Hindawi Publishing Corporation
Psyche
Volume 2012, Article ID 850893, 7 pages
doi:10.1155/2012/850893

Research Article

First Record of *Pyramica epinotalis* (Hymenoptera: Formicidae) for the United States

Xuan Chen,[1] Joe A. MacGown,[2] Benjamin J. Adams,[1] Katherine A. Parys,[1] Rachel M. Strecker,[1] and Linda Hooper-Bui[1]

[1] *Department of Entomology, Louisiana State University Agricultural Center, Baton Rouge, LA 70803, USA*
[2] *Mississippi Entomological Museum, Mississippi State University, Mississippi State, MS 39762, USA*

Correspondence should be addressed to Joe A. MacGown, jmacgown@entomology.msstate.edu

Received 29 March 2012; Accepted 10 April 2012

Academic Editor: David Roubik

Pyramica epinotalis is an arboreal dacetine ant previously known only from Brazil, Costa Rica, Ecuador, and southern Mexico. Here we report the first records of *P. epinotalis* for the United States. Collections were made in three parishes across southern Louisiana in cypress-tupelo swamps using floating pitfall traps placed in floating vegetation and arboreal pitfall traps placed on trunks and limbs of three wetland tree species. One additional specimen of this species was collected in Highlands County, Florida. Based on collections of specimens in Louisiana, including multiple dealate females at different localities, *P. epinotalis* appears to be well established in this state. We discuss the design and implementation of modified arboreal pitfall traps that were instrumental in this discovery.

1. Introduction

The tribe Dacetini (Hymenoptera: Formicidae) is composed of small, cryptic, predatory ants that typically occur in soil and/or leaf litter where they feed on various minute arthropods [1, 2]. Species in this group show great diversity in predatory strategies, which is reflected in the marked differentiation between species groups. With their unique-looking body types and head shapes that are variously adorned with bizarre station, elongate mandibles with uniquely arrayed dentition, and as-yet-unexplained cuticular outgrowths called spongiform tissue, members of this group are among the most unusual in the ant world. This large and diverse tribe includes more than 900 described species worldwide, of which 327 are in the genus *Pyramica* [3]. Primarily considered a tropical group, only 41 species of *Pyramica* have been reported from the USA. Thirty-seven of these species occur in the southeastern United States [4]. Five species of the related *Strumigenys* are known from the same region [5]. The relatively high density of dacetine species in the Southeast is likely due to the humid, subtropical climate and mild winters typical of the region and the availability of large continuous tracts of forested habitats, which appear to facilitate establishment of these species' colonies.

Currently, nine introduced dacetine species are known from the southeastern USA including *Pyramica eggersi* (Emery) (Florida), *P. gundlachi* (Roger) (Florida), *P. hexamera* (Brown) (Alabama, Florida, Louisiana, and Mississippi), *P. margaritae* (Emery) (Alabama, Florida, Georgia, Louisiana, and Mississippi), *P. membranifera* (Emery) (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, and South Carolina), *Strumigenys emmae* (Emery) (Florida), *S. lanuginosa* Wheeler (Florida), *S. rogeri* Emery (Florida), and *S. silvestrii* Emery (Alabama, Florida, Georgia, Louisiana, and Mississippi) [6]. *Pyramica subnuda* MacGown and Hill, which is in the *schulzi* species group, may also be introduced despite the fact that it was described from a specimen collected in Mississippi as other members of this group are tropical [4]. Here, we present records of another introduced dacetine ant from South America, *P. epinotalis* (Weber), which also belongs to the *schulzi* species group.

2. Taxonomy and Identification

Weber described *Strumigenys (Cephaloxys) studiosi* subsp. *epinotalis* (= *P. epinotalis*) in 1934 from specimens collected by G. C. Wheeler from Costa Rica, Prov. Limon, Estrella Valley, Talia Farm, 18.vi.1924 [7]. *Strumigenys* (*Cephaloxys*) *skwarrae,* a synonym of *P. epinotalis*, was described by W. M. Wheeler in 1934 from specimens collected in *Tillandsia streptophylla* Scheidweiler (Bromeliaceae) in Tlacocintla, Mexico by E. Skwarra in 1929 [8]. In 1953, Brown synonymized *S. skwarrae* with *S. epinotalis* and transferred it to *Smithistruma* [9]. Bolton later moved the species to *Pyramica* in 1999 [10], Baroni Urbani and De Andrade synonymized *Pyramica* with *Strumigenys* in 2007 [11], and Bolton and Alpert reconfirmed *Pyramica* as a valid genus in 2011 [12].

2.1. Worker (Figures 1(a)–1(c)) (Description Modified from Bolton [13]). Total length 1.9–2.1 mm. Head wedge-shaped. Color yellowish-brown, appendages only slightly paler. Entire head including clypeus with reticulate-punctate sculpture. Mandibles subtriangular, lacking diastema; nine acute teeth present following basal lamella; third tooth from basal lamella spiniform, elongate and distinctly longer than other teeth, with subsequent teeth alternating in length with the fifth being longer than the fourth and the seventh being longer than the sixth, and the remaining two teeth smaller and blunter. Clypeus somewhat pentagonal shaped, narrowing anteriorly, and with anterior margin slightly convex. Dorsum of clypeus with numerous clavate hairs directed anteriorly or away from midline of clypeus; clypeal margin with similarly shaped clavate hairs all curving anteriorly toward midline of clypeus; remainder of head with slightly larger clavate to spoon-shaped hairs that curve toward midline of head; elongate flagelliform cephalic hairs absent; and leading edge of scape with a row of elongate, curved hairs, all of which curve toward the base of the scape or are directed downward. Eye large with 5–7 ommatidia in longest diameter.

Mesosoma, including sides, and petiole with distinct reticulate-punctate sculpture; postpetiole disc lacking sculpture, smooth. Pronotum with an arched transverse ridge with rowed, erect spoon-shaped hairs; pronotal humeral hairs absent; mesonotum with appressed spoon-shaped hairs. Propodeal spines somewhat short and dentiform, directed upward; propodeal declivity bordered by a high arched lamella on each side. Petiole with longitudinal spongiform crest ventrally and fan-shaped, spongiform bodies present posteriorly; elongate, spoon-shaped hairs present dorso-posteriorly. Postpetiole with large, spongiform mass ventrally, but becoming a lamina-like structure posteriorly; with elongate, spoon-shaped hairs present dorsoposteriorly. First gastral tergite smooth and shining except for basigastral costulae, which are distinct and extend to at least the basal quarter to third of the length of the tergite. Several to numerous suberect to erect, elongate, thickened hairs present on first tergite.

2.2. Alate Female (Figures 1(d) and 1(e)). Similar to worker, but larger (total length approximately 2.5 mm), ocelli present, mesosoma enlarged with typical modifications for flight muscles, wings present, and katepisternum mostly lacking sculpture.

This species is easily differentiated from other species known from the USA by the combination of having the third tooth (from basal lamella) on mandible longer than the other teeth, the mesosoma of the worker being completely reticulate-punctate, having a curved row of spoon-shaped hairs on the pronotal dorsum, a distinct propodeal lamella, a ventral spongiform crest beneath the petiole, and fan-shaped patches of spongiform tissue on the petiole and postpetiole. Currently, the only other species reported from the USA with which *P. epinotalis* might be confused is *P. margaritae*, another introduced species in the *schulzi* group. *Pyramica margaritae* is the only other species known to occur in the United States that has sculpture on the entire side of the mesosoma; however, *P. margaritae* lacks a curved row of spoon-shaped hairs on the pronotal dorsum, has much longer propodeal spines, lacks a propodeal lamella, lacks spongiform bodies beneath the petiole, and has reduced spongiform tissue present beneath the postpetiole.

3. Natural History

Although the vast majority of dacetine ants nest in soil and leaf litter, members of the *schulzi* species group are typically associated with plants, and several species have been recorded from epiphytes or plant cavities [13]. Many species in this group also differ in that workers have enlarged compound eyes, as compared with their epigeic and hypogeic relatives. Similar to most members of this group, *P. epinotalis* also has enlarged eyes and is thought to be an arboreal species. Weber described this species in 1934 from specimens collected by George Wheeler in 1924 in an Atlantic slope wet forest in Costa Rica, but he did not indicate whether the ants were collected arboreally or in litter [7]. Collecting in the same region years later, Longino reported that multiple litter samples from near the type locality did not yield specimens of this species, which suggests that perhaps this species might be arboreal [14]. In 1934, Wheeler reported that Dr. Skwarra discovered four colonies of this species (reported as *Strumigenys skwarrae* Wheeler) in *Tillandsia streptophylla* at two localities in Mexico in 1929 [8]. Bolton [13] reported that collections of this species were made in Mexico by Dressler and by Dejean, both of whom worked with epiphytes, which implies that their specimens were also from epiphytes. More recently, Rider reported collections of this species in the canopy in Ecuador, which further validates its status as an arboreal species [15].

4. Methods

A single alate female was collected by Mark Deyrup on 14 August 2009 using a Townes Malaise trap placed in Florida scrub habitat in Highlands County. Scrub habitat was located near a "bayhead," a periodically flooded forest dominated by magnolia (Magnoliaceae) and gordonia (Theaceae) trees. Deyrup compared his specimen to specimens identified by

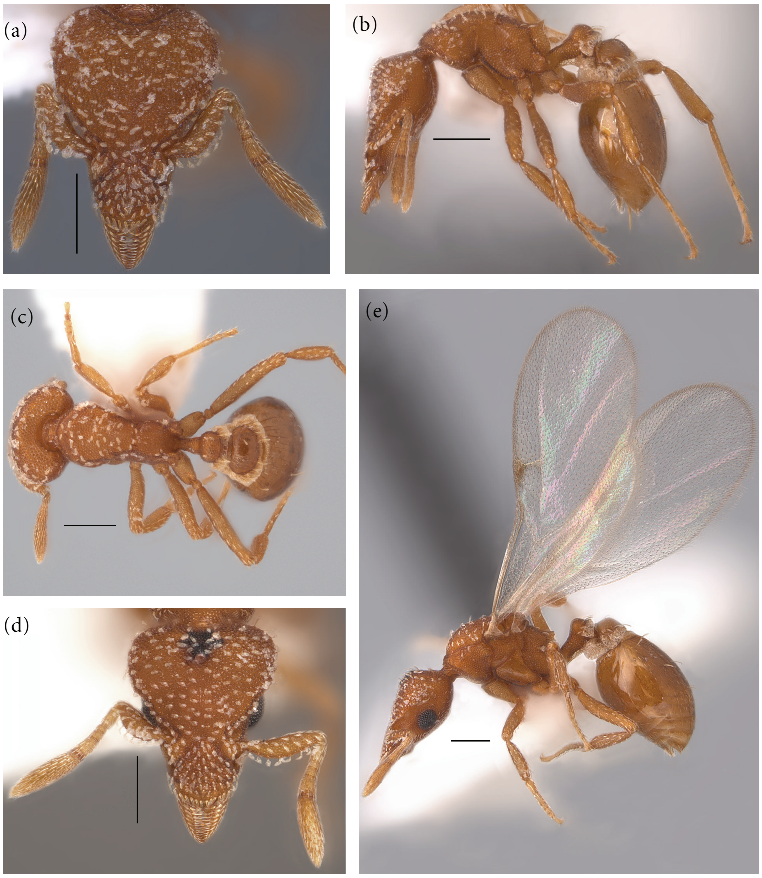

Figure 1: *Pyramica epinotalis*: (a) full face view of worker, (b) lateral view of worker, (c) dorsal view of worker, (d) full face view of female, and (e) lateral view of alate female. Scale bar equals 200 μm.

Figure 2: Cypress-tupelo swamp north of Gramercy, Ascension Parish, Louisiana.

Figure 3: Cypress-tupelo swamp in Jean Lafitte National Historical Park and Preserve, Jefferson Parish, Louisiana.

W. L. Brown, which were collected by R. L. Dressler in Ocosingo, Chiapas, Mexico in 1954 (M. Deyrup, pers. comm.).

Collections of ants in Louisiana were made in cypress-tupelo swamps from spring through fall of 2009 and 2010 on a privately owned tract of land north of Gramercy in Ascension Parish (30°09′48″ N 90°48′39″ W) (Figure 2) and during the late spring and summer of 2011 (May to September) in Jean Lafitte National Historical Park and Preserve in Jefferson Parish (29°47′38″ N 90°06′17″ W) (Figure 3) and Maurepas Swamp Wildlife Management Area (Western Tract) in Saint James Parish (30°06′56″ N 90°40′47″ W)

Figure 4: Cypress-tupelo swamp in Maurepas Swamp Wildlife Management Area, Saint James Parish, Louisiana.

Figure 5: Floating pitfall trap shown floating on surface of water in cypress-tupelo-blackgum freshwater swamp.

(Figure 4). All locations are within the Mississippi River deltaic plain in coastal Louisiana.

Cypress-tupelo swamps in Louisiana are characterized and dominated by the presence of bald cypress, *Taxodium distichum* (L.) Rich (Cupressaceae), water tupelo, *Nyssa aquatica* L. (Cornaceae), and red maple, *Acer rubrum* L. var. *drummondii* (Hook. and Arn. Ex Nutt.) Sarg. (Aceraceae) [16]. Collections from floating vegetation were made using a floating pitfall trap in Gramercy, LA, as described by Parys and Johnson [17]. These collections were made as part of a larger study to examine the biodiversity of insects associated with invasive aquatic vegetation. In addition to the characteristic tree species, this site has dense mats of invasive aquatic vegetation formed from common *salvinia* (*Salvinia minima* Baker (Salviniaceae)), water hyacinth (*Eichornia crassipes* (Mart.) Solms (Pontederiaceae)), and water pennywort (*Hydrocotyle* sp. (Araliaceae)). Traps were filled with ethylene glycol as a preservative and emptied at two-week intervals.

Arboreal collections were made on bald cypress (*T. distichum*), water tupelo (*N. aquatica)*, and red maple (*A. rubrum* var. *drummondii)* because they were the most common tree species observed. We chose three to six of each of the aforementioned tree species spaced >50 meters apart for trap deployment. We placed both a cup trap and a bottle trap in each selected tree's canopy and tied a trunk trap at breast height onto the trunk of each tree. Each of the traps was filled with approximately 50 mL ethylene glycol as a specimen preservative.

4.1. Trap Designs

4.1.1. Floating Pitfall Trap (Figure 5). Floating pitfall trap designs were described in detail by Parys and Johnson [17].

4.1.2. Cup Trap (Figures 6(a)–6(e)). We modified a trap that was originally described by Oliveira-Santos et al. [18]. Cup traps were constructed from a single 400 mL tricorner plastic beaker (Figure 6(a)). Three holes were bored into a flange on the rim of the cup (Figure 6(b)). A 6.35 mm cotton rope strand was then threaded through each of the three holes, and hot glue was used to secure each rope (Figure 6(c)). Braided nylon rope was used to link the 6.35 mm cotton rope together at a common point above the trap (Figure 6(d)). The excess cotton rope below the flange on the cup was then taped to the sides of the cup (Figure 6(e)).

4.1.3. Bottle Trap (Figures 7(a)–7(h)). We modified the bottle trap design as described in Kaspari [19]. The traps were created using an inverted 600 mL drink bottle with the base removed (Figure 7(a)). Three holes were bored into the edge of the base (now top) of the container (Figure 7(b)). A foam square (10 cm × 10 cm) was fitted around the base opening of the bottle allowing for at least 2 cm between the opening and the outer edge of the foam square (Figure 7(c)). Fishing line (40 lb test) was tied through the holes in the base of the bottle and around the foam square to connect the square to the bottle (Figure 7(d)). We attached two plastic dowels (6.35 mm dia) to the 10 cm long ends of a length of canvas (40 cm × 10 cm) using hot glue. A hole was burned through the canvas and dowels using a soldering iron; a zip-tie was then attached to the dowel through this hole. A 6 cm hole was also cut into the middle of the canvas 5 cm from one of the dowels. Eight 2 cm slits were then cut 4 cm apart into the canvas around the edge of the hole (Figure 7(e)). The canvas was attached to the base of the bottle using hot glue applied to the inside of the bottle (Figure 7(f)). We tied a 28.3 g fishing weight to the bottle using fishing line (Figure 7(g)). An optional modification to reduce friction on the branches when setting up the traps was to cut the extra tail of canvas to 3 cm width (Figure 7(h)).

4.1.4. Trunk Trap. Trunk trap designs were taken directly from Pinzón and Spence [20]. The only modification was the removal of the plastic flues used to funnel insects into the traps.

4.1.5. Trap Placements. Placement of floating pitfall traps is discussed in Parys and Johnson [17]. The top quarter of

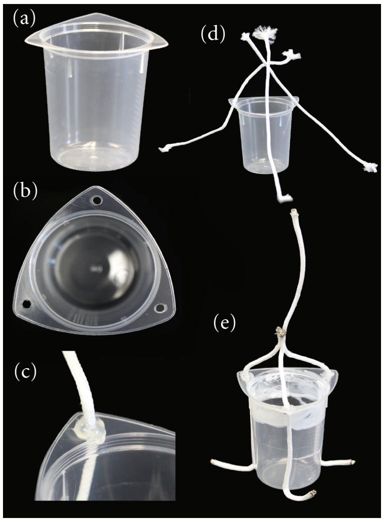

FIGURE 6: Cup trap design: (a) tricorner beaker, (b) holes bored in flange of beaker, (c) cotton rope threaded through flange hole and secured with hot glue, (d) cotton ropes linked together using nylon rope above trap, and (e) completed trap with excess cotton rope below lip of flange taped to sides of beaker (cup).

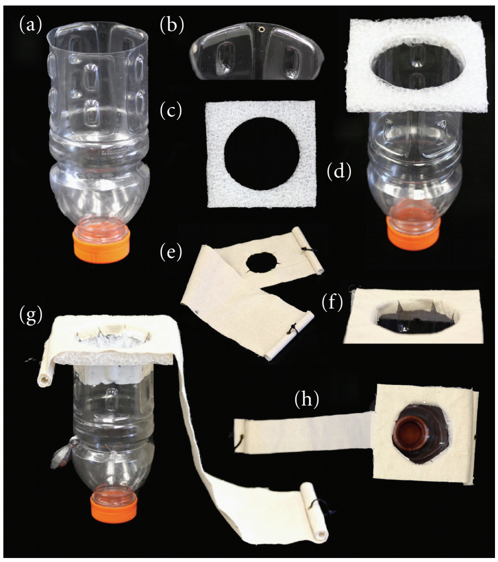

FIGURE 7: Bottle trap design: (a) inverted 600 mL plastic bottle, (b) hole bored into base of bottle, (c) foam square cut to bottle base, (d) foam square place around bottle base with fishing line tied through holes and around square, (e) canvas strip, with hole, slits around hole, dowels at each end, and zip-ties added, (f) canvas attached to inside of bottle with hot glue (g) fishing weight added to bottle with fishing line, and (h) excess canvas trimmed from foam square.

each arboreal trap was brushed with liquid Teflon (Dupont Polymers, Wilmington, Delaware) to prevent ants from escaping. Canopy traps were set in the trees using the same slingshot method as Kaspari [19]. However for ease of sampling and returning the traps to the canopy, the tie-down lines were tied together to make a loop similar to the methods of Oliveira-Santos et al. [18]. For bottle trap designs, the fishing line was connected to the zip-ties attached to the plastic dowels. It is critical that the edge of the cup trap and the edge of the foam on the bottle trap be in contact with a tree branch or trunk to ensure maximum yield of specimens. After each sampling period, the entire contents of the traps were removed, new ethylene glycol was added, and the trap was returned to the canopy.

5. Results and Discussion

Here we report the first records of *P. epinotalis* for the United States. A single alate female was collected by Mark Deyrup in Highlands County, Florida, on 14 August 2009 using a Townes Malaise trap (M. Deyrup, pers. comm.). We collected five females and 14 workers of *P. epinotalis* in Ascension, Jefferson, and Saint James Parishes in Louisiana on various dates from 8 to 21 September 2009 and from 30 May to 23 September 2011. Louisiana collections were made using floating pitfall traps placed directly upon the surface of the water and with cup traps, bottle traps, and trunk traps placed on trunks and branches of three species of trees as described in the methods section. Louisiana collections were made by Katherine Parys, Xuan Chen, and Benjamin Adams. Other collection data are as follows: Florida: Highlands County, Highlands Park Estates, N27.53864, W081.35071, 14 August 2009, M. Deyrup, Townes trap in scrub habitat (near bayhead). Louisiana: Ascension Parish, Gramercy, N of 61 and I-10, 30°09′48″ N 90°48′39″ W, 8–21 Sept; 2009, K. A. Parys, floating pitfall trap in cypress-tupelo freshwater swamp with dense mats of *Salvinia minima* on water surface (1 worker). Jefferson Parish, Jean Lafitte National Historical Park and Preserve, 29°47′38″ N 90°06′17″ W, 30 May–13 June 2011, cup trap on *Nyssa aquatica* branch (1 female); same data except, trunk trap on trunk of *Acer rubrum* var. *drummondii* (1 worker); same data except, 13 June–18 August 2011, bottle trap on *Taxodium distichum* branch (1 female); same data except, trunk trap on trunk of *Taxodium distichum* (2 females); same data except, trunk trap on trunk of *Nyssa aquatica* (2 workers); and same data except, bottle trap on *Acer rubrum* var. *drummondii* branch (1 worker); same data except, cup trap on *Acer rubrum* var. *drummondii* branch (1 female); same data except, 18 August–23 September 2011, bottle trap on *Nyssa aquatica* branch (1 worker); same data except, trunk trap on trunk of *Acer rubrum* var. *drummondii* (2 workers). Saint James Parish, Maurepas Swamp Wildlife Management Area (Western Tract), 30°06′56″ N 90°40′47″ W, 9 June–17 September 2011, trunk trap on trunk of *Nyssa aquatica* (4 workers); same data except, cup trap on *Nyssa aquatica* branch (2 workers).

This is a significant contribution to the distributional record for this species as previously it had only been reported from southern Mexico (Veracruz, Chiapas, Quintana Roo, Tlacocintla), Ecuador (Tiputini), Costa Rica (Limon Province), and Brazil (Mina Gerais) [6, 8, 10]. According to Longino [14], in Costa Rica *P. epinotalis* is known only from the southern Atlantic lowlands, south of Limon. As mentioned in the Natural History section, this species is thought to be primarily an arboreal species. Similarly, collections in Louisiana were all made from arboreal traps except for a single worker that was collected using a floating pitfall trap, which was in the same habitat type. Xuan Chen also collected ants in leaf litter and quadrats on ground cover in both locations, yet *P. epinotalis* was not found. Although the single Florida collection was made in scrub habitat, the alate female could have flown there from nearby bayhead habitat. Based on the collections made by Longino and other records [8, 13–15], this species may prefer wetland forest habitats. This also appears to be the case with the Louisiana collections, all of which were made in swampy, wetland habitats.

It seems likely that *P. epinotalis* is an introduced species. Evidence for this includes the large geographical gap between the known distribution and the new records of this species from Florida and Louisiana. Other exotic ants (i.e., *Brachymyrmex patagonicus* Mayr, *Pheidole obscurithorax* Naves, *Solenopsis invicta* Buren, and *S. richteri* Forel) from South America have been introduced to the southeastern states [21–24]. However, these species are native to southern South America whereas *P. epinotalis* is more likely native to northern South America, Central America, or southern Mexico making this record more unique. Given the relative novelty of trapping methods used here, it is possible that the range of this species actually may be much more extensive. For example, the range of another introduced arboreal species, *Pseudomyrmex gracilis* (F.), is almost continuous from South and Central America to southern Texas and is now found in Florida, Louisiana, and Mississippi [25, 26]. Dacetine ants native to the USA are not known to nest arboreally but rather have only been reported to nest in rotting wood, soil, or litter [5]. Consequently, most ant collectors in the USA would not consider searching trees for dacetines, given that only a few species, which are primarily tropical, nest arboreally [13].

Typical methods for arboreal collections in USA such as baiting or beating vegetation (unless they are present on outer limbs) would not likely yield dacetines even if they were present. Dacetines are specialized predators [2] and likely would not be attracted to standard baits used to attract other generalist species of ants. Due to their coloration and cryptic habits, these ants could easily be overlooked during visual searches on tree trunks. Furthermore, few ant collectors spend time in wetlands, as most ants in this region are terrestrial. If *P. epinotalis* is truly associated with wetland forests, this species could easily have been overlooked. Collections along the eastern edge of Mexico and into Texas could greatly enhance our knowledge of this species' distribution and provide information on whether or not it is truly an introduced species. Until such time as these collections can be made, we tentatively consider this species to be an exotic species to the US.

Acknowledgments

The authors thank Dr. Julie L. Witbeck with Jean Lafitte National Historical Park and Preserve for facilitating work at that location. They also thank Mr. James Boyce for access to his property in Gramercy as well as Anna Mészáros and Jordan Fryoux for assistance in the field. Thanks to Mark Deyrup for his comments and specimen data, this project was supported by the Northern Gulf Institute (L. Hooper-Bui, Principle Investigator), the Gulf of Mexico Research Initiative (year 1 funds through LSU to L. Hooper-Bui), Mississippi Agricultural and Forestry Experiment Station State Project MIS-311080, the USDA-ARS Areawide Management of Imported Fire Ant Project (Richard L. Brown, Principal Investigator), and Louisiana Department of Wildlife and Fisheries Contracts nos. 673252, 686647, and 696303 (Seth J. Johnson, Principal Investigator). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of this manuscript. This paper was approved for publication by the Louisiana State University Agricultural Experiment Station and approved for publication as journal article number. J-12146 of the Mississippi Agricultural and Forestry Experiment Station, Mississippi State University.

References

[1] E. O. Wilson, "The ecology of some North American dacetine ants," *Annals of the Entomological Society of America*, vol. 46, pp. 479–497, 1953.

[2] B. Hölldobler and E. O. Wilson, *The Ants*, Harvard University Press, Cambridge, Mass, USA, 1990.

[3] B. Bolton, G. Alpert, P. S. Ward, and P. Naskrecki, *Bolton's Catalogue of the Ants of the World*, Harvard University Press, Cambridge, Mass, USA, 2007.

[4] J. A. MacGown and J. G. Hill, "A new species of *Pyramica* (Hymenoptera: Formicidae) from Mississippi, U.S.A.," *Florida Entomologist*, vol. 93, no. 4, pp. 571–576, 2010.

[5] M. Deyrup and S. Cover, "Dacetine ants in Southeastern North America (Hymenoptera: Formicidae)," *The Southeastern Naturalist*, vol. 8, no. 2, pp. 191–212, 2009.

[6] J. A. MacGown, "Ants (Formicidae) of the Southeastern United States," 2012, http://www.mississippientomologicalmuseum.org.msstate.edu/Researchtaxapages/Formicidaepages/faunal.lists/SE.exotics.htm.

[7] N. A. Weber, "Notes on Neotropical ants, including the descriptions of new forms," *Revista de Entomologia*, vol. 4, pp. 22–59, 1934.

[8] W. M. Wheeler, "Neotropical ants collected by Dr. Elisabeth Skwarra and others," *Bulletin of the Museum of Comparative Zoology*, vol. 77, pp. 157–240, 1934.

[9] W. L. Brown, "Revisionary studies of the ant tribe Dacetini," *America Midland Naturalist*, vol. 50, pp. 1–137, 1953.

[10] B. Bolton, "Ant genera of the tribe Dacetonini (Hymenoptera: Formicidae)," *Journal of Natural History*, vol. 33, no. 11, pp. 1639–1689, 1999.

[11] C. Baroni Urbani and M. L. de Andrade, "The ant tribe Dacetini: limits and constituent genera, with descriptions of new species," *Annali del Museo Civico di Storia Naturale "Giacomo Doria"*, vol. 99, pp. 1–191, 2007.

[12] B. Bolton and G. D. Alpert, "Barry Bolton's Synopsis of the Formicidae and Catalogue of Ants of the World," 2011, http://gap.entclub.org/.

[13] B. Bolton, "The ant tribe Dacetini," *Memoirs of the American Entomological Institute*, vol. 65, pp. 1–1028, 2000.

[14] J. T. Longino, "Ants of Costa Rica: *Pyramica epinotalis* (Weber)," 2001, http://academic.evergreen.edu/projects/ants/genera/pyramica/species/epinotalis/epinotalis.html.

[15] K. Rider, "The Ant Room: Tiputini *Pyramica* and *Strumigenys*," 2007, http://theantroom.blogspot.com/2007/05/tiputini-pyramica-and-strumigenys.html.

[16] W. H. Conner, J. G. Gosselink, and T. P. Roland, "Comparison of the vegetation of three Louisiana swamp sites with different flooding regimes," *American Journal of Botany*, vol. 68, pp. 320–331, 1981.

[17] K. A. Parys and S. J. Johnson, "Collecting insects associated with wetland vegetation: an improved design for a floating pitfall trap," *The Coleopterists Bulletin*, vol. 65, pp. 341–344, 2011.

[18] L. G. R. Oliveiera-Santos, R. D. Loyola, and A. B. Vargas, "Armadilhas de dossel: uma técnica para amostrar formigas no estrato vertical de florestas," *Neotropical Entomology*, vol. 38, pp. 691–694, 2009.

[19] M. Kaspari, "Do imported fire ants impact canopy arthropods? Evidence from simple arboreal pitfall traps," *The Southwestern Naturalist*, vol. 45, no. 2, pp. 118–122, 2000.

[20] J. Pinzón and J. Spence, "Performance of two arboreal pitfall trap designs in sampling cursorial spiders from tree trunks," *The Journal of Arachnology*, vol. 36, no. 2, pp. 280–286, 2008.

[21] J. A. MacGown, J. G. Hill, and M. A. Deyrup, "*Brachymyrmex patagonicus* (Hymenoptera: Formicidae), an emerging pest species in the Southeastern United States," *Florida Entomologist*, vol. 90, no. 3, pp. 457–464, 2007.

[22] J. R. King and W. R. Tschinkel, "Range expansion and local population increase of the exotic ant, *Pheidole obscurithorax*, in the Southeastern United States (Hymenoptera: Formicidae)," *Florida Entomologist*, vol. 90, no. 3, pp. 435–439, 2007.

[23] W. F. Buren, G. E. Allen, W. H. Whitcomb, F. E. Lennartz, and R. N. Williams, "Zoogeography of the imported fire ant," *Journal of the New York Entomological Society*, vol. 82, pp. 113–124, 1974.

[24] J. A. MacGown, "Exotic ants of the Southeastern United States," 2012, http://www.mississippientomologicalmuseum.org.msstate.edu/Researchtaxapages/Formicidaepages/faunal.lists/SE.exotics.htm.

[25] J. K. Wetterer, "Worldwide spread of the graceful twig ant, *Pseudomyrmex gracilis* (Hymenoptera: Formicidae)," *Florida Entomologist*, vol. 93, no. 4, pp. 535–540, 2010.

[26] J. A. MacGown and J. G. Hill, "Two new exotic pest ants, *Pseudomyrmex gracilis* and *Monomorium floricola* (Hymenoptera: Formicidae) collected in Mississippi," *Midsouth Entomologist*, vol. 3, no. 2, pp. 106–109, 2010.