

Spread of a Non-Native, Millipede-Eating Ant, *Gnamptogenys triangularis* (Hymenoptera, Formicidae), in the Southeastern United States

Authors: Wang, Steven, Stoll, Aaron C., Richter, Heath J., Dandridge, Cloud, Perez, Ruthie A., et al.

Source: Transactions of the American Entomological Society, 147(3) : 819-825

Published By: The American Entomological Society

URL: <https://doi.org/10.3157/061.147.0303>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Spread of a non-native, millipede-eating ant, *Gnamptogenys triangularis* (Hymenoptera, Formicidae), in the southeastern United States

Steven Wang¹, Aaron C. Stoll², Heath J. Richter³, Cloud Dandridge⁴, Ruthie A. Perez⁵, James T. Doucet⁶, & James K. Wetterer^{7*}

1. Department of Entomology, Cornell University, Ithaca, NY 14850

2. 8406 Alekai Drive, Pensacola, Pensacola, FL 32526

3. 6594 Lubarrett Way South, Mobile, AL 36695

4. 109 Filson Bluff Drive, Irmo, SC 29063

5. Alabama Department of Environmental Management, Montgomery, AL 36110

6. Lake Charles, LA 70605

7. Wilkes Honors College, Florida Atlantic University, Jupiter, FL 33458

*corresponding author e-mail: wetterer@fau.edu

ABSTRACT

Gnamptogenys triangularis (Mayr) is a predatory ant that feeds primarily on millipedes. This species has an enormous native range in South and Central America that extends from subtropical Argentina (38.1°S) to tropical Costa Rica (10.4°N). The earliest known records of *G. triangularis* outside its native range were from Florida beginning in 1985, with subsequent published records from Alabama (1996–) and Mississippi (2002–). Here, we present new records of *G. triangularis* documenting further expansion of populations in the southeastern US, including first published site records from Texas (2013–), Louisiana (2019–), and South Carolina (2019–). In the southeastern US, *G. triangularis* occurs in a wide range of habitats, from relatively intact forest to highly disturbed urban sites. Its northernmost site records are from South Carolina (34.1°N), but based on its South American range, *G. triangularis* may have the potential to spread further north. *Gnamptogenys triangularis* readily consumes the greenhouse millipede, *Oxidus gracilis* (Koch), a cosmopolitan species originally from Asia, which is now very common in disturbed environments of the southeastern US, so potential prey for *G. triangularis* may be plentiful throughout this region.

INTRODUCTION

Gnamptogenys triangularis (Mayr) is a predatory ant that feeds primarily on millipedes (Lattke 1990, 1995). This species has an enormous native range in South and Central America that extends from subtropical Argentina (38.1°S) to tropical Costa Rica (10.4°N) (MacGown & Wetterer 2012). Records of *G. triangularis* come from nine countries in South America (all except Chile and Paraguay), and the two

southernmost countries of Central America (Panama and Costa Rica) (MacGown & Wetterer 2012).

Deyrup et al. (1989) reported *G. triangularis* from Florida, the earliest known record outside its native range. MacGown & Forster (2005) first recorded *G. triangularis* from Alabama. MacGown & Wetterer (2012) mapped the known distribution of *G. triangularis*, with site records from Florida, Alabama, and Mississippi. In a paper concerning *Gnamptogenys hartmani* (Wheeler), Wetterer (2014)

mentioned a record of *G. triangularis* from Texas based on a photo Steven Wang posted on Bugguide.net, but did not include the site information (see Results). MacGown et al. (2021) mapped additional *G. triangularis* site records in Mississippi based on material in the Mississippi Entomological Museum, but also did not include the collection information (see Results). Here, we present these and additional new records of *G. triangularis* in the southeastern US, including the first site records from Louisiana and South Carolina.

METHODS

Using published and unpublished records, we documented the known range of *G. triangularis* in the southeastern US. We obtained site records from on-line databases with specimen collection information on Antweb (www.antweb.org) and the Integrated Digitized Biocollections (www.idigbio.org), and from on-line photographs on BugGuide.net and iNaturalist.org.

In 2013–2021, we recorded *G. triangularis* in Texas (S. Wang), Mississippi (S. Wang), South Carolina (C. Dandridge), Louisiana (J.T. Doucet), Florida (A.C. Stoll), and Alabama (R.A. Perez, J.K. Wetterer).

Gnamptogenys triangularis and *G. hartmani* are the only two members of the subfamily Ectatomminae known to occur in the southeastern USA. These very distinctive ants can be recognized immediately by the deep horizontal grooves covering the entire head and body (Fig. 1). *Gnamptogenys triangularis* workers are 5.0mm in length and dark brown, while *G. hartmani* workers are 3.5–4.0mm and pale orange-brown. *Gnamptogenys triangularis* queens and males are also larger and darker than their *G. hartmani* counterparts.

RESULTS

In addition to the 12 records presented in MacGown & Wetterer (2012), we compiled and mapped the following 49 site records of *G. triangularis* in the US, listed below in chronological order by state, with geo-coordinates, date; collector/photographer, and source in parentheses (Fig. 2). ABS = Archbold Biological Station. MEM =

Mississippi Entomological Museum. TAMU = Texas A & M University collection. USNM = US National Museum of Natural History. HRPC = H.J. Richter personal collection. CDPC = C. Dandridge personal collection. SWPC = S. Wang personal collection. These include the first published site records of *G. triangularis* from Texas, Louisiana, and South Carolina. The previously published mention of *G. triangularis* from Texas (Wetterer 2014) was based on the 2013 record presented below. Camacho et al. (2020) listed *G. triangularis* as known from Florida, Alabama, Mississippi, and Texas, but included no site records or sources. MacGown et al. (2021) mapped most of the specimen-based Mississippi site records listed below.

Alabama

- Mobile Co., Muddy Creek Wetlands (30.518, -88.154; 4-May-14; H.J. Richter; MEM; antweb.org/specimen.do?code=mem214805) worker specimen; nest in rotting pine log.
- Monroe Co., Atmore (31.222, -87.472; 9-Jun-14; A. Van Hoogmoed; MEM; idigbio.org/portal/records/2322e457-afc2-4a28-a4de-5ff1265dcf21) queen specimen.
- Mobile Co., 6.5 miles S of Semmes (30.6797, -88.2486; 9-Jun-14; A. Van Hoogmoed; MEM; idigbio.org/portal/records/755703fb-197f-491f-aacd-c142eb4dafda) queen specimen.
- Mobile Co. (30.643, -88.069; 30-Jun-14; A. Van Hoogmoed; MEM; idigbio.org/portal/records/4afe2076-36ab-48b6-a014-04e12226b119) queen specimen.
- Mobile Co., Camp Grace (30.680, -88.305; Fall-14; H.J. Richter; HRPC) male specimen; on nature trail.
- Mobile Co., Calvert (31.147, -87.998; 1-Nov-14; H.J. Richter; HRPC) worker specimen; on sidewalk by office building.
- Tallapoosa Co., Dadeville (32.771, -85.728; 30-Jun-15; H.J. Richter; HRPC) queen specimen; under rotting plywood board below oak tree.
- Shelby Co., Calera (33.185, -86.767; 5-Aug-17; M. West; inaturalist.org/observations/7668734) male photo.
- Mobile Co., Grand Bay Savanna Preserve (30.421, -88.324; 11-Apr-19; H.J. Richter; HRPC;



Figure 1. *Gnamptogenys triangularis* workers subduing an *Oxidus gracilis* millipede in Pensacola, Florida (photo by A.C. Stoll).

- youtube.com/watch?v=z8OQDtPp3_4) worker specimens and video; several colonies in rotting logs; workers foraging in abandoned fire ant mound.
- Baldwin Co., Orange Beach (30.288, -87.572; 19-Jun-19; richardthecrittercatcher, inaturalist.org/observations/27290383) queen photo.
- Montgomery Co., Montgomery (32.387, -86.262; 6-Jul-19, 24-Apr-20, & 17-Jul-21; R.A. Perez; USNM) worker specimens and video; nest under sheet of plywood.
- Mobile Co., Mobile (30.618, -88.276; <16-Feb-21; H.J. Richter; HRPC; youtube.com/watch?v=AGNr7Ur3cQQ&t=1s) worker specimens and video; millipede remnants around colony entrance under board.
- Houston Co., Dothan (31.224, -85.397; 22-Jun-21; J.K. Wetterer; USNM) worker specimens; in leaf litter under shrubs planted within an urban parking lot.
- Shelby Co., Oak Mountain State Park (33.310, -86.756; 5-Jul-21 & 12-Aug-21; V. Charny; inaturalist.org/observations/85955140 & 90946147) male photo.

Florida

- Miami-Dade Co., Matheson Hammock Park (25.6743, -80.2712; 9-Dec-86; J. Umphrey; ABS; idigbio.org/portal/records/16685614-c5c6-4e33-baa9-f815068776e3) worker specimens.
- Marion Co., Dunnellon (29.019, -82.304; 1-Sep-07; M. Jones; ABS; idigbio.org/portal/records/eff5a7b0-451a-4b52-8b84-66782515f8e9) worker specimens.
- Escambia Co., Pensacola (30.443, -87.327; 21-Aug-18 & 1-Jun-21; A.C. Stoll; USNM; inaturalist.org/observations/85955140)

org/observations/20232369 & 81265342) worker photos and specimens.
 Orange Co., Lake Apopka North Shore (28.686, -81.5989; 1-Nov-20; J. Gammon; inaturalist.org/observations/64001148) queen photo.
 Santa Rosa Co., Gulf Breeze (30.375, -87.096; 5-Jul-21; M. Macy; inaturalist.org/observations/85858453) queen photo.
 Escambia Co., Pensacola; Big Lagoon State Park (30.319, -87.412; 3-Aug-21; A.C. Stoll; USNM; inaturalist.org/observations/89798965) queen photo.

Louisiana

Calcasieu Par. (30.15, -93.35; 5-Apr-19; J.T. Doucet; inaturalist.org/observations/22068435) worker photo.
 Calcasieu Par. (30.10, -93.23; 11-Apr-19; J.T. Doucet; inaturalist.org/observations/22384633) worker photo.
 Calcasieu Par. (30.06, -93.33; 22-Jun-19; J.T. Doucet; inaturalist.org/observations/27484715) worker photo.
 Calcasieu Par. (30.03, -93.30; 16-Jul-19; J.T. Doucet; inaturalist.org/observations/28954025) queen photo.
 Calcasieu Par. (30.04, -93.34; 1-Aug-19; J.T. Doucet; inaturalist.org/observations/29982054) queen photo.
 Calcasieu Par. (30.08, -93.33; 16-Aug-19; J.T. Doucet; inaturalist.org/observations/30938270) queen photo.
 Calcasieu Par. (30.03, -93.29; 16-Sep-19; J.T. Doucet; inaturalist.org/observations/32875616) male photo.
 Calcasieu Par., Lake Charles (30.180, -93.237; 25-Dec-19; J.T. Doucet; inaturalist.org/observations/36977692) worker photo.
 Calcasieu Par., Lake Charles (30.227, -93.217; 22-Mar-20; 12-Apr-20, 23-Apr-20, 20-May-20, & 12-Jun-20; J.T. Doucet; inaturalist.org/observations/40563060, 42024178, 42984416, 49277067, & 49455571) worker photos.

13; J.L. Gesell & C.P. Dunphey; MEM; idigbio.org/portal/records/e72821d8-17e0-4c31-b5aa-ad8f3a2ae021) queen specimen.
 Stone Co. (30.855, -88.9964, 4-Jun-14; L. McAnally; MEM; idigbio.org/portal/records/4f0d5115-0bfa-493d-97f7-6562e957b602) queen specimen.
 Stone Co. (30.711, -89.138, 4-Jun-14; L. McAnally; MEM; idigbio.org/portal/records/edf3fa20-20db-4c4d-9d6d-376e2ef2e3a8) male specimen.
 Stone Co. (30.844, -89.253, 23-Jun-14; L. McAnally; MEM; idigbio.org/portal/records/7f8d3699-500a-412a-a448-b0e97ebc5252) male specimen.
 Forrest Co. (30.939, -89.184, 24-Jun-14; L. McAnally; MEM; idigbio.org/portal/records/2dd5a091-e4ca-4fff-93be-2a4b950af335) male specimen.
 Lamar Co. (31.010, -89.469; 8-Jul-14; L. McAnally; MEM; idigbio.org/portal/records/9c7ab70a-e190-4ec7-8646-b55e3a0f70b6) queen specimen.
 Harrison Co., D'Iberville (30.4989, -88.9036; 19-Aug-14; T.L. Schiefer; MEM; idigbio.org/portal/records/d0e7e4b5-a463-4459-81e5-18363d4b35ca) queen specimen
 Perry Co., DeSoto National Forest; Janice Landing (30.995, -89.051; 3-Aug-15; S. Wang; bugguide.net/node/view/1527233) worker photo.
 Jefferson Davis Co., Carson (31.532, -89.848; 13-Jul-19; J. McPhail; inaturalist.org/observations/28724510) male photo.
 Hinds Co., Jackson, Millsaps College (32.326, -90.179; 12-Oct-21; boxxag; inaturalist.org/observations/98042397) queen photo.

South Carolina

Richland Co., Dentsville (34.058, -80.969; 25-Jun-19; K. Keivit; inaturalist.org/observations/27672897) male photo.
 Richland Co., Irmo (34.119, -81.152; 7-Nov-19; C. Dandridge; CDPC; inaturalist.org/observations/37453625 & 35431228; youtube.com/watch?v=IUUWJg_RQgc)queen specimen, photos, and video.

Mississippi

Pearl River Co., Picayune (30.554, -89.658; 12-Dec-

Texas

Harris Co., Houston, Houston Arboretum (29.765,

- 95.453; 14-Dec-13, S. Wang; SWPC; bugguide.net/node/view/876055/bgp) worker specimens and photos; nesting under log next to playground in mesic forest.
- Harris Co., Houston Memorial Park (29.761, -95.444; 11-Feb-18; S. Wang; TAMU; bugguide.net/node/view/1592672) workers specimens and photos; nesting under log in forest.
- Williamson Co., Austin (30.47, -97.80; 8-Mar-18; L. Brase; inaturalist.org/observations/10143124) worker photos.
- Harris Co., Cypress, Kleb Woods (30.075, -95.743; 20-May-20; S. Wang) worker photo; nesting under log in pine forest.
- Fort Bend Co., Sugarland, Cullinan Park (29.633, -95.666; 27-May-20; S. Wang) worker photo; foraging on forest trail.
- Fort Bend Co., Sugarland, Cullinan Park (29.635, -95.659; 27-May-20; S. Wang) male photo.
- Harris Co., Cypress, Kleb Woods (30.070, -95.739; 4-Feb-21; S. Wang; SWPC; inaturalist.org/observations/74190962) worker specimens and photo; nesting under paving stones around visitor center.
- Smith Co., Tyler, University of Texas at Tyler (32.314, -95.255; 13-Oct-21; B. Bringhurst; inaturalist.org/observations/98125474; bugguide.net/node/view/2051475) worker photo.

SW noted that *G. triangularis* workers have a strong odor, similar to that of the greenhouse millipede, *Oxidus gracilis* (Koch). SW saw bits of an *O. gracilis* inside a nest at Kleb Woods. SW kept a small captive colony of *G. triangularis* and noted that *O. gracilis* millipedes seem to be their favorite prey, though they also fed on native julid (Order Julida) millipedes. Workers in this colony did not attack large millipedes and refused to take in living or dead mealworms, though they fed on chopped mealworms placed inside the nest.

ACS observed (and photographed; Fig. 1) a group of ~10 *G. triangularis* workers subduing a greenhouse millipede, *O. gracilis*, in a mulch bed in Pensacola, Florida (30.443, -87.327; 1-Jun-21; bugguide.net/node/view/1976574). For an hour, the group dragged the millipede >4m to another part of the mulch bed where they disappeared beneath the mulch with the millipede, presumably to their

nest. The group appeared to have difficulty pulling the millipede over a small area of sand. The path to their nest passed millimeters from the nest entrance of a young *Solenopsis invicta* colony, but the *S. invicta* did not attack.

RAP observed several *G. triangularis* colonies at an urban property in Montgomery, Alabama beginning in summer 2019. Most nests were in shallow leaf litter with an entrance hole surrounded by bleached-out millipede segments and in one instance, a few pieces of beetle exoskeleton. On 24-Apr-20, RAP discovered one *G. triangularis* colony under a piece of plywood and videoed workers moving cocooned pupae down into the substrate. In the video, workers appear to sting each pupa before moving it, perhaps marking them with pheromones.

JKW has done extensive leaf litter sifting in peninsular Florida and southernmost Georgia, primarily under and around pines and oaks, but has never found *G. triangularis* in these areas.

The many records of *G. triangularis* based on photos posted to iNaturalist, including new state records (Table 1), amply demonstrate the value of such outlets for “citizen scientists.” Photos are particularly useful sources of site records in areas where specimen collection is severely restricted, e.g., National Parks.

DISCUSSION

Gnamptogenys triangularis records in the southeastern US are uncommon, but come from a wide range of habitats, from relatively intact forest to highly disturbed urban sites. Given its known distribution in Texas, Louisiana, Mississippi, Alabama, Florida, and South Carolina, it seems likely that *G. triangularis* also occurs in Georgia, but has not yet been recorded. Our northernmost site records come from 34.1°N in South Carolina. However, based on its South American range extending to 38.1°S, *G. triangularis* may have the potential to spread further north in the US, perhaps as far as Richmond, Virginia (37.5°N) and Lexington, Kentucky (38.0°N) (MacGown & Wetterer 2012). A large portion of records of *G. triangularis* in the southeastern US come from specimens and photographs of alate queens and males. This may indicate that this species is more common than

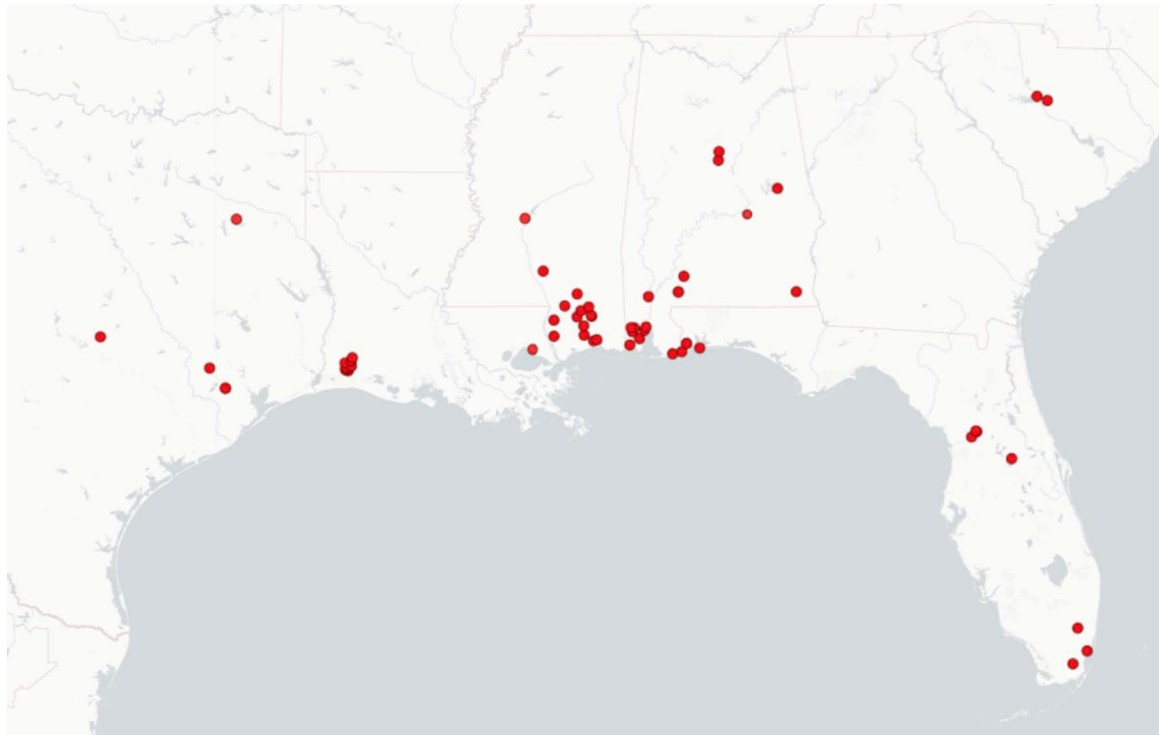


Figure 2. Site records of *Gnamptogenys triangularis* in the US. Map made using carto.com.

generally appreciated, but simply overlooked.

In both its native and exotic range, *G. triangularis* preys on millipedes (Lattke 1990, 1995, Deyrup et al. 2000). Millipedes are often particularly common in disturbed environments, so potential prey for *G. triangularis* is plentiful. The greenhouse millipede, *O. gracilis*, a cosmopolitan species originally from Asia, is now very common in the southeastern US. Millipedes produce a wide range of defensive chemicals that protect them from most potential predators. Although *O. gracilis* produces several highly toxic defensive chemicals, including hydrogen cyanide (Taira et al. 2003), *G. triangularis* has overcome these defensives. *Gnamptogenys triangularis* may even be able to use these chemicals to make themselves toxic to potential predators.

There have been no studies examining potential impacts of *G. triangularis*. Even if this species were having a localized impact on millipede populations, this might be difficult to detect. Nonetheless, it seems unlikely that *G. triangularis* will ever become

a significant pest.

ACKNOWLEDGMENTS

We thank M. Wetterer and J.A. MacGown for comments on this manuscript; M. West, K. Keivit, L. Brase, B. Bringhurst, and others who posted their photos of *G. triangularis* to BugGuide.net and iNaturalist.org; Florida Atlantic University for financial support.

LITERATURE CITED

- Camacho GP, Franco W, Feitosa RM (2020) Additions to the taxonomy of *Gnamptogenys* Roger (Hymenoptera: Formicidae: Ectatomminae) with an updated key to the New World species. *Zootaxa* 4747: 450–476.
- Deyrup M, Davis L, Cover S (2000) Exotic ants in Florida. *Transactions of the American Entomological Society* 126: 293–326.

- Deyrup M, Johnson C, Wheeler GC, Wheeler J (1989) A preliminary list of the ants of Florida. *Florida Entomologist* 72: 91–101.
- Lattke JE (1990) Revisión del género *Gnamptogenys* para Venezuela. *Acta Terromoria* 2: 1–47.
- Lattke JE (1995) Revision of the ant genus *Gnamptogenys* in the New World (Hymenoptera: Formicidae). *Journal of Hymenoptera Research* 4: 137–193.
- MacGown JA, Forster JA (2005) A preliminary list of the ants (Hymenoptera: Formicidae) of Alabama. *Entomological News* 116: 61–74.
- MacGown JA, Hill JG, Brown RL, Whitehouse R, Lewis JG (2021) Exotic ants (Hymenoptera: Formicidae) of Mississippi. *Mississippi Agricultural and Forestry Experiment Station Bulletin* 1229: 1–106.
- MacGown JA, Wetterer JK (2012) Geographic spread of *Gnamptogenys triangularis* (Hymenoptera: Formicidae: Ectatomminae). *Psyche* 2012 (571430): 1–4. doi:10.1155/2012/571430
- Taira J, Nakamura K, Higa Y (2003) Identification of secretory compounds from the millipede, *Oxidus gracilis* C. L. Koch (Polydesmida: Paradoxosomatidae) and their variation in different habitats. *Applied Entomology and Zoology* 38: 401–404.
- Wetterer JK (2014) Geographic distribution of *Gnamptogenys hartmani* (Hymenoptera: Formicidae), an “agro-predator” that attacks fungus-growing ants. *Terrestrial Arthropod Reviews* 7: 147–157.

Table 1. Earliest known records for *Gnamptogenys triangularis* from the US. += no previously published site records. SWPC = S. Wang personal collection.

	Earliest record
Florida	1985 (Deyrup et al. 2000)
Alabama	1996 (MacGown & Wetterer 2012)
Mississippi	2002 (MacGown & Wetterer 2012)
+Texas	2013 (S. Wang; SWPC): Houston
+Louisiana	2019 (J.T. Doucet; iNaturalist photo): Calcasieu Parish
+South Carolina	2019 (K. Keivit; iNaturalist photo): Dentsville