colonies 1 & 2) and area B (colonies 3 & 4). Workers from within the same colony and workers from colonies in the same area showed no intraspecific aggression marked higher than level 2. Workers from colonies in opposing areas (1 & 3, 2 & 4, 1 & 4, and 2 & 3) always showed intraspecific aggression, often fighting to the death. Thus, *Brachymyrmex obscurior* workers appear to show localized unicoloniality with neighboring colonies (1 & 2 and 3 & 4) forming small supercolonies.

Discussion

The presence of unicoloniality acknowledges *B. obscurior* to be a potential invasive concern: *B. obscurior* is a tramp ant, or species that lives largely within areas of human disturbance, so the distribution of *B. obscurior* may expand with increased construction. However, it is beyond the scope of this research to predict if *B. obscurior* will become a major invasive species in South Florida, as *Linepithema humile* or *Solenopsis invicta* are in their respective areas. In addition to unicoloniality, phylogenetic and morphological diversity, foraging mechanisms and opportunity are important factors involved in successful ant invasions (Holway 2002). Further aggression assays of *B. obscurior* colonies in the area are needed to evaluate the extent of the supercolonies, as well as the construction of density maps to establish the presence and prevalence of the species.

The growth in populations of invasive species through unicoloniality threatens ecological communities and agricultural systems. Ants fulfill multiple roles in the ecosystem—scavenger, herbivore, detritivore, granivore, etc. (Holway 2002)—so the expulsion of native ants by invasive species with different foraging methods can alter the ecological niche filled by the native species, disrupting the maintenance and development of natural communities. Native ants act as agents of soil turnover, nutrient redistribution, and small-scale disturbance (Folgarait 1998), as well as predators of destructive agricultural pests, whereas invasive species such as, the crazy ant (*Anoplolepsis gracilipes*), may protect insects that damage ecological structures (Lowe 2000). The presence of the little fire ant (*Wasmannia auropunctata*) in Brazilian cocoa fields resulted in a four-fold population increase in mealybugs (*Planococcus citri*), a herbivorous

agricultural pest (De Souza et al 1998). Furthermore, the expulsion of native ants by invasive species may rob ecologists of the opportunity to study kin selection, reproductive skews, levels of selection, foraging behavior, and self-organization (Holway 2002) in native ant species.

Many invasive ant species go unnoticed until the threat can no longer be controlled. In ecology, there is a need for more ant surveys and origin mapping, geographic distribution studies of potential invaders, unicoloniality studies, including species-specific studies, and for studies that identify the possible social and/or genetic mechanisms that allow for unicoloniality in ant species. From there, ecologists can build species and site-specific invasion models that may allow for the prediction and control of burgeoning invasive species. These efforts, combined with stricter trade regulations and more thorough examinations and screenings of imported goods, may reduce the ecological, agricultural and residential costs incurred by the overabundance of exotic species.

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