New Species Distributions of Ants in Oklahoma, including a South American Invader

Marc Albrecht
Department of Zoology, 730 Van Vleet Oval, University of Oklahoma, Norman, OK 73019

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Intensive sampling of ants in Caddo County, Oklahoma has revealed eight species not previously reported in Oklahoma and twelve additional species never recorded in Caddo County. The populations of species not previously reported in Oklahoma may be surviving here, far from known ranges, because environmental extremes are ameliorated by sheltering canyons. Also the presence of the South American invader *Linepithema humilie* (Mayr), the Argentine ant, is noted. *L. humilie* is the only species newly reported here which occurs commonly.

INTRODUCTION

Collection of approximately 28,000 ants in Caddo County, Oklahoma resulted the discovery of 8 species of ants not previously reported in Oklahoma, and an 12 additional species not listed for Caddo County. These records result from sampling over a 5-year period in a 9-km² section of this County in and around the unusual sandstone canyons found there (Fig. 1). These Permian formations were repeatedly filled and excavated by Pleistocene glaciations (*1-3*). Most of the large canyons are about 30 m deep and extend 2-5 km in length. These canyons may play a key role in determining why a number of ant species were found at this location far from their known ranges.

On the uplands in this area of Oklahoma, tall-grass prairie alternates with forest communities of blackjack, red cedar, and post oak. Rice and Penfound (*4*) give a thorough listing of upland forest communities in Oklahoma. The canyon bottoms have ameliorated environmental conditions compared to the uplands: cooler air and soil temperatures, lower wind speeds, higher precipitation:evaporation ratio, and twice the soil moisture (*5*). The canyons harbor species not found on adjacent uplands, such as a distinct ecotype of sugar maple (*5-7*) and a number of vascular plant species in what are described as "disjunct ranges" (Rice, personal communication). That is, these species occur in the canyon bottoms in Caddo County, and the nearest population may be hundreds of miles to the east, in cooler areas of Oklahoma or Kansas. These canyons may serve as refugia, or islands, during warm climactic periods.

MATERIALS AND METHODS

Ants were collected in two areas of Caddo County, Oklahoma (Fig. 1). The first area, containing sites 1 and 2, is 12 km east of Binger, Oklahoma along state highway 152. Site 1 is adjacent to state highway 152 and is a 1-2 m wide area of sand, with patches of grass, extending 25 m along a south-facing 10-m-high cliff and is not shaded. Site 2 is 300 m further west along a 10-m-high cliff also with southern exposure, overlooking highway 152. The soil is primarily sand and devoid of vegetation, except for small plants and vines.

The second area, containing sites 3-8, is located about 9 km E of Binger. Site 3 is a 3-m-wide strip extending 60 m along the base of a 15-m cliff facing SW and bordering a forested area. Sites 4 and 5 are in grassland in a large canyon bottom. The grassland is lightly grazed by two horses and annually mowed. Site 4 is a 25×25-m permanently marked plot located in an open bottom that receives almost no shade. Site 5 is a 20×20-m plot of grassland on a recently constructed flood control area 200 m west of the permanent plot. Sites 6 and 7 are two 20×20-m plots on upland fields between canyons, separated from each other by almost a kilometer. Site 8 is a 20×20-m plot on an isolated and undisturbed grassland located in another large canyon north of the other sites.

A number of pitfall-trap series were located at these sites. Pitfall sampling was conducted annually in July for 5 yr at sites

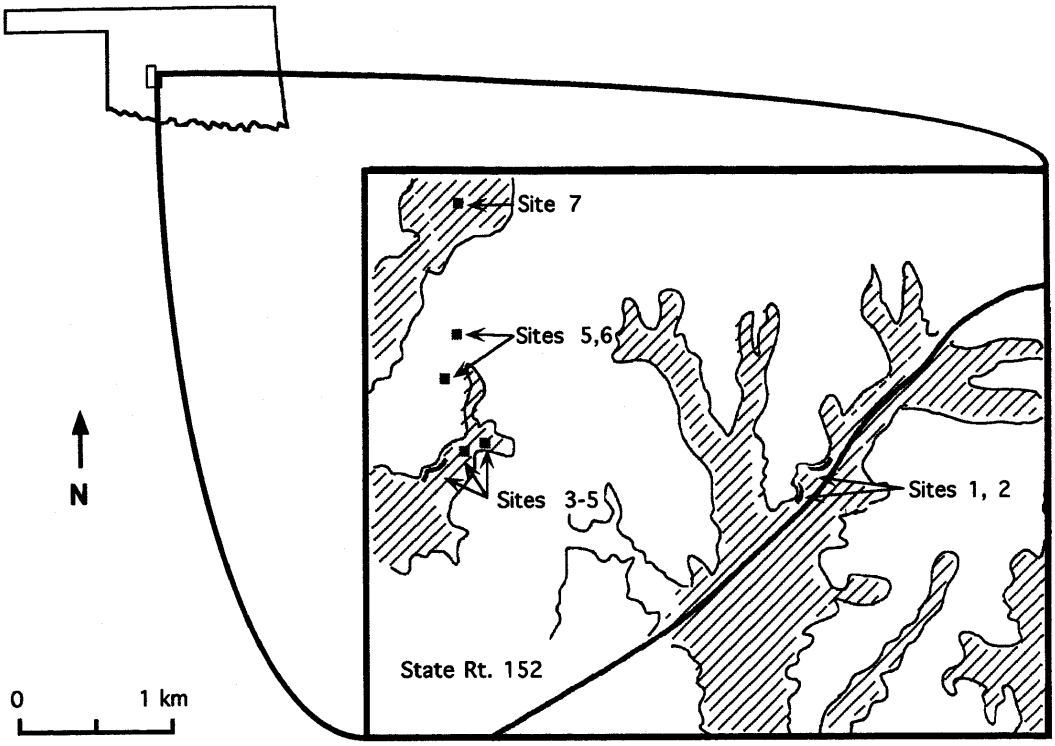

Figure. 1 Map of a northeastern section of Caddo County, OK; hatched areas indicate lower elevations.

1, 2, and 3, as described by Gotelli (*8*). At each site an array of 24 pitfalls were set out for 72 h. Twelve traps were placed under sandstone cliffs and 12 traps placed 1 m away from the cliffs. Each group of 12 pitfalls consisted of 6 large (4×10 cm), and 6 small (2.5×7 cm) bottles placed in buried PVC sleeves. The inner rim of each bottle was coated with Fluon™, and the bottles were partially filled with ethylene glycol.

Site 4 was sampled with both tuna-fish baits and pitfalls. From October 1991 through October 1992, ants were collected once per month at tuna-fish baits. Twenty-five tuna-fish baits (approx. 50 g) were placed on fiberboard cards in a 5×5 grid, each row and column separated by 5 m. Every hour, for 24 consecutive hours, the individuals on each bait card were counted and identified to species. If the species could not be identified in the field, I collected specimens with suction aspiration for laboratory identification.

Two pitfall collections at site 4 were completed during the summer of 1993. These pitfall traps were 1.7×10-cm polyethylene test tubes, 2/3 filled with soapy water, left in place for 72 h. The protocol was 25 traps placed in a 5×5 grid pattern, each row and column separated by 5 m.

In July 1993 one collection was made at sites 4-8. At each site 16 traps, as described above, were placed in a 4×4 grid pattern, spaced by 5 m, and collected after 72 h.

RESULTS

Table 1 lists new ant records for Caddo County and the state of Oklahoma. Species not reported previously for Oklahoma have their closest known ranges listed (*9, 10, 11*). Most of the species have ranges to the west and/or north of Oklahoma, and are areas with lower temperatures.

The presence in these canyons of species usually found in cooler climates indicates that physiological needs of these species may be met in this part of Oklahoma only in the cooler canyons. For example, *Lasius neoniger* (Emery) was the numerically dominant ant at site 4 baits only when the temperature was below 20 °C. Also, the placement of artificial roofs (0.25 m² in size) near site 4 caused *L. neoniger* to construct new tunnels and nest entrances under those roofs in a matter of days. This relationship was significant as compared to new entrances in unshaded plots of the same size

TABLE 1. New records for ant species in either Caddo County or for all of Oklahoma.

Subfamilies follow Creighton (9), and genera have been arranged alphabetically. After the species name, "Caddo" denotes a new listing of the species for Caddo County, and "Oklahoma" denotes a new listing of the species for the state of Oklahoma. The next item in each record is the site number(s) where the species was found. The three-digit number following the site listing is the number of the voucher specimen deposited at the K.C. Emerson Entomology Museum in Stillwater, Oklahoma. If the species is a new record for Oklahoma, the previously reported geographical range is also given.

Subfamily **Ponerinae**

Hypoponera opacior (Forel) Caddo, 4, 001.

Subfamily **Myrmicinae**

Aphenogaster subterranea (Creighton) Oklahoma, 3, 002; California mountains east to Nevada; another subspecies, Colorado to British Columbia.

Aphenogaster texana carolinensis (Emery) Caddo, 3, 003.

Crematogaster minutissima smithi (Creighton) Caddo, 4, 004.

Crematogaster punctulata (Buren) Caddo, 4, 005.

Pheidole bicarinata (Mayr) Caddo, 4, 006.

Pogonomyrmex comanche (Wheeler) Caddo, 1, 007.

Pogonomyrmex occidentalis (Shattuck) Caddo, 1, 008.

Pogonomyrmex salinus (Olsen) Oklahoma, 1, 009; only known by type from California.

Solenopsis picta (Emery) Caddo, 3, 010.

Solenopsis texana (Emery) Caddo, 3 & 4, 011.

Subfamily **Dolichoderinae**

Conomyrma Conomyrma flava (Creighton) Caddo, 4, 012.

Linepithema humilie (Mayr) Oklahoma, 4, 013; South America via Alabama.

Tapinoma sessile (Creighton) Caddo, 3, 014.

Subfamily **Formicinae**

Brachymyrmex depilis (Creighton) Caddo, 3, 015.

Camponotus modoc (Wheeler) Oklahoma, 3. 016; Pacific coast, east to Rockies.

Formica bradleyi (Wheeler) Oklahoma, 4, 017; Colorado north to Alberta, east to North Dakota.

Lasius pallitarsus (Provancher) Oklahoma, 4, 018; nearly all of US, southern Canada, not in Texas or Florida.

Lasius sitiens (Wilson) Oklahoma, 3, 019; southwest US and northern Mexico.

Paratrachina arinevaga (Wheeler) Oklahoma, 4, 020; New Jersey to Gulf Coast.

(Albrecht, in prep.). *L. neoniger* is also absent from the more exposed upland samples, sites 6 and 7.

The one species I report that is not indigenous to North America is *Linepithema humilie* (Mayr), a South American invader. This species is not yet a common ant, making up <2% of all individuals identified. *L. humilie*, also called the Argentine ant, has reached this area ahead of the more well-known invader, the imported fire ant (*Solenopsis invicta* Buren). *S. invicta* has extended its range north to Oklahoma at the Lake Texoma Biological Station, on the Texas-Oklahoma border (pers. obs.). The only other populations of *S. invicta* in Oklahoma are introductions via nursery plantings and other accidental events. The Biological Station is 160 km south and 135 km east of the Caddo County field sites.

This study shows the value of intensive sampling, especially in habitat "islands". Of 89 species known to be present in Oklahoma, 25 were found by this survey in an area <10 km^2 (*12*). The large number of samples collected also led to the previously unrecorded species being found. The location of sampling sites was also helpful in this regard. The canyon bottoms have abiotic conditions different from those in the uplands. By sampling in these unusual "patches" or "islands", species unrecorded for the entire state were found, far from the nearest state border.

The populations found in these canyon "islands" could be isolated from populations in their non-Oklahoma ranges and thus represent a natural experiment useful for a number of evolutionary and ecological studies. In this particular case it is possible some of the species maintain genetic flow with populations in neighboring canyons and thus may constitute a metapopulation (*13*). If this is the case, studies of extinction, conservation, or speciation would be possible.

The detection of the Argentine ant is also an important piece of information gained from this sampling effort. Charting the progress and success of invaders may have immediate implications in pest control. Studying invasions may also lead to answers

about the processes of invasions, such as the invasibility of communities and interspecific competition for resources.

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