THE ANTS (HYMENOPTERA, FORMICIDAE) OF WESTERN TEXAS. PART II. SUBFAMILIES ECITONINAE, PONERINAE, PSEUDOMYRMECINAE, DOLICHODERINAE, AND FORMICINAE

James C. Cokendolpher and Oscar F. Francke

THE ANTS (HYMENOPTERA, FORMICIDAE) OF WESTERN TEXAS. PART III. ADDITIONS AND CORRECTIONS

James C. Cokendolpher

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CONTENTS

INTRODUCTION

This contribution is the second part of a study of the ants of western Texas. The first part (Moody and Francke, 1982) dealt with ants of the subfamily Myrmicinae; this contribution deals with the remaining five subfamilies. The third part, the final section, will contain additions and corrections to Part I.

The objectives of this study are the same as in Part I of the series: to determine which ant species inhabit western Texas, to define geographic regions in which they occur, and to explore some of the abiotic factors correlated with their distribution. Ecological data gathered at each collecting locality were used to determine the preferred habitat of the different species.

MATERIALS AND METHODS

Study Area

Texas can be partitioned into 10, major, vegetative zones (Correll and Johnson, 1970). These zones are useful in describing general environmental differences that often serve to limit biotic distributions. The study area for this research included all of Texas west of the 100th meridian as well as several localities from 10 to 60 kilometers east of that line; five of the vegetative regions are within this study area (Fig. 1).

The Texas High Plains occupy approximately 81,000 square kilometers (Fig. 1) and receive from 43 to 58 centimeters of precipitation annually. The elevation of the High Plains ranges from 800 to 1300 meters. Much of the region is irrigated cropland, although large tracts also support rangeland.

The Rolling Plains (Fig. 1) occupy approximately 77,000 square kilometers of the study area and have an average annual precipitation from 44 centimeters on the Texas-New Mexico border in Oldham County to 70 centimeters at the 100th meridian. Elevation of the Rolling Plains study area ranges from 450 to 800 meters. Almost all of the Rolling Plains within the study area is rangeland.

Approximately 69 percent of the 97,000 square kilometers of the Edwards Plateau lies west of the 100th meridian (Fig. 1). The average annual precipitation of this area is 43 centimeters in the west and 71 centimeters along the 100th meridian. Ranging in elevation from 250 to 800 meters, the Edwards Plateau is primarily rangeland, with some cultivation practiced in valleys and areas with deeper soils.

About 20,000 square kilometers of the Rio Grande Plains are within the boundary of the study area (Fig. 1). Within this area, the average annual rainfall is 45 centimeters, and the elevation ranges from 150 to 200 meters. With the exception of a few large farms, most of the land is used as rangeland.

The Trans-Pecos region includes approximately 77,000 square kilometers in the area west of the Pecos River (Fig. 1). The average annual precipitation varies with elevation (450 to 2650 meters), ranging from less than 35 centimeters in some parts of the Chihuahuan desert to as much as 55 centimeters at higher elevations.

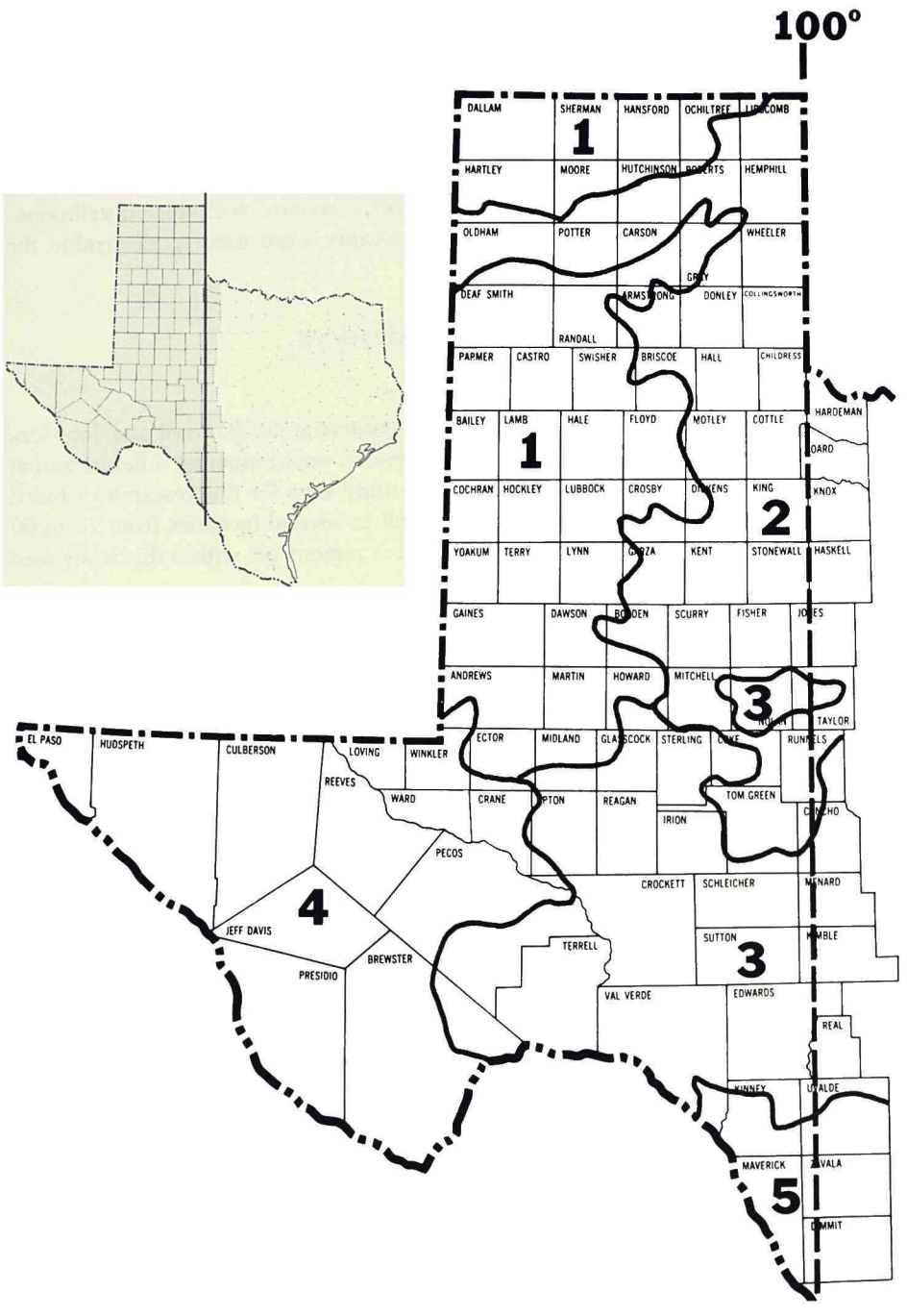

FIG. 1.—The vegetational regions of western Texas (from Correll and Johnston, 1970): 1, High Plains; 2, Rolling Plains; 3, Edwards Plateau; 4, Trans-Pecos region; 5, Rio Grande Plains. Gray on insert map indicates study area.

Collecting Procedures

Ants were sampled at 691 collecting sites in 97 counties, covering an area of approximately 324,700 square kilometers. Collecting techniques used in this study were based on methods outlined by Wheeler and Wheeler (1963). During the day, aspirators were used to collect ants from nests found at each locality. At night, bait stations were set, at which peanut butter, hamburger meat, or grease were used to attract nocturnally foraging workers. In addition, ultraviolet lights (black lights) were used to collect night-flying males and females.

Samples equalling one nest series usually consisted of several dozen workers, brood, and any reproductive forms observed. Data such as slope angle and exposure, nest description, and caste(s) collected were compiled for most nest series; the plant association for each collecting locality also was recorded.

Ecological data for samples collected prior to March 1978 are unavailable, and their numbers are reflected under the "no data" column heading of Appendices 3 and 4. All ants collected were preserved in 80 percent ethyl alcohol and deposited in the Entomological Collection at Texas Tech University.

The elevation of each collecting locality was determined using United States Geological Survey Maps with contour intervals of 30.5 meters (100 feet). Soil texture data for all localities were determined in the field by wetting a pinch of soil and rubbing it between the fingers. The accuracy of field determinations was verified for 355 of the collecting localities by comparing them to the soil texture class for each locality as given in the county soil surveys published by the Soil Conservation Service (United States Department of Agriculture, 1975). The remaining field determinations could not be verified because county soil surveys were not available for those localities. Nonetheless, the data were considered to be reliable and were used in analyses.

Analytical Methods

Elevation and soil texture data for each species taken at more than two localities were analyzed separately with Chi-Square tests. Elevation distribution data were partitioned into cells of 100-meter intervals for the analyses (Appendix 2). Eleven soil texture classes were used (Appendix 3).

The distribution of those parameters among the 691 localities sampled were used to calculate the expected values of occurrence for each ant species, using the null hypothesis that each species is randomly distributed in western Texas with respect to both elevation and soil type. Following the methods of Snedecor and Cochran (1967), we assumed the smallest expected value for each cell in each analysis was at least one; in reality, most were substantially larger. If, after combination of adjacent cells, the above criterion was not met or if the degrees of freedom were below seven, the analysis was not attempted.

Slope angle and exposure data for each nest series were tabulated and analyzed. Ants were collected primarily from nests that were on level or slightly sloping surfaces, but a few species were found in areas with more severe slopes (Appendix 4). Nests located on slopes were not collected in sufficient quantities to suggest any

definite exposure trends or preferences for any one species. For this reason, the nest slope-exposure data are not included.

Plant association data for each collecting locality did not show any relationship with individual ant species, except in those cases where an ant species was directly associated with certain plants. This relationship occurred for those ants found nesting in plants, such as arboreal nesting species of *Camponotus* and *Colobopsis*. In the Edwards Plateau area of western Texas, gall-nesting ants are primarily associated with live oak trees (*Quercus virginiana* Mill). For convenient reference, all appendices and figures showing ant distributions in western Texas are grouped at the end of the text.

Results and Discussion

The largest subfamily of the Formicidae, the Myrmicinae, was dealt with in the first part of this study (Moody and Francke, 1982). The remaining five subfamilies, with 24 genera present in western Texas, are considered herein. The cerapachyines, regarded as a subfamily in the first part, are treated as members of the Ponerinae in this paper. The army ants, referred to the Dorylinae in the first part, are here considered to belong to the subfamily Ecitoninae. These changes are discussed under the appropriate subfamilial headings and are reflected in the key to the subfamilies below.

Key to Workers of the North American Subfamilies of Ants (modified from Creighton, 1950)

1. Gaster with a distinct constriction between the first and second segments, or, if this constriction is faint, the mandibles are linear and the petiole is produced into a conical dorsal spine . . . . . Ponerinae
   Gaster without a constriction between the first and second segments 2
2. Abdominal pedicel consisting of two segments 3
   Abdominal pedicel consisting of one segment 5
3. Frontal carinae narrow and not expanded laterally so that the antennal insertions are fully exposed when the head is viewed from above 4
   Frontal carinae expanded laterally so that they partially or wholly cover the antennal insertions when the head is viewed from above . . . . . Myrmicinae
4. Eyes large, suboval or reniform, and consisting of several hundred fine ommatidia . . . . . Pseudomyrmecinae
   Eyes vestigial or absent, if present consisting of a single ocelluslike structure . . . . . Ecitoninae
5. Apex of gaster with a distinctly circular orifice, the acidopore, which usually is surrounded by a fringe of hairs . . . . . Formicinae
   Apex of gaster lacking acidopre, but with a broad, slitlike cloacal orifice; hairs, when present, not forming an encircling fringe . . . . . Dolichoderinae

Subfamily Ecitoninae

The members of this subfamily commonly are referred to as army ants. They are predaceous in habits and stage massive, well-organized raids, earning their common name. Army ants also are well known for their cyclic nomadic behavior: the cycles are related to the reproductive condition of the colony, alternating between statary

and nomadic phases. The species found in Texas are mostly subterranean, although the raiding columns of some appear above ground. These species are also primarily nocturnal, a behavior that can be exploited to find them; workers engaged in raids can be spotted on the surface with the aid of a flashlight or a headlamp. Winged reproductives are attracted to light traps.

Until recently, army ants (New World) and legionary ants (Old World) were considered to be members of the subfamily Dorylinae. Taylor (1978) and Snelling (1981), among others, have treated the army ants as a distinct subfamily, the Ecitoninae, although Smith (1979) and Wheeler and Wheeler (1985*a*) did not follow that change. Two genera of army ants occur in western Texas (Watkins, 1985). Because some of these species are known either only from workers or only from males and because the two sexes often are collected separately, the generic key presented below will serve to identify both.

Generic Key to Western Texas Ecitoninae
(adapted from Creighton, 1950, and Watkins, 1976)

1. Workers (wingless) 2
   Males (winged) 3
2. Tarsal claws with a median tooth . . . . . Labidus
   Tarsal claws simple, without a median tooth . . . . . *Neivamymex*
3. Apex of aedegus with setae . . . . . *Labidus*
   Apex of aedegus without setae . . . . . Neivamyrmex

Checklist of the Ecitoninae of Western Texas

The list below has been compiled primarily from Watkins (1976, 1985), where keys to species also are found. Because almost half the species recorded from western Texas are known throughout their ranges by only a single sex, we have indicated whether each is known (throughout its range) from workers (W), queens (Q), or males (M). Species previously reported from western Texas but not found during this study are indicated by a dagger; species strongly suspected to occur in western Texas but that have not been reported there are indicated by a question mark; species recorded for the first time from western Texas are indicated by an asterisk.

Labidus Jurine, 1807	
L. coecus (Latreille, 1802)	WQM
Neivamyrmex Borgmeier, 1940	
?N. carolinensis (Emery, 1894)	WQM
†*N. fallax* Borgmeier, 1953	W
**N. fuscipennis* (Wheeler, 1908)	M
N. harrisii (Haldeman, 1852)	WQM
N. leonardi (Wheeler, 1915)	W
N. macropterus Borgmeier, 1953	M
†*N. melsheimeri* (Haldeman, 1852)	M
N. minor (Cresson, 1872)	M
N. nigrescens (Cresson, 1872)	WQM
N. opacithorax (Emery, 1894)	WQM
†*N. pauxillus* (Wheeler, 1903)	WQ
N. pilosus mexicanus (Smith, 1859)	WQM
N. swainsonii (Shuckard, 1840)	M
N. texanus Watkins, 1972	WQM

Accounts of Species

Genus *Labidus* Jurine

This is a small Neotropical genus of army ants with eight described species that is found from the United States south to Paraguay and Argentina (Watkins, 1976). The behavior of these army ants is not as well known as that of other genera. Their nomadism seems to be erratic and unpredictable, and the statary phase can last for months. Their foraging raids are mostly subterranean (Rettenmeyer, 1963). Only one species occurs in the United States.

Labidus coecus (Latreille)

The most widespread species in its genus, *L. coecus* ranges from the southern United States, south to Argentina. In the United States, it occurs in southern Arkansas, Louisiana, Texas, and perhaps Oklahoma (Watkins, 1985). In western Texas, we collected 18 nest series at 16 different localities in 14 counties (Fig. 1, Appendix 1). It seems to be absent from the High Plains region. The elevation range of the samples is from 200 to 1100 meters, and the majority of nests for which slope data are available were taken from level ground (10 of 12). *Labidus coecus* was found on seven of the 11 soil textural categories, ranging from sandy to clay soils with no discernible pattern of abundance or absence toward either end of the gradation of soil textures. Eleven nests were found under objects (rocks, stumps, and a block of concrete); one had an entrance fully exposed to the sun, and the remaining six series consisted of stray workers found under various situations.

Genus *Neivamyrmex* Borgmeier

This genus contains approximately 124 species of which 24 are found in the United States (Watkins, 1976, 1985). In the United States, their bivouacs are mostly subterranean, and their raiding is done at night. During the warmer months, they behave like 'typical'' army ants, with regular, cyclic, alternating bouts of nomadism and statary phases; however, this activity ceases during the colder months (Rettenmeyer, 1963). The species found in western Texas can be identified using keys provided by Watkins (1976, 1985).

Neivamyrmex carolinensis (Emery)

This species has been reported in the United States from Virginia and North Carolina south to Florida, west to Arizona, and south into México (Smith, 1979). Despite records of its occurrence east (Louisiana), north (Kansas and Nebraska), west (New Mexico and Arizona), and south (México) of Texas (Watkins, 1976), this species has yet to be found in the state.

Neivamyrmex fallax Borgmeier

In the United States this species is known from Kansas, Louisiana, Texas, New Mexico, and Arizona (Smith, 1979). It has been reported to occur in western Texas in the Trans-Pecos area (Watkins, 1985), but we failed to find it during the present study.

Neivamyrmex fuscipennis (Wheeler)

This species, known only from males, occurs in Kansas and Texas (Watkins, 1985). We obtained one specimen (Fig. 2, Appendix 1), a male taken at a streetlight in September at Spofford, Kinney County. This is the first record of this species from western Texas.

Neivamyrmex harrisii (Haldeman)

This species is known from all castes and occurs in Oklahoma, Texas, New Mexico, and Arizona in the United States, and south into México (Smith, 1979). We obtained six specimens in western Texas from the High Plains, Edwards Plateau, and Trans-Pecos regions: five represent males taken at light traps and one represents workers (Fig. 2, Appendix 1). The workers were emerging from a small hole in level ground, on clay soil. Males were trapped during July and August. This army ant was found at elevations ranging from 800 to 1700 meters.

Neivamyrmex leonardi (Wheeler)

This army ant is known from workers only. It occurs in California, Oklahoma, and Texas in the United States, and in México (Smith, 1979). We have one record of this species from the High Plains of western Texas (Fig. 2, Appendix 1). A sample of workers, possibly a bivouac, was found under a rock; the elevation was about 1000 meters, and the soil was clay loam. Two additional localities (on the High Plains and in the Trans-Pecos region) were mapped for this species in western Texas by Watkins (1985).

Neivamyrmex macropterus Borgmeier

This species is known only from males and is found in México and in Arizona, New Mexico, and Texas (Smith, 1979). We have one sample from western Texas: several adult males were collected in August at an ultraviolet light trap in the Guadalupe Mountains National Park (Fig. 2). The elevation was about 1650 meters. Two additional localities in the Trans-Pecos region of western Texas were mapped by Watkins (1985).

Neivamyrmex melsheimeri (Haldeman)

This army ant is known only from males, from Oklahoma, Louisiana, and Texas in the United States, south to Costa Rica (Smith, 1979). Watkins' (1985) distribution map for this species includes a single collection from western Texas, in the area of Ozona, Crockett County. No individuals of this species were taken during this study.

Neivamyrmex minor (Cresson)

This is one of the smallest army ants in the United States, and it is known only from males. It occurs from Kansas and Oklahoma, south and west to Nevada and California in the United States, and south into México (Smith, 1979). We obtained it at ultraviolet light traps at five different localities in the Trans-Pecos area (Fig. 3) in June, July, and August. All localities were at elevations higher than 1400 meters. Several additional localities in the Trans-Pecos, High Plains, and Rolling Plains regions of western Texas were mapped by Watkins (1985).

Neivamyrmex nigrescens (Cresson)

The range of this species extends from Kentucky and West Virginia to Illinois and Iowa, west to California in the United States, and south to southern México (Watkins, 1985). It is known from all castes. In western Texas, we found it at 13 different localities spanning all the vegetative regions (Fig. 3, Appendix 1). Two bivouacs found in March and June, respectively, contained brood. The elevational range of the samples was from 500 to 1900 meters, and they were found on six different soil textural classes (fine sandy loam, sandy loam, loam, clay loam, silty clay loam, and clay). Six samples were obtained from under objects, primarily rocks; two represented exposed nesting holes in the ground, and five consisted of raiding columns.

Neece and Bartell (1982) reported that a single undetermined mite (Acarina: Trachyaropodidae) was collected from a *N. nigrescens* colony in Real County.

Neivamyrmex opacithorax (Emery)

This army ant, known from all castes, occurs from California to Iowa and Virginia in the United States, and south to Costa Rica (Smith, 1979). In western Texas, we collected it at three different localities on the Edwards Plateau and Rio Grande Plains (Fig. 3, Appendix 1). Two bivouacs were found under a rock and a large sheet of metal, respectively, and the third sample came from a raiding column. The elevations were 160, 320, and 840 meters, and the soil types were loam, clay loam, and clay. Two additional localities from the Trans-Pecos area were mapped by Watkins (1985).

Neivamyrmex pauxillus (Wheeler)

The male of this species in not known. This species is recorded only from Texas in the United States and México (Smith, 1979). Wheeler (1908) reported the only collection of this species from western Texas, at Paisano Pass, near Alpine, Brewster County. This ant was not collected during this study, despite repeated visits to the specific locality from which it was reported previously.

Neivamyrmex pilosus mexicanus (Smith)

This is another taxon known from all castes and that ranges from the United States south to Colombia (Smith, 1979). In the United States, it has been reported from California, Texas, Oklahoma, Mississippi, Arkansas, and Louisiana (Watkins, 1985). In western Texas, we found it at two widely separate localities: one on the Rolling Plains and one in the Trans-Pecos region (Fig. 3, Appendix 1). One series of workers was dug up while a nest of *Crematogaster laeviuscula* Mayr was being excavated. Perhaps the army ants were staging a subterranean raid on that colony. The elevation was about 650 meters, and the soil type was clay loam. The other sample represents adults taken in an ultraviolet light trap in August, at an elevation of approximately 1500 meters. Additional localities in the Trans-Pecos, High Plains, and Rolling Plains regions of western Texas were mapped by Watkins (1985).

Neivamyrmex swainsonii (Shuckard)

This widespread species, found from the southern United States, south to central Argentina, is known only from males (Smith, 1979). In the United States, it occurs from California to Louisiana. In western Texas, we found it at five localities in the Trans-Pecos region and on the High Plains (Fig. 3, Appendix 1). The elevational range was from 1000 to 2000 meters, and all specimens were collected from ultraviolet light traps. Additional localities in the Trans-Pecos, High Plains, and Rolling Plains regions of western Texas were mapped by Watkins (1985).

Neivamyrmex texanus Watkins

This species is known from all castes and occurs from Virginia south into Florida, westward to Colorado and Arizona in the United States, and south into México (Smith, 1979). We found it at two localities in the Trans-Pecos region and one locality on the Edwards Plateau (Fig. 2, Appendix 1). One series of workers was taken from an abandoned nest of a harvester ant, *Pogonomyrmex* sp. The location was about 1700 meters in elevation, on silty loam soil. The second sample represents an underground bivouac (larvae found) located at sunset as the workers prepared for a nocturnal raid. The ants were emerging from a bare hole in the ground (that is, no tumulus present), at an elevation of about 1500 meters on loam soil. The third sample represents workers taken from a raiding column found at an elevation of about 500 meters. An additional locality on the southern High Plains of western Texas for this species was mapped by Watkins (1985).

Subfamily Ponerinae

This subfamily of primitive ants is found primarily in tropical regions. Members of the group are predaceous. Brown (1975) placed the cerapachyines within the Ponerinae rather than treating them as a separate subfamily. Snelling (1981) concurred with Brown's placement, but Smith (1979) and Wheeler and Wheeler (1985*a*) continued to treat the cerapachyines as a separate subfamily.

This group is represented in western Texas by eight genera belonging to five different tribes.

Generic Key to Workers of Western Texas Ponerinae (modified from Creighton, 1950)

1. Antennal scape short and stout, even at the base, the scape flattened throughout or with a greatly enlarged tip that bears a prominent lateral furrow for the reception of the funiculus . . . . . *Cerapachys*

   Antennal scape not as above, usually long and slender, but if short and enlarged at the tip, at least the basal third is slender 2

2. Gaster without a distinct constriction between the first and second segments; node of petiole forming a conical spine above; mandibles linear and inserted near the midline of head; antennal fossae bounded in the rear by a rounded ridge, which runs diagonally inward from the eye . . . . . *Odontomachus*

   Gaster with a distinct constriction or groove between first and second segments; node of petiole blunt or rounded above; mandible inserted at sides of head; antennal fossae not bounded in the rear by a diagonal ridge 3

3. Anterior border of the clypeus denticulate; mandibles with a row of coarse, bidenticulate teeth . . . . . *Amplyopone*
   Anterior border of the clypeus variously shaped but never denticulate; mandibular teeth, when present, single 4
4. Thoracic dorsum without sutures, with at most a shallow impression at the point at which the suture otherwise exists . . . . . *Proceratium*
   Thoracic dorsum with at least the promesonotal suture present, and usually the mesopropodeal suture present as well 5
5. Tarsal claws distinctly pectinate; mandibles without distinct teeth . . . . . *Leptogenys*
   Tarsal claws simple; mandibular teeth usually distinct 6
6. Tibiae of middle and hind legs with two spurs . . . . . *Pachycondyla*
   Tibiae of middle and hind legs with a single spur 7
7. Maxillary and labial palps of two segments each; subpetiolar process with a more or less distinct circular or oval thin spot, or fenestra, visible in transmitted light . . . . . *Ponera*
   Maxillary and labial palps of one segment each; subpetiolar process never with a fenestra . . . . . *Hypoponera*

Checklist of the Ponerinae of Western Texas

This list follows the sequence given by Smith (1979) and Wheeler and Wheeler (1985*a*), except that *Cerapachys* has been added at the end of that sequence. Smith (1979) should be consulted for the pertinent taxonomic and biologic bibliography for each species. Species previously reported from western Texas but not collected during this study are indicated by a dagger.

Tribe Amblyoponini
- *Amblyopone* Erichson, 1842
  - *A. pallipes* (Haldeman, 1844)

Tribe Proceratiini
- *Proceratum* Roger, 1863
  - †*P. compitale* Ward, 1988

Tribe Ponerini
- *Pachycondyla* Smith, 1858
  - *P. harpax* (Fabricius, 1804)
  - *P. villosa* (Fabricius, 1804)
- *Ponera* Latreille, 1804
  - *P. pennsylvanica* Buckley, 1866
- *Hyponera* Santschi, 1938
  - *H. inexorata* (Wheeler, 1903)
  - †*H. opaciceps* (Mayr, 1887)
  - *H. opacior* (Forel, 1893)
  - †*H. punctatissima* (Roger, 1859)
- *Leptogenys* Roger, 1861
  - *L. elongata* (Buckley, 1866)

Tribe Odontomachini
- *Odontomachus* Latreille, 1804
  - *O. clarus* Roger, 1861

Tribe Cerapachyini
- *Cerapachys* Smith, 1858
  - *C. augustae* Wheeler, 1902
  - †*C. davisi* Smith, 1942

Accounts of Species

Genus *Amblyopone* Erichson

This genus of subterreanean ponerine ants is most highly developed in the Australian region but occurs throughout much of the tropical and temperate regions of the world. There are only three species reported from the United States and a single species from the Trans-Pecos region of Texas (Smith, 1979; Ward, 1988; Wheeler and Wheeler, 1985*b*).

Amblyopone pallipes (Haldeman)

This species is known from Quebec to Florida, west to northern California and Arizona (Smith, 1979; Ward, 1988). Van Pelt (1983) reported that this species is rare in canyons in the Chisos Mountains, Brewster County, at 1900 meters elevation. An additional collection from the Chisos Mountains (2040 meters in elevation) was recorded by Ward (1988). A single, dealated founding queen was obtained during this study in Upper Dog Canyon, Guadalupe Mountains, Culberson County, at about 2350 meters elevation (Fig. 4, Appendix 1). The specimen was taken in late August. A good redescription and review of literature on this species is provided by Francoeur (1979). Traniello (1982) and Ward (1988) also provided much information on the biology and distribution of this species in the United States.

Genus ***Proceratium*** Roger

This cosmopolitan genus of cryptobiotic ants is represented by five species in the United States (Brown, 1980; Ward, 1988). So far as known (Brown, 1980), species of *Proceratium* are predators on arthropod eggs (especially spider eggs). The few nests discovered have been made of rotten wood.

Proceratium compitale Ward

This species is known only from Val Verde and Terrell counties in western Texas and one additional locality in nearby Coahuila, México (Ward, 1988). All known collections are from caves and a sinkhole.

Genus ***Pachycondyla*** Smith

This is a relatively common genus in the tropical regions of the world, but only three species reach the United States—one in Florida and two in the Rio Grande Plains and Edwards Plateau regions of Texas. The two species found in Texas can be distinguished by the development of a cheek carinae extending from the eye to the clypeus; it is distinct in *P. villosa* and absent in *P. harpax*.

Pachycondyla harpax (Fabricius)

In the United States, *P. harpax* is found in southern Texas, and perhaps adjacent southwestern Louisiana (Creighton, 1950; Smith, 1979). In western Texas, we found it at 10 different localities in five counties (Fig. 4, Appendix 1). The 10 localities are at elevations between 200 and 600 meters and represent five different soil types: one on sandy loam, three on loam, two on clay loam, one on silty clay loam, and three on clay. Nine of 18 nest series were taken on level to slightly sloping ground, two on slopes of six to 15 degrees, and two on slopes of 26 to 35 degrees. No slope information was available on five collections. This species prefers to nest under covering objects; eight series were found under rocks, four under logs, three under pieces of wood, one under a cement block, and two series represent foragers.

Pachycondyla villosa (Fabricius)

This ant, the largest ponerine in the United States, occurs from southern Texas to northern Argentina (Smith, 1979). In western Texas, we found it at one locality in Uvalde County (Fig. 4, Appendix 1). The single nest was under a rock, on silty clay loam soil, at about 150 meters elevation on a slope of 26 to 35 degrees inclination.

Genus ***Ponera*** Latreille

This genus contains approximately 28 species, which are found primarily in the Indo-Australian region (Taylor, 1967). Two species occur in the United States: one, possibly introduced, reported from North Carolina and Oklahoma, and the other widespread from Quebec west to Ontario in Canada, south to Florida, and west to North Dakota, Colorado, Utah, and New Mexico in the United States (Smith, 1979). In Creighton's (1950) treatment of the ants of North America, the species belonging to the genus *Hypoponera* Santschi were included under *Ponera*. The genus *Ponera* was revised by Taylor (1967), and the characters used to separate *Ponera* and *Hypoponera* in the key above were taken from his contribution.

Ponera pennsylvanica Buckley

This species is most abundant in deciduous forests east of the 100th meridian. In western Texas, we found one nest series in Hemphill County in the northeastern Panhandle (Rolling Plains) (Fig. 4, Appendix 1). This locality is at about 725 meters in elevation and the soil is loamy fine sand. The nest was inconspicuous among a stand of fairly dense grass on level ground.

Genus ***Hypoponera*** Santschi

This large cosmopolitan genus contains about 100 to 120 species, including a number of wide ranging tramp species. Taylor (1967) suspected that none of the five species reported from North America is native. These carnivorous ants form small colonies of less than 100 workers, and in western Texas they tend to be secretive, accounting for the sparsity of records from this region.

Hypoponera inexorata (Wheeler)

This species has been reported from South Carolina and Florida, west to Texas and Arizona in the United States; it occurs as far south as Central America (Smith, 1979). In western Texas, we collected it at five different localities in four widely separated counties: two in Crosby County on the Rolling Plains, one in Uvalde County in a region transitional between the Edwards Plateau and the Rio Grande Plains, and one each in Jeff Davis County and Presidio County in the Trans-Pecos (Fig. 5, Appendix 1). The elevational range was from 400 to 1800 meters, and the soil texture classes represented were loam, silt loam, and sandy clay loam. Seven nest series were found under rocks.

Hypoponera opaciceps (Mayr)

This taxon has been reported from South Carolina and Florida, west to Colorado and California in the United States. It also occurs throughout Central America and the West Indies south as far as Argentina in South America, and in southeastern Asia and Polynesia (Smith, 1979). In Texas, this species is most abundant in the eastern three-quarters of the state (Wheeler and Wheeler, 1985*b*). Van Pelt (1983) recorded this species as rare in grasslands at 1400 meters elevation in the Chisos Mountains. This ant was not collected during the present study. Males of this species are wingless and workerlike.

Hypoponera opacior (Forel)

This species is extensively distributed throughout the southern and southwestern United States; records are from Virginia south to Florida and as far west as Oregon and California. It occurs south to Chile and Argentina (Smith, 1979). In western Texas, this ant occurred in 12 of the 97 counties sampled and was found in all regions except on the Rio Grande Plains (Fig. 5; Appendix 1). The 21 localities where this ant was present range in elevation from 400 to 2000 meters, being most common in the range of 1000 to 1099 meters and above 1700 meters (Appendix 2). It was found on seven different soil texture types, and no obvious trends are evident with respect to this ecological factor (Appendix 3).

The majority of nest series for which data are available (15 of 20) were taken on level to slightly sloping ground (Appendix 4). Also, most of these ants were found under covering objects: 15 under rocks, three under cattle dung, one each under a piece of cardboard and under a log; two nests were in the open, one series consisted of strays collected alongside a large boulder, and no specific data were available on two series.

Hypoponera punctatissima (Roger)

This species is nearly cosmopolitan in warmer parts of the world and is probably of African origin. In the United States, it has been reported from Florida, Texas, New Mexico, Arizona, and California (Smith, 1979). We did not find any specimens in western Texas but cannot totally exclude the possibility of its presence in the region.

Genus ***Leptogenys*** Roger

This primarily tropical genus of ants is represented in the United States by two species. One, *Leptogenys manni* Wheeler, occurs in Florida; the other, *L. elongata*, occurs in southern and southeastern Texas, in southwestern Louisiana, and northern México (Trager and Johnson, 1988).

Leptogenys elongata (Buckley)

In western Texas, this ant is restricted in its distribution to the more mesic areas of the Edwards Plateau region and the adjacent Rio Grande Plains (Fig. 5). We collected 36 nest series at 22 localities in 12 different counties (Appendix 1). The

elevations at which it was taken were all less than 800 meters in elevation (Appendix 2), and it was found in seven of the 11 different soil texture classes sampled (Appendix 3). Seventeen of 25 nest series for which slope data are available were found on level to slightly sloping ground (Appendix 4). These predaceous ants were primarily found in moist microhabitats that also were frequented by the "pill bug" isopods on which they feed; 24 nests were under rocks, eight under logs, and one under a piece of bark. One nest series came from a recently excavated open nest on clay loam soil; it was topped by a mound 15 centimeters in diameter and had three separate entrances one to two centimeters in diameter. Finally, two series represent foragers.

Neece and Bartell (1982) recorded a myrmecophile, *Grassiella* sp. (Thysanura: Nicoletiidae), that was collected in a *L. elongata* nest in western Kerr County.

Genus ***Odontomachus*** Latreille

This is another tropicopolitan genus of ponerines; it is represented in the warmer parts of the United States by three species (Brown, 1976; Deyrup *et al.*, 1985). As the etymology of the generic name suggests (*Odontomachus* = "fighting tooth"), these ants are armed with well-developed, linear mandibles that can be snapped shut rather rapidly and forcibly. Nonetheless, these are rather shy ants; they retreat into the confines of the nest when disturbed, often leaving their brood behind. Only a single species occurs in Texas.

Odontomachus clarus Roger

This ant ranges from Florida and Texas to Arizona in the United States, and southward into México to at least Mexico City and the state of Guerrero (Brown, 1975; Deyrup *et al.*, 1985). In western Texas, this ant is widespread throughout the southern half and is only absent from the High Plains and the northern reaches of the Rolling Plains (Fig. 6). It was found in 32 of the 97 counties surveyed, and 111 nest series were found at 69 different localities (Appendix 1). The elevational distribution of this species (Appendix 2) reflects its preference for more mesic habitats; it was more abundant than expected below 800 meters (Rio Grande Plains and Edwards Plateau) and above 1500 meters (Trans-Pecos mountains areas), and less abundant than expected from 800 to 1500 meters ($\chi^2 = 56.94$, d.f. = 10, $P < 0.001$).

The distribution of *O. clarus* with respect to soil textures appears in Appendix 3. Contrary to published statements that this species prefers to nest in coarse, gravelly soils (Creighton, 1950; Smith, 1979), in western Texas it was more abundant than expected on the five finer soil categories containing clay and less abundant than expected in soil types without clay (with all soil categories $\chi^2 = 89.84$, d.f. = 8, $P < 0.001$).

This species was found primarily on level situations, but it occurred on slope exposures of up to 45 degrees of inclination (Appendix 4). Also contrary to the published statements that this species prefers to have its nest fully exposed to the sun (Creighton, 1950; Smith, 1979), 67 percent of the nests (75 of 111) in western Texas were under covering objects: 63 nests under rocks, seven under logs, two

under cattle dung, and one each under a railroad tie, a downed telephone pole, and a sack. No situation data were available for one nest; 15 series are represented by stray workers collected foraging on the surface, and only 20 series (18 percent) were taken from nests built on exposed situations.

Neece and Bartell (1982) recorded a myrmecophile, *Oeclidius* sp. (Homoptera: Kinnaridae), that was collected in an *O. clarus* nest in Uvalde County.

Genus ***Cerapachys*** Smith

This is primarily a genus of the Old World tropics, which contains approximately 140 species (Brown, 1975). Only two rare species occur in the United States, and both originally were described from specimens collected in Texas. Additional samples of workers, and of males not associated with workers, are known from southern New Mexico, Arizona, and California (Brown, 1975; Snelling and George, 1979). However, their identifications, as well as those of the two nominal taxa, cannot be properly ascertained until samples of all three castes (workers, males, and females) are obtained.

Cerapachys augustae Wheeler

This species was known previously in Texas from two series collected in Austin (Wheeler, 1902, 1903*b*), from three workers on a shipment of plants of Mexican origin intercepted at El Paso (Smith, 1942), from 22 workers dissected from the stomach of an armadillo taken at Huntsville (Smith, 1942), and from the Chisos Mountains, Big Bend National Park (Van Pelt, 1983). Ants from the Chisos Mountains were reported to be rare in canyon(s) at 1600 meters elevation and were found nesting under rocks. Van Pelt (1983) did not report the number of ants (or series) obtained, indicating only that they were rare (that is, less than five collections).

During this study we found this species on two occasions (Appendix 1). The first nest series was found at about 800 meters elevation in the city park of Big Lake, Reagan County (Fig. 4), under an abandoned railroad tie. The soil was clay, and about a dozen workers were excavated. The second collection is represented by a single worker accidentally unearthed while digging up a nest of *Pheidole bicarinata vinelandica* Forel. The find occurred at 510 meters elevation, 10 km. W Benjamin, Knox County (Fig. 4), in soil that was clay loam. Although we immediately recognized the importance of this find, and we spent approximately one hour enlarging the original excavation, we were unable to find any additional specimens. It is significant to note, however, that other species in the genus are known to be ant predators, and many prey on *Pheidole* (Brown, 1975).

Cerapachys davisi Smith

This species was described from, and is known definitely only from, males taken at a light at Fort Davis, Jeff Davis County (Smith, 1942; Creighton, 1950; Brown, 1975). Despite repeated visits to the Davis Mountains at various times of the year and the deployment of ultraviolet lights on those occasions, we were unable to collect additional specimens of this rare and elusive ant.

Subfamily Pseudomyrmecinae

This is a small subfamily, represented by only one genus in the New World and several genera in the Old World tropics.

Checklist of the Pseudomyrmecinae of Western Texas

In the following list, the species marked by a dagger was previously reported from western Texas but was not collected during this study.

Pseudomyrmex Lund, 1831
P. apache Creighton, 1952
†*P. pallidus* (Smith, 1855)

Accounts of Species

Genus ***Pseudomyrmex*** Lund

Ants of the genus *Pseudomyrmex* Lund are arboreal and prefer to nest in preformed plant cavities, and some have entered obligatory mutualistic relationships with various species of *Acacia* Mill. The genus contains about 200 species, which are found mostly in the New World tropics; nine species occur in the United States, and six have been reported from Texas. However, as indicated above, only two of them occur in the drier, western parts of the state. A key to the Nearctic species of *Pseudomyrmex* was provided by Ward (1985).

Pseudomyrmex apache Creighton

This ant is known from California, Arizona, and Texas in the United States, and from the northern Mexican states of Chihuahua, Durango, Nuevo León, Sonora, Baja California, and Baja California Sur (Ward, 1985). It occurs from -13.5 meters to about 2000 meters in elevation, primarily nesting in cavities in mesquites (*Prosopis* sp.) at lower elevations and in live oaks (*Quercus* sp.) at higher elevations (Snelling and George, 1979). During this study, we collected it at two different localities, one each in the Edwards Plateau and Trans-Pecos regions (Fig. 6, Appendix 1). One sample was represented by foraging workers and the second collection by a newly mated queen.

Pseudomyrmex pallidus (Smith)

This species is widely distributed from New Jersey and North Carolina to Florida, and west to California along the southern United States, and in much of México, Central America, and some of the Greater Antilles (Ward, 1985). *Pseudomyrmex pallidus* was encountered at 1400 meters elevation in the Chisos Mountains, Big Bend National Park by Van Pelt (1983). Specimens (''less than 5'' collections) were from grasslands and canyons, but Van Pelt (1983) did not report any specific host plants. We did not collect this species during our surveys. Ward (1985) reported that *P. pallidus* has a preference for dead stalks or culms of herbaceous plants for nesting sites.

Subfamily Dolichoderinae

Our treatment of this subfamily essentially follows that of Smith (1979). We recognize the transfer of *Iridomyrmex pruinosus* (Roger) to the genus *Forelius* by Snelling and George (1979). *Conomyrma flava* (McCook) also is retained as a valid and distinct species.

This relatively small subfamily of primarily tropical ants is represented in western Texas by four genera belonging to the same tribe. The western Texas dolichoderines all appear to be omnivorous and nest in soil.

Generic Key to Workers of Western Texas Dolichoderinae (modified from Creighton, 1950)

1. Propodeum with a prominent, sharp, toothlike protuberance projecting vertically at the junction of the basal and declivious faces; third segment of the maxillary palp long, as long or longer than the succeeding segments taken together . . . . . *Conomyrma*
   Junction between the basal and declivious faces of the propodeum unarmed, rounded or angular; third segment of the maxillary palp not unusually long and notably shorter than the three succeeding segments taken together. 2
2. Dorsum of thorax without an impression at the mesopropodeal suture; worker caste moderately polymorphic. . . . . *Liometopum*
   Dorsum of thorax at least with a slight impression at the mesopropodeal suture; worker caste monomorphic. 3
3. Scale of petiole vestigial . . . . . *Tapinoma*
   Scale of petiole present although often small and difficult to see . . . . . *Forelius*

Checklist of the Dolichoderinae of Western Texas

The following list essentially follows the sequence given by Smith (1979), except for the two taxonomic changes noted above under the subfamilial treatment. A species previously reported from western Texas but not collected during this study is denoted by a dagger.

Accounts of Species

Genus ***Liometopum*** Mayr

Tribe Tapinomini
- *Liometopum* Mayr, 1861
  - *L. apiculatum* Mayr, 1870
  - †*L. luctuosum* Wheeler, 1905
- *Forelius* Emery, 1888
  - *F. foetidus* (Buckley, 1866)
  - *F. pruinosus* (Roger, 1863)
- *Conomyrma* Forel, 1913
  - *C. bicolor* (Wheeler, 1906)
  - *C. flava* (McCook, 1879)
  - *C. insana* (Buckley, 1866)
- *Tapinoma* Foerster, 1850
  - *T. sessile* (Say, 1836)

This small Holarctic genus of ants is represented in the New World by three species, two of which occur in western Texas. A key to the species of this genus in the United States is provided by Wheeler and Wheeler (1986). The two species that occur in western Texas nest under cover in soil or beneath bark or in crevices

of trees. Colonies are often populous and individuals are pugnacious, biting and spraying repellent secretion on intruders. Workers forage in long files and sometimes tend homopterans.

Liometopum apiculatum Mayr

The range of this species extends from western Texas to Arizona and Colorado in the United States and also into México (Smith, 1979). We collected it in nine counties in the Trans-Pecos and Edwards Plateau regions of western Texas (Fig. 7, Appendix 1). Most (72 percent) of the collection localities were above 1600 meters in elevation (Appendix 2). *Liometopum apiculatum* was found on half the soil textural classes sampled, but no obvious preference of soil types was noted, except nests were not located in the four most complicated soil types (Appendix 3). Only a little more than half the nests located were on level to slightly sloping ground (Appendix 4). Of the 48 colonies located, 85 percent were under rocks. Two colonies were under bark, and single colonies were in a maple tree log, under a log, under a concrete slab, inside a large oak tree, and at the base of a Mexican pinyon pine (*Pinus cembroides* Zucc.). Smith (1979) listed numerous citations to papers in which the biology of this species elsewhere in the country is discussed. Neece and Bartell (1982) recorded a myrmecophile, *Sceptobius* sp. (Coleoptera: Staphylinidae), that was collected in *L. apiculatum* nests in Brewster and Culberson counties.

Liometopum luctuosum Wheeler

Although this species ranges from Wyoming to western Texas, and westward to Nevada and California (Wheeler and Wheeler, 1986), it was not collected during this study. The single reported western Texas record is from Paisano Pass, near Alpine, Brewster County (Wheeler, 1905; Wheeler and Wheeler, 1985*b*). Several citations on the biology of this species from elsewhere in the country were provided by Smith (1979).

Genus ***Forelius*** Emery

This small New World genus of ants is represented in the United States by two species, both of which are present in western Texas. Characters to separate these two taxa can be found in the key provided by Snelling and George (1979). Both species in western Texas are commonly encountered ants in both urban and rural settings. Multiple queens may be found in a single colony, and workers often forage in populous trails of rapidly running individuals. Entire colonies, including brood and queens, often are observed in long, rapidly moving trails on sidewalks in cities. When crushed, members of this genus release a pungent and disagreeable odor.

Forelius foetidus (Buckley)

This species is known from México and the southwestern and south-central United States, from Arkansas and Texas west to California (Smith, 1979). This ant is widespread and found in all regions of western Texas (Fig. 8). We found *F. foetidus* in 81 of 97 counties surveyed (Appendix 1).

Forelius foetidus was encountered at all elevations sampled (Appendix 2), but no significant difference (χ^2 = 16.15, d.f. = 13, $P > 0.05$) was found between elevational data and abundance. These ants were collected on all soil types examined (Appendix 3), but were more abundant than expected on clay loam, silty clay, and clay soils, and less abundant than expected on loamy fine sand and fine sandy loam soils (χ^2 = 36.91, d.f. = 9, $P < 0.001$). The majority (81 percent) of the 264 nests observed was on level to slightly sloping (zero to five degrees) ground (Appendix 4). Of the 255 nests on which data were recorded, 70 percent were in fully exposed situations. Seventy-six percent of the nests found under objects were covered by rocks. One nest each was found covered by a gourd (*Cucurbita* sp.), weeds, "plant," board, cattle dung, and stump. Two nests were under a can and 10 were at the bases of clumps of grass. Other biological data were provided by Snelling and George (1979), Allred (1982), and publications cited by Smith (1979).

Neece and Bartell (1982) reported the finding of two different myrmecophiles in *F. foetidus* nests in western Texas: *Myrmecophila nebrascensis* Bruner (Orthoptera: Gryllidae) from Terrell County and an unidentified rove beetle (Coleoptera: Staphylinidae) from Webb County.

Forelius pruinosus (Roger)

Traditionally, this species has been considered to be a member of *Iridomyrmex*. Snelling and George (1979) transferred it to *Forelius*, and they did not recognize the two subspecific names formerly applied to this species.

Wheeler and Wheeler (1985*b*) reported this ant from only three counties in central and northeastern Texas. We encountered *F. pruinosus* throughout western Texas from 76 counties (Fig. 9, Appendix 1). Elsewhere this species has been recorded from New Jersey to Florida, and west to Idaho, Oregon, and California in the United States, the northern half of México, Cuba, and the Bahama Islands (Snelling and George, 1979).

This species was collected at each elevational gradient sampled above 200 meters (Appendix 2) but was encountered more often than expected at 400, 700, 900, and elevations higher than 1200 meters (χ^2 = 37.60, d.f. = 14, $P < 0.001$). This widespread species was collected from all but one soil type (silty clay) examined (Appendix 3), and no significant difference (χ^2 = 17.7, d.f. = 10, $P > 0.05$) was found between the soil texture classes.

Of the 338 nests on which slope distribution data were obtained (Appendix 4), 78 percent were on level to slightly sloping (zero to five degrees) ground. Data on individual nesting situations were obtained on 316 nests. Most nests (60 percent) were in fully exposed situations. The majority (66 percent) of nests in covered situations were under rocks. Other covering objects included: 16 under plant bases (six grass clumps, two weeds, one salt cedar (*Tamarix* sp.), one mesquite (*Prosopis* sp.), plus unidentified plants), nine under wood (boards, sticks, and logs), eight under cattle dung, and five nests were under road pavements. Only a single series of ants was observed tending aphids.

Because this species is widespread and commonly encountered, much literature is available on its distribution and biology. The publications by Snelling and George (1979) and Allred (1982) should be consulted as well as those cited by Smith (1979).

Neece and Bartell (1982) reported finding numerous myrmecophiles with this species of ant in western Texas. The nest-inhabiting myrmecophiles included an unidentified jumping bristletail (Microcoryphia: Machilidae) from Cottle County and a cricket, *Myrmecophila nebrascensis* Bruner (Orthoptera: Gryllidae), from Hartley County. Unidentified mites (Acarina: Astigmata) also were recorded as ectoparasites of *F. pruinosus* from Scurry County. On some individuals, the mites were so numerous that the ants had difficulty walking.

Genus ***Conomyrma*** Forel

This genus is restricted to the New World, and the taxonomy of its members remains confused. Snelling (1973) recognized only two species from the western United States, but Snelling and George (1979) pointed out that the *Conomyrma insana* (*sensu lato*) of Snelling (1973) is a complex of closely related species. Our study of hundreds of nest series (with males and workers) from western Texas revealed the presence of three distinct species, which can be identified by the following key.

Key to Workers of Western Texas *Conomyrma*

1. Body pale brown to dark brown in color . . . . . *C. insana*
   Head and thorax yellow to red in color; abdomen, at least apex, contrasting in color. 2
2. Head and thorax yellow to red, abdomen dark brown to black . . . . . *C. bicolor*
   Head, thorax, and abdomen yellow to straw-colored; tip of abdomen distally infuscate. . . . *C. flava*

Conomyrma bicolor (Wheeler)

According to Smith (1979), this ant ranges from Texas and New Mexico to California, Nevada, and Utah in the United States, and south into México. Nests are in exposed surmounted situations in the soil and are usually irregular or craterlike mounds.

This species was found on all soil types and vegetational regions examined (Fig. 10, Appendix 2). *Conomyrma bicolor* was collected at all elevations sampled above 200 meters in western Texas (Appendix 2) and was encountered more often than expected at 500 meters and elevations above 1100 meters (χ^2 = 19.93, d.f. = 11, $0.05 > P > 0.02$). It was more abundant than expected on sand, loamy fine sand, fine sandy loam, and sandy loam, whereas it was less abundant than expected on loam soil (χ^2 = 20.43, d.f. = 9, $P < 0.02$; Appendix 3). Most nests (86 percent) were on level to slightly sloping ground (Appendix 4) and 125 (98 percent) were in the open. Of the nests in the open, 19 had multiple openings in the mound. Nests not in open situations included: one each in a rock, under

a rock, under cattle dung, under a sunflower (*Helianthus* sp.), and two each under a clump of grass, against a weed, and in a crack of pavement.

Neece and Bartell (1982) reported the collection of the myrmecophile *Formicilla munda* LeConte (Coleoptera: Anthicidae) from a nest of *Conomryma* sp. in Pecos County. Their ants have now been identified as *C. bicolor*.

Conomyrma flava (McCook)

The precise range of *C. flava* is unknown because it has long been confused with *C. insana* (see comments on this latter species). In western Texas, *C. flava* was present at all elevations and in all regions sampled (Fig. 11, Appendix 2) but was encountered more often than expected at 100, 400, 600 to 900, 1000, and 1400 meters elevation ($\chi^2 = 31.31$, d.f. = 15, $P < 0.01$). *Conomryma flava* was collected on all soil types sampled (Appendix 3). It was more abundant than expected on loamy fine sand and fine sandy loam soils and less abundant on loam than expected ($\chi^2 = 22.67$, d.f. = 9, $P < 0.01$). Only 11 of 449 colonies in open situations had multiple nest entrances. Open situations accounted for 96 percent of the colonies located. The remaining colonies were under covering objects: five under rocks, seven under grass tufts, three under weeds, and one each in a crack of a sidewalk, under a wheat plant, under a flower. Two colonies were collected in close association with termites.

Neece and Bartell (1982) reported the collection of larvae of the myrmecophile *Cremastocheilus* sp. (Coleoptera: Scarabaeidae) from a nest of *Conomyrma* sp. in Hardeman County. The ants have now been identified as *C. flava*.

Conomyrma insana (Buckley)

For many years this species was misidentified in North America as *Dorymyrmex pyramicus* (Roger), a distinct species found only in South America. The precise range of *C. insana* is uncertain because of the lumping of records for *C. insana, C. flava*, and other species (Trager, 1988).

Conomryma insana was collected on all soil types and in all regions sampled (Fig. 12, Appendix 3). It was more abundant than expected on sandy clay loam and clay soils, less abundant than expected on fine sandy loam and silty clay loam ($\chi^2 = 25.67$, d.f. = 9, $P < 0.01$). *Conomryma insana* was collected at all elevations sampled in western Texas (Appendix 2). It was found more than expected at 800 to 1000, 1100, and elevations above 1300 meters, and less than expected at 400 to 800 and 1000 meters ($\chi^2 = 44.78$, d.f. = 12, $P < 0.001$). The majority (95 percent) of the 188 nest observed were in open situations. Eighty-six percent of the colonies were on level to slightly sloping ground (Appendix 4). Of the nests in the open, only 10 had multiple openings. Colonies located under covering objects include two under rocks, five under tufts of grass, one under cattle dung, and two under weeds. One series of workers collected was tending aphids on sunflowers (*Helianthus* sp.).

Two different myrmecophiles were reported by Neece and Bartell (1982) from nests of *Conomyrma* sp. in western Texas: *Prolepismina* sp. (Thysanura: Lepismatidae) from Hudspeth County and *Araeoschizus decipiens* Horn (Coleoptera:

Tenebrionidae) from Reeves County. Their ants have now been identified as *C. insana.*

Genus ***Tapinoma*** *Foerster*

Members of this genus are found throughout most of the world. Three species are known from the United States, but only one widely distributed species is found in Texas. A key to workers of the species present in the United States was provided by Creighton (1950).

Tapinoma sessile (Say)

Smith (1979) reported the range of this ant as Nova Scotia and Quebec in Canada, south to Florida, west to Washington and California in the United States, and also in México. This well known house-infesting ant is commonly referred to as the odorous house ant. Smith (1979) reported that it is a highly adaptable ant and that it occurs in a varity of habitats. Many thousands of individuals and numerous queens can be found in some colonies. They feed on honeydew and tend honeydew excreting insects.

Five nests of this species were located during this study in the Trans-Pecos and Edwards Plateau regions (Fig. 7, Appendix 1). Four nests were under rocks and one nest was in the open with an entrance 18 millimeters wide and with a pebble tumulus on the northwestern side. The three collection localities were more than 1200 meters in elevation and were from three different soil types—clay, clay loam, and sandy clay loam.

Subfamily Formicinae

This cosmopolitan subfamily is the second largest in North America. Nine genera in three tribes are known from western Texas. The two most abundant genera are in need of taxonomic revision and, because of this problem, some differences in names reported from the region can be found. Although a few members of this subfamily are arboreal, most nest in soil. They are primarily scavenger-predators, but some rely almost entirely on carbohydrates obtained from Homoptera (Snelling, 1981). Repletes are known from several genera.

Generic Key to Workers of Western Texas Formicinae
(modified from Creighton, 1950)

1. Antennae with nine segments . . . . . *Brachymyrmex*

   Antennae with 12 segments 2

2. Head of major worker circular in cross section and abruptly truncated in front; the truncated portion consisting of the clypeus and adjacent parts of cheeks with mandibles forming the ventral segment; medias absent . . . . . *Colobopsis*

   Head of major worker not circular in cross section and not abruptly truncated in front; if truncated, the slant is oblique and involves the frontal lobes as well as the clypeus; medias present 3

3. Thoracic dorsum evenly convex in profile, the propodeum not depressed below the level of the promesonotum, the mesopropodeal suture unimpressed or only slightly impressed; mesothoracic

spiracles borne on the sides of the thorax at a level well below the basal face of the propodeum; antennal scapes usually inserted well behind the posterior edge of the clypeus. . . . . *Camponotus*

Thoracic dorsum, in profile, with the propodeum depressed below the level of the promesonotum; the impression at the mesopropodeal suture always distinct and often profound; mesonotal spiracles usually occurring in this impression on or close to the dorsal surface of the thorax; antennal scapes inserted at or near the posterior border of the clypeus. 4

4. Maxillary palps very short and consisting of three segments. . . . . *Acanthomyops*

Maxillary palps longer and consisting of six segments. 5

5. Maxillary palps longer than head; third and fourth segments long, each as long or longer than the terminal segments combined; psammophore present . . . . . *Myrmecocystus*

Maxillary palps shorter, or at least no longer, than head; third and fourth segments not unusually long; psammophore absent 6

6. Frontal carinae prominent, their lateral margin slightly reflected upward; ocelli distinct. . . . . *Formica*

Frontal carinae poorly marked, their lateral margins flat; ocelli indistinct or absent. 7

Antennal scapes surpassing occipital margin by at least one-third their length, usually much longer; erect body hairs coarse, long, and usually brown or black in color. 8

Antennal scapes never surpassing the occipital margin by an amount greater than length of the first funicular joint, often much shorter; erect body hairs not coarse, but short and golden . . . . . *Lasius*

8. Mesonotum of thorax very strongly compressed and subcylindrical . . . . . *Prenolepis*

Mesonotum only slightly compressed . . . . . *Paratrechina*

Checklist of the Formicinae of Western Texas

This list follows the arrangement of tribes by Wheeler and Wheeler (1985*a*), with the generic sequence following Smith (1979). Species known from western Texas, but not collected during this study, are indicated by a dagger; species that are reported from western Texas for the first time are indicated by an asterisk, and new state records are indicated by a star. The one species that has not been reported from western Texas, but that probably occurs there, is preceeded by a question mark.

Tribe Brachymyrmecini
- *Brachymyrmex* (Mayr, 1868)
  - *B. depilis* Emery, 1893
- *Paratrechina* Motschulsky, 1863
  - *P. arenivaga* (Wheeler, 1905)
  - †*P. austroccidua* Trager, 1984
  - *P. bruesii* (Wheeler, 1903)
  - *P. terricola* (Buckley, 1866)
  - *P. vividula* (Nylander, 1846)
- *Prenolepis* Mayr, 1861
  - *P. imparis* (Say, 1836)

Tribe Camponotini
- *Camponotus* Mayr, 1861
  - †*C. abdominalis transvectus* Wheeler, 1910
  - *C. acutirostris* Wheeler, 1910
  - *C. americanus* Mayr, 1862
  - †*C. cuauhtemoc* Snelling, 1988
  - *C. decipiens* Emery, 1893
  - *C. discolor* (Buckley, 1866)
  - *C. festinatus* (Buckley, 1866)
  - †*C. ocreatus* Emery, 1893
  - *C. pennsylvanicus* (DeGeer, 1773)
  - *C.* sansabeanus (Buckley, 1866)
  - *C. semitestaceus* Emery, 1893
  - *C. texanus* Wheeler, 1909
  - †*C. ulcerosus* Wheeler, 1910
  - ★*C. vicinus* Mayr, 1870
- *Colobopsis* Mayr, 1861
  - **C. impressa* Roger, 1863
  - †*C. pylartes* (Wheeler, 1904)

Tribe Formicini
- *Lasius* Fabricius, 1805
  - *L. neoniger* Emery, 1893
  - †*L. sitiens* Wilson, 1955
- *Acanthomyops* Mayr, 1862
  - ★*A. arizonicus* (Wheeler, 1917)
  - *A. interjectus* (Mayr, 1866)
  - ★*A. latipes* (Walsh, 1862)

Myrmecocystus Wesmael, 1838
M. depilis Forel, 1901
M. melliger (Forel, 1886)
M. mendax Wheeler, 1908
M. mexicanus Wesmael, 1838
M. mimicus Wheeler, 1908
M. navajo Wheeler, 1908
M. placodops Forel, 1908
M. romainei Cole, 1936
Formica Linné, 1758
★*F. bradleyi* Wheeler, 1913
F. gnava Buckley, 1866
★*F. gynocrates* Snelling and Buren, 1985
★*F. montana* Emery, 1893
?*F. neoclara* Emery, 1893
F. nitidiventris Emery, 1893
F. pallidefulva Latreille, 1802
F. perpilosa Wheeler, 1902
†*F. puberula* Emery, 1893
F. schaufussi Mayr, 1886
★*F. subsericea* Say, 1836
★*F.* sp. (near *integroides* Emery, 1893)

Accounts of Species

Genus ***Brachymyrmex*** Mayr

This is a small New World genus of minute ants. Most of the species are tropical; one is native to the United States, and two or three others have been introduced into the southeastern United States (Snelling and George, 1979). A single species is found in western Texas.

Brachymyrmex depilis Emery

This tiny, yellowish-colored ant ranges over much of North America—from Nova Scotia to British Columbia in Canada, all of the continental United States, and south to central México (Snelling and George, 1979). In western Texas, it is relatively uncommon, but widely distributed in all regions. Only rarely (12 percent) was more than one colony collected at any of the 25 known localities (Fig. 13, Appendix 1).

The collection localities were primarily (80 percent) between 700 and 1100 meters in elevation, but collections were recorded from less than 300 and more than 1700 meters in elevation (Appendix 2). *Brachymyrmex depilis* was found on most soil textural classes, but was not collected from fine sandy loam, silt loam, sandy clay loam, or silty clay soils (Appendix 3). Most nests (77 percent) that were observed were located on or near level (one to five degrees) ground (Appendix 4).

A single series of *B. depilis* was found in the excavations of a colony of *Crematogaster punctulata* Emery. All other colonies located were at least partially covered: 15 under rocks, and a single nest each was under a stick, leaf litter, cattle dung, and a can. One foundress was found in an open excavation with a 3.8-centimeter tumulus. The remaining seven collections were of foragers and stray workers of which the nests were not located.

Elsewhere this species is known to occupy a wide variety of habitats and is known to feed on honeydew secreted by root-feeding homopterans (Snelling and George, 1979).

Genus ***Paratrechina*** Motschulsky

This relatively large genus of ants is found throughout most of the world that is habitable by ants, but it is most diverse in tropical Australasia. Several species

have been introduced by man to various locations, and some have attained minor pest status in some situations (Trager, 1984). There are 16 species reported from the United States, of which five occur in western Texas. The taxa found in the continental United States were revised by Trager (1984), who should be consulted for keys and descriptions. *Nylanderia* Emery has been used as a subgenus of *Paratrechina* and as a separate genus by some previous authors. We herein follow Trager (1984) in treating *Nylanderia* as a junior synonym of *Paratechina*.

As noted by Trager (1984), workers of *P. vividula* and *P. terricola* cannot always be separated by the morphology of workers. Some of our samples could not be reliably identified and those samples are not included in the discussion that follows.

Neece and Bartell (1982) reported finding several myrmecophiles in association with *Nylanderia* sp. We are able to identify one of their samples as *P. terricola*, and report further on it under the appropriate species heading. Their remaining samples are correctly *Paratrechina* sp. and include the myrmecophiles: *Myrmecophila nebrascensis* Bruner (Orthoptera: Gryllidae) from Dallam County, *Emblethis vicarius* Horvath (Hemiptera: Lygaeidae) from Oldham County, and larvae of *Cremastocheilus* sp. (Coleoptera: Scarabaeidae) from Oldham County. Additional data on biology of all *Paratrechnia* species was provided by Trager (1984).

Paratrechina arenivaga (Wheeler)

This species was recorded by Trager (1984) from New Jersey to Nebraska south to Florida and Texas in the United States. He also reported *P. arenivaga* as most abundant in highly drained, sandy soils. Collections from western Texas were restricted to the High Plains and northern Rolling Plains (Fig. 20, Appendix 1) at 700 to 799, 1100 to 1199, and 1300 to 1399 meters in elevation. One nest was located under a rock; four other nests were in the open in sandy, fine sandy loam, and clay loam soils. Van Pelt (1983) collected this ant in the Chisos Mountains, but misidentified it as *P. melanderi*, along with several other species.

Paratrechina austroccidua Trager

Trager (1984) described this species from mountain localities in México and scattered localities in the United States in Utah, Arizona, and Texas. In Texas, collections are known only from higher elevation forests in the Chisos Mountains of Brewster County. *Paratrechina austroccidua* was not collected during this study.

Paratrechina bruesii (Wheeler)

This ant is found primarily in the deserts and foothills of México and the southern border areas of Texas and Arizona in the United States (Trager, 1984). Nests were under stones near streambeds or in desert washes (Trager, 1984).

In western Texas, this species was collected only in the Trans-Pecos region (Fig. 20, Appendix 1). Samples were from 800 to 899, 1100 to 1199, and more than 1600 meters in elevation in sandy, sandy clay, and clay loam soils. All nests were from under rocks.

Neece and Bartell (1982) reported some myrmecophiles from *Nylanderia bruesii* nests. Their ants have been reexamined and found to be *P. vividula.*

Paratrechina terricola (Buckley)

This species long has been recorded under the name of *P. melanderi* (Wheeler). Trager (1984) cleared the confusion regarding the identification of this species and his publication should be consulted for details. *Paratrechina terricola* ranges over eastern México and the southern United States from Louisiana, Arkansas, Tennessee, and Illinois, west to South Dakota, Arizona, and Nevada.

In western Texas, this ant was collected in all regions examined except the Trans-Pecos region (Fig. 19, Appendix 1) at elevations from 100 to 1100 meters (Appendix 2). Nests were found predominantly (91 percent) under rocks, but a single nest each was located amid bark and small rocks, under a concrete block, under a branch, and in the open soil with a tumulus five centimeters in diameter. Most nests were located on level to slightly sloping (zero to five degrees) substrates of all soils sampled except loamy fine sand, fine sandy loam, and silt loam (Appendices 3, 4).

One of the samples reported as *Nylanderia* sp. by Neece and Bartell (1982) is correctly referred to this species. Those authors reported an unidentified myrmecophile (Homoptera: Cixiidae) from the nest of this species in Runnels County.

Paratrechina vividula (Nylander)

Trager (1984) reported this species probably was native to Texas and portions of western México, but now has been introduced elsewhere in the United States from California to Florida, north to Kansas and North Carolina. Introductions are known also from Chile and indoor localities in the northern United States and Europe.

Paratrechina vividula is a common ant in western Texas and was collected in all regions examined (Fig. 19, Appendix 1). Collections were from all soil types sampled except loamy fine sand and silty clay (Appendix 3). Almost half the nests located were on sloping ground (6 to 45 degrees) at all elevations examined above 200 meters, except in the range of 1200 to 1299 meters (Appendices 2, 4). Most nests located were under covering objects: 71 under rocks, two under logs, three under cattle dung, two under tin cans, and a single nest each under a stick, fence post, board, and dead spanish-bayonet (*Yucca* sp.). Only three nests were discovered in open situations.

A re-examination of the ants reported as *Nylanderia bruesii* and *N. melanderi melanderi* Wheeler by Neece and Bartell (1982) revealed they were misidentified and that they are correctly assigned to *P. vividula.* Those authors reported several myrmecophiles (Coleoptera: Pselaphidae) from nest of this ant—*Atinus brevicornis* Casey from Motley County, *Biotus formicarius* Casey from Uvalde County, and an undetermined genus and species from Hudspeth County.

Genus ***Prenolepis*** Mayr

This small genus is found primarily in the Holarctic region. One of its seven species occurs in the United States, and that one is considered by some to be geographically differentiated into several subspecies (Wheeler, 1930; Creighton, 1950). The form found in Texas has been referred to the nominate subspecies.

Prenolepis imparis (Say)

The nominate subspecies of this species is recorded from Connecticut to Florida, west to Wisconsin, Iowa, Missouri, Oklahoma, and Arizona in the United States and Ontario in Canada (Smith, 1979). In western Texas, this species has only been taken in two disjunct areas; the Guadalupe Mountains in Culberson County and in Hemphill County (Fig. 20, Appendix 1).

Prenolepis imparis has not attained pest status as it has elsewhere in the country (Smith, 1979) because of its rarity in western Texas. Of the five localities where this species was collected, four were above 1700 meters, and one was at 716 meters in elevation. Three of these localities had loam soil, and the others had silty clay loam and clay. Seven nests found in the Guadalupe Mountains all were under rocks. Of Hemphill County records, one was from a nest in a fully exposed situation and two series were collected as individuals foraged. Additional biological notes, including details on semirepletes, can be found in a publication by Wheeler (1930) and in those cited by Smith (1979).

Genus ***Camponotus*** Mayr

This large genus, with more than 1000 species, is widely distributed around the world, and it is badly in need of taxonomic revision. There are several subgenera and species-groups of doubtful value among the North American taxa. Fortunately, the taxonomic status of species found in western Texas has been relatively stable. Keys to the species and supraspecific categories were provided by Creighton (1950), except *C. semitestaceus*, which will key to *C. maccooki* Forel. The later species is endemic to Guadalupe Island, off the Baja California coast, and all published records for this species from the southwestern United States should be referred to *C. semitestaceus*. A key and descriptions to the members of the subgenus *Myrmentoma* Forel was provided by Snelling (1988).

These ants commonly are referred to as carpenter ants because many species nest in wood. Some are pests due to their nest building activities in decaying wood of human homes and buildings.

Camponotus abdominalis transvectus Wheeler

The range as given by Smith (1979) for this species is southern Texas and México. Wheeler and Wheeler (1985*b*) recorded it from western Texas. Their record from Culberson County is based on a collection from Upper Dog Canyon, Guadalupe Mountains, at 1900 meters elevation (G. C. Wheeler, personal communication). *Camponotus abdominalis* was not collected during this study.

Camponotus acutirostris Wheeler

This species was reported (Smith, 1979) to nest in soil under stones in Texas, New Mexico, and Arizona in the United States. In western Texas, samples are available from the Edwards Plateau and the Trans-Pecos regions (Fig. 15, Appendix 1). Three nests series were collected, each in a separate county. All were from under rocks on clay loam soil at slopes of 16 to 35 degrees. One nest was at 800 to 899 meters, whereas the two other series were from 1600 to 1699 meters in elevation.

Camponotus americanus Mayr

The range of this species was reported (Smith, 1979) as Ontario in Canada, south to Florida and west to Michigan, Iowa, Missouri, Oklahoma, and Texas. Smith (1979) further reported that this ant prefered to nest in soil under stones or rotten logs.

During the present study this species was collected at eight localities in five counties in the Edwards Plateau and Trans-Pecos regions (Fig. 14, Appendix 1). Collection localities were at 800 to 899, 1400 to 1499, and elevations above 1600 meters. Two series each were collected from areas of clay loam and loam soils, and single collections were from sandy, silt clay, and clay soils. All collections were from under rocks.

Camponotus cuauhtemoc Snelling

This recently described species is only known from the Davis Mountains, Jeff Davis County, and Big Bend National Park, Brewster County, in Texas. It is also recorded from Chihuahua, México (Snelling, 1988) All collections recorded are from oak trees (*Quercus* sp.) at 1200 to 1800 meters in elevation. This species was not collected during the present study.

Camponotus decipiens Emery

This ant occurs from Georgia and northern Florida west to North Dakota and Texas in the United States. Specimens also have been reported from Nuevo León and Tamaulipes in México (Snelling, 1988).

This house-infesting ant forms small colonies in wood and wood products: insect galleries in wood, insect galls, twigs and branches, under bark, stalks of plants, and rotting logs and stumps. When nesting in houses this ant may feed on household foods.

During this study, *C. decipiens* was collected from 12 counties in all regions sampled except the High Plains and the Rio Grande Plains (Fig. 16, Appendix 1). Collections were primarily at 500 to 899 meters in elevation, but one locality was at 300 to 399 meters, and two others were at elevations above 1700 meters.

One colony located was in and under a log, whereas all other nests were in arboreal situations—four in dead branches, two in oak tree galls, one under bark, three in mesquite trees (*Prosopis* sp.), and one in a hackberry tree (*Celtis* sp.).

Camponotus discolor (Buckley)

Until recently (Snelling, 1988), this ant was treated as a subspecies of *C. caryae* (Fitch). This house-infesting species may nest in woodwork, especially if preformed

cavities or rotting wood are available. Otherwise, plant cavities in twigs, branches, under bark, and in logs and stumps, and in insect galls are utilized for nests (Smith,1979). This ant ranges from Ohio, South Carolina, and Florida west to North Dakota, Iowa, Kansas, and Texas in the United States (Smith, 1979; Snelling, 1988).

In western Texas, *C. discolor* was found in all regions examined except the Trans-Pecos (Fig. 17, Appendix 1). Snelling (1988), however, reported that specimens have been taken in the Davis Mountains, Jeff Davis County. Seventy-five percent of the 16 collection localities were at 500 to 1099 meters in elevation, but two colonies were encountered at 1200 to 1299 meters and single colonies were located at 200 to 299 meters and 1300 to 1399 meters. Seven of the 22 series collected were foraging ants on which no nest data were obtained. Because many of the nests were from arboreal habitats, ground slope data are not available (Appendix 4). A single nest each was recorded from under bark, in a dead branch, in a honey locust tree (*Gleditsia tricanthos* Linné), and in a cottonwood tree (*Populus* sp.); two nests were on buildings and eight nests were in plant galls. Longino and Wheeler (1987) and Wheeler and Longino (1988) reported the occurence of this ant in live oak (*Quercus virginiana*) galls elsewhere in Texas. Snelling (1988) stated this species is most commonly associated with oaks, but that it also has been taken in hickory, willow, and cottonwood. Numerous papers on the biology and economic importance of this species were cited by Smith (1979).

Camponotus festinatus (Buckley)

Smith (1979) recorded the range of this ant as Texas, Colorado, New Mexico, Arizona, and California, as well as México. Nests are in the soil under rocks, logs, or dried cattle dung.

This species was present at most elevations sampled (Appendix 2) but was found more than expected below 900 meters and significantly less than expected at 900 to 1400 meters in elevation ($\chi^2 = 62.02$, d.f. = 10, $P < 0.001$). It was collected in all regions sampled in western Texas and on all soil types except loamy fine sand (Fig. 15, Appendix 3). In addition to the one soil textural class from which it was absent, this species was less abundant than expected on fine sandy loam and more abundant than expected on silty clay and clay soils ($\chi^2 = 39.01$, d.f. = 7, $P < 0.001$). Most of the colonies (79 percent) were collected from level to slightly sloping (zero to five degrees) ground (Appendix 4). Most nests were from under covering objects—72 under rocks, three under dead prickly pear cactus (*Opuntia* sp.), and a single colony under a board. Twenty-three colonies were in open soil and a single colony each was located under rotten bark, in a log, at the base of broomweed (*Xanthocephalum* sp.), in a dead plant stump, and around a root of a desert willow (*Chilopsis linearis* [Cav.] Sweet).

Camponotus ocreatus Emery

This species was first reported from Texas by Van Pelt (1983) from the Chisos Mountains of Brewster County. He reported it as abundant in areas with Mexican pinyon pines (*Pinus cembroides*), with nests being under rocks at 1600 to 2100 meters

elevation. Smith (1979) recorded this ant elsewhere in New Mexico, Arizona, southern California, and México.

Camponotus pennsylvanicus (DeGeer)

The black carpenter ant ranges from New Brunswick and Quebec in Canada south to Florida, and west to North Dakota and Texas in the United States (Smith, 1979). Nests are located in trees, rotting logs and stumps, and in man-made wood products. Because of the nesting habits of this species, it has become a common and important house-infesting ant, commonly feeding on household foods. Many papers have been published on the biology and economic importance of this species and were cited by Smith (1979).

In western Texas, this ant is relatively rare and has been only collected in three counties in the Edwards Plateau and Trans-Pecos regions (Fig. 14, Appendix 1). Of the four collections, three are workers collected as they foraged. A single colony was located in a log. The localities are all at 700 to 1099 meters in elevation on sandy and loamy fine sand soils.

Camponotus sansabeanus (Buckley)

Smith (1979) recorded the range of this ant as Arkansas and Louisiana, west to Colorado, Utah, Arizona, and southern California in the United States. Smith (1979) stated that nests are under rocks and stones in dry woods. Several citations to publications dealing with the biology of this species also provided were by Smith.

This species was collected in western Texas primarily at elevations between 400 and 1099 meters, but 29 percent were from sites more than 1600 meters in elevation (Appendix 2). *Camponotus sansabeanus* was present in all regions examined except the Rio Grande Plains (Fig. 16) and on all soil types sampled except loamy fine sand, sandy clay loam, silty clay loam, and silty clay (Appendix 3). Only 62 percent of the colonies located were from level to slightly sloping ground (Appendix 4). Most nests (78 percent) located were under rocks. Other colonies were: two in logs, one under a branch, one in a dead stump, one in an abandoned nest of *Pogonomyrmex* sp., and three nests in open soil.

Camponotus semitestaceus Emery

This species will key to *C. maccooki* in Creighton's (1950) revision. It now is known that *C. maccooki* is found only on Guadalupe Island, off the Baja California coast, and all previously published records of *C. maccooki* from the southwestern United States should be referred to *C. semitestaceus* (Snelling, 1970). Smaller workers of *C. semitestaceus*, which lack the lobe or bulge on the antennal scape base, will key to *C. vicinus*. Smith (1979) recorded the range of this species as Oklahoma and Texas, west to Washington, Oregon, and California in the United States, and also in México.

In western Texas, this species was found in two counties in the Trans-Pecos and Rio Grande Plains regions (Fig. 16, Appendix 1). The two localities are physically quite different. The locality in the Trans-Pecos region was at 1814 meters with silt loam soil; the locality from the Rio Grande Plains was at 320 meters elevation with

clay soil. Smith (1979) reported that this species nests in soil under stones or in soil surmounted by low craters. Both of the western Texas nests were under rocks.

Camponotus texanus Wheeler

This ant is known thus far only from Texas. Nests have been located in oak logs in central and southern Texas (Smith, 1979; Wheeler and Wheeler, 1985*b*).

In western Texas, this species was collected in three counties of the High Plains and Rolling Plains (Fig. 14, Appendix 1). A single nest was located in an oak tree (*Quercus* sp.). The remaining three collections were all foraging workers. The collection localities were from 600 to 699 meters and above 1600 meters in elevation.

Camponotus ulcerosus Wheeler

Smith (1979) recorded the range of this species as Texas and Arizona in the United States, and México. The single western Texas record listed by Wheeler and Wheeler (1985*b*) is Wheeler's (1910) record from Ft. Davis, Jeff Davis County. Wheeler (1910) described this species as *C. bruesi*. *Camponotus ulcerosus* was not collected during this study.

Smith (1979) stated the nests of this species are constructed in soil beneath rocks. A carton shield is placed at the entrance with the opening the same size as the head of the major worker. Like major workers of *Colobopsis* sp., their heads are used as doors in nest entrances. Unlike *Colobopsis* sp., the head of *C. ulcerosus* is not round in cross section.

Camponotus vicinus Mayr

The range of this species as given by Smith (1979) is Manitoba west to British Columbia in Canada, North Dakota, Colorado, and Oklahoma west to Oregon, and California in the United States, and México. In western Texas, *C. vicinus* was collected from all soils sampled except silt loam, sandy clay loam, silty clay loam, and silty clay. This species was located in all regions sampled except the Rio Grande Plains (Fig. 17, Appendix 1). This is the first record of this taxon from Texas.

Most nests (70 percent) located were on level to slightly sloping ground (Appendix 4). This ant is well known for tending homopterans (Wheeler and Wheeler, 1963, 1986), and Smith (1979) stated that nests are built in soil beneath stones or rotting wood that are buried in the soil. Nests in western Texas were located under rocks (five), at the base of oak trees (three), in open soil (seven), and a single nest each was located under old wood, under a garage, and under broomweed (*Xanthocephalum* sp.).

Genus ***Colobopsis*** Mayr

For many years, *Colobopsis* was considered a subgenus of *Camponotus* (Smith, 1979), but Snelling (1981) and Wheeler and Wheeler (1985*b*) have raised it to full generic status. The peculiar cylindrical, truncated heads of soldiers and gynes are used to block the single-entrance hole to the nest. Nests are arboreal in hollow twigs or

branches of trees and shrubs, in insect galls, and nuts. A key for the identification of the species found in Texas can be found in Creighton (1953).

In addition to the two species listed below, Van Pelt (1983) reported that "*C[amponotus] (Colobopsis)* species A" was occasionally found in arboreal habitats at elevations of 1500 to 2000 meters in the Chisos Mountains, Brewster County. We were unable to determine which species he collected because we were unable to examine his specimens.

Colobopsis impressa Roger

This ant ranges in the United States from Maryland south to Florida and west to central Texas (Smith, 1979). The only previous record in Texas was from Dallas County (Wheeler and Wheeler, 1985*b*). During this study, *C. impressa* was found in six counties of the Edwards Plateau and Rio Grande Plains (Fig. 14, Appendix 1). Collections were from 300 to 399 meters and 500 to 799 meters in elevation. Smith (1979) reported nests from insect galls and in twigs of trees. In western Texas, 13 nests were located in oak tree galls and a single nest each was located in a dead twig and a branch.

Colobopsis pylartes (Wheeler)

The range for this ant as given by Smith (1979) is Louisiana and Texas in the United States. The only western Texas record is that reported by Van Pelt (1983) from the Chisos Mountains, Brewster County. Colonies have been found in twigs and spines of trees and shrubs (Smith, 1979). Van Pelt (1983) reported these ants were common in high forests and rare in canyons and areas with Mexican pinyon pines (*Pinus cembroides*) at 1600 to 1800 meters elevation. *Colobopsis pylartes* was not collected during this study.

Genus ***Lasius*** Fabricius

Members of this genus are restricted to the Holarctic region and, when present, are among the most abundant of all insect genera. Only two of the 17 known species from the United States occur in western Texas, and they can be identified with the key provided by Wilson (1955).

Lasius neoniger Emery

Smith (1979) recorded this species from Maine to Florida and west to Idaho, Wyoming, Colorado, and New Mexico. There also are scattered records from the Sierras of California and a questionable record from Alaska in the United States. This species is also recorded from Quebec in Canada (Smith, 1979). Until the present, *L. neoniger* has been recorded only from Texas by a single collection made in Dallam County (Wilson, 1955). We obtained 54 additional series from 15 counties but did not collect it in Dallam County (Fig. 18, Appendix 1). All known collections in western Texas are from the High Plains of the Panhandle, at elevations of 500 to 1400 meters (Appendix 2). Collections were from most soil textural classes except silt loam, sandy clay loam, silty clay and clay (Appendix 3). Seventy-five percent of the collections with slope distribution data available were from level to slightly sloping (up

to five degrees) situations (Appendix 4). Of the 44 nests located, 89 percent were in open, fully exposed situations. Those in covered situations were two at bases of plants, one under a weed, one under a log, and one under an old rag.

Lasius sitiens Wilson

This species has been reported previously in the United States from Colorado, New Mexico, Arizona, Nevada (Smith, 1979), and Texas (Van Pelt, 1983). It is reportedly abundant in the Chisos Mountains, Brewster County, at elevations of 2000 to 2200 meters, nesting under rocks in Mexican pinyon pine (*Pinus cembroides*) woodland habitats (Van Pelt, 1983). Further ecological notes for this species from other states were provided by Wilson (1955). It was not collected during the present study.

Genus *Acanthomyops* Mayr

Only one of the 16 described species in this genus does not occur in the United States (Wing, 1968; Smith, 1979). Taxonomic keys to the members of this exclusively North American genus were given by Wing (1968). Three species are known from western Texas. Worker ants of this genus easily are recognized by the strong citronella odor they release when disturbed.

Acanthomyops arizonicus (Wheeler)

Until the present study, this species was known only from southern Arizona in the United States. A single nest series was taken at 2400 meters elevation in The Bowl, Guadalupe Mountains National Park, Culberson County (Fig. 18). The nest was under a rock, on level ground, in clay soil. The series of workers, brood, and males was collected in the middle of August.

Acanthomyops interjectus (Mayr)

Smith (1979) reported the range of this ant as from Massachusetts and New York south to Georgia, and west to Montana, Idaho, and New Mexico. *Acanthomyops interjectus* is a frequent house pest and has the common name of the larger yellow ant (Smith, 1979).

This species is known in Texas only from Hemphill County in the Rolling Plains (Wheeler and Wheeler, 1985*b*). We collected two nest series during our survey, both taken at 700 meters elevation in Hemphill County. One nest was inside an abandoned, dry, cement-lined tank on loamy fine sand, and the second nest had a seven-centimeter dirt mound partly under loose bark on level silty clay loam soil.

Acanthomyops latipes (Walsh)

This widespread species is reported from Quebec west to British Columbia in Canada, Maine south to the Carolinas and Tennessee, and west to Oklahoma, New Mexico, Arizona and California in the United States (Smith, 1979). Four nest series taken during this study are the first records of this species for Texas. All were from the Rolling Plains and Trans-Pecos regions (Fig. 18, Appendix 1). Two series are from 8 km. S Wheeler, Wheeler County, at an elevation of 780 meters; one series is from 22.4 km. N Dickens, Dickens County, 793 meters; and the fourth is from The Bowl, 2400 meters, Guadalupe Mountains National Park, Culberson County.

Only two nests were discovered; one nest was under a rock and the other was under a clump of grass.

Genus *Myrmecocystus* Wesmael

This genus is endemic to western North America, and its 29 species are restricted to arid and semiarid habitats. Eight species are known from western Texas. The genus was revised by Snelling (1976, 1982), who provided excellent keys and descriptions of the various species-groups and species. Most, if not all, of the species in this genus, have the ability to develop replete workers during times of extreme food abundance. These replete ants store a honeylike substance in their crops for use by the colony during leaner times. This unusual habit forms the basis for their common name: honey ants.

Myrmecocystus depilis Forel

Snelling (1976) recorded the range of this species as western Texas to southern Nevada in the United States, south to central México. Specimens were collected from from all soil types and regions sampled except the Rio Grande Plains (Fig. 21, Appendix 3). This species was more abundant than expected on sandy loam and less abundant than expected on clay loam and silty clay loam soils ($\chi^2 = 21.31$, d.f. = 7, $P < 0.01$). It was rarely collected below 800 meters elevation (Appendix 2), but was more abundant at 800 to 1000 meters elevation than expected ($\chi^2 = 48.41$, d.f. = 10, $P < 0.001$). Most nests (93 percent) were from level to slightly sloping ground (Appendix 4). One hundred nests were discovered in open situations, of which 20 had noticeable craterlike tumuli and 20 nests had domed tumuli. Only a few nests were in covered situations—one under a rock, one under tarbush (*Flourensia tripteris* D. C.), two at the base of a plant, and three under tufts of grass.

Several myrmecophiles were recorded from nests of this species in western Texas by Neece and Bartell (1982). Their samples included *Prolepismina* sp. (Thysanura: Lepismatidae) from Hudspeth, Presidio, and Winkler counties; *Myrmecophila nebrascensis* Bruner (Orthoptera: Gryllidae) from Hudspeth County; and *Araeoschizus decipiens* Horn (Coleoptera: Tenebrionidae) from El Paso County. Additional nests associates from Arizona were recorded by Cazier and Statham (1962). Their samples were reported as *M. "mimicus." Snelling (1976) also provided additional notes on the biology of this species.*

Myrmecocystus melliger (Forel)

Snelling (1976) reported the range of this ant in the United States as the Big Bend to the Jeff Davis area of Texas. Otherwise this ant is known primarily from México. He reported that this ant lives in semiarid mountain habitats, with most collections being from oak-juniper woodlands and a few collections from pinyon-juniper habitats.

This species was collected at only 10 localities in the Trans-Pecos region of western Texas (Fig. 22, Appendix 1). The localities were on loam, silt loam, and clay loam

soils at elevations above 1600 meters. Two nests were located under rocks, whereas the remaining nests were in the open.

Myrmecocystus mendax Wheeler

This species ranges from central Colorado south to Texas, and west to southern California in the United States, and in adjacent areas in México (Snelling, 1976). In Texas, Snelling reported that this ant inhabits pinyon-oak and mesquite-acacia savannas of the Edwards Plateau. Gregg (1963) reported a preference for clay soils by this ant in Colorado.

In western Texas, *M. mendax* was collected in all regions and on all soil types sampled except the Trans-Pecos region and silty clay soil (Fig. 22, Appendices 1, 3). This ant appears to be most abundant at elevations from 500 to 999 meters, but samples also were taken at 200 to 299, 400 to 499, 1000 to 1399 meters (Appendix 2). Only 62 percent of the nests were located on level to slightly sloping ground (zero to five degrees). The remaining 12 nests were found at slopes of six to 45 degrees (Appendix 4). Of the 30 nests located, 26 were in open situations, one was at the base of a grass plant, and three were under rocks.

Myrmecocystus mexicanus Wesmael

This ant ranges from western Texas, New Mexico, and Colorado west to Nevada and California in the United States, and in northern and central México (Snelling, 1976, 1982). Many papers on the biology of this species were cited by Snelling (1976).

Myrmecocystus mexicanus was found in eight counties of the Edwards Plateau and Trans-Pecos regions (Fig. 21, Appendix 1). The 12 collection localities were at 700 to 899, 1100 to 1199, 1300 to 1499, and above 1600 meters in elevation. This ant was collected from all soil types sampled except loamy fine sand, sandy clay loam, and silty clay. All nest were in the open, with 46 percent of them having craterlike tumuli.

Myrmecocystus mimicus Wheeler

Snelling (1976) reported the range as southwestern Kansas south to the Big Bend region of Texas, and west to California in the United States, and north-central México. Snelling also recorded considerable information on the biology of this ant.

In western Texas, this species was found in all regions examined except the Rio Grande Plains (Fig. 21, Appendix 1). This species was collected from all soil textural classes examined, except silty loam and sandy clay loam (Appendix 3). In addition to the significant absence of this species from two soil types, it was more abundant than expected on loamy fine sand and fine sandy loam ($\chi^2 = 30.82$, d.f. = 7, $P < 0.001$). Specimens were not collected below 600 meters elevation (Appendix 2), and this species was more abundant than expected from 1000 to 1400 meters elevation ($\chi^2 = 42.92$, d.f. = 10, $P < 0.001$). Most nests (92 percent) were on soils that sloped up to 15 degrees, with 23 percent of total being from six to 15 degrees (Appendix 4). Most nests (74) were from open situations. Additional nests

were located at roadsides (six), among grass tufts (two), and single nests each were at base of broomweed (*Xanthucephalum* sp.), at side of railroad tracks, under creosote bush [*Larrea tridentata* (D. C.)], at base of weed, and under brush.

Myrmecocystus navajo Wheeler

Snelling (1976, 1982) reported the range of this species as western Texas, New Mexico, Colorado, west to Nevada and southern California in the United States, and northern Sonora and Baja California in México. Little has been reported on the biology of this species; Snelling (1976) reviewed the known literature.

A single mound with a five-centimeter diameter crater of pebbles on level loam soil was found in Lipscomb County (Rolling Plains: Fig. 21). The site was at 823 meters in elevation.

Myrmecocystus placodops Forel

The range for this species is the Rio Grande Valley and adjacent lowlands of Texas and México, west to Arizona in the United States and to Sonora in México (Snelling, 1976). In western Texas, Snelling reported this species from grama-buffalo grass grasslands in the Panhandle region and mesquite savannahs and southern cordgrass prairies in the Rio Grande Valley and plains areas.

This ant was present in all regions sampled in western Texas (Fig. 22, Appendix 1). All nests were in open situations and 85 percent of the nests were on level to slightly sloping ground (Appendix 4). The collections were primarily from 800 to 899 meters, but collections were also from 200 to 299, 400 to 999, and 1200 to 1499 meters in elevation. Although samples were from all soils types examined, except loamy fine sand and silt loam, most collection sites were composed of sandy loam, clay loam, and silty clay loam soils.

Myrmecocystus romainei Cole

This ant ranges from western Kansas, Oklahoma, and Texas, west to Utah and southern California in the United States (Snelling, 1976, 1982). In western Texas, collections were from the High Plains region (Fig. 22, Appendix 1). Elevations ranged from 1100 to 1399 meters, and the soil types present at collection localities were sandy and loamy fine sand. Seven nests were located, six in open situations and one in an abandoned *Pogonomyrmex* nest. The nests reported from western Texas by Snelling (1976) were in deep, soft sand. Tumuli were low, somewhat irregular craters about 20 centimeters in diameter. Some additional biological data were presented about this ant in other regions by Snelling (1976). Wheeler and Wheeler (1985*b*) reported the presence of this ant in the far west of the Trans-Pecos region (El Paso County) and from two counties (Hall and Scurry) on the Rolling Plains of Texas.

Genus ***Formica*** Linné

This large genus of Holarctic ants is in need of taxonomic revision. Some of the species found in western Texas can be identified with the keys of Creighton (1950), Francoeur (1973), and Snelling and Buren (1985), but others are virtually impossible to identify. All of our identifications were provided or verified by Dr. Francoeur,

who currently is revising this genus. Some of the names applied to western Texas samples by Dr. Francoeur are not the same as those used by Smith (1979) and Wheeler and Wheeler (1985*b*); these nomenclatorial discrepancies are noted under the specific taxa in question.

Formica bradleyi Wheeler

This species is a member of the *neogagates* species group and is found in Minnesota, Iowa, and Kansas, west to Montana, Wyoming, and Colorado in the United States, and from Manitoba west to Alberta in Canada (Halverson *et al.*, 1976). Halverson *et al.* (1976) provided an extensive report on the biology and behavior of this arenicolous ant.

In western Texas, this species was collected only twice on the High Plains (Fig. 23, Appendix 1). The two nests from a single locality were at 1204 meters elevation in sandy soil. Both nests were in an exposed situation; one nest was large with several openings, whereas the other had 10 openings and was about 30 centimeters tall and 76 centimeters in diameter. These are the first records of this species form Texas.

Formica gnava Buckley

This member of the *fusca* species group is recorded from Colorado and Texas, west to Nevada and Arizona in the United States, and in México (Francoeur, 1973). Nests are generally in soil under rocks in desert or semidesert areas or in open woods.

Wheeler and Wheeler (1985*b*) reported *F. neorufibarbis* Emery and *F. gnava* from western Texas. We here consider those records all referable to *F. gnava*. The Wheelers' samples identified as *F. neorufibarbis* are from Fisher and Lubbock counties. We encountered *F. gnava* in all regions sampled in western Texas (Fig. 24, Appendix 1). Most collections were at elevations from 500 to 1099 meters, but others were made at 300 to 399, 1200 to 1399, and elevations above 1600 meters (Appendix 2). Although *F. gnava* was collected from all soil types examined in western Texas except fine sandy loam, silt loam, silty clay loam, and silty clay, this ant appears to be most abundant on sandy clay loam and clay loam soils (Appendix 3). Eighty-eight percent of the nests located were on level to gently sloping ground (zero to 15 degrees), with 69 percent located on slopes of zero to five degrees (Appendix 4). Most nests were located in or under covering objects—15 under rocks, two in and under logs, one under a cross-tie near railroad tracks, and two under tin cans. Several nests were located in or at the bases of trees—one in and two at the base of mesquite trees (*Prosopis* sp.), the base of a large elm tree (*Ulmus* sp.), and in a sugarberry tree (*Celtis laevigata* Willd.). Four colonies were located in open situations and two series were collected while they tended homopterans (aphids and treehoppers). The remaining series were foragers for which no nests were located.

Formica gynocrates Snelling and Buren

The range reported for this ant by Snelling and Buren (1985) is Michigan, North Dakota, Wyoming, and Colorado. This slave-making ant is a member of the

sanguinea species group and was reported to enslave members of the *neogagates* species group, *F. vinculans* Wheeler and *F. lasioides* Emery. Additional biological data were supplied by Talbot (1985) and Snelling and Buren (1985).

The present records from western Texas are the first for the state and represent a new host record. Two nests of *F. gynocrates* were found at 1100 to 1299 meters in elevation on sandy and fine sandy loam soils. A *neogagates* species group member, *F. perpilosa*, was collected at both localities on the High Plains in nests of *F. gynocrates* (Fig. 24, Appendix 1).

Formica montana Emery

This *fusca* species group member is reported from Ohio, Wisconsin, Illinois, Minnesota, Iowa, Dakotas, Nebraska, Kansas, and Colorado in the United States, and Manitoba in Canada (Francoeur, 1973). Nests of this prairie species are in soil and commonly are covered with grass, sometimes with thatching.

The collection of this ant in Hutchinson County on the High Plains represents the first record for the state (Fig. 23, Appendix 1). No nest data were obtained.

Formica neoclara Emery

The range given for this *fusca* species group member is Texas, Kansas, western Iowa, and the Dakotas, west to the Pacific coastal states in the United States, and British Columbia, Alberta, and the Northwest Territories in Canada (Francoeur, 1973). Nests are usually in sandy soil, on grasslands or in open woods.

This species has not been collected in western Texas, but its presence is suspected because of its wide distribution. Specimens were reported from central Texas (Eastland County) by Francoeur (1973).

Formica nitidiventris Emery

This member of the *pallidefulva* species group was treated as a subspecies of *F. pallidefulva* by Smith (1979). Smith cited numerous publications on the biology of this species and recorded the range as Ontario and Quebec in Canada, south in the United States to Georgia, and west to Wisconsin, South Dakota, Wyoming, Colorado, and New Mexico.

In western Texas, collections were made only in the Trans-Pecos region (Fig. 23, Appendix 1). Two nests were located at a site, 2438 meters in elevation, with ponderosa pine (*Pinus ponderosa* Laws), juniper (*Juniperus* sp.), and grass (*Bromus* sp.). Both nests were in clay soil; one under a rock, and the other under a dead branch.

Formica pallidefulva Latreille

Smith (1979) recorded the range of this ant as from New York and New Jersey south to Florida, and west to Colorado, Oklahoma, and Texas in the United States. Trager (personal communication) stated that this species probably is restricted to a more southerly range, at least in the eastern United States.

One nest of *F. pallidefulva* was found on the Rolling Plains of western Texas (Fig. 24, Appendix 1). The single nest was at 716 meters elevation in loamy fine sand. The mound was 30 centimeters high and had a diameter of 60 centimeters.

Formica perpilosa Wheeler

This member of the *neogagates* species group is recorded from Texas, Oklahoma, Kansas, Colorado, and Wyoming west to California in the United States, and also from México (Smith, 1979). Nests are usually craterlike and constructed in the soils of grasslands and open fields.

Samples were collected from all regions of western Texas except the Edwards Plateau and the Rio Grande Plains (Fig. 23, Appendix 1). The record of *F. neogagates* Emery by Wheeler and Wheeler (1985*b*) was based on a sample of what we here refer to *F. perpilosa*. Their sample was collected in Lubbock County.

Collections in western Texas were at sites from 600 to 1599 meters (except none in the 800 to 899 meters range) in elevation (Appendix 2). Soil types present at the collection localities included all those examined except silty clay loam. The majority of collections were from sandy soils (Appendix 3). Only 77 percent of the nests located were on level to slightly sloping ground with the remainder being at six to 25 degrees (Appendix 4). Approximately half of the nests were under covering objects: board (one), can (one), log (four), large gourd (*Cucurbita* sp.) (one), debris (four), rocks (four), cattle dung (five), and grass tufts (three). Numerous colonies were found at the bases of plants: salt cedar (*Tamarix* sp.) (three), desert willow (*Chilopsis linearis* [Cav.] Sweet) (one), mequite (*Prosopis* sp.) (one), grass clumps (four), cottonwood tree (*Populus* sp.) (one), and willow tree (*Salix* sp.) (one). Fifteen colonies were located in fully exposed situations. Mounds in the open ranged in size from a few centimeters in height and diameter to one meter in diameter and 18 centimeters tall.

Neece and Bartell (1982) reported several myrmecophiles from nests of "*F. neogagates* Emery," samples correctly identified as *F. perpilosa*. The myrmecophiles of *F. perpilosa* known from western Texas are: *Prolepismina* sp. (Thysanura: Lepismatidae) from El Paso County, *Blapstinus sulcatus* LeConte (Coleoptera: Tenebrionidae) from Culberson County, and *Xenodusa caseyi* Wasmann (Coleoptera: Staphylinidae) from Potter County. This species is sometimes enslaved by *F. gynocrates* in western Texas.

Formica puberula Emery

This slave-making ant is a member of the *sanguinea* species group. It enslaves numerous *Formica* species (Smith, 1979), of which *F. bradleyi, F. montana, F. neoclara,* and *F. nitridiventris* have been recorded from western Texas.

Wheeler and Wheeler (1985*b*) reported a collection of this ant from Jeff Davis County, based on the collection reported by Wheeler (1913) from Ft. Davis. This species was not recollected in the present study.

Formica schaufussi Mayr

Smith (1979) reported the range of this member of the *pallidefulva* species group as from Ontario in Canada south in the United States to the Carolinas and Tennessee, and west to Wisconsin and Iowa. Wheeler and Wheeler (1985*b*) were the first to report this species from Texas.

During this study, two series of this ant were collected from two localities, one each on the High Plains and Rolling Plains (Fig. 24, Appendix 1). Both collections

were from sites at 914 meters in elevation. One series was taken while individuals foraged on sunflowers (*Helianthus* sp.) and the second was from a nest that had a tumulus 10 centimeters in diameter.

Formica subsericea Say

This member of the *fusca* species group ranges from New Burnswick, Quebec, and Manitoba in Canada south to Florida, and west to Montana, Iowa, Kansas, Arkansas, and Mississippi in the United States (Smith, 1979). Nests are in soil under stones or leaf litter, sometimes with low mounds covered with debris. Smith (1979) reported that this species occurs in open deciduous woodlands.

Two nests of this species were located in the Rolling Plains of western Texas (Fig. 23, Appendix 1), and are the first records for that state. Both were at approximately 716 meters in elevation; one had a mound 30 centimeters high and 30 centimeters in diameter in sandy loam soil, whereas the second nest was in sandy clay loam soil. The second nest had several openings within a tumulus 12 centimeters in diameter.

Formica sp. (near *integroides* Emery)

This species is a member of the *rufa* species group. Members of this group sometimes have founding queens that behave as temporary social parasites (Smith, 1979). During this study, five collections were made in three counties on the High Plains of western Texas (Fig. 24, Appendix 1). The collection sites were from 900 to 1099 meters in elevation and had sandy loam and sandy clay loam soils. Only two nests were located, both in the open. One nest had a mound composed of twigs and grasses and was 30 centimeters high and had a diameter of about 60 centimeters at the base. The second was much smaller and had no mound. The second nest had debris from the nest piled about 10 centimeters from the entrance.

SUMMARY

In Part I of this series, Moody and Francke (1982) reported that the subfamily Myrmicinae is represented in western Texas by 17 genera and 89 species. Herein, 24 genera and 83 species are recorded from western Texas in the subfamilies Ecitoninae, Ponerinae, Pseudomyrmecinae, Dolichoderinae, and Formicinae. Two additional species (*Formica neoclara* and *Hypoponera punctatissima*) are probably also present, based on their known distributions elsewhere in Texas and surrounding states.

Although several species are wide ranging, most are restricted to one or two vegetative regions. Thirteen wide-ranging species are present in all of the western Texas regions: *Brachymyrmex depilis, Camponotus discolor, C. festinatus, Conomyrma bicolor, C. flava, C. insana, Forelius foetidus, F. pruinosus, Formica gnava, Labidus coecus, Myrmecocystus placodops, Odontomachus clarus,* and *Paratrechina vividula*. Eight other species are relatively common and were found in four of the five regions sampled: *Camponotus sansabeanus, C. vicinus, Hypoponera opacior, Myrmecocystus depilis, M. mendax, M. mimicus, Neivamyrmex nigrescens,* and *Paratrechina terricola*.

More species were encountered in the Trans-Pecos region than in any other in western Texas. Furthermore, more species are restricted to the Trans-Pecos area than all others taken together in western Texas. Of the 58 species recorded from the Trans-Pecos, 21 were restricted to that region: *Acanthomyops arizonicus, Amblyopone pallipes, Camponotus abdominalis transvectus, C. cuauhtemoc, C. ocreatus, C. ulcerosus, Cerapachys davisi, Colobopsis pylartes, Formica nitidiventris, F. puberula, Hypoponera opaciceps, Lasius sitiens, Liometopum luctuosum, Myrmecocystus melliger, Neivamyrmex fallax, N. macropterus, N. minor, N. pauxillus, Paratrechina austroccidua, P. bruesii,* and *Pseudomyrmex pallidus*. The wide variety of habitats—from lowland deserts to highland coniferous forests—certainly accounts for much of this diversity in ants.

Approximately the same numbers of ant species occur on the High Plains, Rolling Plains, and that part of the Edwards Plateau in western Texas as here defined, 34, 38, and 47, respectively. Those species restricted to the High Plains of western Texas include *Formica bradleyi, F. gynocrates, F. montana, F.* sp. (near *integroides*), and *Myrmecocystus romainei.* Species recorded only from the Rolling Plains are *Acanthomyops interjectus, Formica pallidefulva, F. subsericea,* and *Myrmecocystus navajo.* The two species recorded only from the Edwards Plateau are *Neivamyrmex melsheimeri* and *Proceratium compitale.* Only 23 species are recorded from that part of the Rio Grande Plains that extends into western Texas. Of those species, only three, *Neivamyrmex fuscipennis, N. texanus,* and *Pachycondyla villosa* do not occur elsewhere in western Texas.

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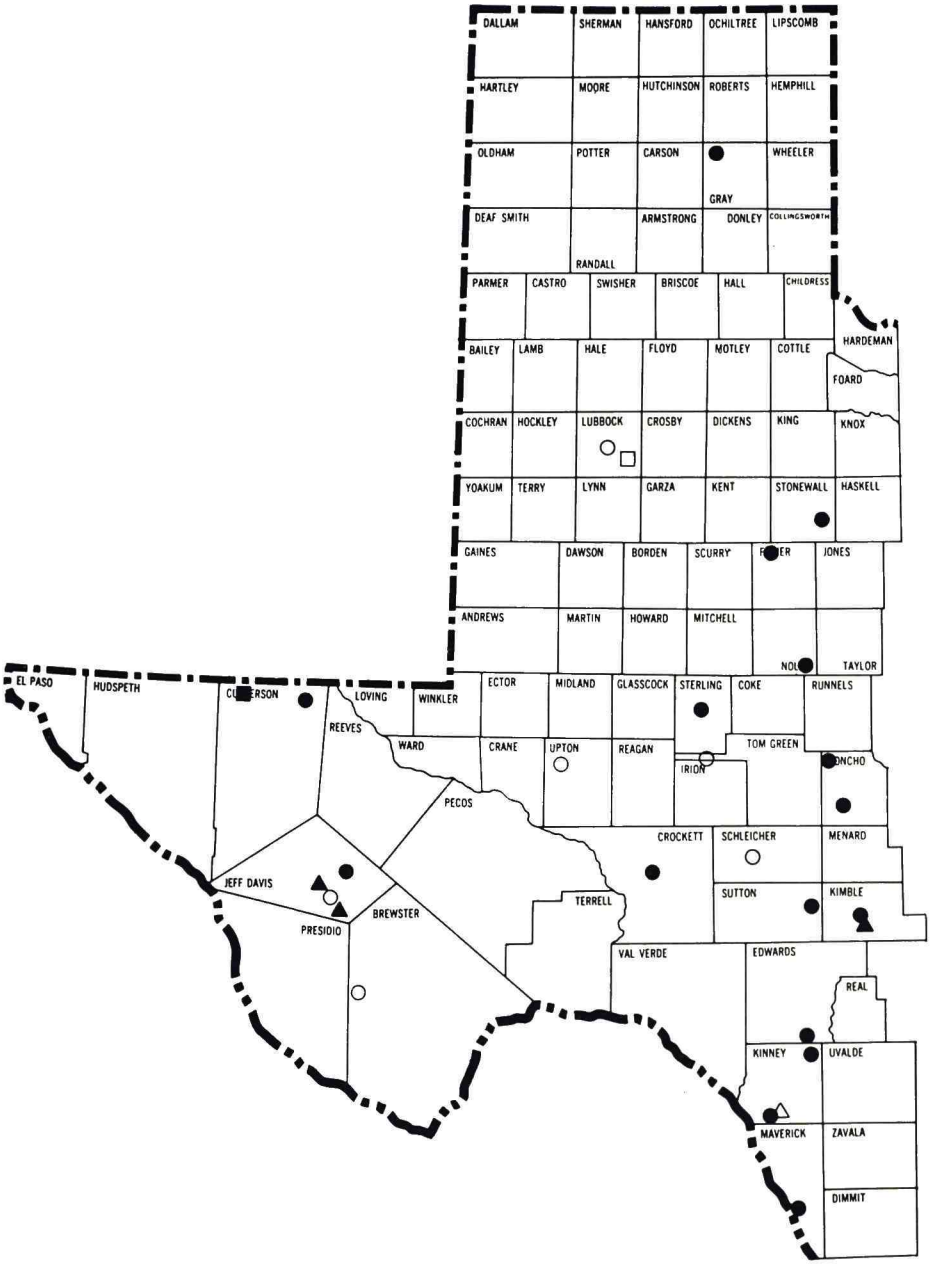

FIG. 2.—The distribution in western Texas of *Labidus coecus* (Latreille) (solid circle); *Neivamyrmex fuscipenis* (Wheeler) (open triangle); *N. harrisii* (Haldeman) (open circle); *N. leonardi* (Wheeler) (open square)—see text for additional records; *N. macropterus* Borgmeier (solid square)—see text for additional records; and *N. texanus* Watkins (solid triangle)—see text for additional record.

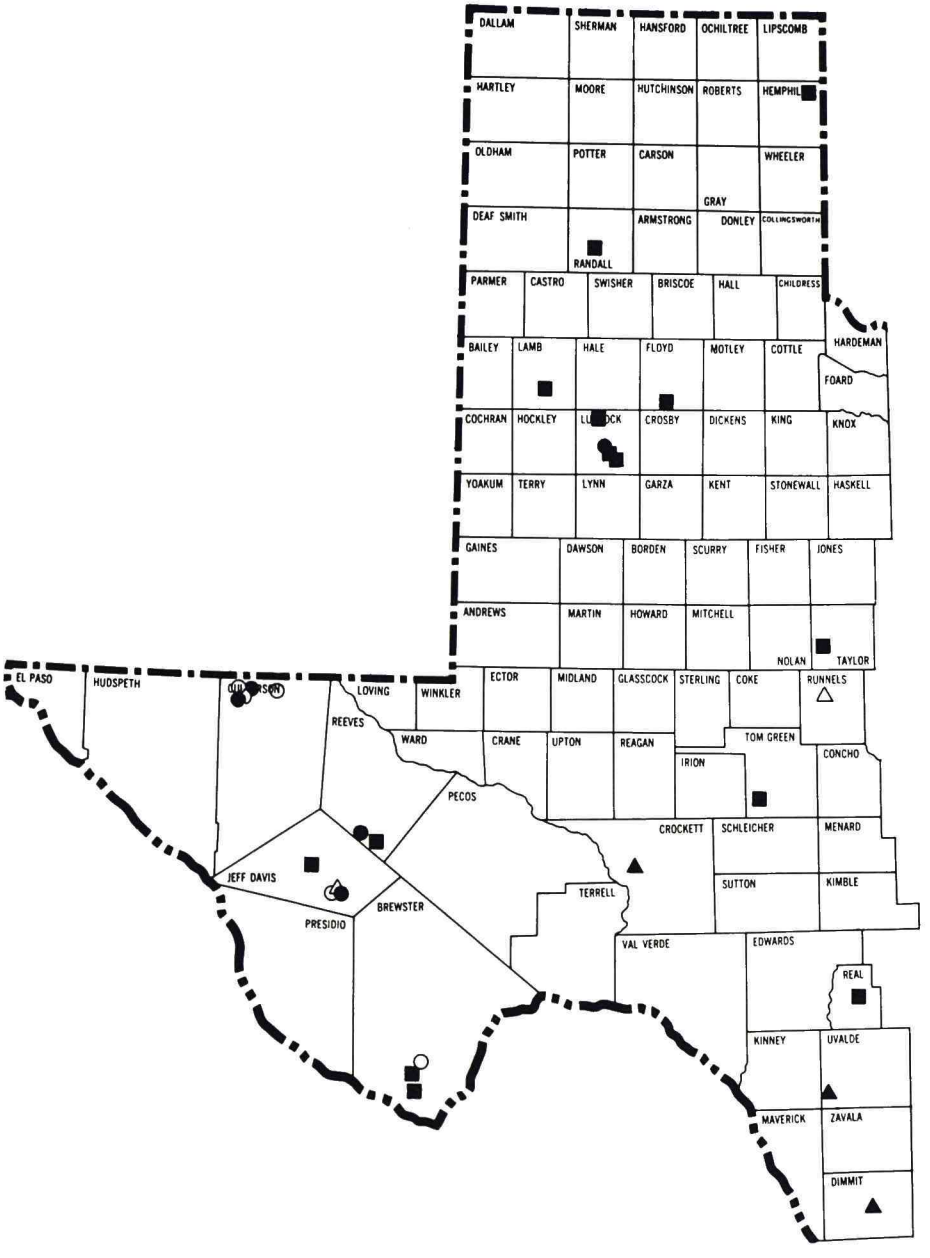

FIG 3.—The distribution in western Texas of *Neivamyrmex minor* (Cresson) (open circle)—see text for additional records; *N. nigrescens* (Cresson) (square); *N. opacithorax* (Emery) (solid triangle)—see text for additional records; *N. pilosus mexicanus* (Smith) (open triangle)—see text for additional records; and *N. swainsonii* (Shuckard) (solid circle)—see text for additional records.

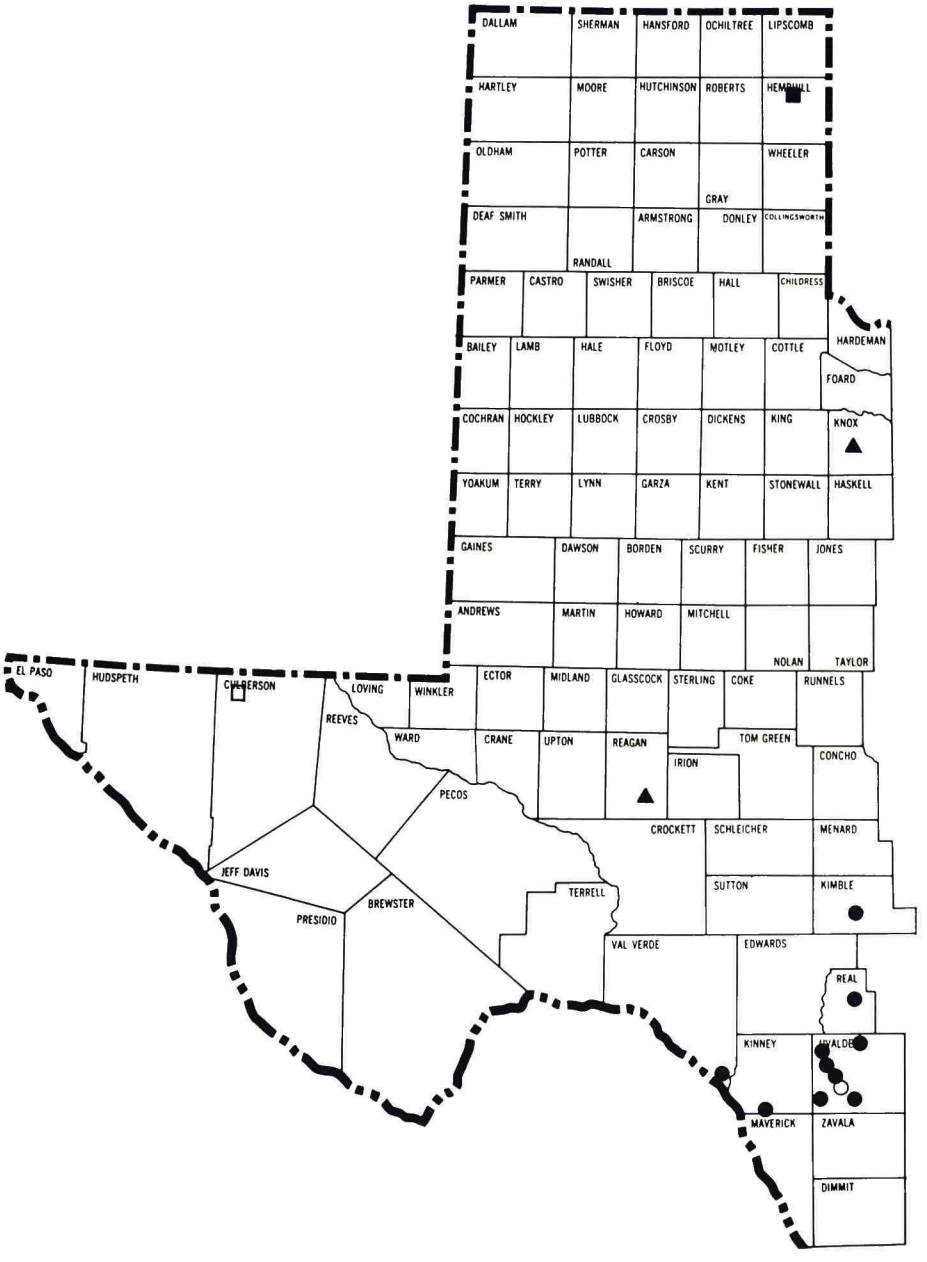

FIG. 4.—The distribution in western Texas of *Amblyopone pallipes* (Haldeman) (open square); *Pachycondyla harpax* (Fabricius) (solid circle); *P. villosa* (Fabricius) (open circle); *Ponera pennsylvanica* Buckley (solid square); and *Cerapachys augustae* Wheeler (triangle).

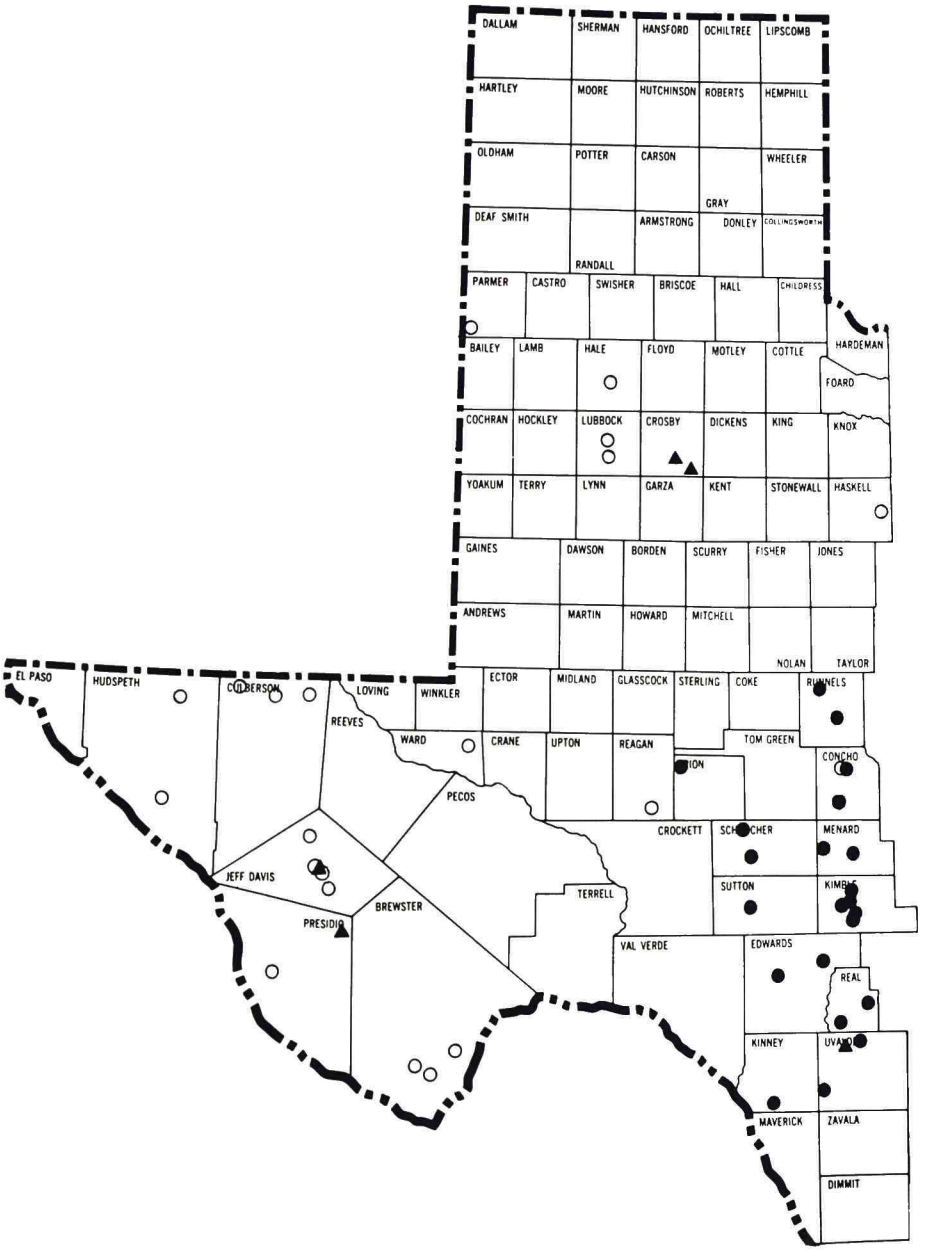

FIG. 5.—The distribution in western Texas of *Hypoponera inexorata* (Wheeler) (triangle); *H. opacior* (Forel) (open circle); and *Leptogenys elongata* (Buckley) (solid circle).

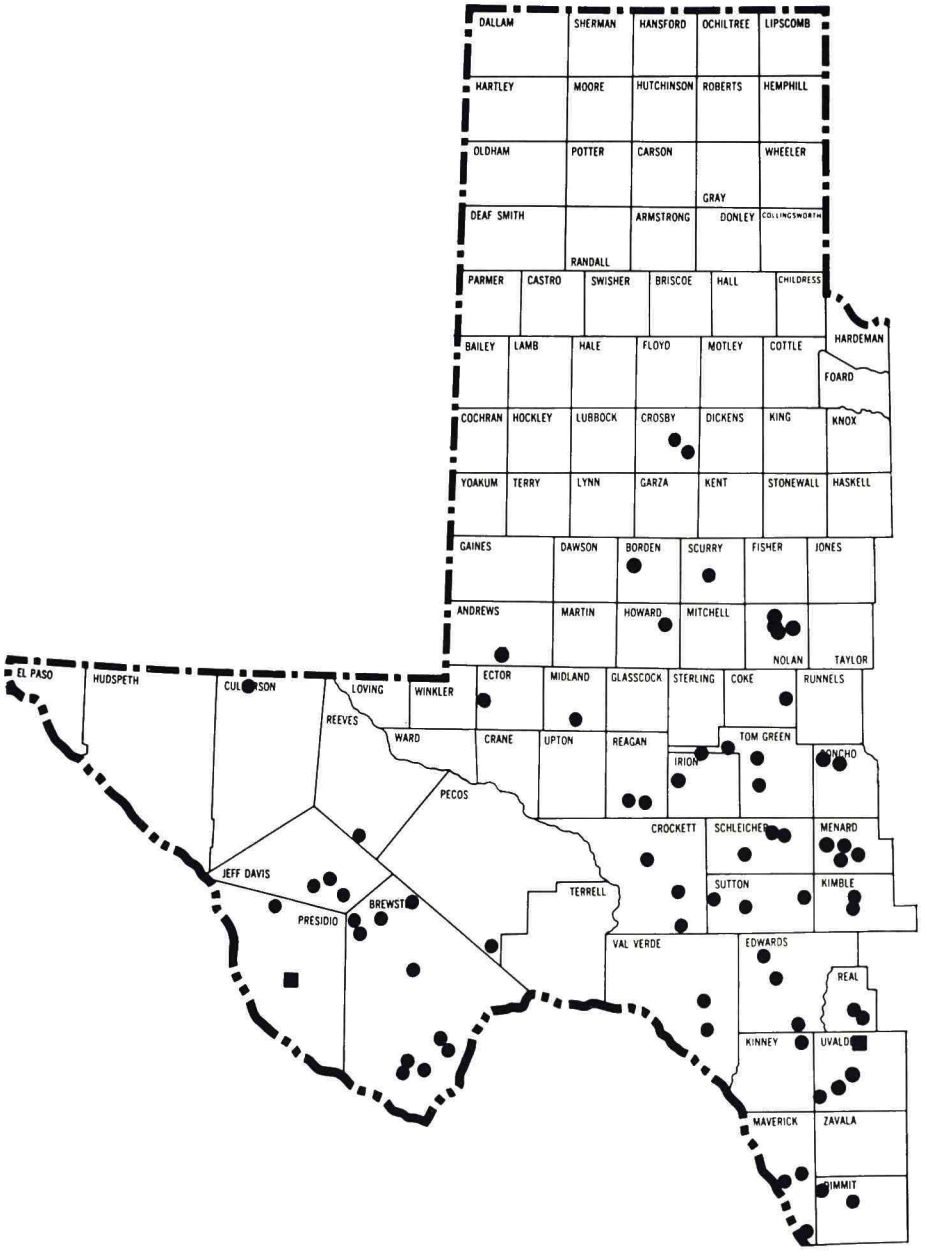

FIG. 6.—The distribution of *Odontomachus clarus* Roger (circle); and *Pseudomyrmex apache* Creighton (square) in western Texas.

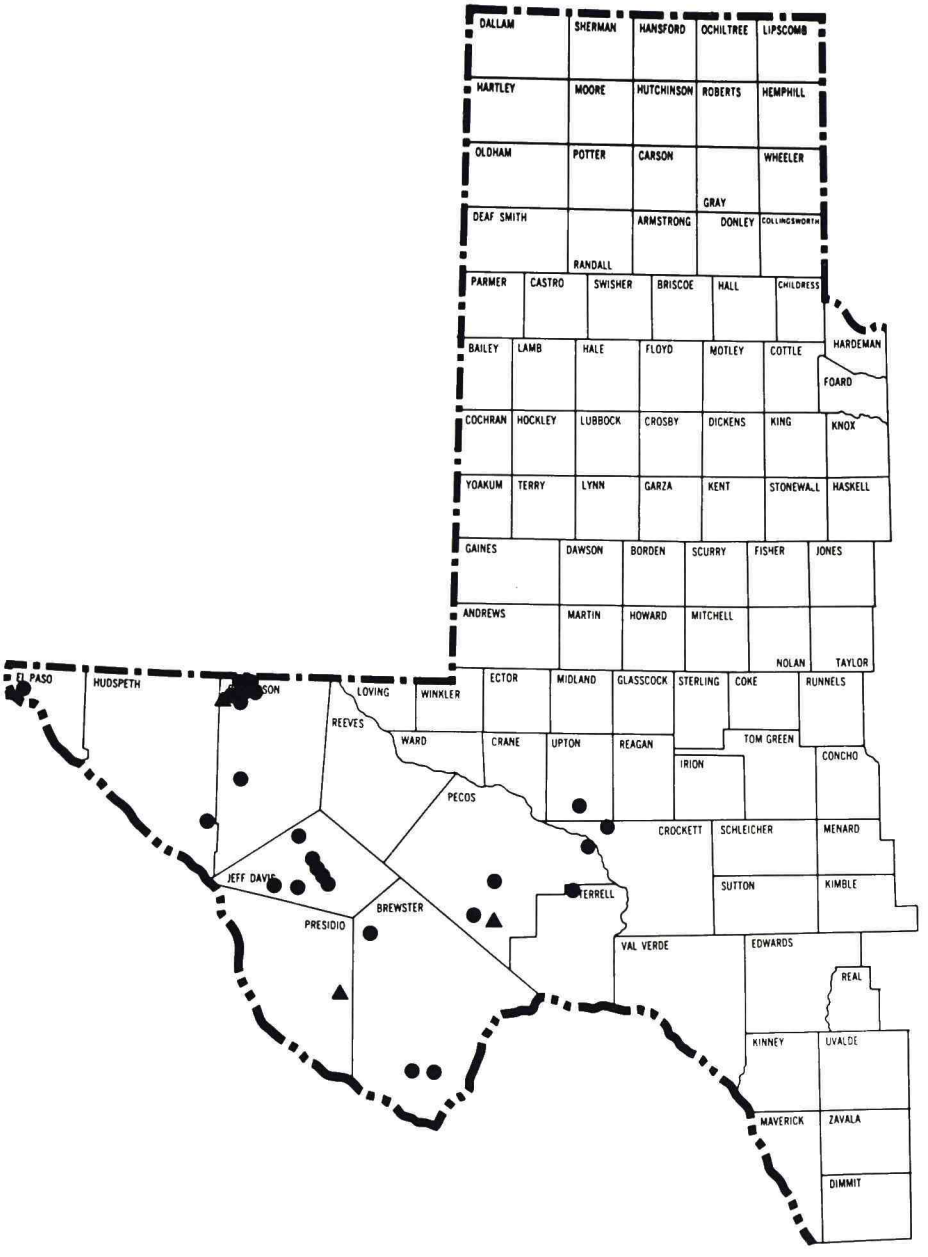

FIG. 7.—The distribution of *Liometopum apiculatum* Mayr (circle); and *Tapinoma sessile* (Say) (triangle) in western Texas.

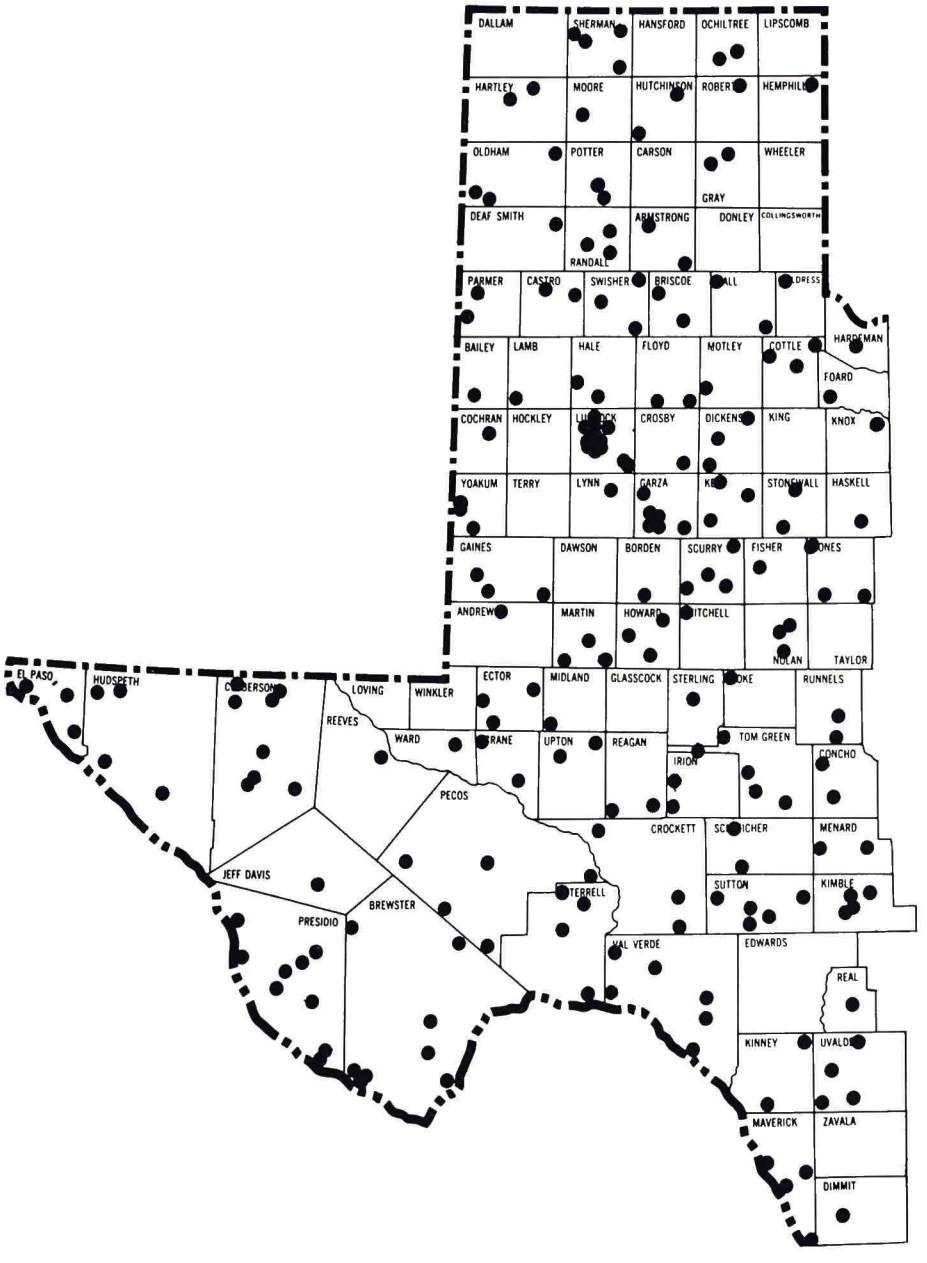

FIG. 8.—The distribution of *Forelius foetidus* (Buckley) in western Texas.

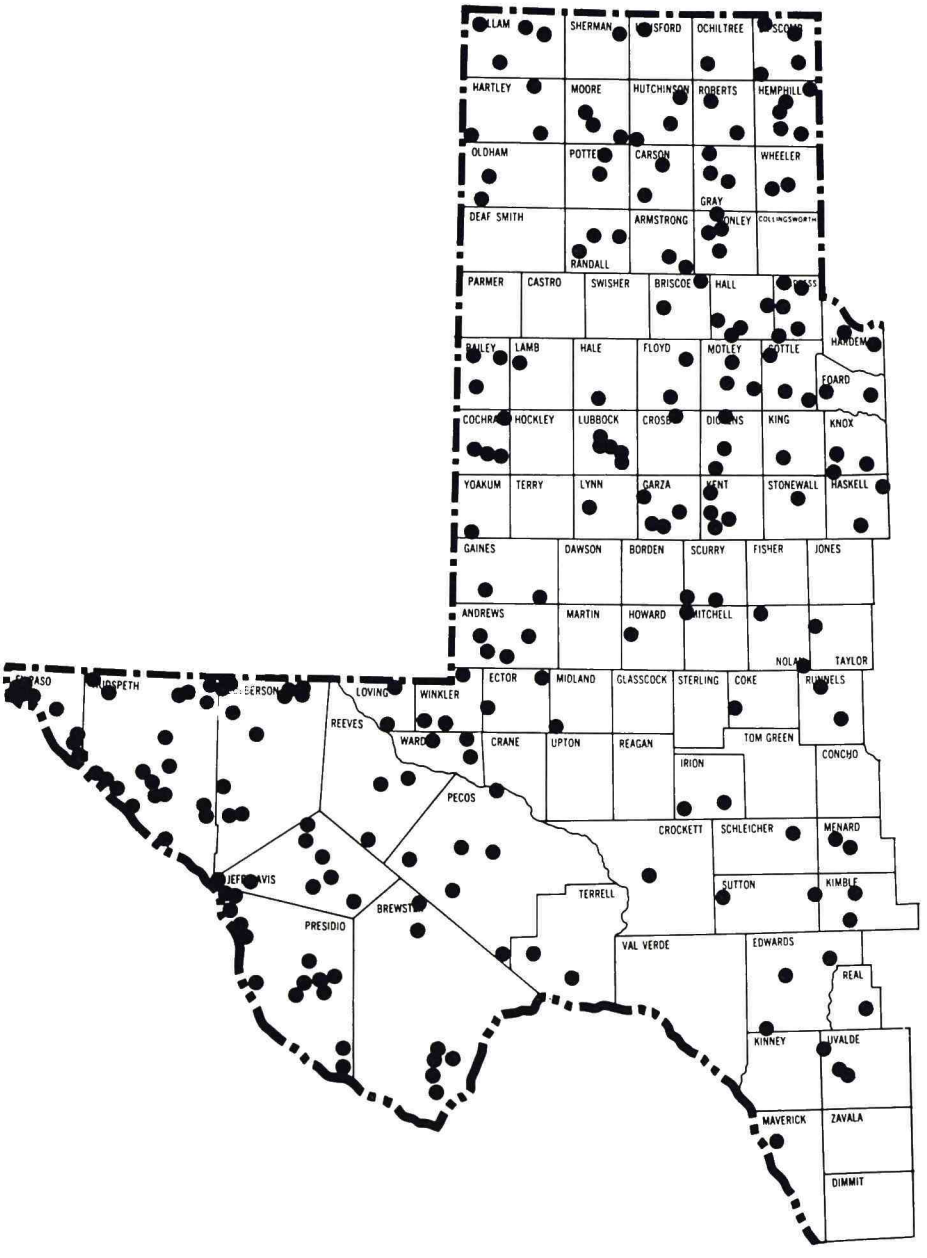

FIG. 9.—The distribution of *Forelius pruinosus* (Roger) in western Texas.

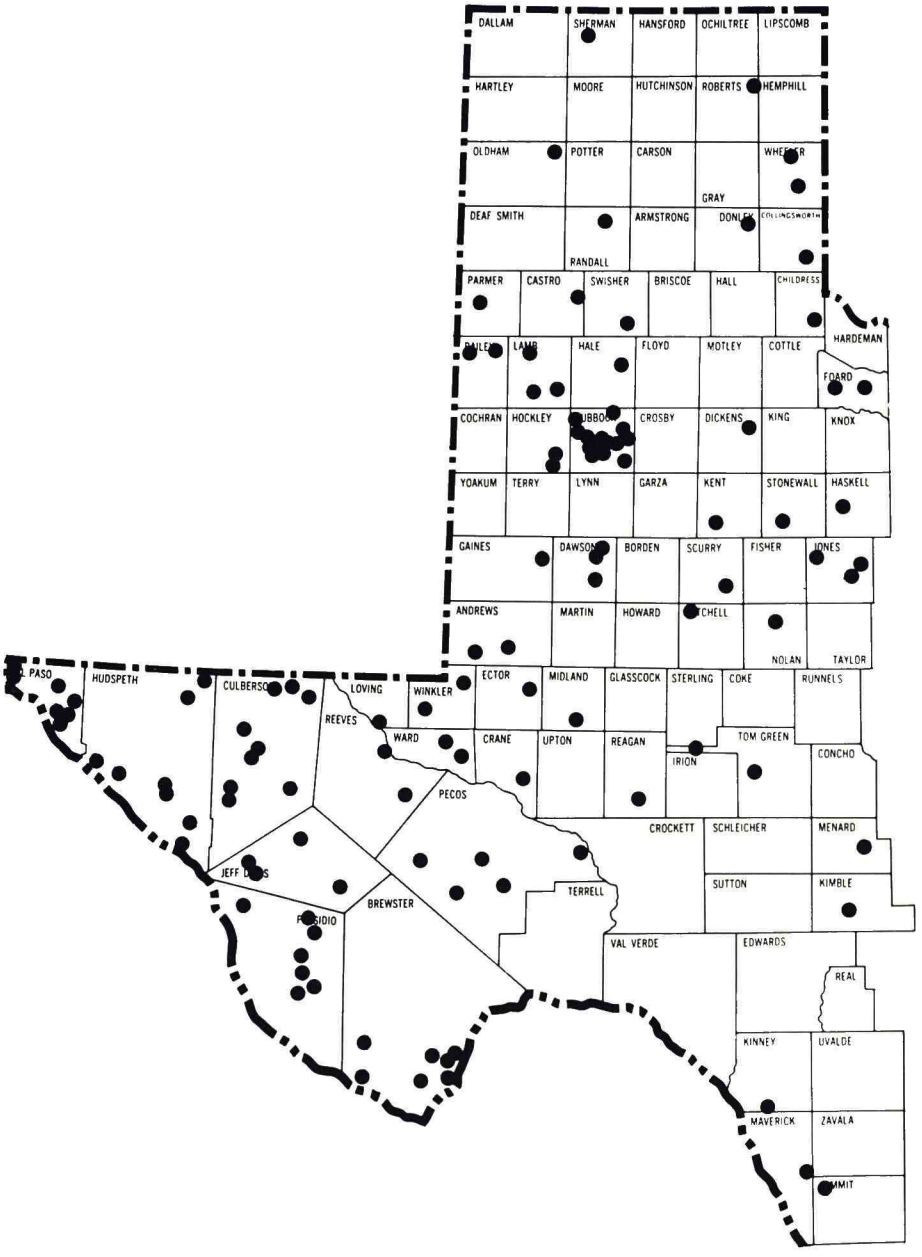

FIG 10.—The distribution of *Conomyrma bicolor* (Wheeler) in western Texas.

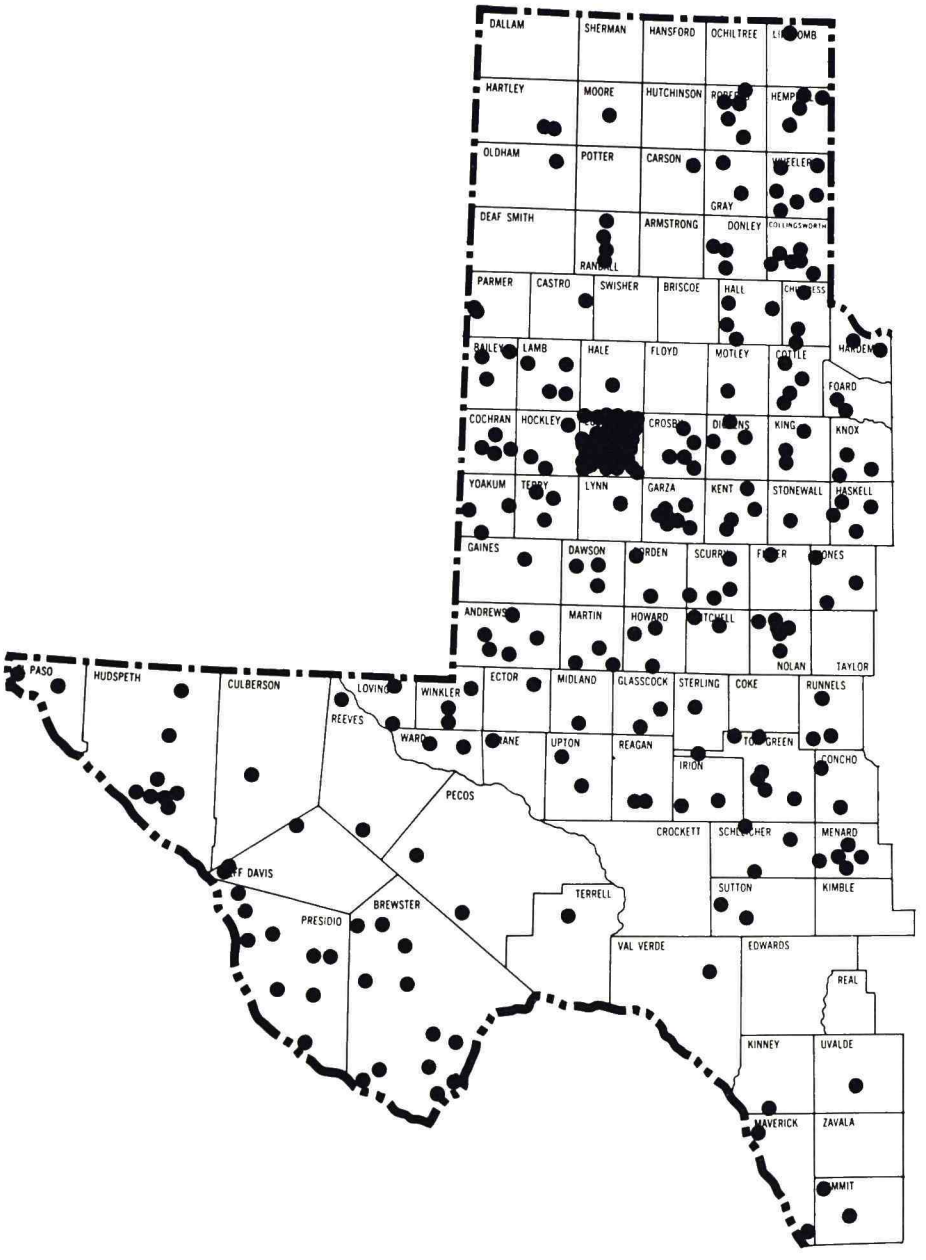

FIG. 11.—The distribution of *Conomyrma flava* (McCook) in western Texas.

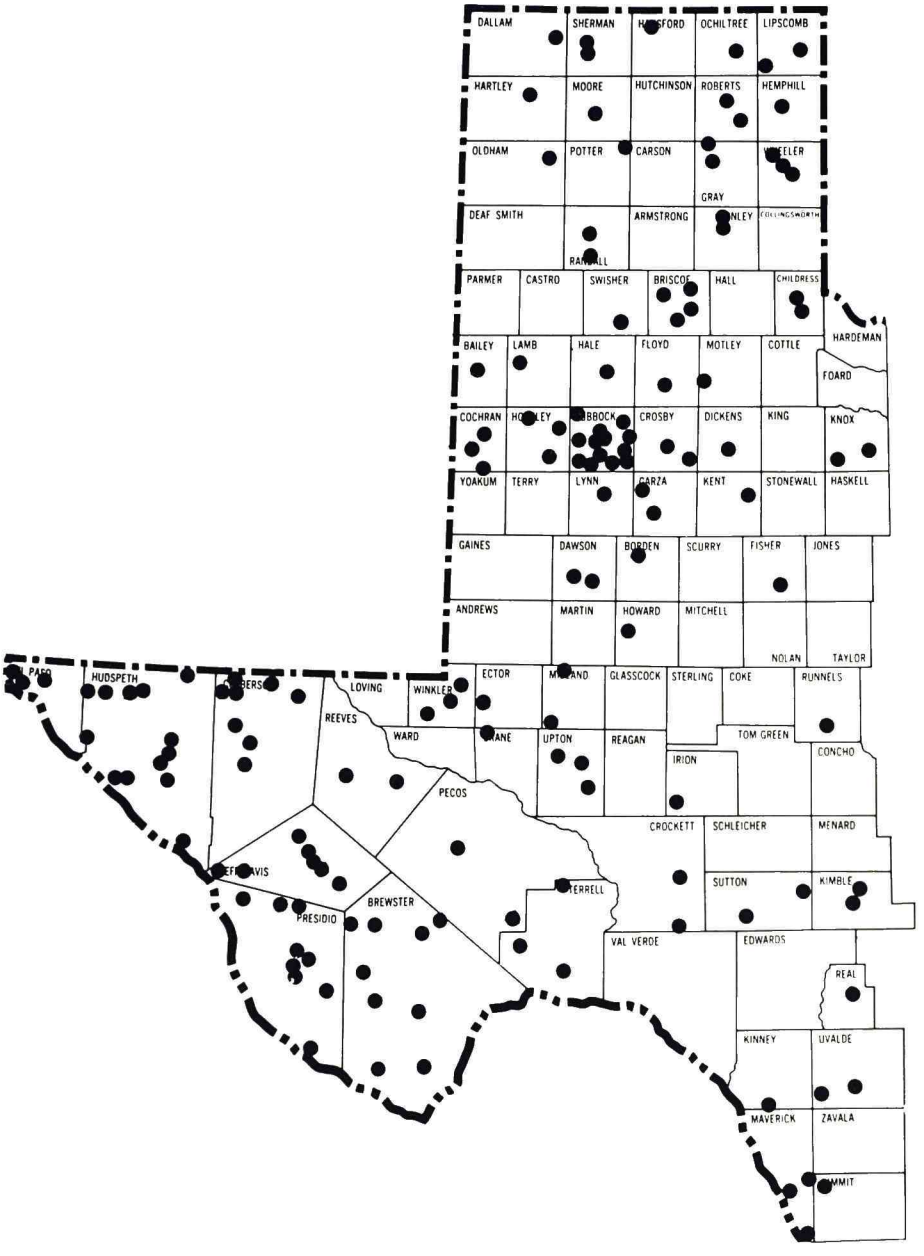

FIG. 12.—The distribution of *Conomyrma insana* (Buckley) in western Texas.

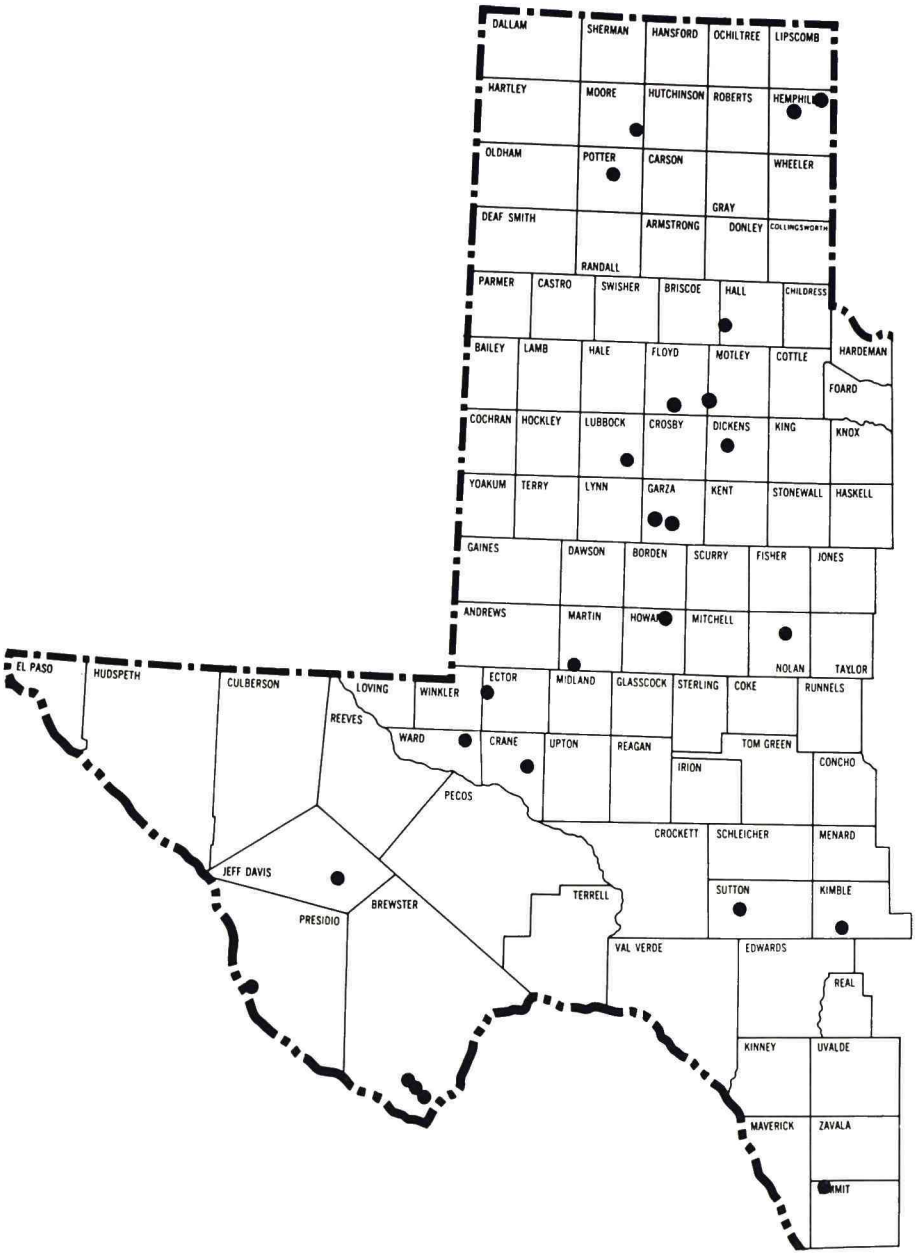

FIG. 13.—The distribution of *Brachymyrmex depilis* Emery in western Texas.

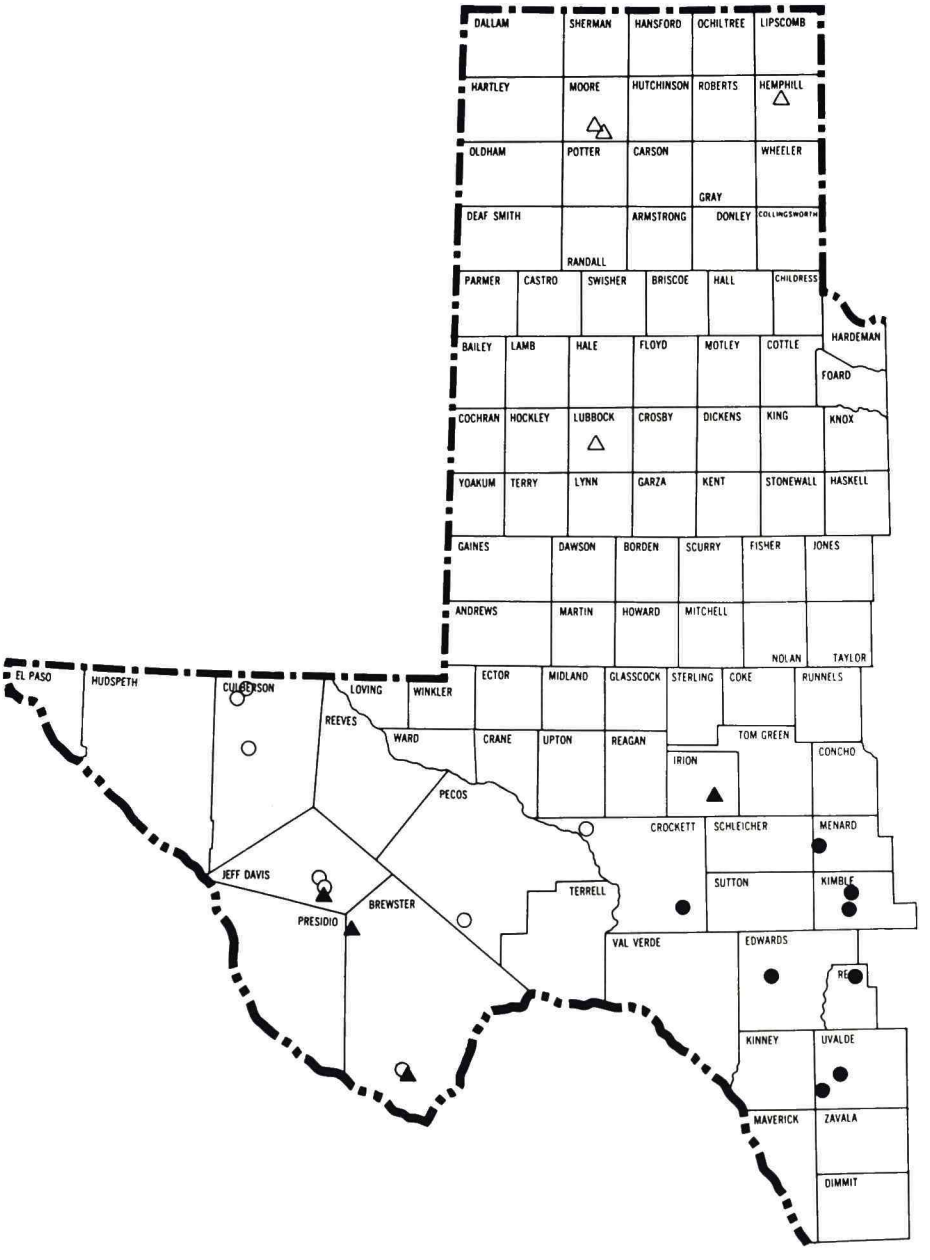

FIG. 14.—The distribution in western Texas of *Colobopsis impressa* (Roger) (solid circle); *Camponotus americanus* Mayr (open circle); *C. pennsylvanicus* (DeGeer) (solid triangle); and *C. texanus* Wheeler (open triangle).

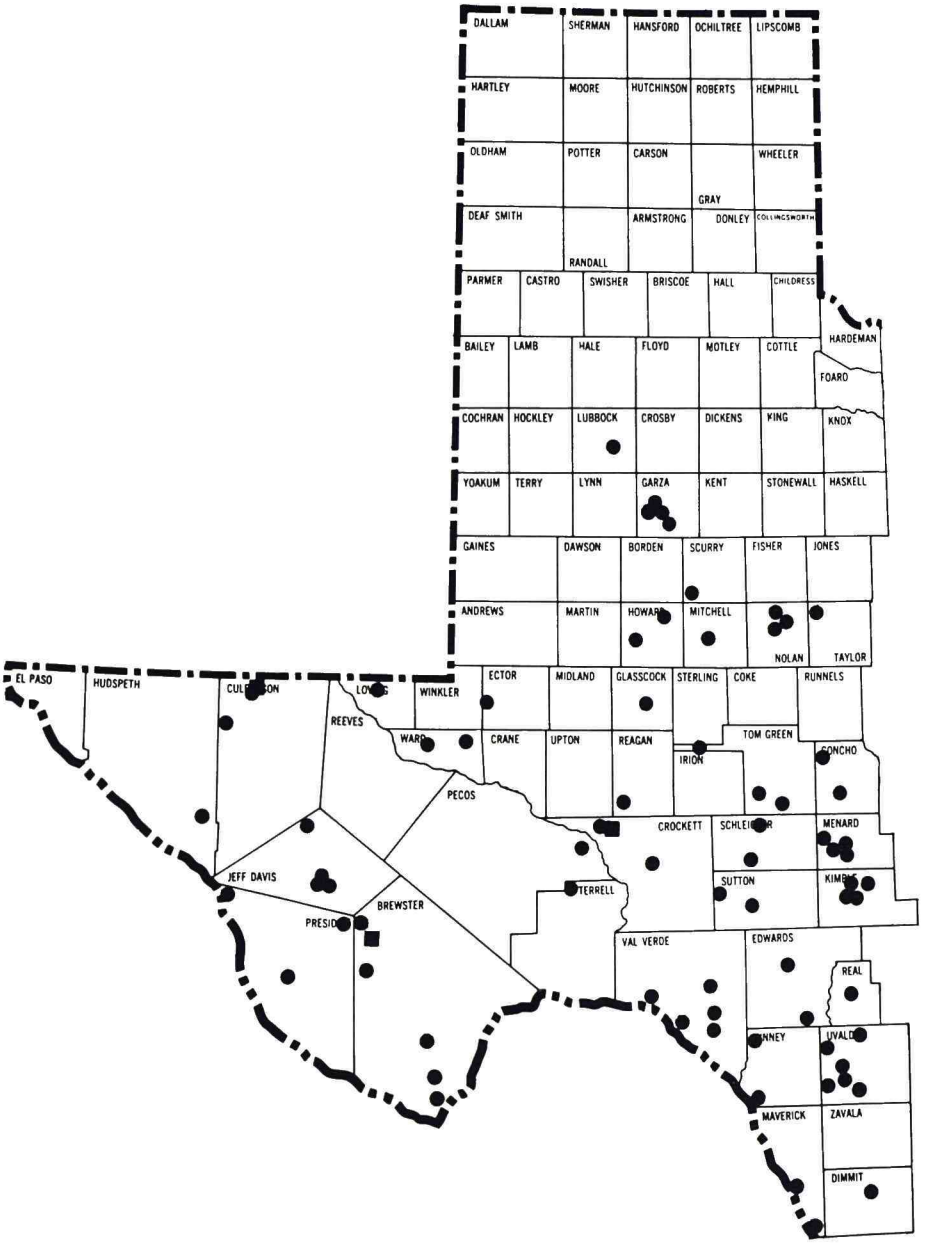

FIG. 15.—The distribution in western Texas of *Camponotus acutirostris* Wheeler (square) and *C. festinatus* (Buckley) (circle).

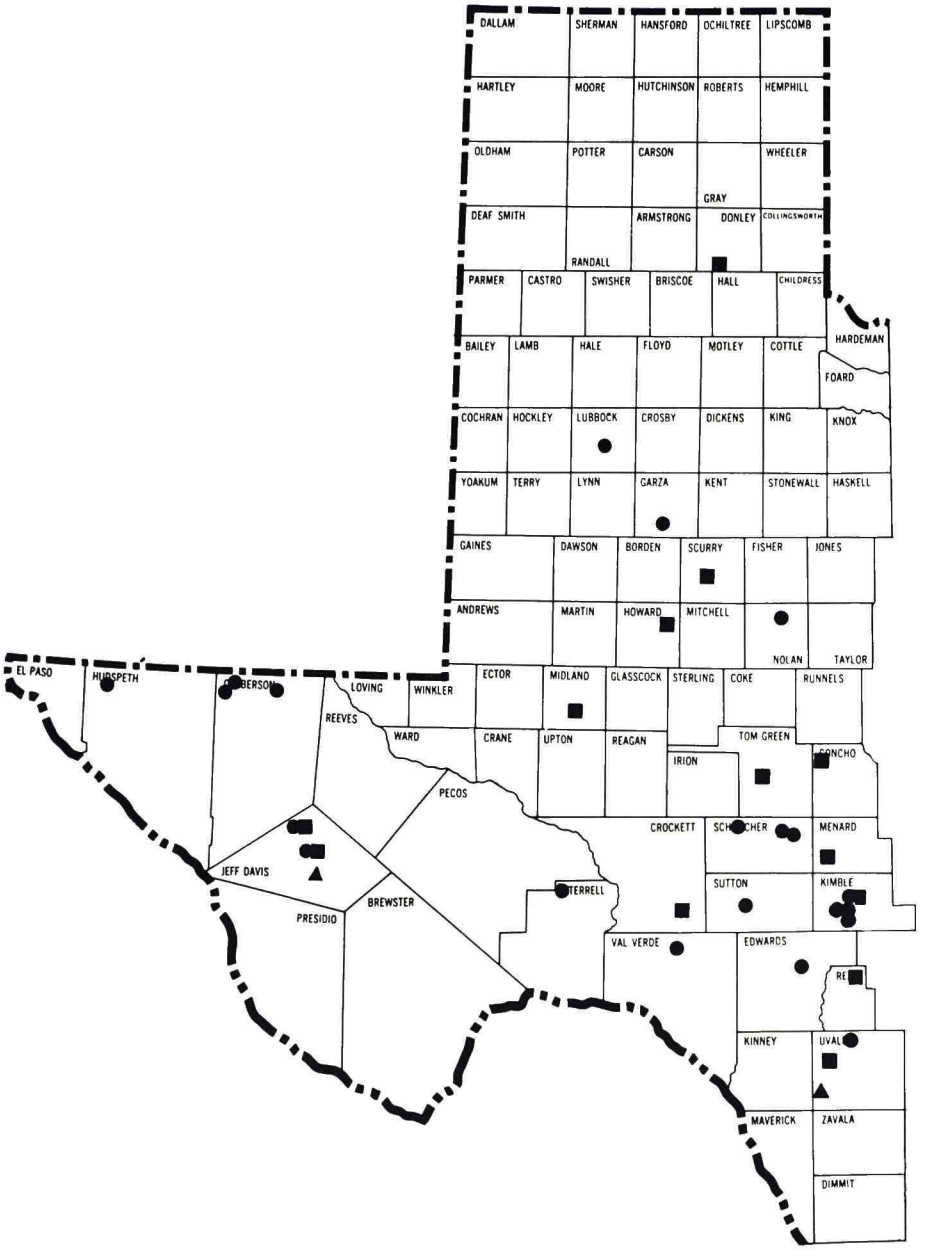

FIG. 16.—The distribution in western Texas of *Camponotus sansabeanus* (Buckley) (circle); *C. semitestaceus* Emery (triangle); and *C. decipiens* Emery (square).

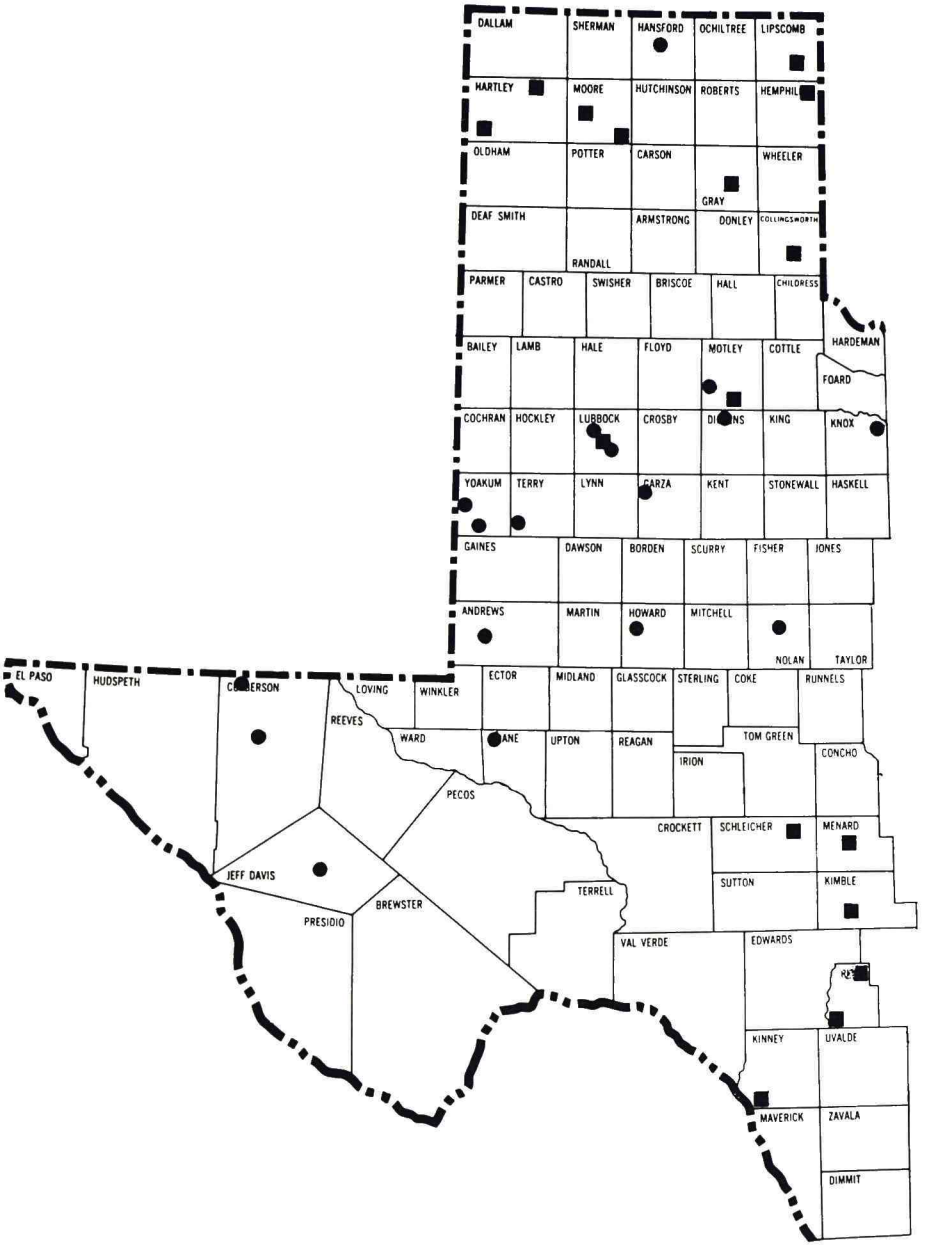

FIG. 17.—The distribution of *Camponotus vicinus* Mayr (circle) and *C. discolor* (Buckley) (square) in western Texas.

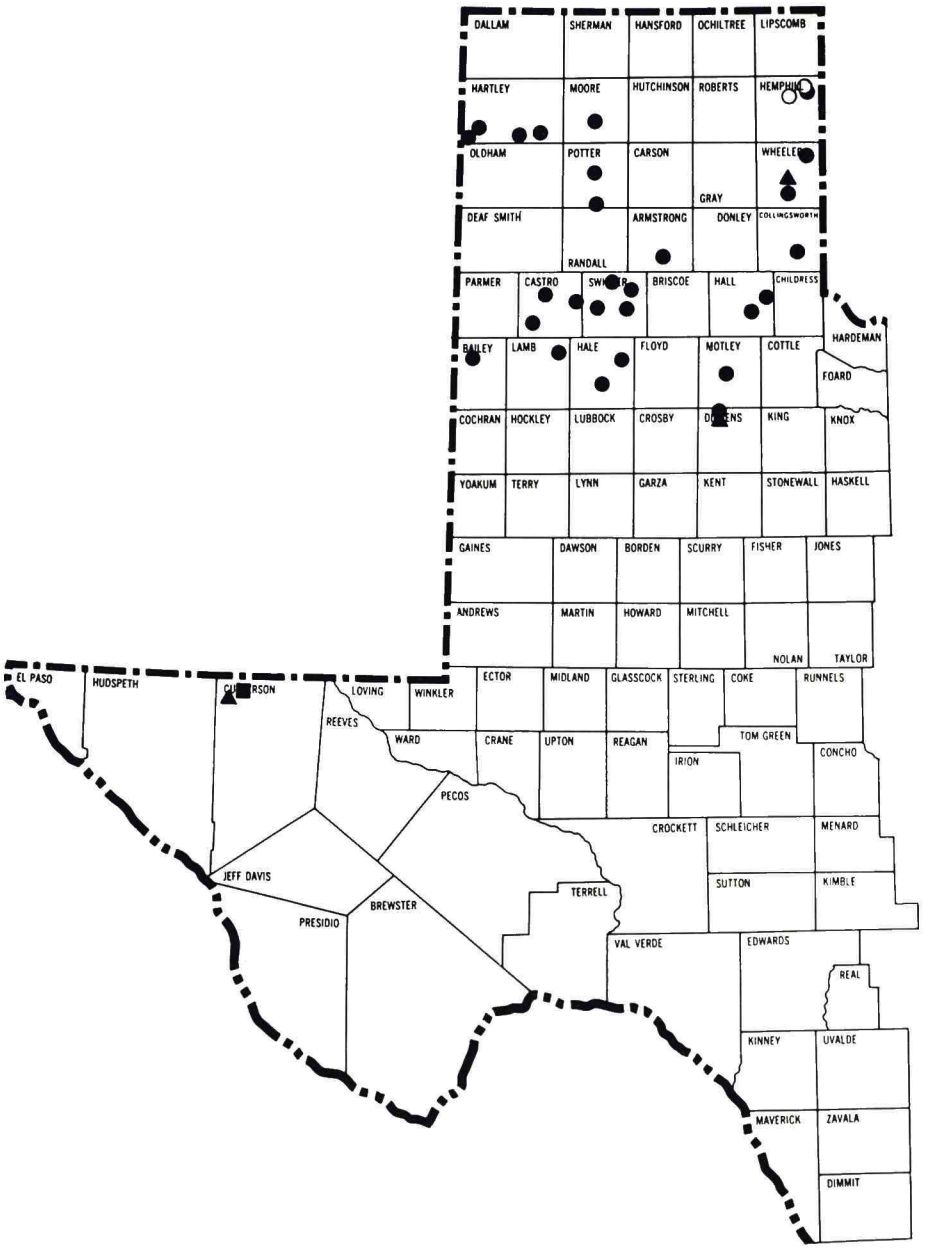

FIG. 18.—The distribution in western Texas of *Lasius neoniger* Emery (solid circle); *Acanthomyops arizonicus* (Wheeler) (square); *A. interjectus* Mayr (open circle); and *A. latipes* (Walsh) (triangle).

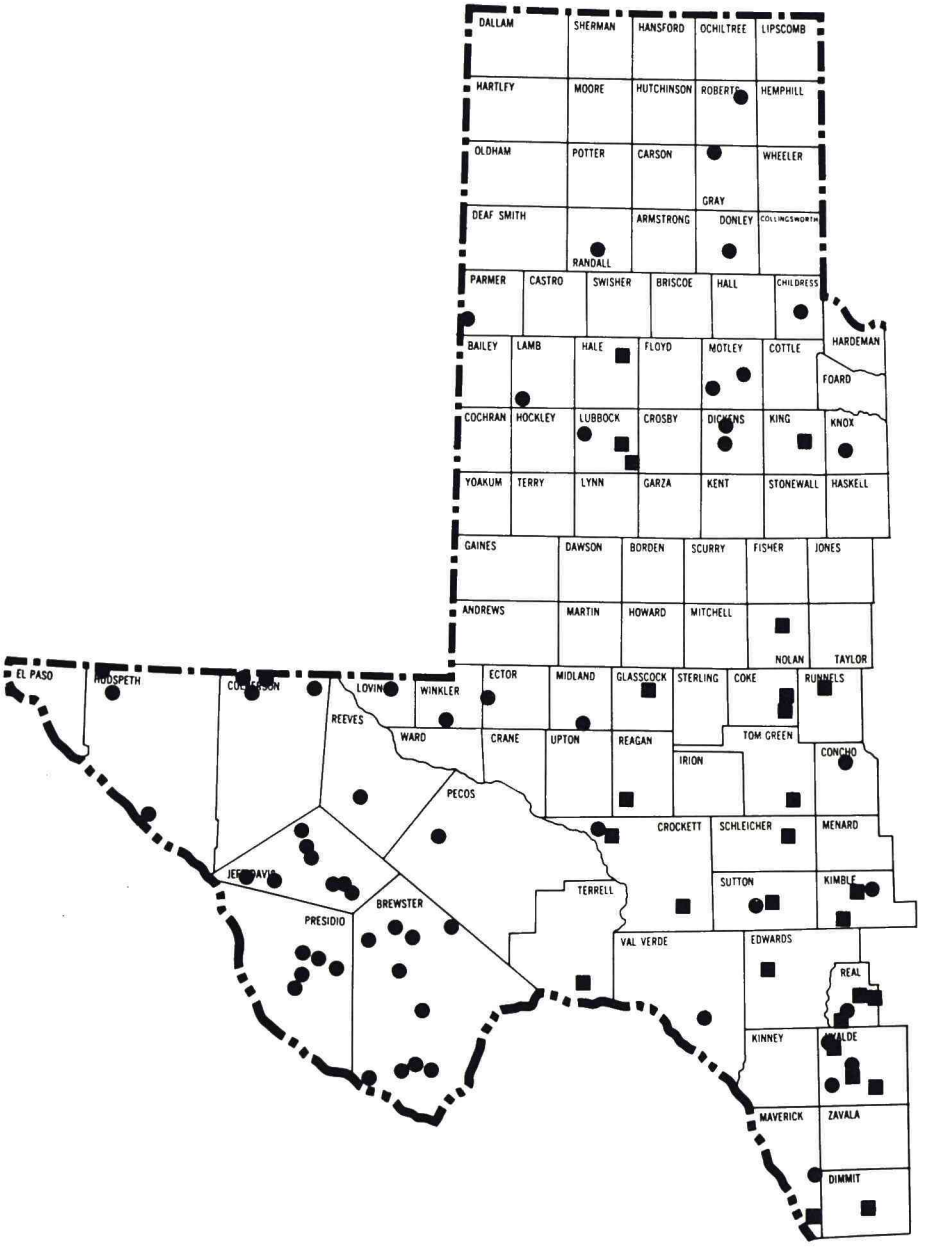

FIG. 19.—The distribution of *Paratrechina terricola* (Buckley) (square) and *P. vividula* (Nylander) (circle) in western Texas.

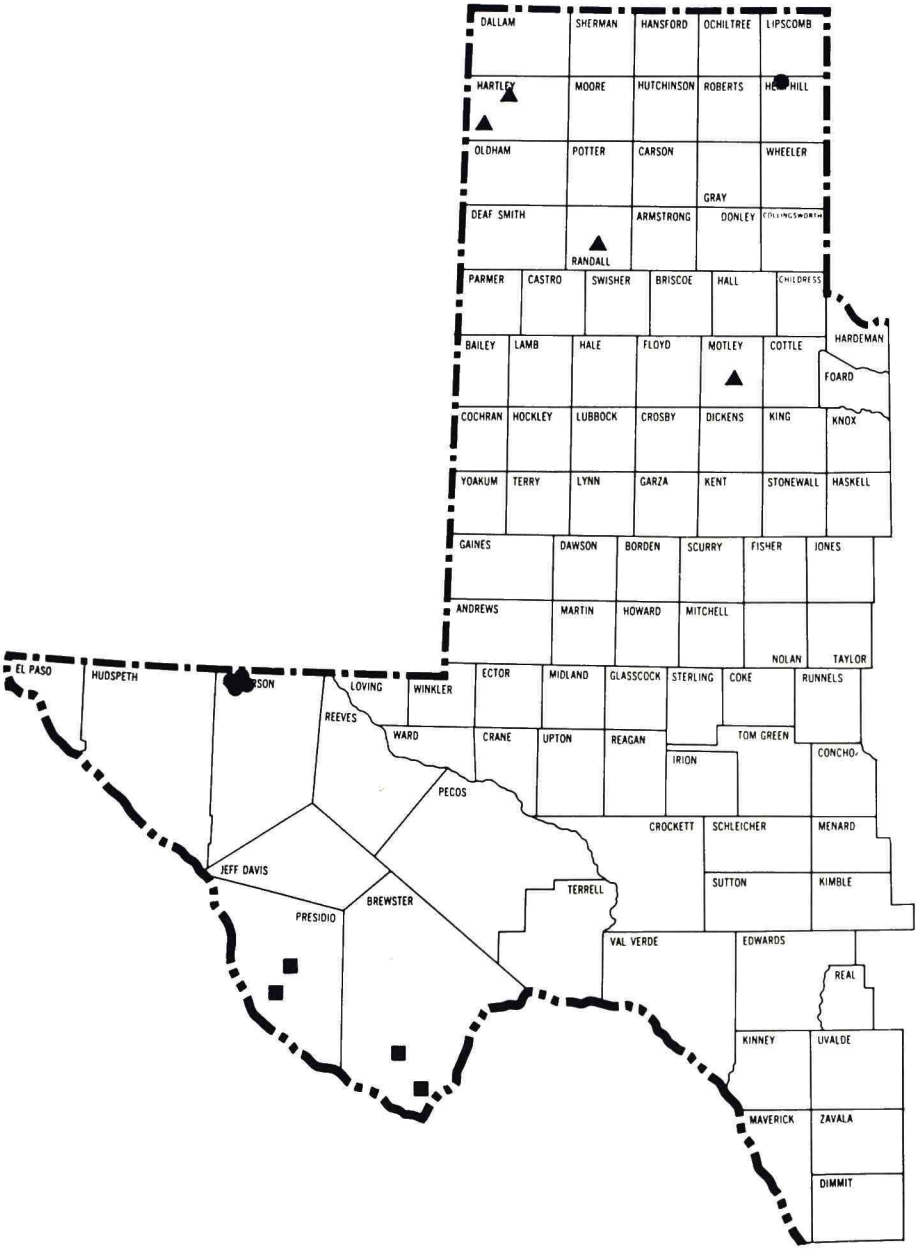

FIG. 20.—The distribution in western Texas of *Paratrechina arenivaga* (Wheeler) (triangle); *Paratrechina bruesii* (Wheeler) (square); and *Prenolepis imparis* (Say) (circle).

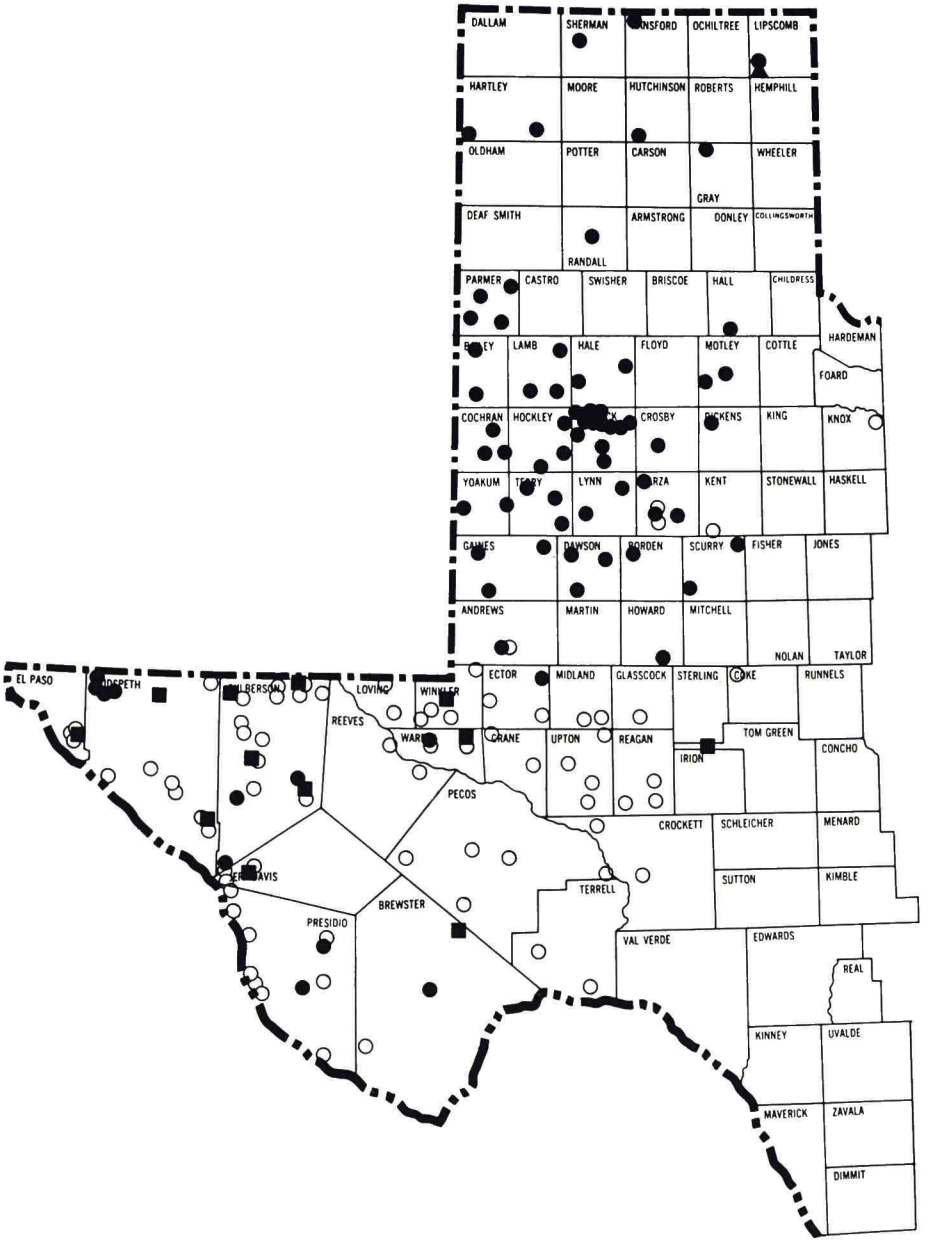

FIG. 21.—The distribution in western Texas of *Myrmecocystus mexicanus* Wesmael (square); M. navajo Wheeler (triangle); *M. depilis* Forel (open circle); and *M. mimicus* Wheeler (solid circle).

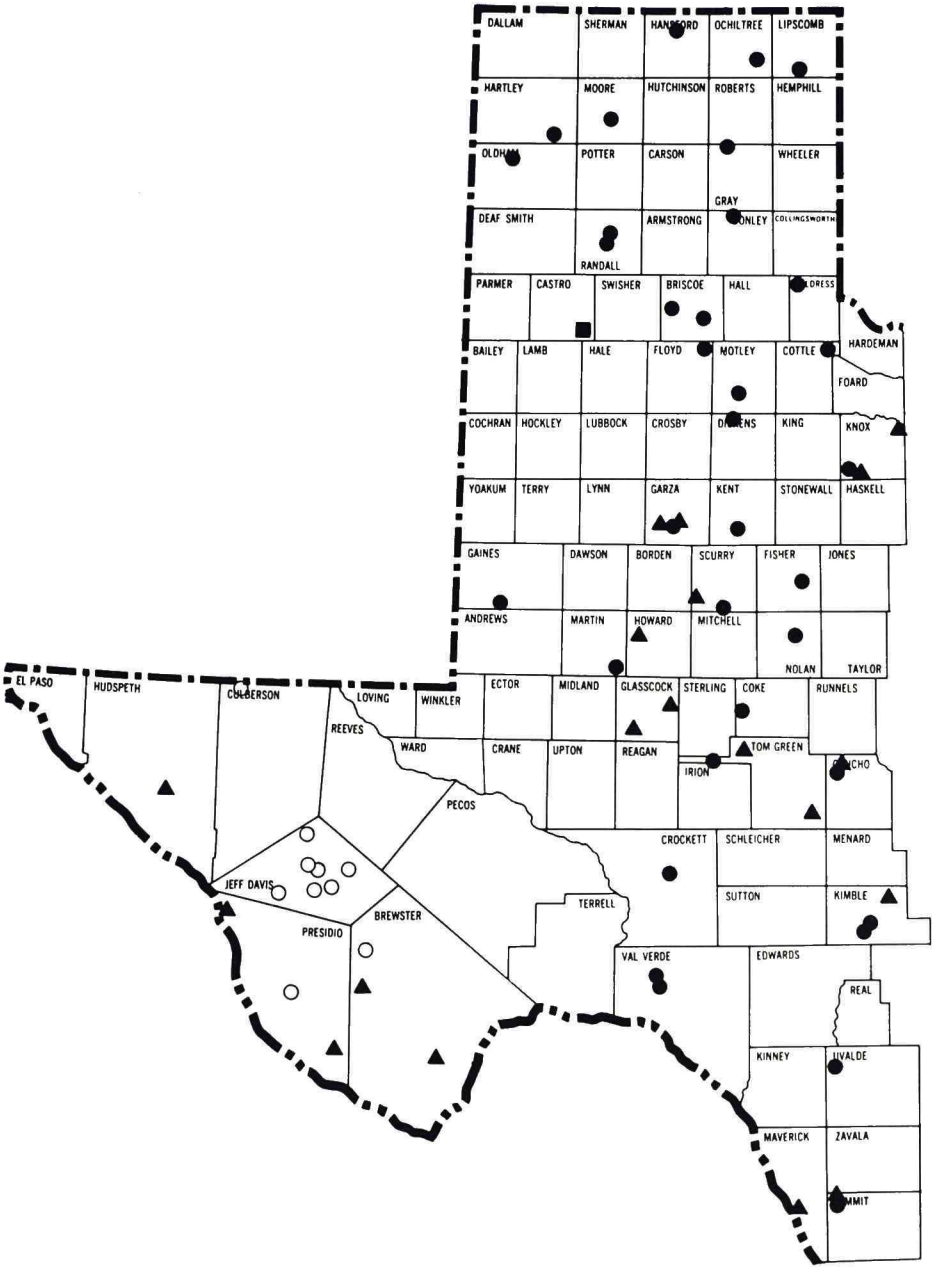

FIG. 22.—The distribution in western Texas of *Myrmecocystus melliger* Forel (open circle); *M. mendax* Wheeler (solid circle); *M. placodops* Forel (triangle); and *M. romainei* Cole (square).

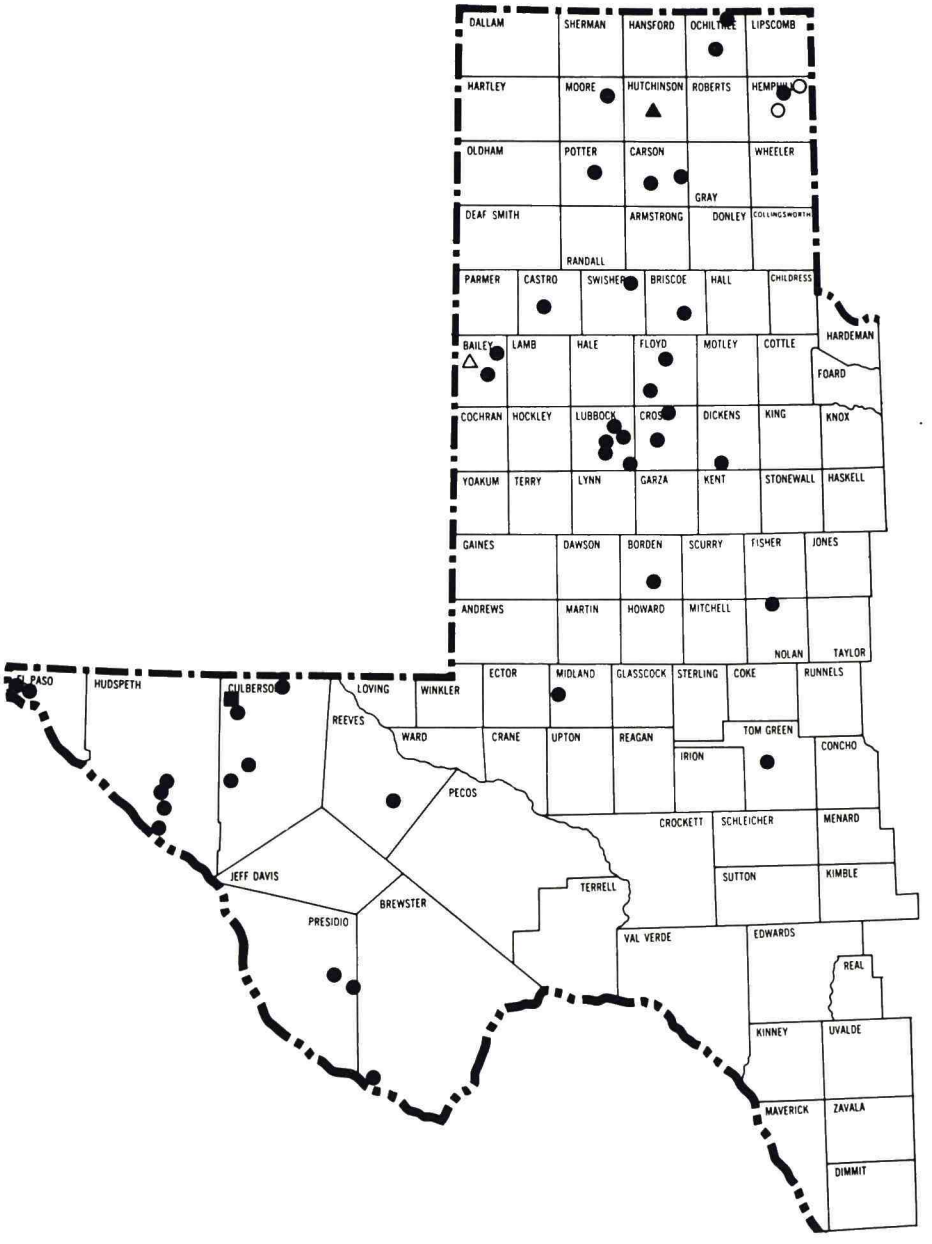

FIG. 23.—The distribution in western Texas of *Formica bradleyi* Wheeler (open triangle); *F. perpilosa* Wheeler (solid circle); *F. nitidiventris* Emery (square); *F. montana* Emery (solid triangle); and *F. subsericea* Say (open circle).

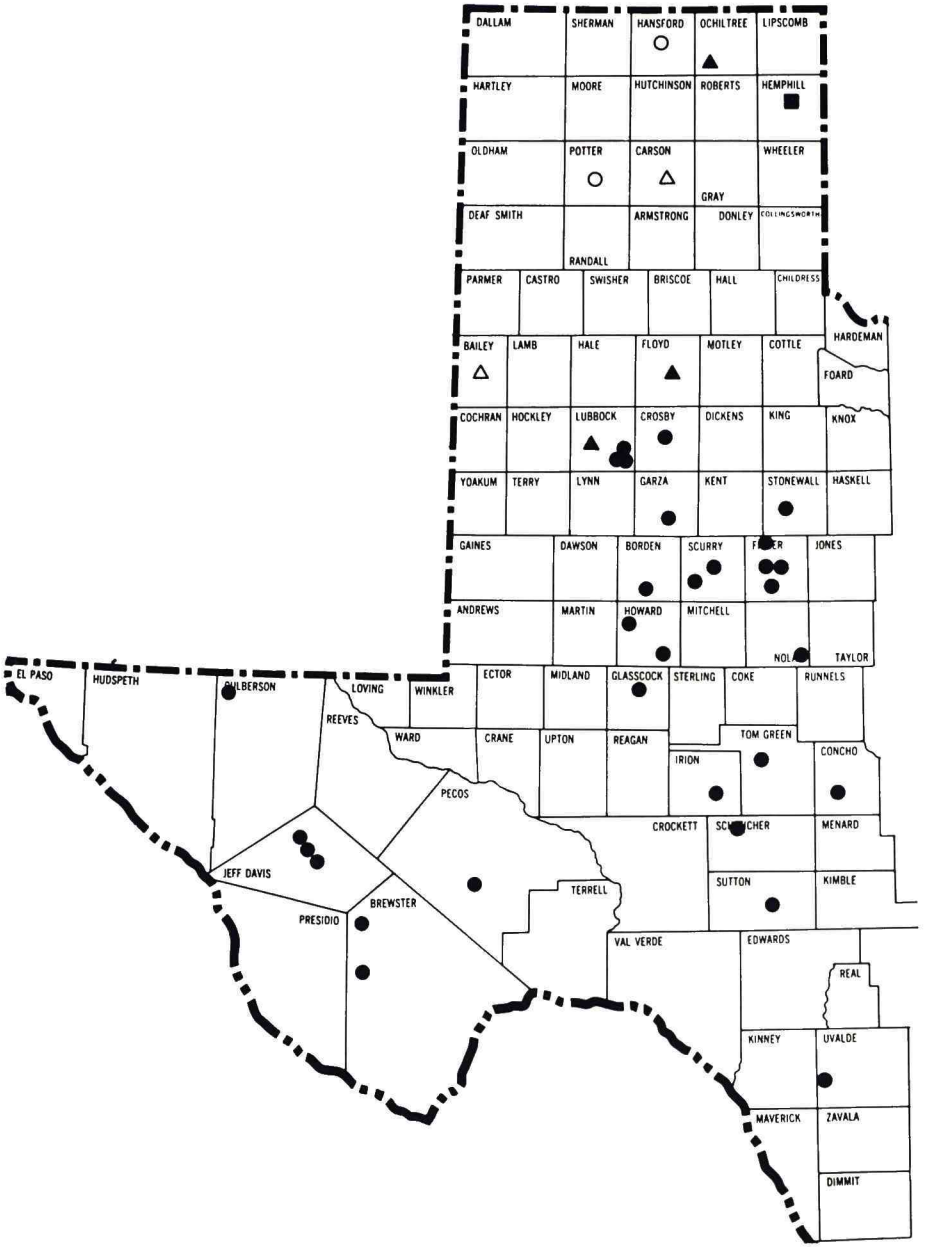

FIG. 24.—The distribution in western Texas of *Formica gnava* Buckley (solid circle); *F. pallidefulva* Latreille (square), *F. schaufussi* Mayr (open circle); *F. gynocrates* Snelling and Buren (open triangle); and *Formica* sp. (solid triangle).

APPENDIX 1.—*Ants of western Texas: number of series collected and number of localities and counties in which each species was found during this study. Ants recorded in other studies but not recollected during this study are* listed, *followed by dashes.*

Taxa	Series	Localities	Counties
ECITONINAE			
Labidus coecus	18	16	14
Neivamyrmex fallax	-	-	-
Neivamyrmex fuscipennis	1	1	1
Neivamyrmex harrisii	6	6	6
Neivamyrmex leonardi	1	1	1
Neivamyrmex macropterus	1	1	1
Neivamyrmex melsheimeri	-	-	-
Neivamyrmex minor	5	5	3
Neivamyrmex nigrescens	14	13	11
Neivamyrmex opacithorax	3	3	3
Neivamyrmex pauxillus	-	-	-
Neivamyrmex pilosus mexicanus	2	2	2
Neivamyrmex swainsonii	5	5	4
Neivamyrmex texanus	3	3	2
PONERINAE			
Amblyopone pallipes	1	1	1
Cerapachys augustae	2	2	2
Cerapachys davisi	-	-	-
Hypoponera inexorata	7	5	4
Hypoponera opaciceps	-	-	-
Hypoponera opacior	26	21	12
Hypoponera punctatissima	-	-	-
Leptogenys elongata	37	22	11
Odontomachus clarus	110	70	31
Pachycondyla harpax	18	10	5
Pachycondyla villosa	1	1	1
Ponera pennsylvanica	1	1	1
Proceratium compitale	-	-	-
PSEUDOMYRMECINAE			
Pseudomyrmex apache	2	2	2
Pseudomyrmex pallidus	-	-	-

APPENDIX 1.—*Continued.*

Taxa	Series	Localities	Counties
DOLOCHODERINAE			
Liometopum apiculatum	52	25	9
Liometopum luctuosum	-	-	-
Forelius foetidus	321	210	81
Forelius pruinosus	380	230	76
Conomyrma bicolor	156	116	49
Conomyrma flava	549	297	79
Conomyrma insana	210	151	60
Tapinoma sessile	5	3	3
FORMICINAE			
Brachymyrmex depilis	28	25	21
Paratrechina arenivaga	5	4	3
Paratrechina austroccidua	-	-	-
Paratrechina bruesii	6	4	2
Paratrechina terricola	43	27	19
Paratrechina vividula	86	59	30
Prenolepis imparis	10	5	2
Camponotus abdominalis transvectus	-	-	-
Camponotus acutirostris	3	3	3
Camponotus americanus	11	8	5
Camponotus cuauhtemoc	-	-	-
Camponotus decipiens	15	13	12
Camponotus discolor	22	16	13
Camponotus festinatus	104	74	33
Camponotus ocreatus	-	-	-
Camponotus pennsylvanicus	4	4	3
Camponotus sansabeanus	38	21	13
Camponotus semitestaceus	2	2	2
Camponotus texanus	4	4	3
Camponotus ulcerosus	-	-	-
Camponotus vicinus	25	17	14
Colobopsis impressa	14	8	6
Colobopsis pylartes	-	-	-
Lasius neoniger	54	27	15
Lasius sitiens	-	-	-
Acanthomyops arizonicus	1	1	1
Acanthomyops interjectus	2	2	1
Acanthomyops latipes	4	3	3
Myrmecocystus depilis	112	74	24

APPENDIX 1.—*Continued.*

Taxa	Series	Localities	Counties
Myrmecocystus melliger	11	10	4
Myrmecocystus mendax	39	35	31
Myrmecocystus mexicanus	13	12	8
Myrmecocystus mimicus	117	76	36
Myrmecocystus navajo	1	1	1
Myrmecocystus placodops	22	19	13
Myrmecocystus romainei	7	4	2
Formica bradleyi	2	1	1
Formica gnava	45	30	20
Formica gynocrates	2	2	2
Formica montana	1	1	1
Formica nitidiventris	2	1	1
Formica pallidefulva	1	1	1
Formica perpilosa	69	39	23
Formica puberula	-	-	-
Formica schaufussi	2	2	1
Formica subsericea	2	2	1
Formica sp.	5	3	3

APPENDIX 2.—*Elevational distribution (in meters) of ants (excluding Myrmicinae) in western Texas. Only those species present at 20 or more localities are included (extreme right column). The total number of localities sampled (bottom row) was used to predict the expected numbers for Chi-Square analyses reported in the text.*

SUBFAMILY Species	100-199	200-299	300-399	400-499	500-599	600-699	700-799	800-899	900-999	1000-1099	1100-1199	1200-1299	1300-1399	1400-1499	1500-1599	1600-1699	>1700	Total
PONERINAE																		
Hypoponera opacior	0	0	0	1	1	0	0	2	0	4	1	0	1	1	1	2	7	21
Leptogenys elongata	0	0	2	1	7	5	7	0	0	0	0	0	0	0	0	0	0	22
Odontomachus clarus	2	5	3	1	6	10	17	4	3	6	0	1	1	1	2	4	4	70
DOLICHODERINAE																		
Liometopum apiculatum	0	0	0	0	0	0	0	4	0	0	0	2	0	1	0	4	14	25
Forelius foetidus	2	4	5	7	17	23	27	19	19	34	15	15	8	5	2	5	3	210
Forelius pruinosus	0	2	1	7	15	12	28	18	37	25	20	23	18	9	3	4	8	230
Conomyrma bicolor	0	2	1	1	10	4	6	7	11	26	13	15	10	5	2	1	2	116
Conomyrma flava	2	2	2	8	21	24	41	34	26	83	21	16	4	8	1	2	2	297
Conomyrma insana	1	3	3	2	5	7	6	15	17	27	14	10	13	8	5	7	8	151
FORMICINAE																		
Brachymyrmex depilis	0	1	0	0	1	0	5	5	7	3	0	0	0	0	0	1	2	25
Paratrechina terricola	2	0	2	1	4	5	6	2	1	3	1	0	0	0	0	0	0	27
Paratrechina vividula	0	2	2	1	4	2	4	4	4	7	3	0	5	2	2	7	10	59
Camponotus festinatus	2	3	4	5	7	12	11	11	3	3	0	1	2	0	0	7	3	74
Camponotus sansabeanus	0	0	0	1	3	1	7	1	1	1	0	0	0	0	0	2	4	21
Lasius neoniger	0	0	0	0	1	1	4	2	1	3	9	4	2	0	0	0	0	27
Myrmecocystus depilis	0	0	0	1	0	2	3	16	16	6	7	6	8	5	2	1	1	74
Myrmecocystus mendax	0	1	0	2	6	2	7	4	6	2	3	1	1	0	0	0	0	35
Myrmecocystus mimicus	0	0	0	0	0	1	5	3	7	25	17	8	5	2	0	1	2	76
Formica gnava	0	0	1	0	2	5	9	3	1	2	0	1	1	0	0	4	1	30
Formica perpilosa	0	0	0	0	0	2	5	0	6	10	2	7	4	2	1	0	0	39
Total number of localities	4	9	10	16	53	51	70	61	72	153	55	49	34	16	5	11	22	691

APPENDIX 3.—*Soil textural distribution of ants (excluding Myremicinae) in western Texas. Only those species present in 20 or more localities are included (extreme right column). The total number of localities (bottom row) was used to predict the expected number for Chi-Square analyses reported in the text.*

SUBFAMILY Species	Sandy	Loamy fine sand	Sandy loam	Fine sandy loam	Loam	Silt loam	Sandy clay loam	Clay loam	Silty clay loam	Silty clay	Clay	No data	Total
PONERINAE													
Hypoponera opacior	2	0	2	0	5	2	0	5	1	0	2	2	21
Leptogenys elongata	0	0	0	1	3	0	0	5	0	1	6	6	22
Odontomachus clarus	2	0	0	5	9	1	3	17	4	2	20	7	70
DOLICHODERINAE													
Liometopum apiculatum	2	0	0	0	6	2	0	5	0	0	2	8	25
Forelius foetidus	16	1	28	13	35	2	5	63	7	2	25	13	210
Forelius pruinosus	42	10	31	22	37	8	10	40	9	0	15	6	230
Conomyrma bicolor	19	9	16	16	8	2	5	25	3	1	6	6	116
Conomyrma flava	43	22	54	19	29	2	11	71	20	3	21	2	297
Conomyrma insana	20	4	11	16	29	3	11	34	4	2	17	0	151
FORMICINAE													
Brachymyrmex depilis	4	1	0	2	6	0	0	6	1	0	3	2	25
Paratrechina terricola	1	0	0	1	2	0	1	5	1	3	7	6	27
Paratrechina vividula	7	0	3	7	9	2	3	14	1	0	8	5	59
Camponotus festinatus	7	0	5	3	11	2	4	15	5	3	14	5	74
Camponotus sansabeanus	1	0	2	3	3	1	0	3	0	0	3	5	21
Lasius neoniger	6	4	3	1	4	0	0	7	2	0	0	0	27
Myrmecocystus depilis	15	2	5	13	12	2	2	13	1	1	6	2	74
Myrmecocystus mendax	6	1	5	2	4	1	1	6	3	0	2	4	35
Myrmecocystus mimicus	11	5	25	3	9	0	0	16	2	1	2	2	76
Formica gnava	4	1	0	2	1	0	8	8	0	0	4	2	30
Formica perpilosa	10	1	1	5	2	1	5	5	3	0	1	5	39
Total number of localities	92	27	91	49	104	12	27	160	45	5	38	41	691

APPENDIX 4.—*Slope distribution of ants (excluding Myrmicinae) in western Texas. Only those species represented by 20 or more nest series are included.*

SUBFAMILY Species	0-5° No. Nests	6-15° No. Nests	16-25° No. Nests	26-35° No. Nests	36-45° No. Nests	46° + No. Nests	No Data	Total
PONERINAE								
Hypoponera opacior	15	3	0	2	0	0	6	26
Leptogenys elongata	17	5	0	3	1	0	11	37
Odontomachus clarus	71	12	10	4	2	0	11	110
DOLICHODERINAE								
Liometopum apiculatum	23	8	2	6	2	1	10	52
Forelius foetidus	214	25	17	4	3	1	57	321
Forelius pruinosus	265	36	22	9	3	3	42	380
Conomyrma bicolor	109	12	4	0	2	1	29	157
Conomyrma flava	302	51	28	6	6	2	154	549
Conomyrma insana	145	12	8	2	2	0	41	210
FORMICINAE								
Brachymyrmex depilis	17	2	0	2	1	0	6	28
Camponotus discolor	1	0	0	0	0	0	21	22
Camponotus festinatus	67	7	3	7	1	0	19	104
Camponotus sansabeanus	21	6	1	6	0	0	4	38
Camponotus vicinus	14	2	2	2	0	0	5	25
Lasius neoniger	38	9	3	1	0	0	3	54
Paratrechina terricola	29	4	0	2	0	0	8	43
Paratrechina vividula	43	14	13	8	2	0	6	86
Myrmecocystus depilis	100	3	2	1	0	1	5	112
Myrmecocystus mendax	21	4	2	3	3	0	5	38
Myrmecocystus mimicus	69	23	5	2	1	0	17	117
Myrmecocystus placocops	17	2	0	1	0	0	2	22
Formica gnava	22	6	1	2	0	1	13	45
Formica perpilosa	30	5	4	0	0	0	29	68

THE ANTS (HYMENOPTERA, FORMICIDAE) OF WESTERN TEXAS. PART III. ADDITIONS AND CORRECTIONS

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CONTENTS

Introduction

This contribution is the third and last part to a study on the ants of western Texas. The first part (Moody and Francke, 1982) dealt with ants of the subfamily Myrmicinae, the second part (Cokendolpher and Francke, 1989) dealt with the remaining five subfamilies, and this contribution corrects earlier errors and provides new records.

The objectives of this study are the same as those stated in Part I: to determine which ant species inhabit western Texas, to define geographic regions in which they occur, and to explore some of the abiotic factors correlated with their distributions.

Results and Discussion

Additions and Corrections to Myrmicinae

Since the publication of the first part in this series, many papers have appeared that deal with species of Myrmicinae in western Texas. A revised listing of species of Myrmicinae from western Texas can be found in Appendix 1. Neece and Bartell (1982) reported on the insects and mites associated with ants in western Texas. Their study was extensive and many new records of myrmecophiles were recorded. Twenty-nine species of Myrmicinae in nine genera were listed. Their collections were from 577 localities in 98 western Texas counties.

Van Pelt (1983) published a paper dealing with extensive collections of ants from the Chisos Mountains, Brewster County. In addition to providing new habitat and biological information, he reported several myrmicines for the first time for western Texas (listed below under the appropriate generic headings).

Wheeler and Wheeler (1985) published a checklist of the ants of Texas. They added several new records for Myrmicinae from that state which are discussed below under the appropriate generic headings. They also provided a synopsis of the various vegetational areas in Texas.

Genus ***Myrmica*** Latreille

André Francoeur recently has studied many of the specimens of*Myrmica* collected in western Texas. The two samples reported by Moody and Francke (1982:fig. 2) and Wheeler and Wheeler (1985) as *Myrmica emeryana* Forel are actually representatives of an undescribed species and are to be described by Francoeur. I am not aware of a valid record of *M. emeryana* from Texas. The species listed by Moody and Francke (1982) and Wheeler and Wheeler (1985) as *Paramyrmica colax* Cole now is placed in combination with *Myrmica* (Francoeur, 1968; Bolton, 1988).

Genus ***Pogonomyrmex*** Mayr

Taber *et al.* (1987*b*) and Taber and Cokendolpher (1988) reported on scanning electron microscopic and karyotypic studies, respectively, of all the species of *Pogonomyrmex* (except *P. bigbendensis* Francke and Merikel and *P. texanus* Francke and Merikel) known from western Texas. Taber (1988) provided the description of the gyne of *P. texanus*.

Wheeler and Wheeler (1985) and some other recent authors (see Taber *et al.*, 1987*b*; Taber and Cokendolpher, 1988) have regarded *Ephebomyrmex* Wheeler as a genus separate from *Pogonomyrmex*. Only a single species, *E. imberbiculus* (Wheeler), of what they referred to *Ephebomyrmex* occurs in western Texas. *Ephebomyrmex* is not herein considered to be a valid genus.

Genus ***Aphaenogaster*** Mayr

Van Pelt (1983) reported the first *Aphaenogaster boulderensis smithi* Gregg from western Texas. His specimens were from the Chisos Mountains, Brewster County, at 1100 meters elevation in grasslands. Nests were rare and found under rocks.

Genus ***Pheidole*** Westwood

Van Pelt (1983) reported the first *Pheidole clydei* Gregg and *Pheidole vallicola* Wheeler from western Texas. His specimens were from the Chisos Mountains, Brewster County. *Pheidole clydei* nests were in soil and under rocks in grasslands and pinyon areas at 1600 to 1900 meters in elevation.

Wheeler and Wheeler (1985) added a new western Texas record (Hale County) for *Pheidole sitarches campestris* Wheeler. A gynandromorphic *Pheidole dentata* Mayr was reported from western Texas (Lubbock County) by Jones and Phillips (1985). Beckham *et al.* (1982) found microbial association with ants extremely low. They stated that an examination of 2525 nest series, from 404 sites in western Texas, revealed only one ant, *Pheidole bicarinata vinelandica* Forel, that contained resting spores of the fungus *Entomophthora* sp.

Genus ***Crematogaster*** Lund

Richerson and Jones (1982) reported on aphid tending by *Crematogaster punctulata* Emery in the Davis Mountains area. The aphids (*Aphis lugentis* Williams) were feeding on the treadleaf groundsel, *Senecio douglassii* DC. var. *longilobus* (Benth.).

Genus ***Stenamma*** Westwood

Van Pelt (1983) reported the first *Stenamma huachucanum* Smith from Texas. His material was collected at 1900 meters in elevation in the Chisos Mountains, Brewster County. Nests of this species were under rocks in high forest characterized by Douglas fir, *Pseudotsuga Menziesii* (Mirb.), Arizona cypress, *Cupressus arizonica* Geene, and ponderosa pine, *Pinus ponderosa* Laws.

Genus ***Monomorium*** Mayr

Jones *et al.* (1982) reported on alkaloids found in venom from several species of *Monomorium*. One species, *M. cyaneum* Wheeler (reported as "*M.* near *emersoni*") was from Lubbock, Lubbock County. DuBois (1986) revised the native New World *Monomorium* species. The taxonomic changes proposed in this work require a revised account of this genus in western Texas. *Monomorium minimum* (Buckley) has winged queens. The workers have a smooth mesopleuron and more than 10 erect to suberect setae on the thoracic dorsum. This is the common species of *Monomorium* in the

erect to suberect setae on the thoracic dorsum. This is the common species of *Monomorium* in the midwestern and eastern United States. *Monomorium cyaneum* queens are wingless and thus lack alar sclerites, a feature detectable even in pupae. The workers of *M. cyaneum* have a punctate mesopleuron with four to eight erect setae on the thoracic dorsum. This species is widely distributed in México and also occurs in Arizona, New Mexico, and Texas. In Texas, the distributions of *M. minimum* and *M. cyaneum* overlap (DuBois, 1986), although the two species were not distinguished in Part I. *Monomorium viride peninsulatum*, according to DuBois, is a clear synonym of *M. viride* which does not occur in Texas. The sample reported by Moody and Francke (1982) as *M. viridum* has been examined by Dr. DuBois and found to be *M. cyaneum*.

Wheeler and Wheeler (1985) recorded the first *Monomorium pharaonis* (Linné) from Taylor County. Since the publication of the first part of this series, several additional collections of this species have been made in Lubbock, Lubbock County. This ant has become a pest in several apartment buildings in Lubbock and in at least one dorm building on the Texas Tech University campus.

Genus ***Solenopsis*** Westwood

The fire ants of the genus *Solenopsis* have received considerable attention in the past several years. Francke *et al.* (1983) reported the distribution of members of the genus in Texas, included maps, and county records for the four species found in western Texas. Updated maps and new county records for the red imported fire ant, *Solenopsis invicta* Buren, were provided by Cokendolpher and Phillips (1989). Studies relating the effects of temperature and humidity on four species of *Solenopsis* in western Texas have been reported by Potts *et al.* (1984), Cokendolpher and Francke (1985), Francke *et al.* (1985, 1986), Francke and Cokendolpher (1986), Taber *et al.* (1987*a*), and Braulick *et al.* (1988). Cokendolpher and Phillips (1989) reported on the current distribution and range expansion of *S. invicta* in western Texas. A gynandromorphic *Solenopsis aurea* Wheeler from western Texas (Garza County) was reported by Cokendolpher and Francke (1983).

Genus ***Leptothorax*** Mayr

Since the publication of Part I, Dr. André Francoeur has studied many of the species of *Leptothorax* collected in western Texas. The sample reported from Jeff Davis County as *Leptothorax schaumi* Roger was misidentified. These ants are properly *Leptothorax carinatus* Cole, which is already known from Jeff Davis County. Of the five samples of *Leptothorax nitens* Emery reported (Moody and Francke, 1982:fig. 23), only one series from El Paso County was correctly identified. The remaining samples from Lubbock, Randall, and Potter counties are *Leptothorax obliquicanthus* Cole and represent the first records of this species from Texas. It was formerly known only from New Mexico and Colorado (Smith, 1979). A single founder queen of *Leptothorax hispidus* Cole not previously identified nor reported by Moody and Francke (1982) has now been identified. The queen

was collected at the type locality for the species, Limpia Canyon in the Davis Mountains.

Van Pelt (1983) reported four additional species of *Leptothorax* from western Texas. *Leptothorax pergandei pergandei* Emery, *Leptothorax rugatulus rugatulus* Emery, *Leptothorax terrigena* Wheeler, *Leptothorax tricarinatus neomexicanus* Wheeler all were collected from the Chisos Mountains, Brewster County. *Leptothorax pergandei pergandei* was collected at 1600 to 2000 meters in elevation, occasionally in grasslands, abundantly in the pinyon area, and commonly in the canyons. Nests were in open soil. *Leptothorax rugatulus rugatulus* was collected at 1600 to 2300 meters in elevation with nests being in the soil, under rocks, and in arboreal situations. This species was rare in the pinyon area and abundant in the high forest and canyons. *Leptothorax terrigena* was located in all habitats except the grasslands. Nests were in soil, under rocks, or in arboreal habitats at elevations of 1600 to 2200 meters. *Leptothorax tricarinatus neomexicanus* was rarely found in grasslands and pinyon areas with nests being in arboreal habitats at 1700 to 1900 meters in elevation.

Genus ***Tetramorium*** Mayr

In Part I of this series, *Tetramorium spinosus insons* (Wheeler) was reported from 19 counties in western Texas. A reexamination of those specimens revealed that two species are present, following Bolton's (1979) revision. The two species can be separated by the following couplet which is slightly modified from the key given by Bolton (1979):

Eyes relatively large, maximum diameter at least (usually more than) 0.26 of maximum head width; hairs on pronotal dorsum and on upper frontal carinae short and straight, usually stubblelike, shorter than the maximum diameter of the eye. . . . . *T. hispidium*

Eyes relatively small, maximum diameter at most (usually less than) 0.25 of maximum head width; hairs on pronotal dorsum and on upper frontal carinae long, fine, and often curved, many of them longer than the maximum diameter of the eye. . . . . *T. spinosum*

Tetramorium spinosum (Pergande)

Bolton (1979) reported the range of this ant as western states and Nuevo León in México, Texas, and Arizona. In western Texas, the range of *T. spinosum* overlaps that of *T. hispidum*, but the former species is less abundant in the Trans-Pecos region and *T. spinosum* is found alone in the Rio Grande Plains region. Seventeen series of this species were collected in western Texas from 11 localities in 10 counties—Brewster, Concho, Dimmit, Kimble, Maverick, Nolan, Reagan, Scurry, Val Verde, and Webb. The collection localities (number of series in parentheses) were at 160 to 244 (three), 518 to 853 (seven), and 1204 (one) meters in elevation and soils were sandy loam (two), sandy clay loam (one), clay loam (two), silty clay loam (one), and clay (five). Twelve nests were found in open, fully exposed situations. All nests were on level to slightly sloping (zero to five degrees) ground. Bolton (1979) recorded this species from two additional counties; Crockett and Kinney.

Tetramorium hispidum (Wheeler)

This ant is known only from western Texas and Arizona (Bolton, 1979). As already noted above, the range of this ant overlaps that of *T. spinosum*; however, *T. hispidum* also is found alone in the southern High Plains region. Fifteen series from 14 localities were collected in 12 counties of western Texas—Brewster, Crane, Crosby, Garza, Howard, Irion, Jeff Davis, Lubbock, Midland, Scurry, Sterling, and Terrell. The collection localities (number of series in parentheses) are at 640 to 1006 (11), 1204 (one), 1341 (one), and 1493 (one) meters in elevation. The soils at these localities are fine sandy loam (one), sandy loam (one), loam (seven), silt loam (one), clay loam (three), and clay (one). Seven nests were located on level, open ground; one nest was on open ground with a 10 degrees slope, and two nests were on level ground under rocks.

Genus ***Trichoscapa*** Emery

Members of this monotypic genus have been spread around the tropical regions of the world by commerce. Introductions to temperate zone localities also have been recorded (Smith, 1979).

Trichoscapa membranifera (Emery)

A single dealate female of this minute ant was collected in a yard in Lubbock, Lubbock County. The ant was collected in early September along with Collembola from under a wooden rail partially buried in moist, humic, garden soil. This is the first record of this genus and species in Texas. Previously, this species was recorded in the United States from California, and along the coastal states from Louisiana to Florida (Smith, 1979; Ward, 1988).

Genus ***Trachymyrmex*** Forel

Van Pelt (1983) reported the first *Trachymyrmex arizonensis* (Wheeler) from western Texas. His samples were from 1600 meters in elevation in the Chisos Mountains, Brewster County. Nests were occasionally found in pinyon areas under rocks.

Revised Key to Workers of Western Texas Myrmicinae

With the addition of two genera *(Stenamma* and *Trichoscapa*) and the deletion of one genus (*Paramyrmica*), the key to the genera in Part I of this series is obsolete. The following key incorporates these changes as well as some minor changes correcting problems in terminology.

1. Antennae with six segments 2
   Antennae with more than six segments 3
2. Mandibles short and triangular with uniformly sized denticles distally. . . . . *Trichoscapa*
   Mandibles long and slender, with distal two teeth enlarged. . . . . *Strumigenys*
3. Postpetiole attached to dorsal surface of first gastric segment; gaster flattened dorsally but much more convex ventrally, acutely pointed behind. . . . . *Crematogaster*
   Postpetiole attached to anterior end of first gastric segment; gaster about equally convex above and below, not notably pointed behind. 4
4. Antennae with 10 segments, the last two forming a distinct club . . . . . *Solenopsis*
   Antennae with more than 10 segments, the club, if present, only rarely of two segments. 5

5. Antennae with 11 segments. 6
Antennae with 12 segments. 12
6. Dorsum of the pronotum, mesonotum, and propodeum with spines, teeth, rounded bosses, or prominent ridges; antennal fossa always bounded by a delicate carina that extends diagonally inward from the insertion of the mandible past the inner border of the eye. 7
Dorsum of the pronotum and mesonotum without spines, projecting bosses, or ridges (spines and teeth, when present, confined to the propodeum); antennal fossa only rarely bordered by a diagonal carina and, if present, the size of the worker does not exceed 2 millimeters. 10
7. Frontal carinae projecting forward above clypeus, largely or entirely concealing lateral portions of clypeus when head is viewed from above; thoracic spines, when present, short and dentiform . . . . . *Cyphomyrmex*
Frontal carinae shorter, not projecting above clypeus or at most projecting above its posterior half, the full width of clypeus visible from above; thoracic spines long and prominent 8
8. Thoracic dorsum armed with three pair of spines; large, highly polymorphic species, the length of workers ranging from 2 to 12 millimeters. . . . . *Atta*
Thoracic dorsum armed with more than three pair of spines; less polymorphic or monomorphic species of smaller size, length 6 millimeters or less. 9
9. Entire ant, including antennal scapes and legs, covered with numerous small tubercles; frontal carinae extending almost to occipital corners; occipital emargination shallow. . . . . *Trachymyrmex*
Tubercles confined mostly to gaster, postpetiole, and tops of occipital lobes; frontal carinae indistinct behind and not extending to occipital corners, occiput deeply emarginate in the largest workers . . . . . *Acromyrmex*
10. Antennal club quite distinct and consisting of two segments that are notably broader and longer than the seven smaller, more proximal segments that preceed them . . . . . .Oligomyrmex
Antennal club, if present, usually indistinct, consisting of more than two segments. 11
11. Frontal carinae extending posteriorly at least two-thirds of the distance to posterolateral angels of the head, and each bordering a shallow scrobe for reception of the antennal scape, the latter often flat. . . . . *Tetramorium*
Frontal carinae short, no antennal scrobes present, antennal scape not flattened . . . . . *Leptothorax*
12. Middle and hind tibial spurs finely pectinate, teeth distinct and regular but usually too small to be detected unless a magnification of 100 X or more is used. 13
Middle and hind tibial spurs simple or absent, rarely with a few barbules but never pectinate. . .14
13. Thoracic dorsum with sutures reduced or absent; thorax not impressed between mesonotum and propodeum; psammophore usually present . . . . . *Pogonomyrmex*
At least mesopropodeal suture present and distinct on thoracic dorsum; thorax impressed at mesopropodeal suture; psammophore absent. . . . . *Myrmica*
14. Petiole subcylindrical, without a distinct node above. . . . . *Myrmecina*
Petiole with a distinct node, anterior peduncle distinct even when short. 15
15. Propodeum without spines or teeth, basal face at same level as dorsum of mesonotum. *Monomorium*
Propodeum usually with spines or teeth; but, if unarmed, basal face is distinctly below level of dorsum of mesonotum 16
16. Worker caste dimorphic (rarely polymorphic) with head of the major disproportionately large. . . . . *Pheidole*
Worker caste monomorphic, or if polymorphic, head of the major worker is not disproportionally large. 17
17. Thoracic dorsum with mesopropodeal suture absent or poorly defined. 18
Thoracic dorsum with mesopropodeal suture well marked 19
18. 10 to 12 millimeters in length; antennal scapes projecting well beyond occipital border. . . . . .Aphaenogaster
Not more than 4 millimeters in length and often less; antennal scapes usually not surpassing occipital border and never projecting much beyond it . . . . . *Leptothorax*
19. Eyes small; antennae with last four segments enlarged but not forming a club; small (2 to 25 millimeters), slender ants. . . . . *Stenamma*
Eyes larger; antennal club indistinct with three to five segments, medium-sized ants 20

20. Propodeum depressed well below level of pronotum, in profile mesonotum forming a sloping declivity between them; antennal club indistinct, of four or five segments . . . . . *Aphaenogaster*
Thorax seen in profile with propodeum as high as promesonotum, thoracic dorsum usually forming an unbroken plane, more rarely with the propodeum separated from the mesonotum by a deep impression; antennal club of three segments . . . . . *Leptothorax*

Ant Fauna

Moody and Francke (1982) reported the subfamily Myrmicinae as represented in western Texas by 17 genera and 89 species. Herein, the addition of two genera and 14 species, with the deletion of one genus and two species, results in the recognition of 18 genera and 101 species of Myrmicinae from western Texas. In Part II, 24 genera and 83 species were recorded from western Texas in the subfamilies Ecitoninae, Ponerinae, Pseudomyrmecinae, Dolichoderinae, and Formicinae. Thus, the known formicid fauna of western Texas currently consists of six subfamilies, 42 genera, and 184 species. A revised listing of all ant taxa from this region are listed in Appendix I. Two additional species (*Formica neoclara* and *Hypoponera punctatissima*) probably also are present, based on their known distributions elsewhere in Texas and surrounding states.

Although several species are wide ranging, most are restricted to one or two vegetative regions. Twenty-four wide ranging species are present in all of the western Texas vegetative regions: *Brachymyrmex depilis, Camponotus discolor, C. festinatus, Conomyrma bicolor, C. flava, C. insana, Crematogaster laeviuscula, Forelius foetidus, F. pruinosus, Formica gnava, Labidus coecus, Monomorium minimum, Myrmecocystus placodops, Odontomachus clarus, Paratrechina vividula, Pheidole bicarinata longula, P. dentata, P. sitarches soritis, Pogonomyrmex apache, P. barbatus, P. imberbiculus, Solenopsis aurea, S. xyloni,* and *Trachymyrmex turrifex turrifex.*

Twenty-three other species are relatively common and were found in four of the five regions sampled: *Aphaenogaster cockerelli, Camponotus sansabeanus, C. vicinus, Crematogaster minutissima missouriensis, C. punctulata, Hypoponera opacior, Myrmecocystus depilis, M. mendax, M. mimicus, Neivamyrmex nigrescens, Paratrechina terricola, Pheidole cockerelli, P. crassicornis tetra, P. hyatti hyatti, P. pilifera coloradensis, P. porcula, Pogonomyrmex desertorum, P. rugosus, P. texanus, Solenopsis molesta, S. salina, Tetramorium hispidum,* and *T. spinosum.*

Many more species were encountered in the Trans-Pecos region than in any other "region" in western Texas. As noted by Wheeler and Wheeler (1985), this region is not truly a single vegetational area. It is a group of areas that ecologists have not clearly defined. Of the 132 species recorded from this region, 59 are restricted to the Trans-Pecos region in Texas: *Acanthomyops arizonicus, Acromyrmex versicolor chisosensis, Amblyopone pallipes, Aphaenogaster albisetosa, A. boulderensis smithi, Camponatus abdominalis transvectus, C. cuauhtemoc, C. ocreatus, C. ulcerosus, Cerapachys davisi, Colobopsis pylartes, Crematogaster browni, C. colei, C. depilis, C. emeryana, C. hespera, C. isolata, C. larreae, Formica nitidiventris, F. puberula, Hypoponera opaciceps, Lasius sitiens, Leptothorax carinatus, L. hispidus, L. nitens, L. pergandei pergandei, L. rugatulus brunnescens, L. rugatulus rugatulus, L. terrigena, L. tricarinatus neomexicanus, Liometopum luctuosum, Myrmecocystus melliger, Myrmica* sp., *M. colax, M. striolagaster, Neivamyrmex fallax, N. macropterus, N. minor, N. pauxillus, Paratrechina austroccidua, P. bruesii, Pheidole ceres, P.*

clydei, P. marcidula, P. micula, P. militicida, P. pilifera artemisia, P. pinealis, P. sciophila, P. titanis, P. vallicola, P. xerophila tucsonica, Pogonomyrmex bigbendensis, P. californicus, Pseudomyrmex pallidus, Solenopsis sp. B., *S. tennesseensis, Stenamma huachucanum, Trachymyrmex arizonensis,* and *T. smithi smithi.* The wide variety of habitats from lowland deserts to highland coniferous forests certainly accounts for much of this diversity in ants.

Approximately the same numbers of ant species occur in the High Plains, Rolling Plains, and portion of the Edwards Plateau in western Texas; 71, 80, 86, respectively. The numbers of species restricted to these areas (nine, six, nine, respectively) is about 13 percent that of the number restricted to the Trans-Pecos region. Those species restricted to the High Plains of western Texas include *Formica bradleyi, F. gynocrates, F. montana, Formica* sp. (near *integroides*), *Myrmecocystus romainei, Neivamyrmex leonardi, Pheidole senex, P. tysoni,* and *Trichoscapa menbranifera.* Species recorded only from the Rolling Plains are *Acanthomyops interjectus, Aphaenogaster tennesseensis, Crematogaster lineolata, Formica pallidefulva, F. subsericea,* and *Myrmecocystus navajo.* Species recorded from the portion of the Edwards Plateau that is included in western Texas are *Myrmecina americana, Neivamyrmex melsheimeri, Oligomyrmex longii, Pheidole* sp. B, *P. casta, P. lamia, P. metallescens splendidula, Proceratium compitale,* and *Solenopsis* sp. A.

Only 48 species are recorded from that portion of the Rio Grande Plains that extends into western Texas. Of those species, only seven do not occur elsewhere in western Texas—*Cyphomyrmex rimosus, Neivamyrmex fuscipennis, N. texanus, Pachycondyla villosa, Pheidole sp. A, P. humeralis,* and *P. ridicula.*

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APPENDIX 1.—*Ants of western Texas: number of series collected and number of localities, counties, and vegetational regions (see Cokendolpher and Francke, 1989:fig. 1) in which each species was found during this study. Ants recorded in other studies but not recollected during this study are listed, followed by dashes and numbers in brackets. Ants suspected as occurring in western Texas, but not actually recorded, are listed followed by dashes and a question mark under regions.*

Taxa	Series	Localities	Counties	Regions
MYRMICINAE				
Myrmica colax	-	-	-	[4]
Myrmica striolagaster	3	2	2	4
Myrmica sp.	2	1	1	4
Pogonomyrmex apache	32	25	17	1-5
Pogonomyrmex barbatus	551	313	87	1-5
Pogonomyrmex bigbendensis	2	2	1	4
Pogonomyrmex californicus	8	7	2	4
Pogonomyrmex comanche	15	8	5	1,2
Pogonomyrmex desertorum	86	50	20	1-4
Pogonomyrmex imberbiculus	112	77	31	1-5
Pogonomyrmex maricopa	89	63	22	1,2,4
Pogonomyrmex occidentalis	26	13	8	1,2,4
Pogonomyrmex rugosus	356	217	66	1-4
Pogonomyrmex texanus	22	17	14	1-4
Stenamma huachucanum	-	-	-	[4]
Aphaenogaster albisetosa	28	21	4	4
Aphaenogaster boulderensis smithi	-	-	-	[4]
Aphaenogaster cockerelli	140	102	35	1-4
Aphaenogaster tennesseensis	3	2	1	2
Aphaenogaster texana	12	6	4	2,4
Pheidole bicarinata longula	9	8	8	1-5
Pheidole bicarinata vinelandica	72	103	49	1-3
Pheidole casta	-	-	-	[3]
Pheidole ceres	3	1	1	4
Pheidole clydei	-	-	-	[4]
Pheidole cockerelli	28	23	16	1-3,[4]
Pheidole crassicornis crassicornis	6	6	5	1,4
Pheidole crassicornis tetra	19	16	15	1-4
Pheidole dentata	136	83	43	1-5
Pheidole desertorum	20	12	7	2,4
Pheidole humeralis	4	1	1	5
Pheidole hyatti hyatti	97	70	3	1-4
Pheidole lamia	4	3	3	3
Pheidole macclendoni	3	2	2	3,5
Pheidole marcidula	1	1	1	4
Pheidole metallescens metallescens	10	8	7	2,3,5

APPENDIX 1.—*Continued.*

Taxa	Series	Localities	Counties	Regions
MYRMICINAE *(continued)*				
Pheidole metallescens splendidula	1	1	1	3
Pheidole micula	1	1	1	4
Pheidole militicida	4	1	1	4
Pheidole pilifera artemisia	2	2	2	4
Pheidole pilifera coloradensis	32	24	14	1,2,4,5
Pheidole pinealis	3	3	3	4
Pheidole porcula	68	37	23	2-5
Pheidole ridicula	2	1	1	5
Pheidole rugulosa	27	20	10	1,3,4
Pheidole sciara	12	10	9	1,3,4
Pheidole sciophila	1	1	1	4
Pheidole senex	2	2	2	1
Pheidole sitarches campestris	15	11	10	[1],2,3
Pheidole sitarches sitarches	6	6	5	1,3,5
Pheidole sitarches soritis	71	53	36	1-5
Pheidole tepicana	26	14	10	2,3,5
Pheidole texana	2	2	2	3,5
Pheidole titanis	-	-	-	[4]
Pheidole tysoni	1	1	1	1
Pheidole vallicola	-	-	-	[4]
Pheidole xerophila tucsonica	2	1	1	4
Pheidole xerophila xerophila	68	39	13	3,4
Pheidole sp. A	11	3	3	5
Pheidole sp. B	1	1	1	3
Crematogaster browni	7	5	2	4
Crematogaster colei	3	2	2	4
Crematogaster depilis	10	10	6	4
Crematogaster emeryana	17	6	3	4
Crematogaster hespera	1	1	1	4
Crematogaster isolata	5	3	2	4
Crematogaster laeviuscula	38	33	22	1-5
Crematogaster larreae	1	1	1	4
Crematogaster lineolata	1	1	1	2
Crematogaster minutissima missouriensis	14	11	10	1-4
Crematogaster punctulata	400	214	78	1-4
Monomorium cyaneum	1	1	1	[1]3
Monomorium minimum	174	119	52	1-5
Monomorium pharaonis	1	1	1	1[2,3]
Solenopsis aurea	107	73	32	1-5

APPENDIX 1.—*Continued.*

Taxa	Series	Localities	Counties	Regions
MYRMICINAE *(continued)*				
Solenopsis geminata	17	9	6	3,5
Solenopsis invicta	-	-	-	[1,2]
Solenopsis krockowi	9	8	7	1,3,4
Solenopsis molesta	23	22	12	1-4
Solenopsis salina	43	29	20	1-4
Solenopsis tennesseensis	1	1	1	4
Solenopsis xyloni	322	158	58	1-5
Solenopsis sp. A	1	1	1	3
Solenopsis sp. B	1	1	1	4
Oligomyrmex longii	1	1	1	3
Leptothorax carinatus	-	-	-	[4]
Leptothorax hispidus	1	1	1	4
Leptothorax nitens	1	1	1	4
Leptothorax obliquicanthus	5	4	4	1,2
Leptothorax obturator	2	2	2	3,5
Leptothorax pergandei pergandei	-	-	-	[4]
Leptothorax rugatulus brunnescens	3	2	1	4
Leptothorax rugatulus rugatulus	-	-	-	[4]
Leptothorax schaumi	6	4	3	2,3,[4]
Leptothorax terrigena	-	-	-	[4]
Leptothorax tricarinatus neomexicanus	-	-	-	[4]
Myrmecina americana	1	1	1	3
Tetramorium hispidum	15	14	12	1-4
Tetramorium spinosum	17	11	10	2-5
Strumigenys louisianae	3	3	3	3,4
Trichoscapa menbranifera	1	1	1	1
Cyphomyrmex rimosus	1	1	1	5
Cyphomyrmex wheeleri	11	8	7	2-4
Trachymyrmex arizonensis	-	-	-	[4]
Trachymyrmex septentrionalis	1	1	1	2,[4]
Trachymyrmex smithi smithi	12	8	4	4
Trachymyrmex turrifex turrifex	41	31	22	1-5
Acromyrmex versicolor chisosensis	-	-	-	[4]
Atta texana	11	9	4	3,5
ECITONINAE				
Labidus coecus	18	16	14	1-5
Neivamyrmex fallax	-	-	-	[4]
Neivamyrmex fuscipennis	1	1	1	5

APPENDIX 1.—*Continued.*

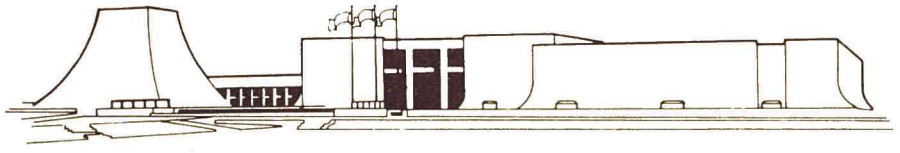
Taxa	Series	Localities	Counties	Regions
ECITONINAE *(continued)*				
Neivamyrmex harrisii	6	6	6	1,3,4
Neivamyrmex leonardi	1	1	1	1
Neivamyrmex macropterus	1	1	1	4
Neivamyrmex melsheimeri	-	-	-	[3]
Neivamyrmex minor	5	5	3	4
Neivamyrmex nigrescens	14	13	11	1-4
Neivamyrmex opacithorax	3	3	3	3,[4],5
Neivamyrmex pauxillus	-	-	-	[4]
Neivamyrmex pilosus mexicanus	2	2	2	2,4
Neivamyrmex swainsonii	5	5	4	1,4
Neivamyrmex texanus	3	3	2	5
PONERINAE				
Amblyopone pallipes	1	1	1	4
Cerapachys augustae	2	2	2	2,3,[4]
Cerapachys davisi	-	-	-	[4]
Hypoponera inexorata	7	5	4	2,[3],4
Hypoponera opaciceps	-	-	-	[4]
Hypoponera opacior	26	21	12	1-4
Hypoponera punctatissima	-	-	-	?
Leptogenys elongata	37	22	11	2,3,5
Odontomachus clarus	110	70	31	1-5
Pachycondyla harpax	18	10	5	3,5
Pachycondyla villosa	1	10	1	5
Ponera pennsylvanica	1	1	1	2,[4]
Proceratium compitale	-	-	-	[3]
PSEUDOMYRMECINAE				
Pseudomyrmex apache	2	2	2	3,4
Pseudomyrmex pallidus	-	-	-	[4]
DOLOCHODERINAE				
Liometopum apiculatum	52	25	9	3,4
Liometopum luctuosum	-	-	-	[4]
Forelius foetidus	321	210	81	1-5
Forelius pruinosus	380	230	76	1-5
Conomyrma bicolor	156	116	49	1-5
Conomyrma flava	549	297	79	1-5
Conomyrma insana	210	151	60	1-5
Tapinoma sessile	5	3	3	3,4

APPENDIX 1.—*Continued.*

Taxa	Series	Localities	Counties	Regions
FORMICINAE				
Brachymyrmex depilis	28	25	21	1-5
Paratrechina arenivaga	5	4	3	1,2
Paratrechina austroccidua	-	-		- [4]
Paratrechina bruesii	6	4	2	4
Paratrechina terricola	43	27	19	1-3,5
Paratrechina vividula	86	59		30 1-5
Prenolepis imparis	10	5	2	2-4
Camponotus abdominalis transvectus	-	-	-	[4]
Camponotus acutirostris	3	3	3	3,4
Camponotus americanus	11	8	5	3,4
Camponotus cuauhtemoc	-	-	-	[4]
Camponotus decipiens	15	13	12	2-4
Camponotus discolor	22	16	13	1-3,[4],5
Camponotus festinatus	104	74	33	1-5
Camponotus nearcticus	8	7	6	3,4
Camponotus ocreatus	-	-	-	[4]
Camponotus pennsylvanicus	4	4	3	1,2
Camponotus sansabeanus	38	21	13	1-4
Camponotus semitestaceus	2	2	2	4,5
Camponotus texanus	4	4	3	3,4
Camponotus ulcerosus	-	-	-	[4]
Camponotus vicinus	25	17	14	1-4
Colobopsis impressa	14	8	6	3,5
Colobopsis pylartes	-	-	-	[4]
Lasius neoniger	54	27	15	1,2
Lasius sitiens	-	-	-	[4]
Acanthomyops arizonicus	1	1	1	4
Acanthomyops interjectus	2	2	1	2
Acanthomyops latipes	4	3	3	2,4
Myrmecocystus depilis	112	74	24	1-4
Myrmecocystus melliger	11	10	4	4
Myrmecocystus mendax	39	35	31	1-3,5
Myrmecocystus mexicanus	13	12	8	3,4
Myrmecocystus mimicus	117	76	36	1-4
Myrmecocystus navajo	1	1	1	2
Myrmecocystus placodops	22	19	13	1-5
Myrmecocystus romainei	7	4	2	1
Formica bradleyi	2	1	1	1
Formica gnava	45	30	20	1-5
Formica gynocrates	2	2	2	1

APPENDIX 1.—*Continued.*

Taxa	Series	Localities	Counties	Regions
FORMICINAE *(continued)*				
Formica montana	1	1	1	1
Formica neoclara	-	-	-	?
Formica nitidiventris	2	1	1	4
Formica pallidefulva	1	1	1	2
Formica perpilosa	69	39	23	1,2,4
Formica puberula	-	-	-	[4]
Formica schaufussi	2	2	1	1,2
Formica subsericea	2	2	1	2
Formica sp. (near *integroides*)	5	3	3	1



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