



## RESEARCH ARTICLE - ANTS

## Geographic Spread of *Solenopsis globularia* (Hymenoptera, Formicidae)

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### Abstract

Several species of *Solenopsis* have spread beyond their native ranges and have become exotic pests, most notably *Solenopsis geminata* (Fabricius) and *Solenopsis invicta* Buren. Here, I examine the geographic spread of a smaller, less conspicuous *Solenopsis* species, *Solenopsis globularia* (Smith). I compiled *S. globularia* specimen records from >700 sites. I documented the earliest known *S. globularia* records for 59 geographic areas (countries, US states, and major West Indian islands), including the following with no published records: Anguilla, Antigua, Aruba, Barbuda, Bonaire, British Virgin Islands, Congo, Curaçao, Dominica, Martinique, Montserrat, Nevis, St Kitts, St Martin, San Andrés Island, Senegal, Tobago, and Trinidad. *Solenopsis globularia* has a broad distribution in the New World, from Corrientes, Argentina (28.4°S) in the south to Craven County, North Carolina (35.1°N) in the north. Most *S. globularia* records come from islands. *S. globularia* may be invasive in some of its New World range, such as the Galapagos Islands. All populations of *S. globularia* outside the New World are probably exotic, introduced through human commerce, including populations on Atlantic islands (Ascension, Cabo Verde, St Helena), Pacific islands (Hawaii, French Polynesia, Philippines), and Africa (Congo, Ivory Coast, Senegal). On the Cabo Verde islands, off the coast of West Africa, *S. globularia* is widespread on all nine inhabited islands. Records from nine diverse sites in Ivory Coast indicates that *S. globularia* is well able to spread in continental Africa as well.

### Introduction

Several species of *Solenopsis* have spread from their native ranges and have become exotic pests, most notably *Solenopsis geminata* (Fabricius) and *Solenopsis invicta* Buren, two Neotropical species that have spread broadly to sites around the world (Wetterer, 2011, 2013). Here, I examine the geographic spread of a smaller, less conspicuous Neotropical *Solenopsis* species that has spread to diverse areas outside its native range: *Solenopsis globularia* (Smith).

The genus *Solenopsis* is often informally divided into two groups: “fire ants” and “thief ants.” Fire ants are relatively large, highly polymorphic, and with a potent sting (e.g., *S. geminata* and *S. invicta*). Thief ants are usually small, monomorphic, and not known to sting humans (e.g., *Solenopsis molesta* Buren). *Solenopsis globularia* falls between these two categories; it is intermediate in size, mildly polymorphic, and not known to sting humans.

The taxonomy of the genus *Solenopsis* has long been in disarray and most researchers do not even attempt to identify small *Solenopsis* specimens to species level. *Solenopsis globularia*, however, has distinctive morphology, allowing reliable positive identification.

### Taxonomy and identification

Smith (1858) described *Myrmica globularia* (= *S. globularia*) from Brazil. The name *globularia* no doubt refers to its large “globular” post-petiole, one primary identifying feature. Many other sub-specific taxa of *S. globularia* were subsequently described, based primarily on color (see Creighton 1950), but researchers disagree over how to distinguish among these taxa. Some authors simply identify specimens as *S. globularia* (s.l.) (Morrison 1998), *Solenopsis* cf. *globularia* (Wetterer, 2011), or as belonging to the *S. globularia* complex (Jacobs et al., 2011).



Pacheco and Mackay (2013) recently simplified the taxonomy of the *globularia* complex, synonymizing most subspecies. Junior synonyms of *S. globularia* now include: *S. globularia borinquenensis* Wheeler, *S. globularia cubaensis* Wheeler, *S. globularia littoralis* Creighton, *S. globularia lucayensis curta* Forel, *S. globularia mobilensis* Smith, *S. globularia pacifica* Wheeler, *S. globularia pacifica rubida* Wheeler, and *S. globularia steinheili* Forel.

Pacheco and Mackay (2013) raised to species level two members of the *S. globularia* complex: the darker-colored *Solenopsis desecheoensis* Mann known only from two specimens collected on Desecheo Island (an uninhabited islet west of Puerto Rico) and the lighter-colored *Solenopsis lucayensis* Wheeler, known only from Nicholl's Town, Bahamas. Pacheco and Mackay (2013) left open the possibility further collections will indicate that both *S. desecheoensis* and *S. lucayensis* are also junior synonyms of *S. globularia*. Unfortunately, collecting more specimens of *S. desecheoensis* may be difficult because the island was used as a bombing range until 1952 and is now closed to the public because of the danger of unexploded ordnance. Pacheco and Mackay (2013) placed one additional species in the *S. globularia* complex: *Solenopsis bucki* Kempf, known only from a single specimen collected in Erechim, Rio Grande do Sul, Brazil. Pacheco and Mackay (2013) wrote: "*Solenopsis bucki* is easily separated by having a mandible with only three teeth that is elongate and nearly straight, while *S. globularia* has a mandible with four teeth on the masticatory border."

Pacheco and Mackay (2013) concluded that a combination of two characters was diagnostic of the *S. globularia* complex: postpetiole more than half as wide as the gaster and eyes of workers with at least 12 ommatidia. *Solenopsis loreтана* Santschi, a species known from Argentina and Paraguay, has a similarly broad postpetiole, but it has much smaller eyes. Pacheco and Mackay (2013) wrote: "*Solenopsis loreтана* is easily differentiated from *S. globularia* as it has a small eye with only 3-5 ommatidia; *S. globularia* nearly always has 15-25 ommatidia." Counting ommatidia under a dissecting scope can be difficult, but counting them from well-focused microphotographs is much easier. From photographs of *S. globularia* posted on-line at AntWeb, I counted only 11-13 ommatidia on most specimens, including types. Still, this eye size is much larger than that of most other small *Solenopsis* species.

## Methods

Using published and unpublished records, I documented the range of *S. globularia*. I obtained unpublished site records from museum specimens in the collections of the Museum of Comparative Zoology (MCZ) and the US National Museum of Natural History (USNM). In addition, I used on-line databases with collection information on specimens by AntWeb ([www.antweb.org](http://www.antweb.org)) and the Global Biodiversity Information Facility ([www.gbif.org](http://www.gbif.org)).

I obtained geo-coordinates for collection sites from published references, specimen labels, maps, or geography web sites (e.g., [earth.google.com](http://earth.google.com), [www.tageo.com](http://www.tageo.com), and [www.fallingrain.com](http://www.fallingrain.com)). If a site record listed a geographic region rather than a "point locale," and I had no other record for this region, I used the coordinates of the largest town within the region or, in the case of small islands and natural areas, the center of the region. Published records usually included collection dates. In a number of cases, publications did not include the collection dates for specimens, but I was able to determine the approximate date based on information on the collector's travel dates or limit the date by the collector's date of death. For example, Wheeler (1913) recorded specimens of *S. globularia cubaensis* collected by J. C. Gundlach (1810-1896) in Cuba that necessarily pre-dated Gundlach's death in 1896.

## Results

I collected *S. globularia* in Florida, El Salvador, Cabo Verde, and on 30 West Indian islands (Anguilla, Antigua, Aruba, Barbados, Barbuda, Bonaire, Buck Island, Culebra, Curaçao, Dominica, Grenada, Guadeloupe, Margarita, Marie Galante, Martinique, Montserrat, Nevis, Puerto Rico, St Croix, St Kitts, St John, St Lucia, St Martin, St Thomas, St Vincent, San Andrés, Tobago, Tortola, Trinidad, Vieques). My pinned *S. globularia* voucher specimens are deposited in the US National Museum of Natural History (USNM), my personal collection (JKWC), and the collection of John T. Longino (JTLC) (see Supplementary File).

I compiled *S. globularia* specimen records from >700 sites (Fig 1), and documented the earliest known *S. globularia* records for 59 geographic areas (countries, US states, and major West Indian islands; Tables 1-3), including the following with no published records: Anguilla, Antigua, Aruba, Barbuda, Bonaire, British Virgin Islands, Cabo Verde, Congo, Curaçao, Dominica, Martinique, Montserrat, Nevis, St Kitts, St Martin, San Andrés Island, Senegal, Tobago, and Trinidad (Tables 1-3).

Collingwood and Van Harten's (1993) report of *Solenopsis innota* from the Cabo Verde islands off the coast of West Africa, appears to be based on misidentification of *S. globularia*. Santschi (1915) described *Solenopsis geminata innota* Santschi from Gabon, Liberia, and Congo (Zaire), but it is now considered a junior synonym of *S. geminata* (Wheeler, 1922; Creighton, 1950; Trager, 1991). Collingwood and Van Harten (1993) compared the Cabo Verde specimens with *S. geminata* and *S. globularia* noting "the enlarged petiole and postpetiole link it with *S. globularia* of South America. It differs from both species by its small eyes." In 2003, I collected ants in Cabo Verde and found no *Solenopsis geminata*, which is very polymorphic. Instead, I found a *Solenopsis* species with an enlarged petiole and post-petiole at 83 sites across all nine inhabited islands (see Supplementary File). The hundreds of specimens I collected are only slightly polymorphic, and have the same range of body size and eye size as *S. globularia*. I conclude that Collingwood and Van



**Fig 1.** Geographic distribution of *Solenopsis globularia* records. Map created using carto.com.

Harten (1993) simply misidentified *S. globularia* in Cabo Verde as *S. innota*, apparently due to a misunderstanding about eye size.

Taylor (2015) presented photos of a specimen identified as *S. globularia* from Brazzaville, Republic of Congo, which is almost black, much like *S. desecheoensis*, and darker than any *S. globularia* specimens I have seen, including those from Cabo Verde and Ivory Coast.

**Table 1.** Earliest known continental records for *Solenopsis globularia* in the New World. Unpublished records include collector, source, and site.

South America	Earliest record
Brazil	≤1858 (Smith, 1858)
French Guiana	1868 (Radoszkowsky, 1884)
Colombia	≤1912 (Forel, 1912 as <i>S. globularia lucayensis curta</i> )
Surinam	1959 (Kempf, 1961)
Venezuela	1977-1978 (Lubin, 1985 as <i>S. globularia</i> group)
Paraguay	1993 (Pacheco & Mackay, 2013)
Argentina	2007-2008 (Calcaterra et al., 2010)
Ecuador	≤2015 (Reyes-Puig & Rios-Alvear, 2015)
Central America	
Costa Rica	≤1908 (Forel, 1908)
Nicaragua	≤1981 (van Huis, 1981)
Guatemala	2009 (J.T. Longino, AntWeb): 3.5km NW Morales
El Salvador	2012 (Wetterer et al., 2016)
North America	
Alabama	1926 (Creighton, 1930 as <i>S. globularia littoralis</i> )
Mississippi	1928 (Creighton, 1930 as <i>S. globularia littoralis</i> )
Mexico	1929 (Creighton, 1930 as <i>S. globularia littoralis</i> )
Florida	≤1933 (Smith, 1933 as <i>S. globularia littoralis</i> )
Georgia	≤1933 (Smith, 1933 as <i>S. globularia littoralis</i> )
South Carolina	≤1933 (Smith, 1933 as <i>S. globularia littoralis</i> )
Louisiana	≤1960 (Moser & Blum, 1960)
North Carolina	≤1962 (Carter, 1962 as <i>S. globularia littoralis</i> )
Arizona	1999 (K. Ross, pers. comm.): Portal

## Discussion

*Solenopsis globularia* has a broad geographic distribution in the New World, from Corrientes, Argentina (28.4°S; Calcaterra et al., 2010) in the south to Craven County, North Carolina (35.1°N; Guénard et al., 2012) in the north (Fig 1). *Solenopsis globularia* appears to be particularly common on islands. For example, *S. globularia* is known from almost every major Caribbean island (Table 2), except Jamaica. Surprisingly, there are no *S. globularia* records from Panama, Honduras, and Guyana.

*S. globularia* may be exotic to the Galapagos Islands. Although Pezzatti et al. (1998) wrote that *S. globularia* was “definitely native” in the Galapagos, Herrera (2015) classified *S. globularia* in the Galapagos as “Introduced, Questionable Native.” Remarkably, *S. globularia* has been reported from 30 different islands of the Galapagos (Herrera & Roque-Albedo, 2007).

All populations of *S. globularia* outside the New World are probably exotic, introduced through human commerce, including populations on Atlantic islands (Ascension, Cabo Verde, St Helena), Pacific islands (Hawaii, French Polynesia, Philippines), and Africa (Congo, Ivory Coast, Senegal). On the Cabo Verde islands, off the coast of West Africa, *S. globularia* is extremely widespread on all nine inhabited islands, primarily in gardens and in *Acacia* stands. The common habit of nesting in planted flower beds may facilitate its ability to colonize new areas, carried along in potted plants. Records from nine diverse sites in Ivory Coast (Kouakou et al., 2018; L.M.M. Kouakou pers. Comm.) indicates that *S. globularia* is well able to spread in continental Africa. In fact, *S. globularia* may already have an extensive but overlooked range in West Africa.

Due to taxonomic difficulties of identifying small *Solenopsis* species, published faunal inventories often include many *Solenopsis* species identified only to genus. For example, Jaffe and Latke (1994) listed eight *Solenopsis* species in their surveys of West Indian islands: *Solenopsis geminata*

plus seven unidentified species, one of which was almost certainly *S. globularia*. No doubt large numbers of *S. globularia* specimen records remain hidden in the long lists of unidentified *Solenopsis* species recorded in similar faunal studies, particularly from South and Central America. I expect that a perusal of unidentified *Solenopsis* specimens in many museums would yield more *S. globularia* records.

There has been little research on the ecology of *Solenopsis globularia*. *Solenopsis globularia* nests in soil and under rocks and logs, and is common on beaches (Pacheco & Mackay 2013). It is seldom found in dense forests (see Supplementary File). In many respects, *S. globularia* is more like a very small fire ant, than a somewhat large thief ant. Unlike most other small *Solenopsis* species, *S. globularia* is

**Table 2.** Earliest known records for *Solenopsis globularia* on islands of the West Indies and the Galapagos. + = no previously published records. MCZ = Museum of Comparative Zoology. USNM = US National Museum of Natural History.

	Earliest record
US Virgin Is.	1878 (Forel, 1881 as <i>S. steinheili</i> )
St Vincent	≤1893 (Forel, 1893)
Cuba	≤1896 (Wheeler, 1913 as <i>S. globularia cubaensis</i> )
Grenada	≤1897 (Forel, 1897)
Galapagos	1899 (Wheeler, 1919 as <i>S. globularia pacifica</i> )
Haiti	1901 (Wheeler & Mann, 1914)
Puerto Rico	1906 (Wheeler, 1908 as <i>S. globularia borinquenensis</i> )
St Lucia	1919 (J.C. Bradley, MCZ): Castries
Dominican Rep.	1928 (Menozzi & Russo, 1930 as <i>S. globularia borinquenensis</i> )
+Antigua	1936 (R.E. Blackwelder, USNM): no site
Isla de Aves	1966 (Pacheco & Mackay, 2013)
Bahamas	1991-1993 (Deyrup, 1994)
Barbados	1998 (Wetterer et al., 2016)
Guadeloupe	1999 (Galkowski, 2016)
+Tobago	2003 (J.K. Wetterer, USNM): Bon Accord
+Trinidad	2003 (J.K. Wetterer, USNM): St. Augustine
+Curaçao	2004 (J.K. Wetterer, USNM): Piscadera
+Bonaire	2004 (G. Van Hoorn, MCZ): Lima
+Dominica	2004 (J.K. Wetterer, USNM): Roseau
+British Virgin Is.	2005 (J.K. Wetterer, USNM): Brandy Wine Bay, Tortola
+Anguilla	2006 (J.K. Wetterer, USNM): Meads Bay
+St Martin	2006 (J.K. Wetterer, USNM): Baie Nettle
+Aruba	2007 (J.K. Wetterer, USNM): Mon Plaisir
+Barbuda	2007 (J.K. Wetterer, USNM): Rock Bay
+St Kitts	2007 (J.K. Wetterer, USNM): Basseterre
+Nevis	2007 (J.K. Wetterer, USNM): Charlestown
+Montserrat	2007 (J.K. Wetterer, USNM): Carrs Bay
+Martinique	2008 (J.K. Wetterer, USNM): Anse Turin
+San Andrés	2015 (J.K. Wetterer, USNM): San Andrés

often found foraging above ground; their comparatively large eyes seem well adapted for this habit. Also, unlike other small *Solenopsis* species, *S. globularia* is commonly collected at baited traps. Levins et al. (1973) anecdotally noted aggressive interactions between *Solenopsis globularia* and *Monomorium ebeninum* at baits. Although this species can be very common, there are few records of *S. globularia* as a pest species, e.g., as a pest inside hospitals (e.g., Bragança & Lima, 2010), perhaps nesting inside potted plants.

Genetic work is needed to determine whether *Solenopsis globularia*, as currently defined, is a single, highly variable species or if it is a species complex. If *Solenopsis globularia* is complex, finding consistent characters that define the boundaries among the species would be valuable.

**Table 3.** Earliest known records for *Solenopsis globularia* outside the New World. + = no previously published records.

Continental	Earliest record
+Congo	2007 (Taylor, 2015): Brazzaville
Ivory Coast	2014 (Kouakou et al. 2018)
+Senegal	2016 (K. Gomez; AntWeb KG03260): Dakar
Island	
Ascension Island	1958 (Duffey, 1964 as <i>S. globularia steinheili</i> )
St Helena	≤1976 (Taylor, 1976)
+Cabo Verde	≤1993 (Collingwood & Van Harten, 1993 as <i>S. innota</i> )
Hawaii	2005 (Wang, 2007)
French Polynesia	2006 (Ramage, 2014)
Philippines	2008 (MabutoI-Afidchao, 2013)

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