

Report

Ants (Hymenoptera: Formicidae) of the Big Thicket Region of Texas

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Abstract: Based on literature records and recent collections, a list of 65 species of ants in the Big Thicket region of Texas is presented. Three new state records for Texas were documented during this survey including *Aphaenogaster miamiana* Wheeler, *Dolichoderus pustulatus* Mayr, and *Strumigenys angulata* Smith. Nine exotic species of ants were documented in the region with three species (*Brachymyrmex patagonicus* Mayr, *Solenopsis invicta* Buren, and *Pheidole moerens* Wheeler) being pervasive.

Key Words: Big Thicket, Ants, Texas, species list

Introduction

The Big Thicket region of Texas is a southerly tilted topographical basin bounded between the Trinity and Sabine rivers in southeastern Texas (Watson 2006). (Figure 1). The Big Thicket has been called "the biological crossroads of North America" as species from the east and west occur relatively near each other within a mosaic of habitats such as arid sandylands, bottomland hardwood forests and cypress sloughs, palmetto hardwood flats, wetland pine savannahs, upland pine forests, and mixed grass prairies (NPS 2010). More than 1,396 species of plants, 185 species of birds, and 60 reptile species have been documented within the Big Thicket (Big Thicket Association 2014). Since the 1930's the Thicket has had a very active army of citizen scientists who have fought for the conservation of the region's biota. In 1974, all of their efforts were realized when the Big Thicket National Preserve was established (it was also the first national preserve in U. S. history). The preserve consists of over 100,000 acres in 15 units spread across seven counties. Additionally, the Nature Conservancy, the state of Texas, and several other entities have preserves and parks established throughout the region.

In 2006, the Big Thicket Association, a non-profit group that works to preserve and promote the conservation of biodiversity and natural resources of the Big Thicket Region, began the All Taxa Biodiversity Inventory (ATBI) of the Thicket of Diversity, in partnership with the Big Thicket National Preserve, The Nature Conservancy, Texas Parks and Wildlife, John H. Kirby State Forest, Big Thicket Natural Heritage Trust, and the Watson Rare Native Plant Preserve (Big Thicket Association 2014). The goal of this ATBI is to document every living species and their distribution within the region. As part of the ATBI, an inventory of the ant (Hymenoptera: Formicidae) fauna of the region was undertaken.

Ants are one of the most dominant and influential forces in terrestrial ecosystems and often comprise a large amount of the animal biomass (Hölldobler and Wilson, 1990). Ants may be found in a variety of habitats where they may occupy an assortment of ecological niches and are involved in many important aspects of ecosystem function, such as influencing the floral and faunal composition of communities and contributing to nutrient and soil turnover. Numerous species of ants have specific habitat requirements and respond quickly to disturbances to their environment, which make them important taxa for comparing habitat diversity and monitoring environmental changes (Andersen, 1990; Kaspari and Majer, 2000). Additionally, many exotic species, such as the imported fire ant and the tawny crazy ant, purportedly cause deleterious ecological and/or economic impacts to the areas they invade. These factors suggest that ants are ideal taxa for baseline inventories like the ATBI. As such, an inventory was initiated to 1) document ant species diversity within the Big Thicket region, 2) to provide some preliminary data on ant species composition of the major terrestrial communities of the Thicket, 3) document new state records of ants for Texas, and 4) detect the presence of any exotic ant species.

Methods

Ants were sampled in the Big Thicket region from 14 September 2011 to 28 July 2014 at twenty-two sites (Table 1, Figure 1.) Sampling was primarily focused in the Big Thicket National Preserve, Roy E. Larson Sandyland Sanctuary, with limited sampling occurring at Marysee Prairie, Village Creek State Park, and the Watson Rare Plant Preserve. Most sampling localities were visited several times and during different seasons to better document the fauna of the area. Additionally, in an attempt to better describe the fauna of the region, collections were focused on eight primary terrestrial habitat types described in Watson (2006): coastal prairie, arid sandyland, upland pine, palmetto hardwood flats, bottomland hardwood forests/cypress slough, mesic pine savannah, beech/hardwood forests, and mixed pine hardwood forests. (Figure 2) Additionally, ant species shown as occurring in the counties of the Big Thicket in O'Keefe et al. (2000) are listed here to give a more complete characterization of the fauna; however, no habitat information was provided in their article.

Ants were sampled using a multi-faceted approach including visual searching for ants on the ground, in leaf litter, and plant parts; baiting; and leaf litter sampling. Foraging ants were collected by hand and with the use of baits, namely Great Value™ creamy peanut butter (on trees) and Keebler Sandies Pecan Shortbread® cookies (on the ground), at each locality. Leaf litter and other decaying organic matter were collected and placed in Berlese funnels in the laboratory for extraction of ants. Ant specimens were deposited in the Mississippi Entomological Museum. Specimens of *Solenopsis invicta* were submitted to David Cross (Department of Entomology, Mississippi State University) for molecular testing of social form. Genomic DNA was isolated for 10-12 individuals from each colony and assayed for the G-9 gene form that is known to be associated with polygyny in U.S. populations of imported fire ants.

Table 1. Collection localities and habitat data for survey sites in the Big Thicket region of Texas. Habitat types after Watson (2006).

Unit	Lat/Long	Habitat Type
R.E Larsen Sandyland Sanctuary	30°20'54"N 94°14'13"W	Arid sandyland
Big Thicket NP - Turkey Creek Unit	30°27'42"N 94°21'04"W	Bottomland hardwood forest
Big Thicket NP - Turkey Creek Unit	30°28'02"N 94°20'45"W	Bottomland hardwood forest
Big Thicket NP - Turkey Creek Unit	30°36'48"N 94°20'39"W	Upland Pine Savannah
Big Thicket NP - Turkey Creek Unit	30°34'56"N 94°20'10"W	Mesic longleaf savannah
Big Thicket NP - Turkey Creek Unit	30°31'15"N 94°20'37"W	Upland Hardwood Forest
Big Thicket NP- Hickory Creek Unit	30°32'53"N 94°23'34"W	Mesic Longleaf Savannah
Big Thicket NP - Lance Rosier Unit	30°15'03"N 94°29'12"W	Bottomland hardwood forest
Big Thicket NP - Lance Rosier Unit	30°15'30"N 94°30'44"W	Bottomland hardwood forest
Big Thicket NP - Lance Rosier Unit	30°18'22"N 94°22'24"W	Cutover Pitcher Plant Bog
Big Thicket NP - Lance Rosier Unit	30°18'21"N 94°26'54"W	Palmetto hardwood flat
Marysee Prairie	30°15'16"N 94°40'43"W	Coastal Prairie
Big Thicket NP - Visitors Center	30°27'30"N 94°40'13"W	Upland Pine Savannah
Watson Preserve	30°34'45"N 94°22'40"W	Mesic Pine Savannah
Big Thicket NP - Big Sandy Creek Unit	30°40'46"N 94°41'58"W	Upland Pine Savannah
Big Thicket NP - Big Sandy Creek Unit	30°36'52"N 94°40'14"W	Upland Pine Savannah
Big Thicket NP - Big Sandy Creek Unit	30°38'34"N 94°39'41"W	Upland Pine savannah
Big Thicket NP - Big Sandy Creek Unit	30°34'22"N 94°38'32"W	Bottomland Cypress forest
Big Thicket NP - Big Sandy Creek Unit	30°43'10"N 94°13'37"W	Beech hardwood forest
Big Thicket NP - Gore-Neches Unit	30°29'50"N 94°11'25"W	Pine-hardwood forest
Village Creek State Park	30°15'17"N 94°10'16"W	Pine-hardwood forest
1 mi E Evendale	30°21'13"N 94°05'43"W	Mesic hardwood forest

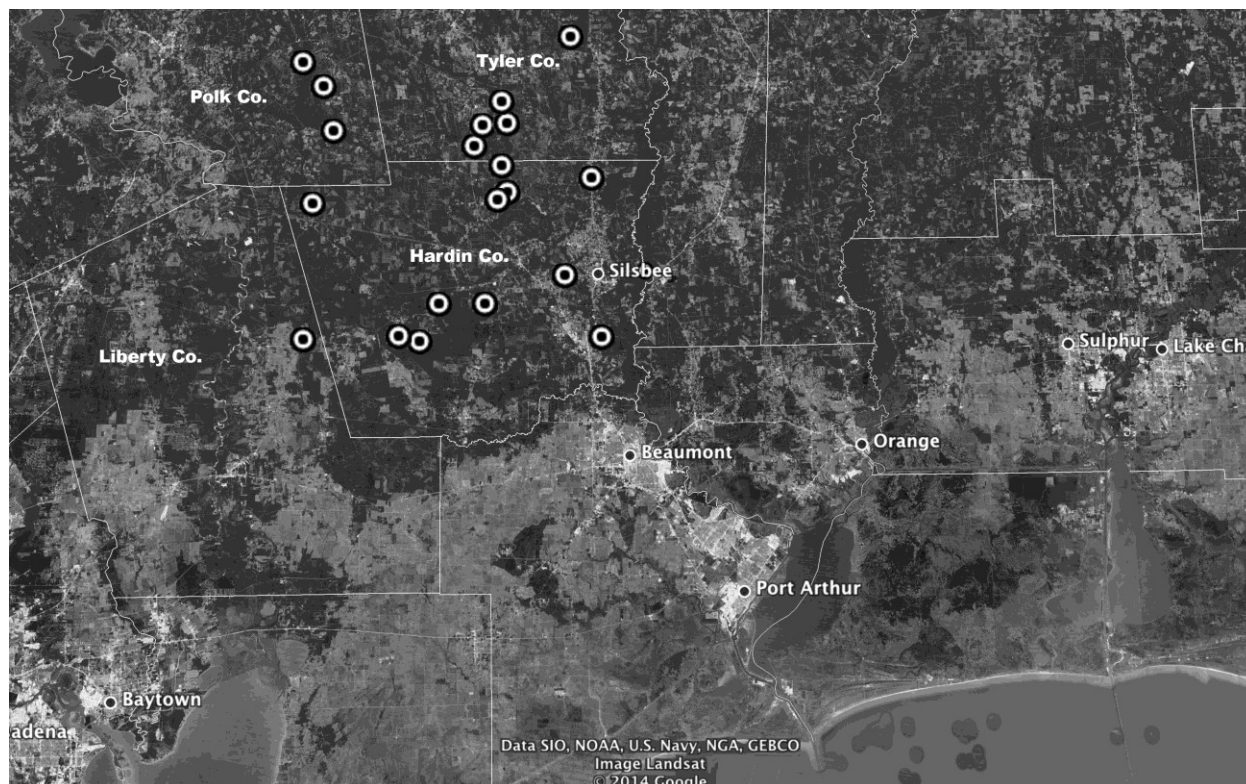


Figure 1. Big Thicket Region of Texas. Circles indicate sampling localities.

Results

Sixty-four species of ants have been documented in the Big Thicket Region. During this survey, 47 ant species from 28 genera were documented across various habitats within the Big Thicket (Tables 2 and 3). Seventeen species listed in O’Keefe et al (2000) were not found during this survey, although two species, *Solenopsis geminata* (F.) and *Solenopsis xyloni* McCook have likely been displaced by *Solenopsis invicta* Buren, their congener and more or less ecological equivalent, an occurrence that has been relatively well documented (See review in Tschinkel 2006). Twenty-nine species were documented in the region, that were not reported in O’Keefe et al (2000), three of which, (*Aphaenogaster miamiana* Wheeler, *Dolichoderus pustulatus* Mayr, and *Strumigenys angulata* Smith), represent new state records for Texas (Figure 3A-C). Additionally, nine exotic ant species were documented in the region with three species (*Brachymyrmex patagonicus* Mayr, *Solenopsis invicta* Buren, *Nylanderia fulva* Mayr, and *Pheidole moerens* Wheeler) (Figure 4A-C) being extremely abundant, even in apparently undisturbed habitats. Molecular analysis of *S. invicta* indicated that both the monogyne and polygyne social forms are present in the region. Two exotic species, *Linepithema humile* (Mayr) (Figure 4D) and *Tetramorium bicarinatum* (Nylander) were known from the region based on O’Keefe et al (2000), but were not documented during this survey.

Discussion

The region, and most of Texas, experienced drought conditions during the first two years (2011-2012) of the survey, which certainly affected the ant community, especially leaf litter dwelling ants. During this drought, the leaf litter and surface soil layer were extremely dry and very few native litter dwelling or epigeic species were extracted from samples. During this period, three exotic species, *S. invicta*, *B. patagonicus*, and *P. moerens* were extremely abundant even in deep forests and apparently undisturbed natural habitats. Effects of the drought are likely reflected in the relatively low number of species documented across the various habitats.

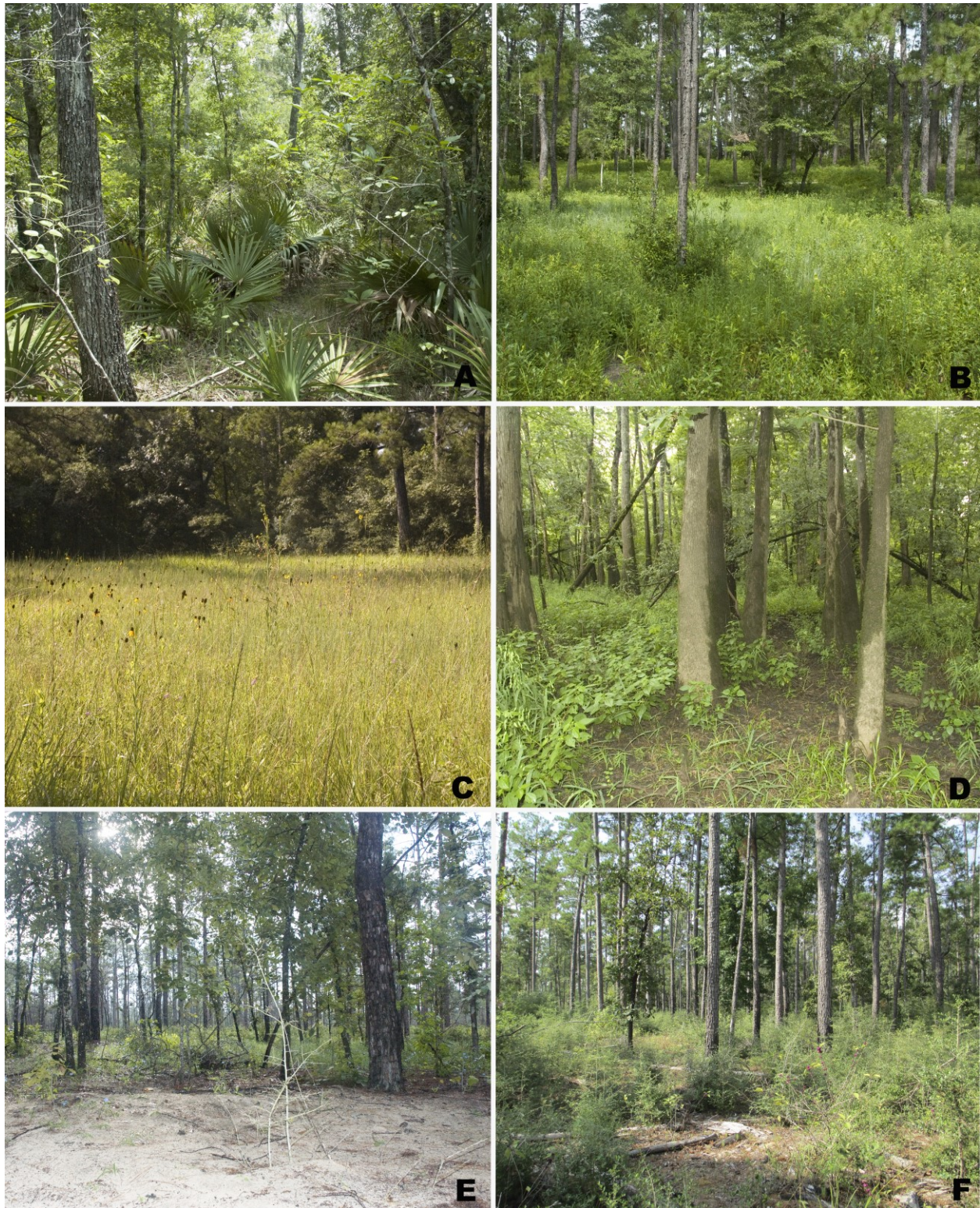


Figure 2. Selected habitats of the Big Thicket. A. Palmetto Hardwood Flat, B. Mesic Pine forest, C. Coastal Prairie, D. Bottomland hardwood forest, E. Arid sandyland, and F. Upland pine forest.

Table 2. Ants of the Big Thicket Region of Texas. Subsequent columns indicates whether the ants were a literature record (L), being reported in O’Keefe 1996 or collected during this survey in Coastal Prairie (CP), Arid Sandyland (AS), Upland Pine Savannah (UPS), Palmetto Hardwood Flats (PHF), Bottomland Hardwood/Cypress Slough (BHCS), Mesic Pine Savannah (MPS), and Beech/Hardwood (BH), and Mixed Pine-Hardwood Forests (MF). Species names in bold denote new state records for Texas. An asterisk (*) denotes specimens only known from literature records and a double asterisk (**) denotes an exotic species. ¹Collected in a lawn at Thicket of Diversity Field Station.

Ant Species	L	CP	AS	UPS	PHF	BHCS	MPS	BH	MF
<i>Aphaenogaster fulva</i> Roger*	1	0	0	0	0	0	0	0	0
<i>Aphaenogaster miamiana</i> Wheeler	0	0	0	0	1	1	0	0	1
<i>Aphaenogaster texana</i> Wheeler*	1	0	0	0	0	0	0	0	0
<i>Aphaenogaster treatae</i> Forel	0	0	1	0	0	0	0	0	0
<i>Atta texana</i> (Buckley)	1	0	1	1	0	0	0	0	0
<i>Brachymyrmex depilis</i> Emery	1	0	0	0	1	0	0	1	1
<i>Brachymyrmex patagonicus</i> Mayr**	0	1	0	1	1	0	1	0	0
<i>Camponotus castaneus</i> (Latreille)	1	0	1	0	1	0	0	0	1
<i>Camponotus nearcticus</i> Emery*	1	0	0	0	0	0	0	0	0
<i>Camponotus pennsylvanicus</i> (DeGeer)	1	0	0	1	1	1	0	0	1
<i>Crematogaster ashmeadi</i> Mayr	1	0	1	0	1	0	0	0	1
<i>Crematogaster lineolata</i> (Say)	0	0	0	1	0	0	0	0	0
<i>Crematogaster minutissima</i> Mayr*	1	0	0	0	0	0	0	0	0
<i>Crematogaster pilosa</i> Emery	0	0	0	0	1	0	0	0	0
<i>Cyphomyrmex rimosus</i> (Spinola)**	0	1	1	0	1	0	0	0	1
<i>Discothyrea testacea</i> Roger	0	0	0	1	0	0	0	0	0
<i>Dolichoderus pustulatus</i> Mayr	0	0	0	0	0	0	1	0	0
<i>Dorymyrmex bureni</i> (Trager)	0	1	1	0	0	0	0	0	0
<i>Dorymyrmex flavus</i> McCook*	1	0	0	0	0	0	0	0	0
<i>Forelius mccooki</i> (McCook)	1	0	0	1	0	0	0	0	0
<i>Formica dolosa</i> Buren	1	1	0	0	0	0	0	0	0
<i>Hypoponera inexorata</i> (Wheeler)	1	0	0	0	1	0	0	0	0
<i>Hypoponera opacior</i> (Forel)	0	1	0	0	1	0	0	0	1
<i>Hypoponera opaciceps</i> (Mayr)*	1	0	0	0	0	0	0	0	0
<i>Labidus coecus</i> (Latreille)	1	0	1	0	1	0	0	0	0
<i>Leptogenys elongata</i> (Buckley)**	0	0	0	0	0	1	0	0	0
<i>Linepithema humile</i> (Mayr)*	1	0	0	0	0	0	0	0	0
<i>Monomorium minimum</i> (Buckley)	1	0	0	1	1	0	0	0	0
<i>Myrmecina americana</i> Emery	1	0	0	0	1	0	0	0	0

Ant Species	L	CP	AS	UP	PHF	BHCS	MPS	BH	MF
<i>Nylanderia arenivaga</i> (Wheeler)	1	0	1	0	0	0	0	0	0
<i>Nylanderia faisonensis</i> (Forel)	0	0	0	0	1	0	0	0	1
<i>Nylanderia fulva</i> (Mayr)** ¹	0	0	0	0	0	0	0	0	0
<i>Nylanderia terricola</i> (Buckley)	1	1	0	0	0	0	0	0	0
<i>Nylanderia vividula</i> (Nylander)*	1	0	0	0	0	0	0	0	0
<i>Neivamyrmex nigrescens</i> (Cresson)*	1	0	0	0	0	0	0	0	0
<i>Neivamyrmex swainsonii</i> (Shuckard)*	1	0	0	0	0	0	0	0	0
<i>Pachycondyla harpax</i> (Fabricius)**	0	0	1	1	1	0	0	1	0
<i>Pheidole dentata</i> Mayr	0	0	1	1	1	0	0	1	1
<i>Pheidole dentigula</i> Smith	0	0	0	0	0	1	0	1	0
<i>Pheidole metallescens</i> Emery	0	0	1	1	1	0	0	0	0
<i>Pheidole moerens</i> Wheeler**	0	0	0	1	1	0	0	1	1
<i>Ponera pennsylvanica</i> Buckley	1	0	0	0	1	0	0	1	1
<i>Ponera exotica</i> Smith	0	0	0	0	0	0	0	0	1
<i>Prenolepis impairs</i> (Say)*	1	0	0	0	0	0	0	0	0
<i>Pseudomyrmex gracilis</i> (Fabricius)**	0	0	0	0	0	0	0	0	1
<i>Pseudomyrmex ejectus</i> (Smith)	0	0	0	0	0	0	0	0	1
<i>Solenopsis carolinensis</i> Forel	0	0	0	0	1	1	0	1	1
<i>Solenopsis invicta</i> Buren**	1	1	1	1	1	1	1	1	1
<i>Solenopsis geminata</i> (Fabricius)*	1	0	0	0	0	0	0	0	0
<i>Solenopsis molesta</i> (Say)*	1	0	0	0	0	0	0	0	0
<i>Solenopsis subterranea</i> MacKay & Vinson	0	1	0	0	0	0	0	0	0
<i>Solenopsis tonsa</i> Thompson	0	0	1	0	0	0	0	0	0
<i>Solenopsis xyloni</i> McCook*	1	0	0	0	0	0	0	0	0
<i>Strumigenys angulata</i> Smith	0	0	1	0	0	0	0	0	0
<i>Strumigenys clypeata</i> Roger*	1	0	0	0	0	0	0	0	0
<i>Strumigenys dietrichi</i> M. R. Smith	0	0	0	0	0	0	0	1	0
<i>Strumigenys louisianae</i> Roger	1	0	1	0	1	0	0	1	1
<i>Strumigenys membranifera</i> Emery**	0	0	0	0	1	0	0	0	1
<i>Strumigenys ornata</i> Mayr	1	0	0	0	1	1	0	0	0
<i>Strumigenys reflexa</i> Wesson & Wesson*	1	0	0	0	0	0	0	0	0
<i>Strumigenys rostrata</i> Emery*	1	0	0	0	0	0	0	0	0
<i>Strumigenys silvestrii</i> Emery**	0	0	0	0	0	1	0	0	0
<i>Tetramorium bicarinatum</i> (Nylander)* **	1	0	0	0	0	0	0	0	0
<i>Trachymyrmex septentrionalis</i> (McCook)	1	0	0	1	0	0	0	0	1
Totals	36	8	15	13	24	9	3	10	19

The palmetto hardwood flats were the most diverse habitat with 24 species. This may be attributed to the relatively moist conditions present during the drought. A rare reddish variant of *Myrmecina americana* (Figure 3D) was collected during the final sampling period in the palmetto hardwood flats. Originally described as the subspecies *Myrmecina americana brevispinosa*, these smaller, less sculptured, and lighter colored variants were synonymized with *M. americana* by Brown (1951) after he discovered that a lab reared colony of typical *M. a. americana* that was starved in an artificial nest produced workers that corresponded to *M. a. brevispinosa*. Other mesic or relatively wet habitats such as mesic pine forests and bottomland hardwood forests/cypress sloughs were dominated by *S. invicta*. Fifteen species were documented in the arid sandylands, which are situated on well-drained, deep sandy soils. Many of the native species that inhabit the sandylands, such as *Nylanderia arenivaga* (Wheeler) and *Dorymyrmex bureni* (Trager), are well adapted to these edaphically arid environments and remained relatively abundant during the drought. In the year after drought, native ant diversity appeared to recover, as many of the litter dwelling species were documented during the two final sampling events. Thus, additional ant species will likely be documented with further sampling in the region.

Of special note is the appearance of *Nylanderia fulva*, the tawny crazy ant, at the Thicket of Diversity field station. An invasion of *N. fulva* in the region may result a shift in the local ant and arthropod community. LeBrun et al. (2013) found that upon invasion, *N. fulva* displaces *S. invicta* and decreases non-ant arthropod abundance and diversity. However, the finding of LeBrun et al (2013) is similar to what Porter and Savignano (1990) demonstrated during an invasion of the polygyne form of *S. invicta*, whereupon, the invasion of *S. invicta* resulted in the displacement of *Solenopsis geminata* (Fabricius), and the diversity and abundance of ants and other arthropods dropped significantly. However, most of the effects of the *S. invicta* invasion were not permanent, as 12 years post-invasion, native ant abundance and richness had returned to pre-invasion levels. Only the displacement of *S. geminata* and increased overall ant abundance (as a result of high abundance of *S. invicta*) seem to be lasting (Morrison 2002). Although the two are not ecological correlates, if *N. fulva* does spread in the Thicket it will hopefully track a similar path to that of the *S. invicta* invasion in central Texas.

This survey provides some baseline information of the ant fauna of the Big Thicket region of southeast Texas. Given the diversity of habitats found in the Big Thicket and the presence of several exotic species, the region would be an interesting area to conduct ecological studies. With rainfall patterns apparently returning to normal, further surveys will undoubtedly document additional species in the region that would enable better documentation of ant species present in each habitat type

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Figure 3. Noteworthy native species collected during this survey of the Big Thicket. A. *Aphaenogaster miamiana* Wheeler, *Strumigenys angulata* Smith, *Dolichoderus pustulatus* Mayr, and D, reddish variant of *Myrmecina americana*.

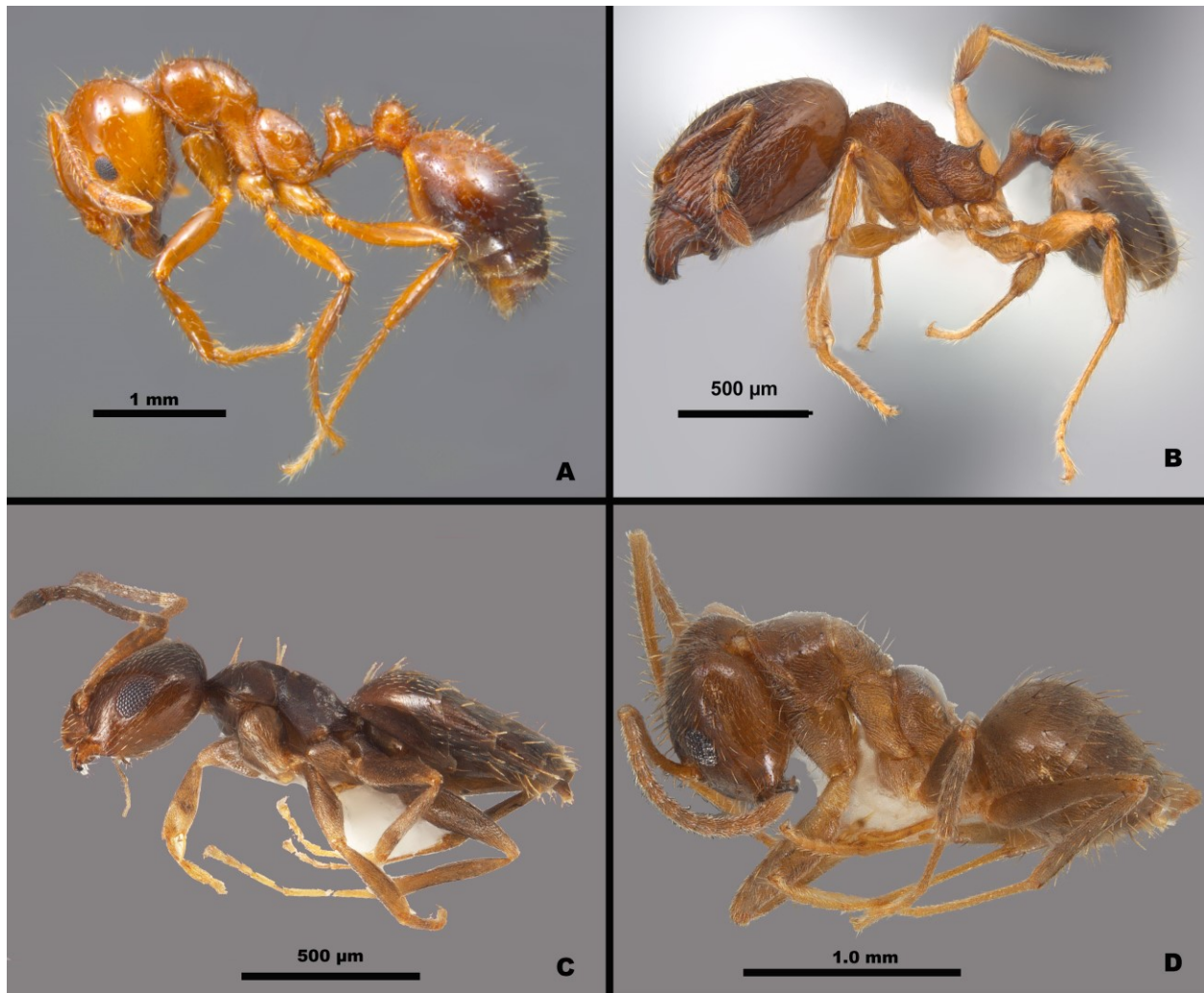


Figure 4. Noteworthy exotic ant species collected during this survey of the Big Thicket. A. *Solenopsis invicta*, B. *Pheidole moerens*, C. *Brachymyrmex patagonicus*, and D. *Nylanderia fulva* (Mayr).

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