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SPREAD IN TRINIDAD OF THE SOUTH AMERICAN FIRE ANT *SOLENOPSIS INVICTA* (HYMENOPTERA, FORMICIDAE)

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ABSTRACT

Solenopsis invicta, a fire ant originally from the grasslands of South America, has become an important exotic pest in the USA, East Asia, and elsewhere. This species arrived by ship in Mobile, Alabama in the 1930s and has since spread across much of the southern USA. Beginning in 1981, *S. invicta* has been reported from a growing number of West Indian islands, including Puerto Rico (1981), the Virgin Islands (1988), the Bahamas (1993), Antigua (2000), Caicos Islands (2001), Anguilla (2006), St Martin (2006), Barbuda (2007), Montserrat (2007), Nevis (2007), St Kitts (2007), Aruba (2007), and Jamaica (2010). In the present study, we examined the status of *S. invicta* on the island of Trinidad.

Although the first published record of *S. invicta* in Trinidad dates to 2000, we have reliable records of this species from sugarcane and rice growing areas of west-central Trinidad dating to 1991 and specimens collected in 1993. In 2003-2004, we surveyed ants at sites all over Trinidad to document the distribution of *S. invicta* and its congener, *Solenopsis geminata*. We collected *S. invicta* at 60 sites, all in west-central Trinidad. In contrast, we collected *Solenopsis geminata* at 158 sites spread across all 7 counties of Trinidad. The highest densities *S. invicta* populations occurred in County Caroni, with scattered populations extending into disturbed areas of County St. George to the north and east, and County Victoria to the south. As of 2004, *S. invicta* occupied ~10% of the island, but we see no reason why this species will not spread throughout most open, disturbed sites in Trinidad, displacing *S. geminata* as the dominant fire ant on the island.

Key Words: biological invasion, exotic species, invasive species

RESUMEN

Solenopsis invicta, una hormiga de fuego originaria de las praderas de América del Sur, se ha convertido en una importante plaga exótica en los EEUU, el este de Asia y otros lugares. Esta especie llegó en barco en Mobile, Alabama, en la década de 1930 y se ha extendido en gran parte del sur de EE.UU. A partir de 1981, *S. invicta* se ha informado de un número cada vez mayor de las islas de las Indias Occidentales, incluyendo Puerto Rico (1981), las Islas Vírgenes (1988), Bahamas (1993), Antigua (2000), Islas Caicos (2001), Anguilla (2006), San Martin (2006), Barbuda (2007), Montserrat (2007), Nieves (2007), San Cristóbal (2007), Aruba (2007) y Jamaica (2010). En el presente estudio , hemos examinado el estado de *S. invicta* en la isla de Trinidad. Aunque el primer registro publicado de *S. invicta* en Trinidad se remonta a 2000, tenemos registros confiables de esta especie en caña de azúcar y arroz áreas de Trinidad el centro-oeste que datan de 1991 y las muestras recogidas en 1993 en crecimiento. En el período 2003-2004, encuestamos a las hormigas en los sitios de todo Trinidad para documentar la distribución de *S. invicta* y su congénere, *Solenopsis geminata*. Recogimos *S. invicta* en 60 sitios, todos en Trinidad el centro-oeste . Por el contrario, hemos recogido *Solenopsis geminata* en 158 sitios repartidos en los siete condados de Trinidad. Las mayores densidades poblaciones de *S. invicta* ocurrieron en el condado de Caroni, con poblaciones dispersas extendiéndose en zonas perturbadas del Condado de St. George al norte y al este, y el condado de Victoria al sur. A partir de 2004, *S. invicta* ocupado ~10% de la isla, pero no vemos ninguna razón por la que esta especie no se extenderán a lo largo de más abiertos , perturbado sitios en Trinidad, desplazando a *S. geminata* como la hormiga de fuego dominante en la isla.

Palabras Clave: invasión biológica, especies exóticas, especies invasoras

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Solenopsis invicta, a fire ant originally from the grasslands of South America, has become an important exotic pest in the US, East Asia, and elsewhere (Ascunce et al. 2011; Wetterer 2013). *Solenopsis*

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invicta is well known for its powerful sting, which in humans causes a burning sensation, usually followed within one or two days by the appearance of a white pustule. The venom is hemolytic and neurotoxic and can cause severe allergic responses. Stings can result in secondary infections, sepsis, anaphylactic shock, and even death (Prahlow & Barnard 1998; de Shazo et al. 2004). *Solenopsis invicta* also poses a significant threat to wildlife (Allen et al. 2004). For example, *S. invicta* attacks and kills hatchling sea turtles in Florida (Allen et al. 2001; Parris et al. 2002; Krahe 2005).

Solenopsis invicta arrived in North America by ship to Mobile, Alabama in the 1930s. It has spread across the southern US, particularly in open, disturbed areas, causing ecological and economic damage (Buren et al. 1974; Apperson & Adams 1983; Callcott & Collins 1996). The earliest known records of *S. invicta* in the West Indies are from Puerto Rico (1981) and the Virgin Islands (1988), where *S. invicta* is now widespread (Buren 1982; Davis et al. 2001; Wetterer & Snelling 2006). More recently, *S. invicta* has been reported from other islands in the West Indies, including the Bahamas (1993), Trinidad (2000), Antigua (2000), the Caicos Islands (2001), Anguilla (2006), St Martin (2006), Barbuda (2007), Montserrat (2007), Nevis (2007), St Kitts (2007), Aruba (2007), and Jamaica (2010) (Davis et al. 2001; Wetterer & Snelling 2006; Wetterer & Davis 2010; Wetterer 2013).

Davis et al. (2001) reported the only published site record of *S. invicta* from Trinidad: Caroni Bird Sanctuary in northern County Caroni (labeled "D" in Fig. 1). In the present study, we report earlier unpublished records of *S. invicta* from Trinidad, and we collected ants from sites throughout Trinidad to delimit the spread of *S. invicta*.

Materials and Methods

GLW has spent much time working in the field in Trinidad and was stung by a wide variety of ants, but prior to 1991, he did not encounter *S. invicta*. Beginning in 1991, GLW recorded *S. in-*

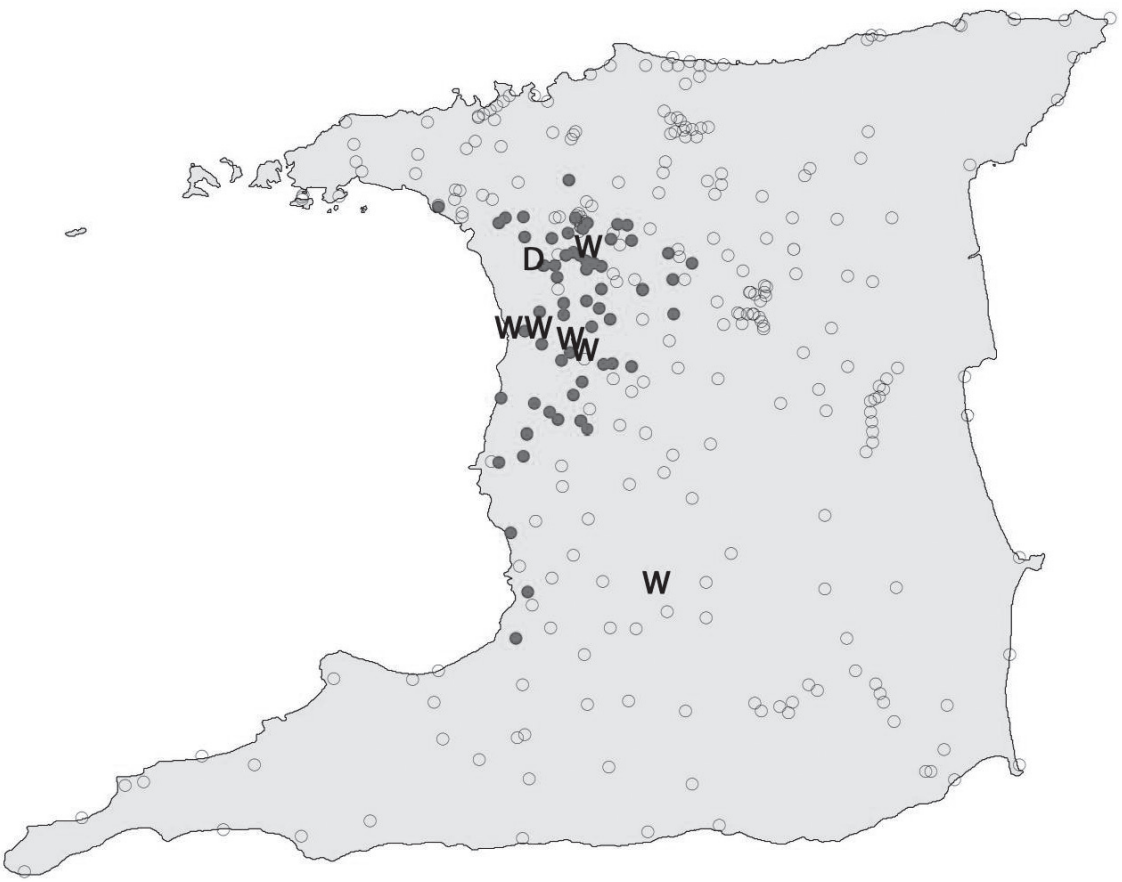


Fig. 1. Records of *Solenopsis invicta* in Trinidad. D = recorded by Davis et al. (2001). W = recorded by GLW (see text). Filled circles = recorded by JKW. Open circles = sites surveyed by JKW without *S. invicta* recorded.

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victa in sugarcane and rice growing areas of west-central Trinidad.

In 2003-2004, JKW surveyed ants at sites throughout Trinidad using several different methods. At most sites, JKW conducted visual surveys, collecting all ants encountered until finding at least 6 fire ant specimens (*S. invicta* and/or *S. geminata*). To maximize chances of detecting *S. invicta*, JKW sampled extensively in preferred habitat of *S. invicta*, i.e., open weedy areas, urban areas, and sugarcane fields. At a subset of sites, JKW conducted much more extensive ant collections, through visual collecting and sifting soil and leaf litter. JKW started sampling for fire ants at Caroni Bird Sanctuary, where Davis et al. (2001) had found *S. invicta*. Working outward from there, at roughly 1 km intervals, JKW found that the area infested with *S. invicta* was too extensive to continue this level of sampling. Instead, sampling sites were typically spaced 3-6 km apart in areas surrounding all sites where *S. invicta* was found. In other parts of the island, distant from any sites with *S. invicta*, JKW sampled at larger intervals, typically 6-12 km. At many sites, JKW interviewed local people in areas infested with *S. invicta* to try to gauge its social impact. JKW did not sample in several regions not accessible by paved road, e.g., the interior of the Caroni Swamp and the Nariva Swamp, some mountainous areas, and restricted military and industrial sites.

LRD identified all *Solenopsis* specimens in this study. We have deposited voucher specimens at Harvard University's Museum of Comparative Zoology and at Florida Atlantic University.

Results

Beginning in 1991, GLW found *S. invicta* in several locales (labeled "W" in Fig. 1), including La Gloria, Waterloo, Todd's Road, and the Caroni Rice Project, but the earliest specimens were apparently destroyed when air-conditioning failed in the entomology collection at the University of the West Indies. GLW and C. Starr collected the

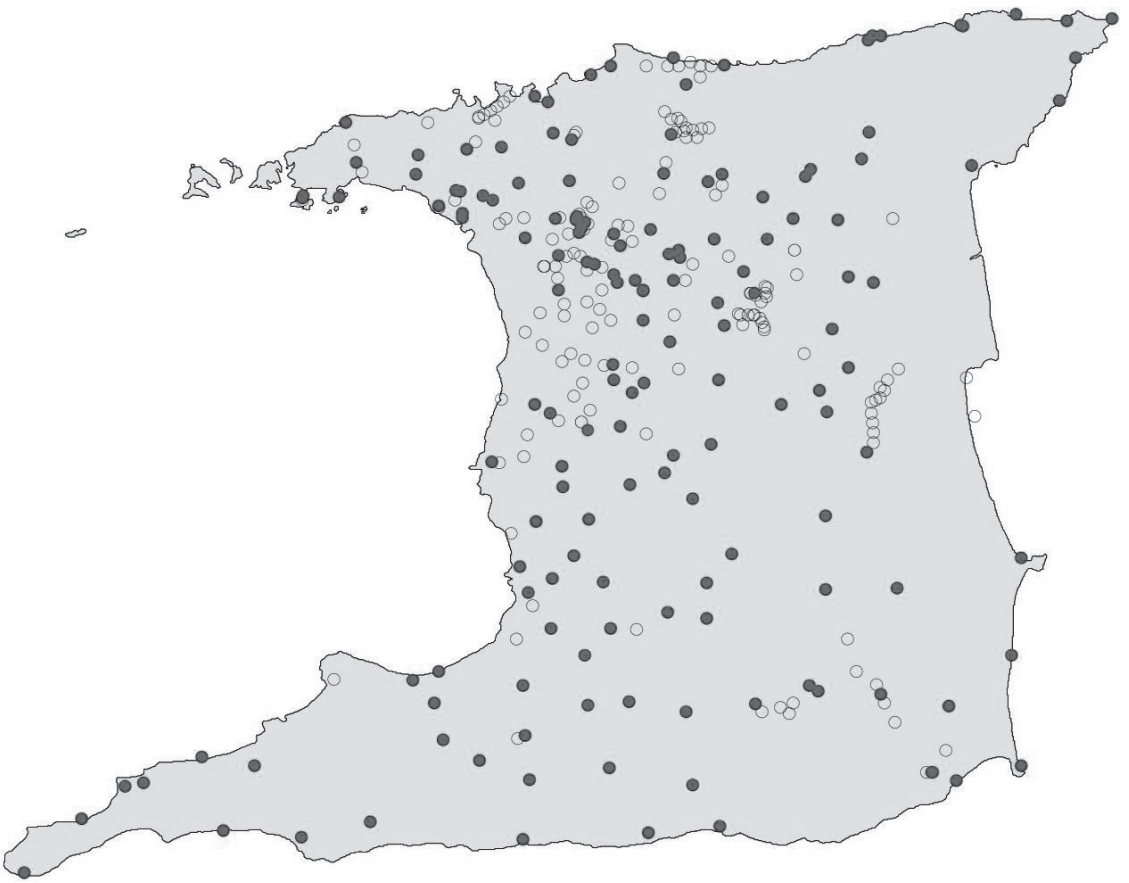


Fig. 2. Records of *Solenopsis geminata* in Trinidad. Filled circles = recorded by JKW. Open circles = sites surveyed by JKW without *S. geminata* recorded.

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earliest extant *S. invicta* specimens from Trinidad in Carapichaima on 2 Nov 1993.

JKW collected *S. invicta* from 60 sites, centering on County Caroni in west-central Trinidad, with a range extending ~40 km from north to south and ~20 km from west to east (Fig. 1). In the northwest, the range of *S. invicta* extended into Port of Spain and its suburbs in County St. George. We found *S. invicta* as far south as Duncan in County Victoria and as far east as the Santa Rosa racetrack in Arima, County St. George. We found *S. invicta* in particularly high densities in northern County Caroni. JKW recorded *Solenopsis geminata* from 158 sites across all seven counties of Trinidad (Fig. 2).

Everyone we spoke with in areas heavily infested with *S. invicta* knew the white pustules diagnostic of *S. invicta* stings. Many people (e.g., boat tenders at Caroni Bird Sanctuary) showed off scars on their bare feet and ankles from repeated stings and pointed out large colonies of *S. invicta*, which they studiously avoided.

Discussion

In 2003-2004, we found *S. invicta* restricted to an area in west-central Trinidad occupying about 10% of the island, including most of County Caroni and parts of County St. George to the north and east, and County Victoria to the south (Fig. 1). This area includes much of the traditional "sugar belt" of Trinidad (Pemberton 1990). We see no reason why *S. invicta* will not invade most open, disturbed sites throughout Trinidad, displacing *S. geminata* as the dominant fire ant on the island. The present study can serve as a baseline for documenting the spread of *S. invicta* in Trinidad.

Whereas *S. invicta* is widespread in Puerto Rico, the Virgin Islands, and the northern Lesser Antilles (see Davis et al. 2001; Wetterer & Snelling 2006; Wetterer & Davis 2010; Wetterer 2013), this species has not yet been recorded from any of the intervening islands north of Trinidad, i.e., Guadeloupe, Marie Galante, Dominica, Martinique, St. Lucia, St. Vincent, Grenada, and Barbados, and Tobago. Nor has *S. invicta* been recorded from Venezuela immediately to the south and west of Trinidad. It is probably only a matter of time before these areas are also invaded.

Although *S. invicta* is originally from the grasslands of South America, we suspect that they came to Trinidad from the southeastern US, as appears to be true for other exotic populations in California, Asia, and Australia (Ascunce et al. 2011). It would be useful to use genetic information from *S. invicta* specimens to evaluate the origin of this infestation in Trinidad and other populations in the West Indies. Future surveys of ants and other invertebrates in neighboring areas with and without *S. invicta* will allow an evaluation of the ant's ecological impact.

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