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DISTRIBUTION OF THE ARGENTINE ANT IN THE UNITED STATES AND SUGGESTIONS FOR ITS CONTROL OR ERADICATION

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INTRODUCTION

Sometime previous to 1891 there entered the United States at New Orleans, La., a South American ant which was destined in less than 50 years to spread over not only a large part of the Southern States but a considerable area in California, as well as small areas in several other widely removed States. Within these limits the Argentine ant, *Iridomyrmex humilis* (Mayr), as it is called, has proved to be probably the most annoying of the economic ants and a pest of no little importance. Although especially obnoxious to housekeepers, hotel managers, and cafe owners, it also causes serious losses to orchardists, planters, beekeepers, and others.

According to Newell (*10*),[2] Edward Foster, of New Orleans, was the first person to observe this ant in the United States. From Foster's observations (*3*) it appears likely that the Argentine ant

[1] The work described in this circular was under the general direction of S. A. Rohwer. The scouting and the evaluation of the Mississippi method of control and eradication were under the supervision of the author. The scouting was done by T. F. McGehee, L. C. Murphree, H. T. Vanderford, and D. E. Read. The States scouted by these men were as follows: Alabama, Mississippi, Arizona, New Mexico, Illinois (Murphree); Georgia, North Carolina, Virginia, West Virginia (Vanderford); Louisiana, Oklahoma (McGehee); Florida, South Carolina, Missouri, Arkansas (Read); Texas (Murphree, Vanderford, Reed, and McGehee); Kentucky and Tennessee (Vanderford and Murphree). Information on the status of the ant in California was furnished by Harry S. Smith, and in Maryland by E. N. Cory. Officials in entomological, plant quarantine, and extension work in the various States offered many helpful suggestions and aid. The data relative to the work in Mississippi were supplied by Clay Lyle and R. P. Colmer, of the State Plant Board of Mississippi. The photographs were made by Ross E. Hutchins.

[2] Italic numbers in parentheses refer to Literature Cited, p. 38.

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was first carried to New Orleans in coffee ships from Brazil. These ants were first found in California at Ontario in 1905 by E. S. G. Titus. In 1907 they were discovered at Berkeley by J. C. Bradley, and by 1910 C. W. Woodworth, of the University of California, reported that 5,000 acres in that State were infested with this pest. In 1915 Newell and Barber (*11*) listed 16 localities in California as being infested. Since that time the ants have continued to spread rapidly over new areas in the United States.

As this insect increased in economic importance, many investigations of its biology and control were undertaken. Newell and Barber (*11*) have published a comprehensive account of the ant's life history and a description of its stages. Work by Horton (*8*, *9*) in the citrus groves of Louisiana and by Woglum and Borden (*17*) in California deals with this ant in its relation to citrus, and the means of combating it. The development of a satisfactory poison bait by Barber (*2*) was the culmination of much work along this line by Barber, R. S. Woglum, and A. D. Borden, working for the Bureau of Entomology, United States Department of Agriculture, and Nickels (*12*), of the Department of Entomology of the University of California. Not only has this bait given satisfactory results wherever it has been used in the South, but Ryan (*13*) has also indicated its successful use in citrus groves in California. Mississippi was the pioneer State in Argentine ant control and eradication work, regular control campaigns having been organized there as early as 1920.

The act making appropriations to the Bureau of Entomology for the fiscal year 1931–32 provided funds for a further study of the Argentine ant. The work outlined was divided into two parts: (1) To determine the present distribution and relative abundance of the Argentine ant in the United States, and to map the infested areas as accurately as possible within a limited time and at a reasonable expense; and (2) to study the methods used by the State of Mississippi in controlling and eradicating the Argentine ant, and appraise the effectiveness of suppression campaigns conducted by that State.

The survey to determine the distribution and abundance was begun in the fall of 1931 and completed late in the spring of 1933. During this time 4 men scouted for the ants in the principal towns and cities in 18 States. No effort was made to scout rural areas because of the great expense involved and the probability of finding only a small number of infestations. The States scouted most thoroughly were South Carolina, Florida, Georgia, Alabama, and Louisiana, one or more localities in every county being examined for ants. Scouting was also done in Oklahoma, North Carolina, Virginia, West Virginia, Kentucky, Tennessee, Mississippi, Illinois, Missouri, Arkansas, Texas, Arizona, and New Mexico. Since the status of the ant in California and Mississippi was rather well known, no work was done in California and only a few localities in Mississippi were scouted. The data collected in connection with this survey, which are summarized in this circular, are believed to be adequate for appraising the Argentine-ant situation as it existed in the United States at that time.

During the summer of 1933 the author and L. C. Murphree inspected certain areas in Mississippi believed to have been freed of

Argentine ants as a result of campaigns directed by the State Plant Board. The methods of inspection and those used in the control and eradication work are described in this circular.

HOW TO RECOGNIZE THE ARGENTINE ANT

Argentine ants are easily confused with other species, and in the course of the surveys native ants that resemble Argentine ants are occasionally encountered. The Argentine ant (fig. 1) can be distinguished from these by the following characteristics: The worker is about one-eighth inch long and of an almost uniformly brown color. It is slender in form and moves rather quickly. The worker possesses a single joint (petiole) between the thorax and the gaster. When several workers are crushed, a characteristic musty or greasy odor (*16*) is given off. Other native ants either are odorless or they have spicy or pungent odors, or a somewhat sweetish, nauseating odor similar to that given off by *Tapinoma* ants. Some of the ants most closely resembling Argentine ants have the last-named odor.

FIGURE 1.—Argentine ant worker. Greatly enlarged.

HABITS AND ECONOMIC IMPORTANCE

Although the Argentine ant affects our interests in many ways, it has made itself notorious primarily as a house-infesting insect. In the South this species invades the house almost continuously throughout the year, even in winter when temperatures are as low as 50° F. When a property is heavily infested, the ants may be found not only in pantries, dining rooms (fig. 2), and kitchens, but even in refrigerators, beds, etc. In certain sections dwellings have been vacated because of the ravages of this pest. The presence of the ants in a house cannot be taken as reflection on the neatness of the housekeeper, as many houses kept spotlessly clean are invaded. Late in the summer and especially after heavy rains, perhaps because the honeydew has been washed off the plants outside, the ants become unusually troublesome in the house.

The Argentine ant is practically omnivorous in its feeding habits. If it has any preference for foods, this would seem to be sweets. A scum of dead ants from one-eighth to one-fourth inch deep has been seen in cans containing table sirup. Sugar, jelly, pies, and candies are consumed with relish. The ant will crawl on top of a block of ice to reach meat lying there. Occasionally it feeds even on corn meal.

Outdoors the ants make themselves noticeable by their numbers as well as by the damage they do. In some sections they are so abundant as to form numerous trails up and down the trunks of trees, along streets, fences, the base of houses, and on the ground. In heavily infested areas it is not uncommon to see trails 5 or 6 inches wide on the trunks of trees. By caring for and fostering mealybugs (Woglum and Neuls (*18*)) and aphids, the Argentine ant enables these insects to become so abundant that they do serious damage to plants. Such injury is especially noticeable in sugar-cane fields and citrus groves. In his scouting T. F. McGehee noted that ladybird beetles were not abundant in localities heavily infested with the Argentine ant. Horton (*8*) also has recorded the lack of predators and parasites of honeydew-producing insects in sections infested with Argentine ants. This is no doubt due to the predaciousness of the ants as well as to the guard which they keep over the honeydew producers. The Argentine ants also affect plants

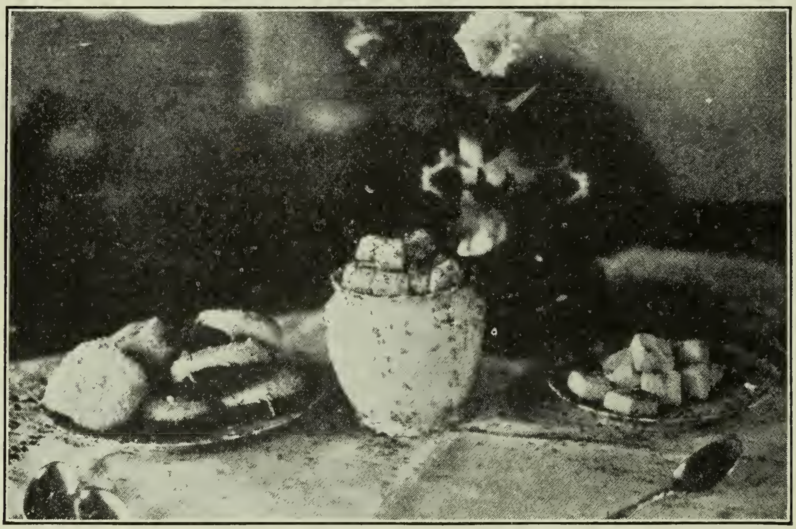

FIGURE 2.—A scene familiar to housekeepers in areas infested with the Argentine ant. (Newell and Barber.)

directly. Gardeners frequently find their lettuce and other small seeds removed from the seed beds. The ants will enter the calyx end of ripe figs and gnaw into the interior. Worker ants have also been noted to cut through the buds of carnation and orange in order to reach the nectaries, and they will feed on the sap of trees where the bark has been broken (Horton (*9*)).

Poultry raisers in localities where Argentine ants are abundant have reported that the ants drive hens from the nests by crawling over them, especially if an egg is broken in the nest or when hatching begins. The ants often kill newly hatched chicks to obtain their blood. According to Newell and Barber (*11*), many species of birds suffer similarly from the ravages of the ants.

Beekeeping is especially hazardous in areas where the Argentine ant is abundant. The ants invade the hives for honey, and, since the bees cannot combat them effectively, this may lead to the destruction of the colony. The author has seen a honeycomb in which every cell had been emptied of its honey content by Argentine ant workers.

As far as known, no one has proved that the Argentine ant transmits human diseases. The workers' habit of visiting garbage, refuse, feces, sputum—in fact, anything that might harbor disease germs—suggests that they might easily transmit such diseases as typhoid fever, diarrhea, and tuberculosis. Horton (*8*) has suggested that the workers may also transmit certain plant diseases through their habit of feeding on the sap flowing from the wounds of plants.

Argentine ants differ from native ants in that, once they have become established on a property, they will usually not tolerate other species. Therefore, instead of many different kinds of ants on a property, there is ordinarily an abundance of only one, the Argentine ant. The author has often witnessed combats in the field between native and Argentine ants. It is not unusual to see five or six Argentine ants attack a single native ant. Although some of the native ants have the advantage in size, or by the possession of a sting, they finally succumb to the attack of these South American invaders because they are outnumbered.

The fact that the Argentine ant destroys practically all the native ants as it advances makes it comparatively easy to delimit an area infested by them. One must not conclude, however, that after Argentine ants are eradicated from an area, that area will be free of native ants also. Just as soon as the Argentine ants begin to disappear, native ants invade the territory, and within a very few years are apparently as plentiful as ever. In Mississippi the fire ant *Solenopsis xyloni* McCook, an arch enemy of the Argentine ant and often mistaken for it, is usually the most abundant native species following the eradication of the Argentine ant.

DISTRIBUTION AND ABUNDANCE

MEANS OF SPREAD

The unusually rapid spread of the Argentine ant has been due to its ability to produce prodigious numbers, its habit of exterminating competitive species as it spreads, its lack of natural enemies, its omnivorous feeding habits, and especially to its ability to thrive in human habitations as well as in rural sections.

Its distribution has been accomplished by both artificial and natural means. Artificial spread has been by far the more important. Common carriers and merchandise have transported the ants great distances, thus establishing infestations in localities remote from one another. Along the important railroad lines in the Southern States, especially those in the Gulf coast section leading out of New Orleans, nearly every locality of any commercial importance is the seat of an Argentine ant infestation. Such cities as New Orleans, Birmingham, Montgomery, and Atlanta have served as focal centers for the distribution of the ants in neighboring towns and rural areas. The ants can be carried in shipments of lumber, plants, dry goods, groceries, etc. The spread by means of boats and rafts has not been so great as by railroad, because there is less water transportation, but in areas where water transportation is common, especially in southern Louisiana, it has accounted for many of the infestations.

The natural spread of the Argentine ants is comparatively slow, because dispersion is dependent upon crawling rather than flight. Only the queens and males have wings, and the nuptial flight is so infrequent as to be negligible, mating usually taking place in the nest. The author recalls only one instance in a period of 13 years' field work when the ants were actually seen in flight. The natural spread is effected for the most part in the search for food and nesting quarters, principally the former. Normally the advance is only a few hundred feet a year. They often spread in some directions much more rapidly than in others. Sometimes the ants will not cross a street on which there is heavy traffic for a number of years. To reach a source of food supply Argentine ants will cross water placed in saucers, but they will not attempt to cross the water of streams of any depth or width, especially if there is a decided current.

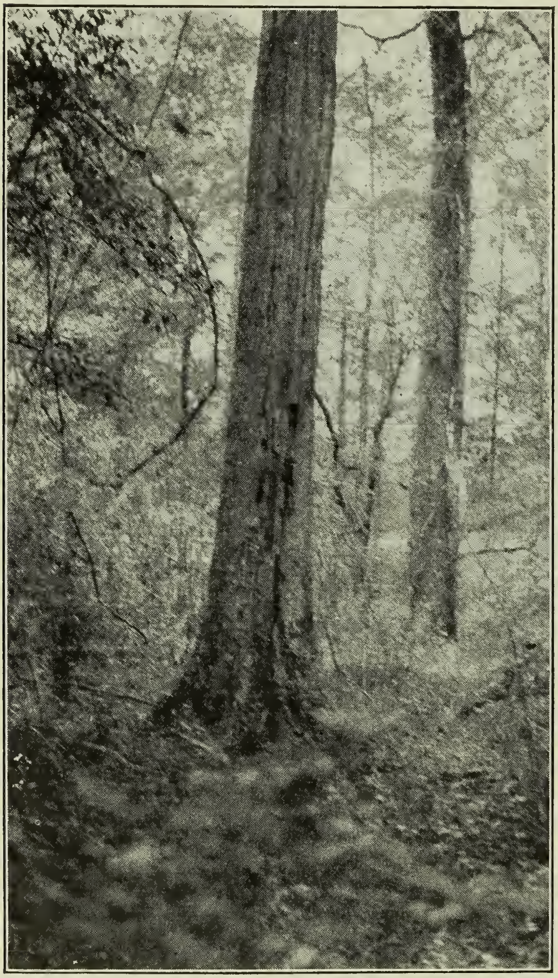

FIGURE 3.—Trees with rotten crevices, which harbor myriads of Argentine ants.

Floods occasionally carry the ants long distances. Colonies may be carried for miles on floating debris such as rotten logs. Often the ants will form a rotating ball in the water, the workers clustering on the outside of their brood in a spherical mass. When such balls of ants lodge in suitable locations, they can start new nests. A scout once observed an ant colony on a wooden post that had been under water 3 days. After the water had receded, the colony was still present and apparently unharmed. Many infestations established by overflows have been found in southern Louisiana, where the ants exist in immense numbers in areas that are subject to flooding. Nesting in crevices and rotten sections of trees (fig. 3), or else in or behind vines twining around the trunks (fig. 4), the ants can easily withstand the highest waters. Some of the territory in which they are found is either sparsely or not at all settled by humans.

RESPONSE TO ECOLOGICAL FACTORS

In the scouting work it has been noticed that Argentine ants are very susceptible to winds. When there is a strong cold wind, they attempt to protect themselves either by crawling into well-protected places or by almost completely ceasing activity. The writer has seen strong gusts of wind blow workers several inches from their trails on concrete pavement, but apparently without harm.

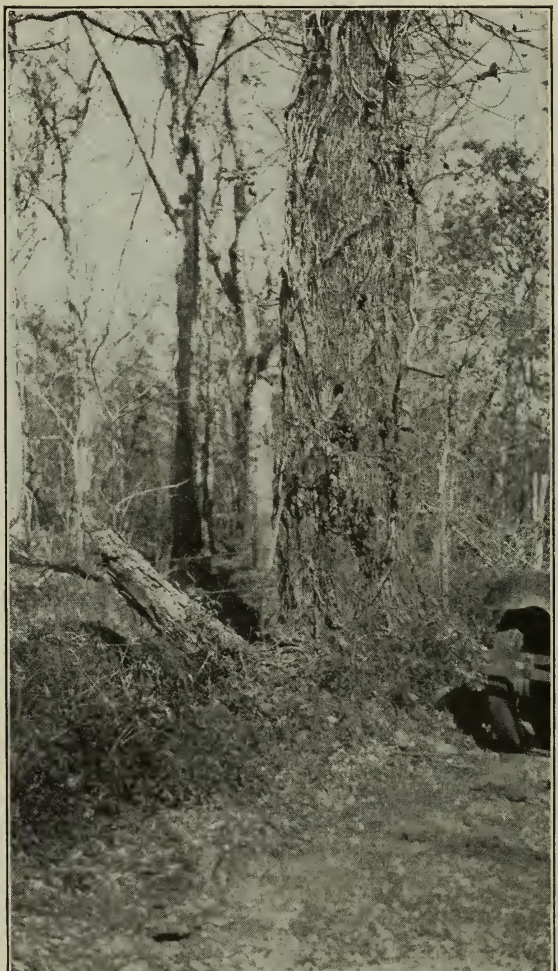

Figure 4.—Vine-covered trees in southern Louisiana, which afford excellent nesting places for Argentine ants.

The ants are dependent on moisture for the success of their colonial activites. Hertzer (7) has shown that in the laboratory the ants prefer moist locations, and she believes that moisture is especially necessary for the transformation of the egg and larval stages. Lyle [3] noted that worker ants always sought the moist spots in experimental cages, and when moisture was not available they died, apparently from no other cause than lack of it. There is, however, a limit to the quantity of moisture that they tolerate. The author has never seen them living in water-logged habitats. In swamps or low places they nest in logs or stumps above the water level (fig. 5) or seek the

[3] Lyle, C. tests of poisons for the argentine ant. 22 pp., illus. 1931. (Master's Thesis, Miss. State Col.)

higher and better drained spots. Barber (*1*) claims that excessive water in their nests, especially in the winter, will reduce their population greatly.

Although the Argentine ant is a tropical insect, and its northward spread is held in check by prolonged severe winters, the writer knows of but one other species of ant, *Prenolepis imparis* Say, in the South that is so tolerant of cold. Mention has already been made of the Argentine ant's ravages in refrigerators. At air temperatures of around 50° F., and sometimes below this, the ants, although active outdoors in places, move along their trails rather sluggishly. In protected places workers can occasionally be encountered moving at temperatures even as low as freezing, but the colder it is the less active and less in evidence are the ants. This makes scouting especially difficult in cold weather, and to be reasonably sure of an accurate survey it is best not to scout at temperatures lower than 65° to 70°. For short intervals the ants will resist temperatures much lower than this. The author once found in a rotten log, packets of workers that were thoroughly encrusted with ice and were so stiff and motionless as to give the appearance of being dead. The temperature the night before had been 13°. When a mass of the workers was taken to a laboratory, they thawed out in an hour or so, without any apparent ill effect, and became as active as ever. Herbert (*6*) states that Argentine ants can be killed under cold-storage conditions by exposure to 31° for 24 hours, but the writer's field experience causes him to question these conclusions, which were based on a limited number of experiments.

FIGURE 5.—Uprooted stump, surrounded by water below, in which Argentine ants were found nesting.

Argentine ants have been found at altitudes ranging from approximately sea level (3 feet) to as high as 3,955 feet.

So far as could be observed, the ants are capable of living under a great variety of soil conditions. They have been found in soils having textures ranging from light sandy loams to clay loams, with poor to good drainage, and with varying amounts of organic matter, including the soils of the stream bottoms, of the prairies, and of the marshes, as well as those of the uplands.

It was found that certain types of vegetation seem to attract the Argentine ant more than others. The presence of aphids, mealybugs, scale insects, and other honeydew-producing forms is undoubtedly the reason for such preference. Trees that are especially frequented include oaks (chiefly water and live oaks), willow, hackberry, pecan, sweetgum, pine, fig, maple, elm, and citrus.

GENERAL DISTRIBUTION IN THE UNITED STATES

Argentine ant infestations have been found in nearly one-third of our States (fig. 6). The total area infested is approximately 4,000 square miles. Practically all the infested areas, with the exception of those in California, are in the Southern States, chiefly in the Gulf coast section. The infestations in Arizona, Missouri, Illinois, and Maryland appear to be isolated, and of these only that in Arizona is typically an outdoor type, as in the other States the ants appear to survive the winter only in buildings, especially those that are heated. In a heavily populated urban area, where the houses are practically contiguous, particularly in northern locations, the ants might spread from house to house until they occupy all or most of the city, because of their ability to survive winter conditions in the interior of buildings.

The Argentine ant has spread more rapidly eastward from New Orleans than it has westward or northward. Except for California and a single infestation in Arizona, it is not found farther west than the eastern half of Texas. In the northern parts of Alabama and Mississippi infested areas are few and small, and in northern Louisiana there are practically none.

Raleigh, N. C., is the most northern locality in the Eastern States where the ant has been found to live outdoors and survive winter temperatures. The infestation here is at least 15 or 16 years old, having been found by the author (*14*) in September 1919, and as yet it apparently extends only about 0.15 square mile. The slow spread of the ants in Raleigh is an indication that they are very near the northern limit of distribution under outdoor conditions. An outdoor infestation at Nashville, Tenn., found by Barber was exterminated within a year, presumably by severe winter weather. Barber also found the ants at Memphis several years ago, but neither the scouts of the Bureau of Entomology nor representatives of the office of the State entomologist of Tennessee have been able to find any there in recent years.

In Mississippi, however, where there were only about a dozen known infestations in 1910 (Harned and Smith (*5*)), in 1934 there were at least 245, exclusive of the isolated areas within many of the infested towns. Inspectional work of the State Plant Board of Mississippi has retarded the spread of the ant considerably, and were it not for such service the situation would be much worse.

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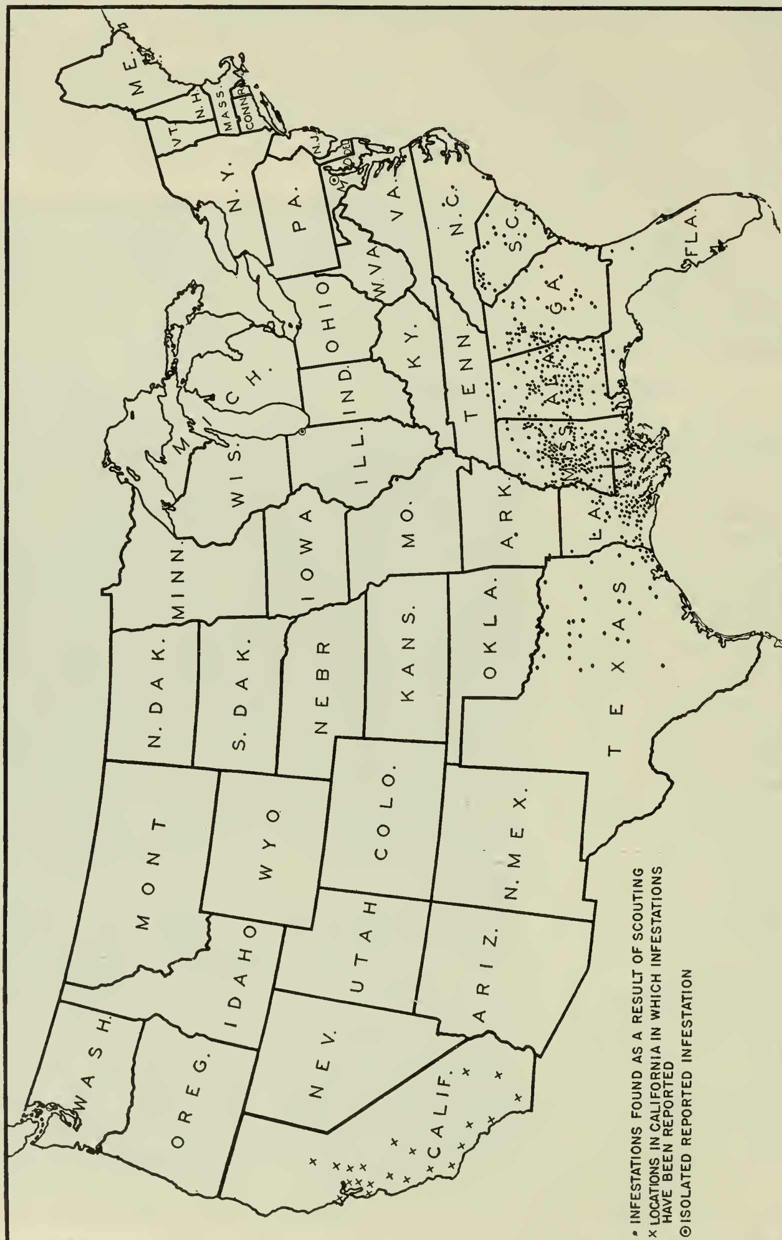

FIGURE 6.—Map of the United States showing Argentine ant infestations.

From what is known of the habits and distribution of the Argentine ant in Mississippi, it is probable that there are isolated rural infestations in many of the States, especially in the Gulf coast region. In Monroe County, Miss., 17 rural infestations are known. Of the known infestations in Mississippi, 26.7 percent are in rural communities.

Unless controlled, it seems likely that the ants will in time be generally, if not continuously, distributed throughout those Southern States in which numerous scattered infestations now occur. In addition they will probably occur in most of the southern half of North Carolina, the extreme southern part of Tennessee, the southern half of Arkansas, the extreme southern part of Oklahoma, the eastern half of Texas, as well as in a large part of California, particularly in the lower altitudes.

OCCURRENCE AND ABUNDANCE IN THE INFESTED STATES

The information on the occurrence of the Argentine ant obtained by scouting or through correspondence is summarized in table 1 and in the following paragraphs. Of the 18 States where scouting was conducted, 13 were found infested.

TABLE 1.—*Status of the Argentine ant in States scouted and in other States where infestations occur*

State	General area scouted	Total counties	Counties scouted	Counties infested		Localities scouted	Localities infested		Area infested
		Number	*Number*	*Number*	*Percent*	*Number*	*Number*	*Percent*	*Square miles*
Alabama	Entire State	67	67	51	76.1	357	119	33.3	247.150
Arizona	Southern principally	14	8	1	12.5	18	1	5.5	.075
Arkansas [1]	Eastern and southern	75	21	2	9.5	26	2	7.7	3.420
California		58							[2] 2,000.000
Florida	Entire State	67	67	4	5.9	190	4	2.1	.435
Georgia	Entire State except Echols County	161	160	38	23.7	418	58	13.8	101.846
Illinois	Southern and along Illinois Central R. R.	102	16	1		26	1		[2] .00003
Kentucky	Northern and western	120	24	0	.0	28	0	.0	
Louisiana	Entire State	64	64	41	64.0	575	316	54.9	921.710
Maryland		23		1			1		[2] .250
Mississippi	Data supplied by State Plant Board	82		63	76.8		245		[2] 250.000
Missouri	Towns near Missouri and Mississippi Rivers	115	11	1		13	1	7.7	.017
New Mexico	Southwestern	26	4	0	.0	9	0	.0	
North Carolina	Eastern, southern, and western	100	40	5	12.5	82	5	6.1	2.696
Oklahoma	Southern	77	18	0	.0	21	0	.0	
South Carolina	Entire State	46	46	15	32.6	159	23	14.4	13.880
Tennessee	Southern and western	95	38	2	5.2	105	2	1.9	.170
Texas [1]	Eastern half, few localities in western	254	137	31	22.6	237	38	16.0	53.190
Virginia	Largest cities in southern half	100	7	0	.0	7	0	.0	
West Virginia	Two of largest cities	55	2	0	.0	2	0	.0	

[1] Texarkana included in both Texas and Arkansas totals.
[2] Estimated.

ALABAMA

Although the infestations in Alabama are rather generally distributed over the State, they are more numerous in the central part and less prevalent in the northern part (fig. 7). Jefferson County, with 10 infested localities, and Wilcox County, with 7, are the two most heavily infested counties. Many of the infestations are extremely small, indicating that they are recent. The largest infestation is at Birmingham and embraces 124.02 square miles. Montgomery follows with 31.39 square miles, and Mobile third with 10.44 square miles.

Practically all the infestations originated from articles shipped by railroad. A few towns, however, apparently became infested through truck or water shipments. Birmingham is an excellent example of a large commercial city that has become a focal center for the spread of the ants to nearly all the small towns in its vicinity.

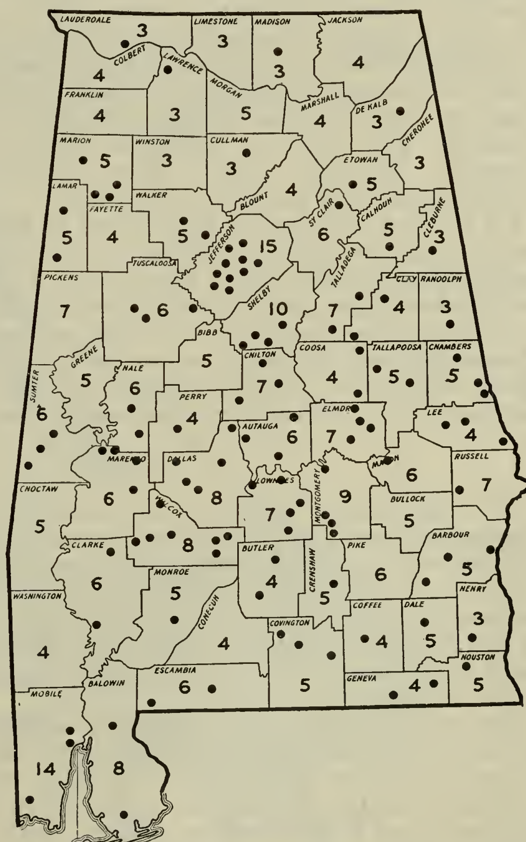

FIGURE 7.—Map of Alabama showing number of localities scouted for Argentine ants and the infested localities (dots) in each county.

ARIZONA

The scouting in Arizona was confined principally to the southern third of the State, but examinations were also made in two localities north of Phoenix, Prescott and Kingman. The localities chosen were the most important commercial points along the main highways and railroad lines. They were as follows: Tombstone, Bisbee, Lowell, Douglas (Cochise County), Safford (Graham County), Phoenix, Tempe, Mesa, Glendale, Buckeye, Gila Bend, and Wickenburg (Maricopa County), Kingman (Mohave County), Tucson (Pima County), Nogales (Santa Cruz County), Prescott (Yavapai County), and Wellton and Yuma (Yuma County).

The single infestation in the State is at Douglas, in Cochise County.

ARKANSAS

In Arkansas the localities scouted were confined for the most part to the larger and more important railroad junctions or river towns in the eastern and southern sections of the State. The river towns lay along the banks of the White, Arkansas, and Mississippi Rivers. The localities scouted were as follows: Blytheville, Osceola, Wilson (Mississippi County), Marion (Crittenden County), Forrest City (St. Francis County), Marianna (Lee County), Helena and Barton (Phillips County), Clarendon (Monroe County), DeValls Bluff and Des Arc (Prairie County), Searcy (White County), Little Rock (Pulaski County), Benton (Saline County), Pine Bluff (Jefferson County), McGehee and Arkansas City (Desha County), Lake Village (Chicot County), El Dorado (Union County), Camden (Ouachita County), Arkadelphia (Clark County), Malvern (Hot Spring County), Hot Springs (Garland County), De Queen (Sevier County), Ashdown (Little River County), Texarkana (Miller County, Ark., and Bowie County, Tex.).

Of the two infestations found, that at Hot Springs is very small, only 0.04 square mile, while that at Texarkana is rather large, comprising four separate areas which cover a total of 3.38 square miles. Both infestations probably originated from railroad shipments.

Although the eastern and southern sections of the State border on Mississippi and Louisiana, respectively, the lack of infestations in these sections is probably due to the fact that neither northern Louisiana nor northwestern Mississippi is as yet heavily infested.

CALIFORNIA

The distribution of the Argentine ant in California can only be summarized here in a general way, because the Bureau of Entomology did no scouting in this State, nor has the exact distribution been determined by the State authorities. The information given below and on the map (fig. 8) was kindly furnished by Harry S. Smith, of the Citrus Experiment Station at Riverside, Calif., and represents a summary of reports supplied him by county agricultural commissioners.

The San Francisco Bay district including the Santa Clara Valley and the coastal plain to the south, the San Joaquin Valley south of and including Sacramento County, a considerable part of Los Angeles and Orange Counties, and western San Bernardino, Riverside, and San Diego Counties may be said to be generally infested; that is, colonies of ants were found in every residence and on a considerable portion of the orchard acreage. Dr. Smith is of the opinion that there are at least 2,000 square miles of infested territory in California, and that this area is far greater than in any other State. He says:

> The ant has been here for more than 30 years, conditions are ideal for its development, and the unusually extensive distribution of balled ornamentals has seemed to disseminate it very widely.

FLORIDA

In Florida the known infestations are in the northeastern and northwestern sections of the State (fig. 9). As yet none of the infestations is large, that at Pensacola (Escambia County) being the largest, with 3 separate areas totaling 0.20 square mile. Caryville (Washington County) has 0.11 square mile, and Palatka (Putnam County) and Jacksonville (Duval County) 0.06 square mile each. The history of these infestations is rather obscure, but it is probable that boats and railroads played almost equal parts in carrying the ant to this State.

That Florida has so few infestations is surprising in view of the many factors that might aid the ant in becoming established there,

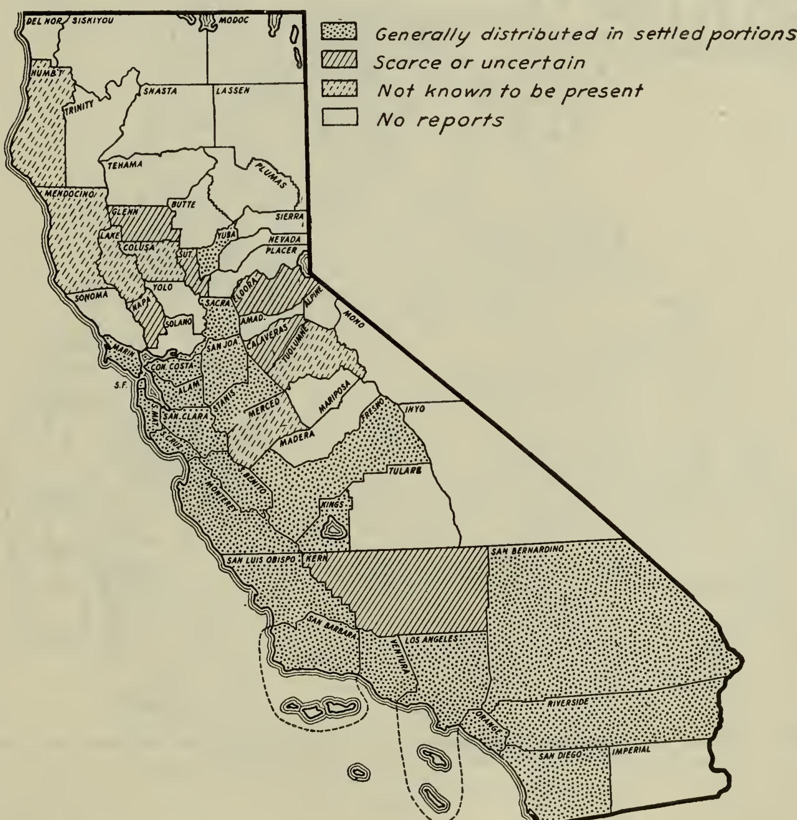

FIGURE 8.—Map of California showing Argentine ant distribution.

such as a semitropical or mild climate, a heavy tourist trade, and opportunities for the ants to come in by both boat and railroad.

GEORGIA

Georgia (fig. 10) is not so generally infested as Alabama, the infestations being confined largely to the northwestern part, especially the area lying between Columbus and Atlanta. The extreme southeastern, southwestern, and northern sections are practically free from infestations. The most heavily infested counties are Coweta, Troup, and Fulton. A large number of these infested areas lie along the Atlanta and West Point Railroad. Most of the infestations in Georgia, like those in Alabama, without doubt originated from ants infesting products shipped by railroad.

The largest infested area in the State is at Atlanta, comprising 26.70 square miles. The next largest are Newnan, 13.68 square miles; Moreland and St. Charles together, 12.48 square miles; and Augusta, 8.15 square miles. Atlanta, like Birmingham, has been the source of infestation of many of the surrounding small towns.

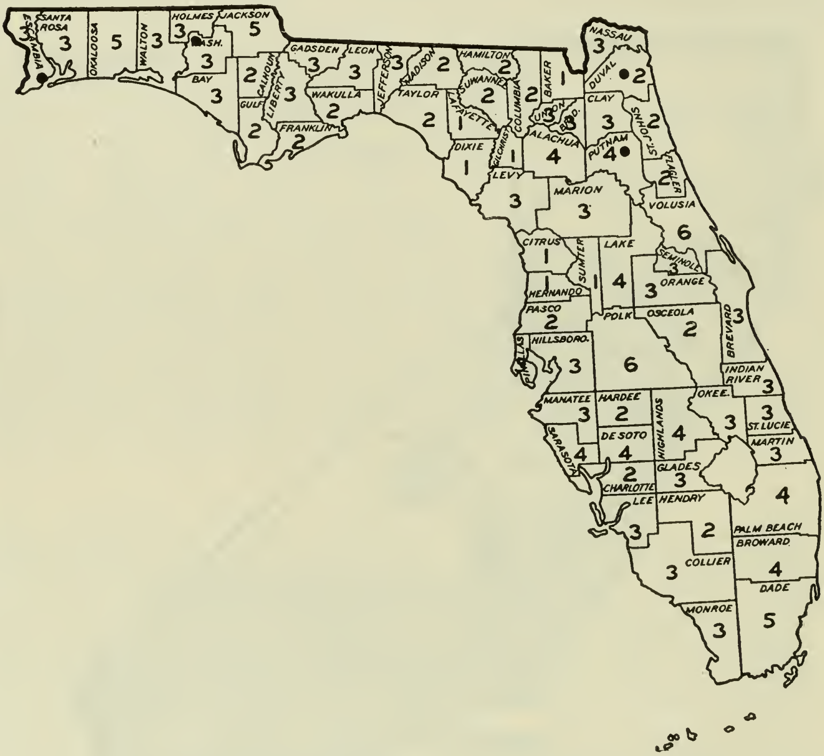

FIGURE 9.—Map of Florida showing number of localities scouted for Argentine ants and the infested localities (dots) in each county.

ILLINOIS

In Illinois the following towns were surveyed: Cairo (Alexander County), Champaign and Tolono (Champaign County), Mattoon (Coles County), Neoga (Cumberland County), Arcola and Tuscola (Douglas County), Edgewood and Effingham (Effingham County), Carbondale and De Soto (Jackson County), Vienna (Johnson County), Centralia, Odin, Salem, Alma, and Kinmundy (Marion County), Metropolis (Massac County), DuQuoin and Tamaroa (Perry County), Mounds and Ullin (Pulaski County), Harrisburg (Saline County), Anna (Union County), Ashley (Washington County), and Marion (Williamson County).

No Argentine ants were found as a result of the scouting, but the species is established in the Zoology Building at the University of

Chicago.[4] This infestation supposedly originated in 1906 from ants introduced on plant material for use in connection with investigations on the Colorado potato beetle (*Leptinotarsa decemlineata* Say). Colonies are located in the basement of the building and occasionally cause considerable annoyance in the laboratories. Although in warm weather the ants are found outdoors a number of feet from the building, they have not spread to other buildings or

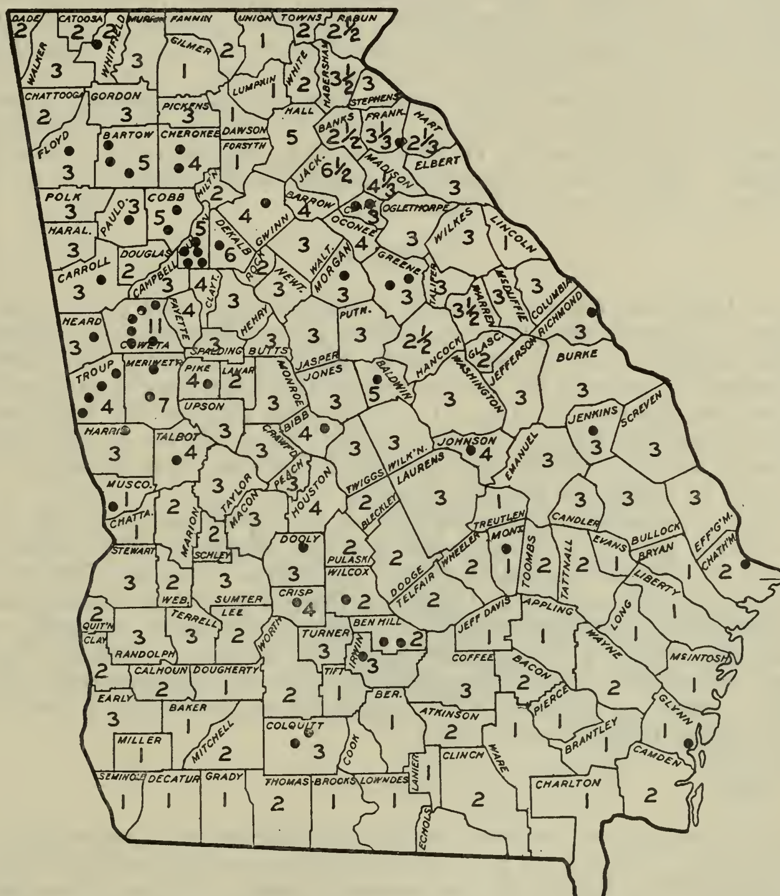

FIGURE 10.—Map of Georgia showing number of localities scouted for Argentine ants and the infested localities (dots) in each county.

over the campus. Apparently they are able to survive the winter only indoors.

KENTUCKY

Scouting in Kentucky was confined to the northern parts lying along the Ohio and Mississippi Rivers, and also along the Illinois

[4] Data on this infestation were supplied by Mary Talbot, of the University of Chicago, and V. E. Shelford, of the University of Illinois.

Central Railroad in the extreme western part of the State. The localities examined were as follows: Wickliffe and East Cairo (Ballard County), Wellsburg (Bracken County), Petersburg (Boone County), Holt (Breckinridge County), Catlettsburg and Ashland (Boyd County), Bardwell (Carlisle County), Carrollton (Carroll County), Weston (Crittenden County), Owensboro (Daviess County), Hickman and Fulton (Fulton County), Warsaw (Gallatin County), Greenup (Greenup County), Clinton and Columbus (Hickman County), Hawesville (Hancock County), Covington (Kenton County), Louisville (Jefferson County), Vanceburg (Lewis County), Smithland (Livingston County), Maysville (Mason County), Paducah (McCracken County), Brandenburg (Meade County), Westport (Oldham County), Henderson (Henderson County), and Uniontown (Union County). No Argentine ants were found. The known infestations nearest to Kentucky are in the extreme southern part of Tennessee.

LOUISIANA

In Louisiana the ant occurs not only in cities and towns, but in rural or sparsely settled areas, and in almost impenetrable swamps. The southern half of the State is not only generally but heavily infested, whereas in the northern part there are only a few widely separated infestations (fig. 11). Although the heavier infestation in the southern half of the State might be attributed to the milder climate and the earlier appearance of the ants, it is probably due largely to spread by floods and boats.

The importance of railroad lines in the dissemination of the ants is clearly shown in Tangipahoa Parish, where 10 of 13 localities along the Illinois Central Railroad were found infested. There are more large infestations in Louisiana than in any other State. Such infestations range from 10 to 35 square miles on an average, and there are several as large as 120 to 135 square miles. Owing to their inaccessibility, many localities, especially in the southern part of the State, were not scouted. The infested area is therefore probably larger than that given in table 1.

MARYLAND

No scouting was carried on by the Bureau of Entomology in Maryland. The author first learned of the occurrence of the Argentine ant in this State when he received from E. N. Cory, State entomologist, specimens collected from the Clifton Park greenhouses in Baltimore. Later investigations by Dr. Cory and members of his staff revealed the presence of this ant in greenhouses at the following parks in Baltimore: Druid Hill, Carroll, Patterson, and Clifton.

On October 7, 1931, the author and D. W. Hookom, of the University of Maryland Department of Entomolgy, visited greenhouses in both Clifton and Carroll Parks where the Argentine ants were established. At Carroll Park colonies were found nesting outdoors 75 yards from the greenhouse, but at Clifton Park the ants were not more than 10 feet away. Little definite information regarding the history of the infestation could be obtained. Judging from the abundance of the ants at Carroll Park and from statements of greenhouse attendants, they undoubtedly have been present there for several years.

As a result of an investigation during the winter of 1931, Mr. Hookom found that the ants lived outdoors in protected places, but the winter was comparatively mild.

MISSISSIPPI

In Mississippi scouting for Argentine ants was confined to 24 localities in the extreme northern part of the State, because the State Plant Board was rather well posted as to the general distribution

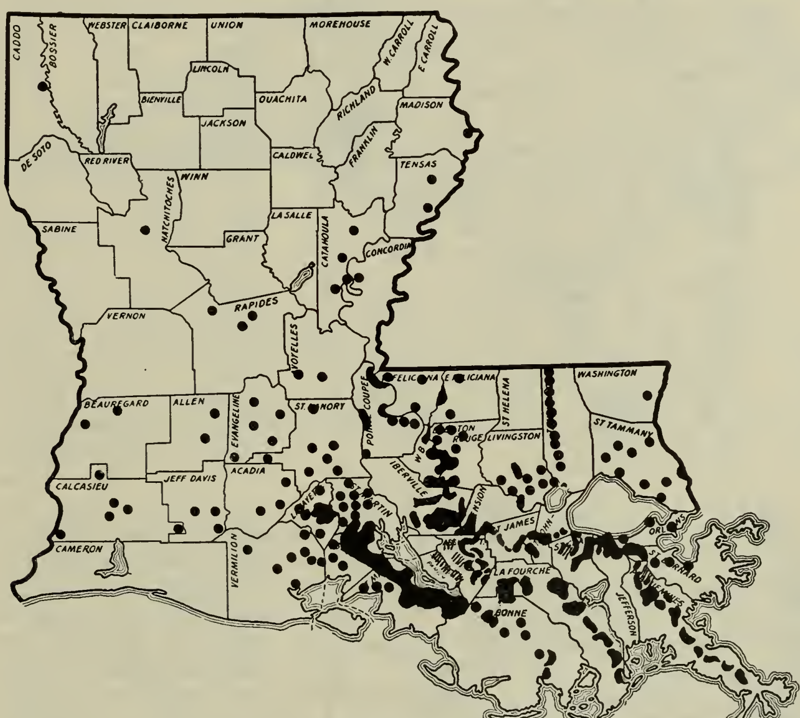

FIGURE 11.—Map of Louisiana showing the infested localities (dots) in each county.

of the ant elsewhere. The summary of conditions in Mississippi is based on records of both the Mississippi State Plant Board and the Federal Bureau of Entomology.

Although the ant is generally distributed throughout the State (fig. 12), it is most abundant in the southern and central sections, and least abundant in the northwestern portion. Railroads have been the principal means of spread. So clearly is this indicated that one can locate the important railroad lines in the State by following on the map the dots representing the infested localities. The most heavily infested counties are Monroe, Hinds, Attala, and Holmes. Many of the infestations are small, but in some of the towns the infestation covers the entire incorporated area and extends into the country for several miles. Those at Jackson, Meridian, and Kosciusko undoubtedly cover from 12 to 15 square miles each. In a number of towns there is more than one infested area; at Columbus, for example, 18 isolated infestations have been found. A large number of the infestations, particularly in the heavily infested counties, occur in rural areas, and these no doubt originated through introduction of groceries or other products from neighboring towns.

Recent intensive scouting shows that 39 of the 245 infested localities have been freed of the pest, as a result of poisoning campaigns.

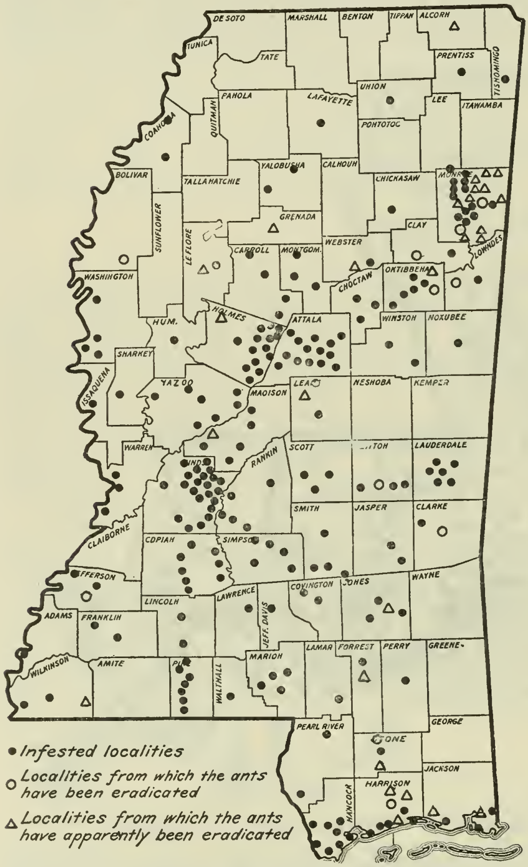

FIGURE 12.—Map of Mississippi showing status of Argentine ant infestations.

MISSOURI

The following towns were scouted in Missouri: Poplar Bluff (Butler County), Cape Girardeau and Delta (Cape Girardeau County), Jefferson City (Cole County), Boonville (Cooper County), Washington (Franklin County), Hermann (Gasconade County), Charleston (Mississippi County), New Madrid (New Madrid County), Sedalia (Pettis County), Caruthersville (Pemiscot County), Ste. Genevieve (Ste. Genevieve County), and St. Louis (St. Louis County).

Argentine ants were found in St. Louis, but only at the Missouri Botanical Gardens and in a nursery nearby. From the information obtained it does not seem possible for the ants to survive outdoor winter conditions here. Within the greenhouses and other heated buildings the ants seem to thrive and are making themselves objectionable through their attendance on aphids and mealybugs. Only two infestations are known to occur farther north than the one in St. Louis, and both of these are also of the indoor type.

NEW MEXICO

The towns scouted in New Mexico lie along the railroad lines and are as follows: Las Cruces, Hatch, Rincon, and Mesilla Park (Dona Ana County), Silver City (Grant County), Lordsburg and Rodeo

(Hidalgo County), and Deming and Cambray (Luna County). Although the scouting was limited, it does not appear likely that the ants occur in this State.

NORTH CAROLINA

In North Carolina the known infestations are confined to the southern and central or east-central sections (fig. 13). None of the infested areas is very large, that at Wilmington, with two areas totaling 1.23 square miles, being the largest and apparently the oldest. The infestation at Goldsboro, covering 0.60 square mile, is

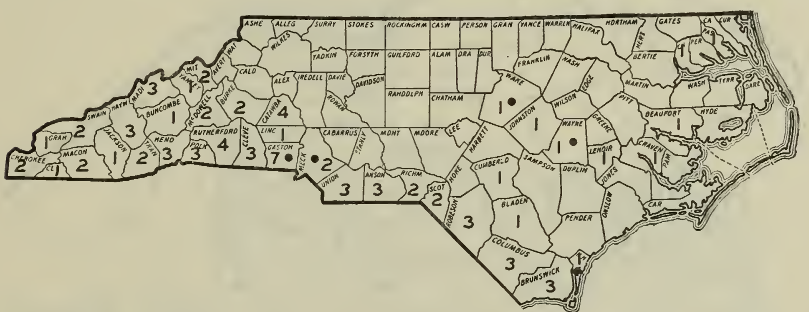

FIGURE 13.—Map of North Carolina showing number of localities scouted for Argentine ants and the infested localities (dots) in each county.

next in size, while that at Raleigh is only 0.15 square mile. It is surprising that no infestation was found in the small towns near Wilmington.

OKLAHOMA

The following localities in southern Oklahoma were scouted: Anadarko (Caddo County), Durant (Bryan County), Ardmore (Carter County), Coalgate (Coal County), Lawton (Comanche County), Hugo (Chocktaw County), Clinton (Custer County), Pauls Valley and Lindsay (Garvin County), Chickasha (Grady County), Holdenville (Hughes County), Altus (Jackson County), Mangum (Greer County), Hobart and Snyder (Kiowa County), Madill (Marshall County), Valliant and Idabel (McCurtain County), McAlester (Pittsburg County), Ada (Pontotoc County), and Frederick (Tillman County). That no ants could be found in southern Oklahoma is surprising, since a number of infested localities in northeastern Texas are not more than 50 to 75 miles away. A vigilant watch should be kept for the appearance of the ants in this section of the State.

SOUTH CAROLINA

In South Carolina the ant was found to be fairly well scattered over the State, but was most prevalent in the southeastern, east-central, and northern sections (fig. 14). Spartanburg County, with five infestations, has the largest number; Greenville County second, with four; and Charleston County third, with two.

The largest infestation in the State, and undoubtedly the oldest, is that at Charleston, which was estimated to cover 6.29 square miles.

The next largest infestation is at Spartanburg, which occupies 2.20 square miles, and that at Gaffney third, with 1.12 square miles. In several towns there is more than 1 infestation, Spartanburg having 12 and Greenville and Gaffney 3 each.

The importance of the railroad in distributing the ant is clearly shown in Greenville and Spartanburg Counties, where nearly all the infestations lie along the main line of the Southern Railroad. Many of the towns in the vicinity of Charleston, where the ant has been known for at least 19 years, are apparently not infested.

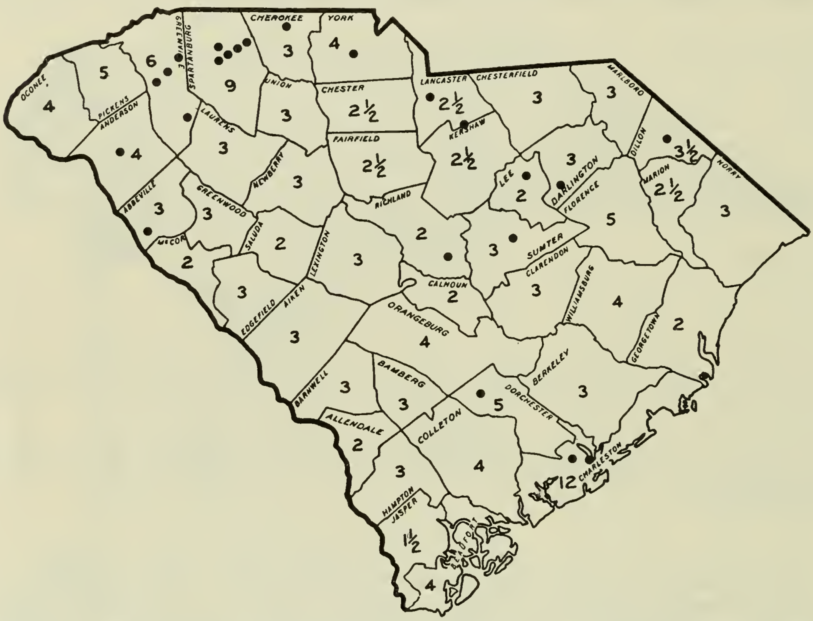

FIGURE 14.—Map of South Carolina showing number of localities scouted for Argentine ants and the infested localities (dots) in each county.

TENNESSEE

In the southern part of Tennessee only the larger and more important commercial towns were scouted, and in the western section the work was confined to towns along the main line of the Illinois Central Railroad and the Mississippi River. Infestations were found in the extreme southern part of the State not far from the Alabama line, one at Pulaski in Giles County and another at Fayetteville in Lincoln County. It was surprising that no Argentine ants were found at Memphis or in any of the larger towns along the railroad or river.

TEXAS

The Argentine ant was found to be rather generally distributed over the eastern half of Texas, or that section lying east of Wichita Falls and Austin (fig. 15). This was to be expected in view of its nearness to Louisiana, its rather densely populated areas, and the more abundant vegetation here than in the western part of the State.

The largest infestations in the State are as follows: Beaumont, 11.4 square miles; Fort Worth, 11.37 square miles; Houston, 8.32 square miles; Dallas, 5.07 square miles. In spite of the large number of localities infested in Texas, the State is much less heavily infested than the States east of Louisiana.

Apparently all but a very few of the infestations were started from produce shipped on railroads. The ant has not become established in many of the towns along the Gulf of Mexico, either because large boats do not come into these towns or because the boats are usually not from ports infested with Argentine ants. Frequent direct water

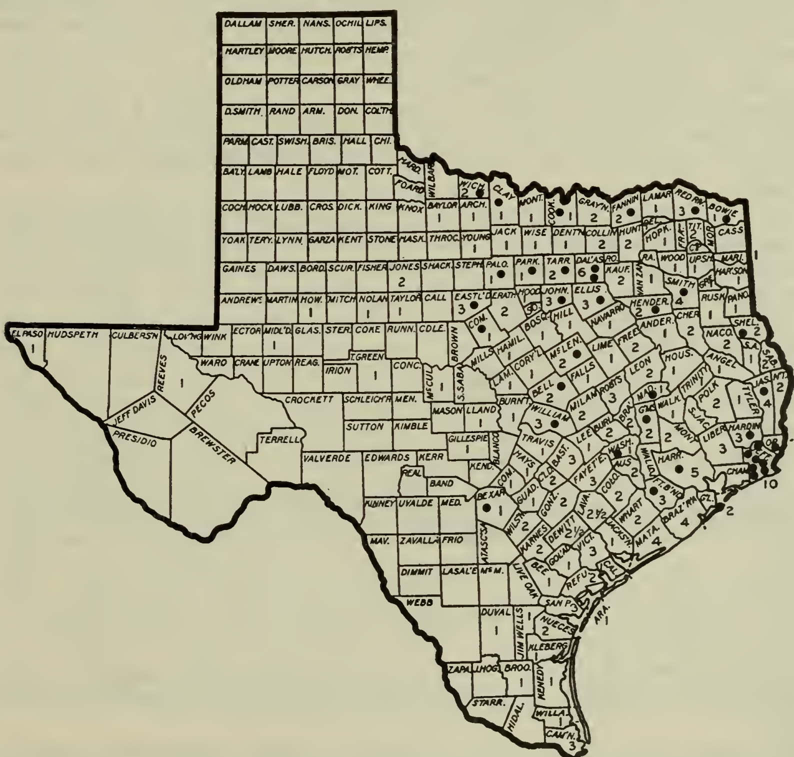

FIGURE 15.—Map of Texas showing number of localities scouted for Argentine ants and the infested localities (dots) in each county.

communication between Louisiana and the southeastern section of Texas would no doubt hasten the establishment of the ants there.

VIRGINIA

The following cities in Virginia were scouted: Lynchburg (Campbell County), Richmond (Henrico County), Petersburg (Dinwiddie County), Suffolk (Nansemond County), Norfolk (Norfolk County), Roanoke (Roanoke County), and Lexington (Rockbridge County). The occurrence of the Argentine ant at Norfolk had been reported in correspondence, but H. T. Vanderford was unable to find any ants after a 5-day search. The limited scouting failed to reveal any ants in the State.

WEST VIRGINIA

Less scouting was done in West Virginia than in any other State. Outdoor infestations so far north did not seem probable, especially since no typical ones had been found north of Raleigh, N. C. In passing through this State to Kentucky, the scouts spent 4 days in Huntington (Cabell County) and Charleston (Kanawha County), with negative results.

CONTROL AND ERADICATION WORK IN MISSISSIPPI

According to Harned (*5*) Argentine ants probably made their first appearance in Mississippi about the year 1900, and by 1909 there were approximately a dozen known infestations in the State. By 1922 infestations in 40 towns had been recorded, and in 1934, 245 infestations had been found. Since only about half a dozen new infestations had been discovered during the previous year, it was presumed that most of the infested areas in Mississippi had been located.

As the number and severity of the infestations increased, and property owners found that their own efforts to combat the pest with commercial poisons were either futile or at least only temporarily beneficial, they appealed to the State officials for help. By this time E. R. Barber, an investigator for the Federal Bureau of Entomology, had proved that the ants could not only be controlled but practically eradicated in small areas. Control campaigns were therefore inaugurated through a cooperative arrangement between the State Plant Board and the infested communities, with the assistance of Mr. Barber in directing the work. The first of these campaigns were conducted in four towns—Durant, Laurel, Crystal Springs, and Woodville—during the fall of 1920, and they were so successful that others were undertaken in the following years. Since 1920 the plant board has supervised this work, while the municipalities and counties have paid the expenses. This work reached its height in 1929, when 121 localities were poisoned for the ants, 1,136,028 cups of poison being used at a cost of approximately $35,000. Even in the depression years there has been a steady demand for control work, although the towns and counties have been handicapped by lack of funds.

The early campaigns were designated control campaigns, and the word "eradication" was not used. In 1924, however, an area embracing a block and a half at Fayette, Miss., was freed of the ants after two successive fall campaigns, at an exceedingly low cost (*15*). So far as is known, this was the first town, not only in Mississippi but in the world, from which the ants had been eradicated. Later other towns began to eradicate the ants, and by 1928 six—Fayette, Shaw, Lyman, Landon, Moss Point, and State College—had been freed of them (*4*). Since then State authorities have not only stressed the fact that it is possible to eradicate Argentine ants by timely and thorough campaigns repeated for several consecutive years, but they have encouraged the municipalities and counties to fight the ants in this manner.

Since it has been definitely shown that both control and eradication of Argentine ants can be achieved by the method used in Mississippi, it is desirable to describe in detail how this is accomplished and to give some idea as to the cost of the work.

SURVEYING INFESTED AREAS

Usually there is only one general infestation in a town, although in some towns as many as 15 to 20 isolated areas have been found. The ideal method of locating and delimiting infestations would be to scout the entire town, property by property, and block by block, but this is both costly and time-consuming. The plant board has therefore not attempted to scout entire towns with such thoroughness unless the town authorities have indicated their intention of

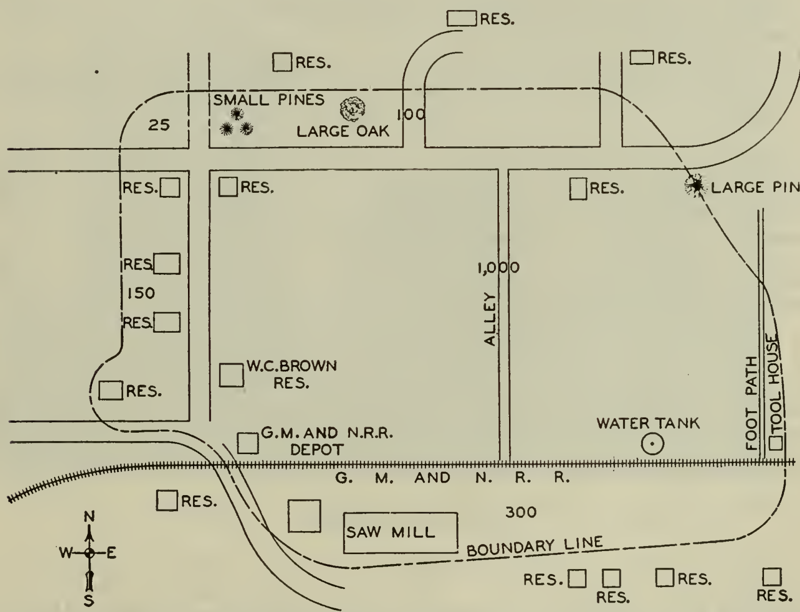

FIGURE 16.—Map of an area infested with Argentine ants, showing the number of cups of poison required for the various blocks.

continuing the work until eradication is accomplished. It is possible, however, to determine the limits of an infested area without visiting every property or block. Since the Argentine ant destroys practically all the native ants, wherever native ants are found one can be reasonably sure that there are no Argentine ants. If the scout, therefore, proceeds from a given point of infestation and examines trees, fences, the ground, and the bases of pillars of buildings, he can consider that he has reached the limit of the infested area when he first encounters native ants instead of Argentine ants. From this point he encircles the infested area and as he finds the division between the infested and the noninfested territory he indicates it on a map (fig. 16). When the circle is completed he is in a position to estimate the cost of poisoning that area.

ESTIMATING THE COST OF A CAMPAIGN

The cost of a campaign is estimated on the basis of the number of cups required. In an ordinary city block this will range from 100 to 200. One familiar with the work can estimate roughly the number needed after walking around the block, but a less experienced person should note the places where cups are needed, spacing them 20 to 25 feet apart, regardless of the character of the block with respect to vegetation, buildings, fences, etc. In areas not bounded by streets the estimate should be made in such a way as to avoid confusion. The number of cups of poison required for each block in the infested area is indicated on the map (fig. 16). The total number of cups required for all the blocks and other areas is then computed. It is advisable to give the totals in even thousands, for manufacturers prefer to ship in such lots.

The cost of supplies and labor for a campaign that will require 6,000 cups is estimated, on the basis of current prices, to be about as follows:

6,000 paperoid cups, at $9.25 per 1,000	$55.50
6,000 brackets, at $3.25 per 1,000	19.50
75 gallons of poison, at 60 cents per gallon	45.00
12 pounds of shingle nails, at 5 cents per pound	.60
Incidentals (four 5-gallon kerosene cans, 1 bucket, 1 funnel, 4 hammers, 4 grocery baskets)	6.00
Express or freight on supplies	2.00
Labor, 120 hours at 20 cents per hour	24.00
Total	152.60
Cost per cup	.0254

In Mississippi many campaigns have been put on at an average of from 2.3 to 3 cents per cup. A well-conducted campaign should seldom cost more than 3 cents per cup.

SUPPLIES NEEDED

CUPS

During the course of the control and eradication work in Mississippi three types of poison containers have been used—tin cans, aluminum cups, and paperoid cups (fig. 17).

Tin cans with detachable lids, measuring 2½ by 4 inches with a capacity of approximately 10 fluid ounces, were first used. Two indentations were made at the top with pliers, which when the lids were placed on the cans formed holes through which the ants might pass. To attach a can to a tree, post, or building, a six-penny nail was driven into the object and the can hung over it through one of the holes beneath the lid. Formerly a gill of poison and a piece of sponge about the size of an egg were placed in each can, the sponge serving as a footing for the ants as they fed. It was later found that the sponge was unnecessary and that 1 to 1½ ounces of sirup per can was sufficient.

The tin can was finally discarded because of its high cost. The cost of the early campaigns averaged from 6 to 7.5 cents per can, and from 2.2 to 2.5 cents of this was for the can. The tin can, however, is somewhat more substantial than the other containers and, because of its greater depth, when buried in the soil it is not so likely to be submerged by successive rains.

The aluminum cups measure 1⅛ by 2⅝ inches and have a capacity of approximately 1 ounce. On the sides of the cups near the top are three small holes through which the ants can enter and leave. The cups are light and easily transported and can be salvaged and used again the following year, but they are not large enough to keep the sirup from drying out when exposed to much sunshine, and they are easily submerged when buried in the soil. Although they do not require brackets, as do paperoid cups, their cost is about one and one-half times that of paperoid cups without brackets.

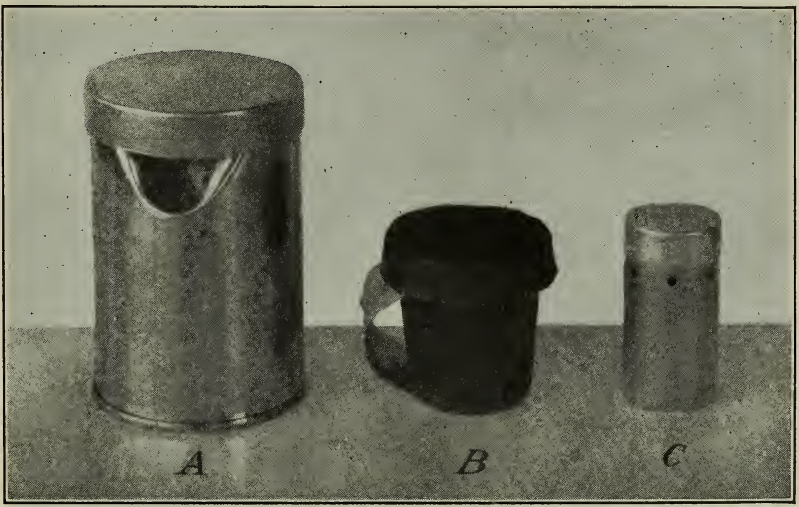

FIGURE 17.—Poison containers that have been used in Argentine ant control and eradication work in Mississippi: *A*, Tin can; *B*, paperoid cup; *C*, aluminum cup.

The paperoid cups, which are made of heavy paraffined paper, resemble small drinking cups with tops. They measure 1¾ by 2⅛ inches and hold approximately 1½ fluid ounces. There are four small holes for the ants near the top but beneath the lid. To attach the cups to trees, buildings, or other objects, metal brackets are necessary (fig. 18). These brackets are so constructed that the cups are suspended from them by fastening the lid over the top, and an emarginated area at the bottom holds the cup firm. The brackets are attached to objects by a small nail driven through a hole in their center. Brackets on buildings and fences will last for several years, but those on young trees sometimes sink so deeply into a tree after a year or so that they can no longer be used. The cups not only withstand severe storms when securely fastened to brackets, but they last much longer than they are needed, for it is seldom, if ever, necessary to refill them in Mississippi. Occasionally, especially where the cups are exposed to sunshine, the sirup may ooze through the paper, but never in quantities to be objectionable. For the first campaign a bracket will be required for each cup attached to an object. In succeeding campaigns, however, only about half as many brackets will be required, since most of the brackets first put up are still in place.

The paperoid cups have the advantage of lightness and low cost, and when from half to two-thirds full they hold just about the quantity of sirup needed. They are not desirable for burying in the ground because of their shallow depth and the fact that water can eventually soak through them. Their paper composition also makes them more easily destroyed by children. In spite of these objections, however, the paperoid cups have proved practical and inexpensive and are now being used in greater numbers than any other type of container. The first paperoid cups used in Mississippi were white,

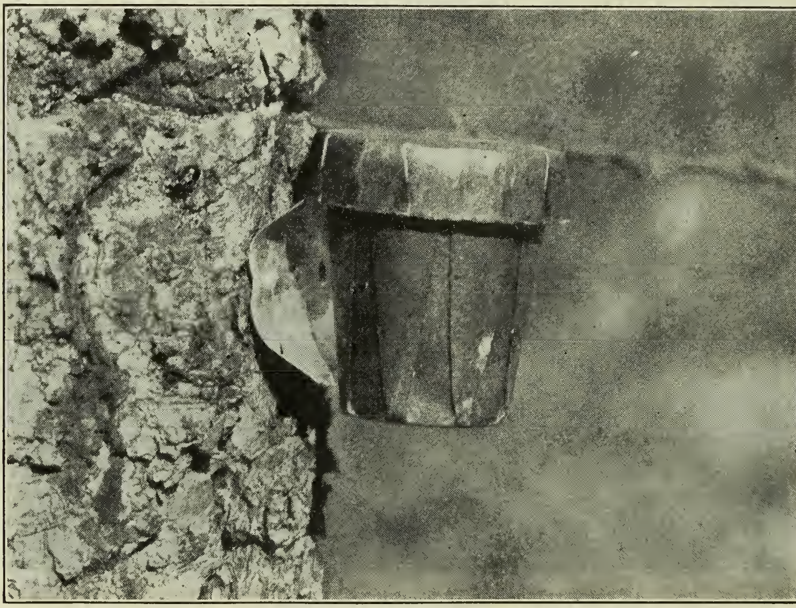

FIGURE 18.—Paperoid cup attached to bracket on a tree. Note how the lid of the cup is suspended over the top of the bracket, and also how the cup rests in an emargination on the lower side of the bracket.

and their conspicuous appearance attracted the attention of mischievous children, and so cups of a chocolate or deep brown color are now used.

POISON

The poison used in the cups is a sirup containing sodium arsenite, made according to a formula devised by Barber (*2*) and now known as the "standard Government-formula Argentine ant poison." There are several firms in Mississippi that manufacture this poison. According to the State chemist of Mississippi, it should meet the following specifications:

Sodium arsenite	0. 16 percent.
Acidity (as tartaric acid)	0. 06 percent.
Solids	50. 0° Brix.

Since it is difficult always to obtain samples that meet these figures exactly, the manufacturers have been allowed the following range:

Sodium arsenite	0. 12–0. 20 percent.
Acidity (as tartaric acid)	0. 00–0. 10 percent.
Solids	50. 0°–56. 0° Brix.

Before being used, all poisons are analyzed from uniform samples taken from the containers by the plant board inspectors after they reach the town or county where the campaign is to be conducted. If the poisons do not fall within the above ranges, they are rejected at the manufacturer's loss. Lyle,[5] who carried on a limited series of poison tests against Argentine ants both in artificial cages and under natural conditions, found that the ants will tolerate an even wider range in arsenic content as well as in acidity of the sirup. Until more work is done on this subject, though, the above ranges should be strictly adhered to.

If the poisoned sirup is to be stored for several months, it is placed where it will not be exposed to exceedingly low or high temperatures, and it is well covered to prevent contamination by dust, water, etc. The poison should never be placed in any receptacle that has contained oil, kerosene, or grease, for these substances are very repellent to ants.

OTHER SUPPLIES

Incidental supplies that are required include 5-gallon cans, funnels with strainers, hammers, and substantial grocery baskets, as well as tanks for distributing the poison in the field (fig. 19). The plant

FIGURE 19.—Equipment used by a field distributing crew—distributing tank, can for temporary storage of poison, carpenter's apron, basket for unfilled paperoid cups and tops, and hammer.

board men often bring these supplies with them. Five-gallon cans of the type usually sold for holding kerosene are excellent for the temporary storage of the poison in the field. A can of this size will hold enough sirup to fill from 375 to 425 cups, which is about the number that a field crew can put out in half a day.

For distributing the poison a rectangular galvanized-iron tank measuring 4 by 12 by 12 inches and having a capacity of 2½ gallons is used. At the lower end of the tank is attached a half-inch hose with a faucet at the end. The tank is strapped to the back of the field assistant. The cost of such a tank, including accessories, is about $5. It can be made by any competent tinner.

[5] LYLE, C. See footnote 3.

ORGANIZING AND CONDUCTING A CAMPAIGN

After a locality has been surveyed, the plant board sends an itemized estimate of the cost of a campaign to the local officials. If they decide to put on a campaign, they are advised concerning the

FIGURE 20.—Field crew distributing poison. Leader is nailing a bracket to a tree for the reception of the cup of poison which his assistant is filling.

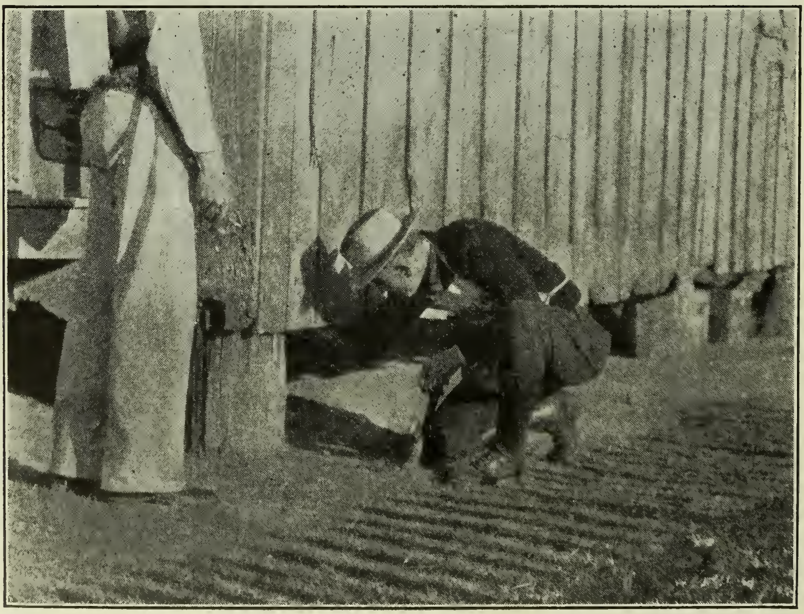

FIGURE 21.—Placing cups of poison on pillar of house that is not enclosed at the base.

supplies needed and where to purchase them, and are requested to notify the plant board when these materials have arrived. One or more plant board men are then sent to direct the campaign. These men purchase incidental materials and also help select the labor if it is not already provided. Supplies are charged to and the labor is paid for out of local funds.

The most intelligent and industrious labor available is obtained. If the men have not had previous experience in Argentine ant control, they are thoroughly instructed before they begin work.

The poison is distributed by crews of two men each, a leader, who is responsible for the placement of cups, and his assistant, who carries the supplies (fig. 20).

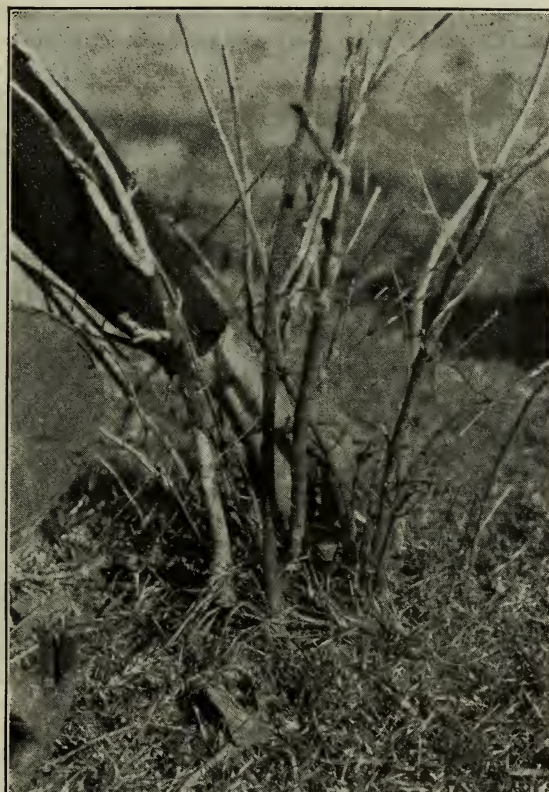

FIGURE 22.—Cups of poison can often be advantageously placed in clumps of weeds, bushes, etc.

To oversee the work there are field supervisors who are responsible for from two to four crews each. These supervisors should have had previous experience and also know how to handle labor. One man with a small truck is responsible for the transportation of the crews and their supplies in the field. In all but the very large campaigns this man can very well direct the entire work through the field supervisors. He sees that the poison and other supplies are kept handy for the field men at all times and also that the crews are so placed that he can keep in contact with them with as little effort as possible. This means that only one crew works a block and this crew works the entire tier of blocks and in the same direction as the other crews. All crews are thus working in tiers of blocks not only adjacent to but parallel with each other.

In working a block a crew covers it property by property, being sure that no part of it is overlooked. Cups of poison are distributed at intervals of about 20 to 25 feet. Under houses that are not enclosed (fig. 21), a cup is placed on every third or fourth pillar. If the base of the house is enclosed, cups are fastened to the sides of the house about 5 or 6 feet from the ground. On fences enclosing livestock the cups are placed outside the fence, about 6 inches from the ground, where they will attract the least attention. Cups should be concealed as much as possible in order not to attract the notice of children. Where there are no trees, buildings, posts, or fences, the cups can be set in the crowns of dense plants (fig. 22) or buried in well-drained soil (fig. 23) and covered with clods of dirt or pieces of debris. It is always desirable to poison slightly beyond the limit of infestation in order to check any ants that might advance that far. Ordinarily from 50 to 75 feet beyond is sufficient. A crew can usually put out on an average 800 cups of poison a day; an extra good crew, with the right type of territory in which to work, may average as many as 1,000 cups or even more. A map of the area should be kept

FIGURE 23.—Burying cups of poison in the ground.

by the supervisor at all times, as this is the most satisfactory way to record the work and the area worked by the various crews.

BEST SEASONS FOR CAMPAIGNS

The best time to put on a campaign is in the fall or winter. At these seasons little honeydew is being produced by scale insects, mealybugs, and aphids and there are few organisms for the ants to feed on; consequently the ants eat the poison sirup greedily. Cool weather, with temperatures ranging from 50° to 60° F., usually stimulates feeding. Furthermore, there is more time available at this season of the year. Campaigns have been put on in Mississippi when it was so cold that the men had to wear overcoats and their hands became numb, with results just as satisfactory as those from campaigns put on during warmer weather, but the discomfort of the men slows up the work and there is danger of carelessness under such conditions. The cost of control work prevents most localities from attempting more than one campaign a year. Moreover, such splendid results have been obtained in Mississippi from fall campaigns that there has been no incentive for putting on spring campaigns.

REACTION OF ANTS TO THE POISON

All the cups of poison are not visited at once by the ants. When feeding does take place, the ants visit the poison rather regularly and in large numbers for from 6 weeks to 2 months, after which time they attend it at infrequent intervals and then only in small numbers. Cups placed on trees, fences, and houses are visited most frequently. It has been noticed that when the sirup begins to thicken its palatability for the ants greatly decreases, and within a year it ceases to attract them, although many of the cups are not yet empty. It is generally believed that worker ants and their brood die within a few days after having fed on the poison. The greatest reduction in the number of ants evidently takes place during the first 2 months after the poison has been distributed.

DETERMINING THE EFFECTIVENESS OF A CAMPAIGN

In the summer following a campaign a survey is made by plant board inspectors to ascertain its effectiveness. Inquiries are made of housekeepers, storekeepers, cafe owners, and hotel managers as to the situation on their property. This is rated as "good" if no ants have been seen in their buildings since the poisoning, "fair" if few ants have been in evidence, and "poor" if the ants have been as abundant as before the poisoning. The "good" and "fair" reports are considered as satisfactory, the "poor" as unsatisfactory. Following the first campaign in a locality, from 95 to 100 percent of the reports are usually satisfactory, and after successive campaigns have been put on 100 percent of the reports are often satisfactory. In obtaining these reports it is necessary to be cautious, especially near the edge of the infested area, lest the property owner mistake native ants for Argentine ants. Some of the native ants cannot be controlled by this poison.

When the first campaign in a locality has been put on in a thorough manner, the abundance of the ants is usually so greatly reduced that few homes are troubled with them any more and the residents often conclude that they have been eradicated. This is rather unfortunate, for it is difficult for the plant board to induce that locality to put on a follow-up campaign. It is customary for the plant board to publish in the local paper a short account of the investigation, informing the public that, although the ants have been greatly reduced in numbers, they have not been eradicated.

In putting on the second fall campaign, the same quantity of supplies as in the first campaign should be used. The summer after the second campaign the infested area can be scouted to determine what sections have been freed of the ants and to what extent the quantity of supplies can be reduced for the next campaign.

Many towns will poison the ants one fall and then wait until they become annoying again before putting on another campaign.

Such a course is always discouraged by the plant board, as the ants can reach their former numbers and cause serious annoyance within 2 or 3 years.

ERADICATION WORK

The Argentine ant can be controlled by one thorough campaign, but these campaigns must be repeated if eradication is desired. Occasionally two campaigns are sufficient, but usually from three to five, and occasionally more, are necessary. To be successful, however, especial attention must be paid to the timeliness and thoroughness of the work and to the protection of the cups. If eradication has not been achieved after the second campaign, further treatment depends on the abundance of the ants. If they are still widely distributed and fairly abundant, a third general campaign with the same quantities of supplies as before is advisable. If, however, only a few colonies are found in a block, it is sufficient to repoison the infested spots, including an area within a radius of about 50 feet. Fresh poison should be applied immediately and again in the fall. The intensive follow-up scouting should be continued for two summers after the area appears to be free from the ants.

SUPPLEMENTARY MEASURES

Although it has been shown that the ants can be eradicated from given areas by poisoning alone, it is frequently desirable to hasten eradication by supplementary measures such as burning and oiling. In woodland areas where the ants are colonized in stumps, logs, and rotton branches of trees, many strong colonies can be destroyed by making fires in the woods and burning all the movable wood containing colonies. Stumps and immovable logs (fig. 24) can be burned by pouring on kerosene and setting them afire.

The burning should be done when the wood is dry and there is no wind. The best time for this is probably late in the fall or in winter, when the temperature is 50° F. or lower and the ants in their nests are inactive. The fires should be carefully guarded to prevent them from getting out of control and starting woodland fires. With labor in the South ordinarily not costing more than 12.5 cents an hour, and kerosene selling at 14 cents a gallon, the cost of treating is not more than $2 to $3 per acre.

Digging colonies out of the soil and burning them with a blowtorch is such a laborious task that it is prohibitive except where the ants have been almost completely exterminated. It is doubtful if it would be practical where there are more than one or two colonies per block. This work requires a higher type of labor than some of the other control work. It sometimes takes half a day or longer to burn out a large colony, which has many ramifying galleries in the soil. As a worker can only burn from one to three colonies a day by this method, the eradication of each colony would cost from $1.25 to $4. Waste oil, such as can be obtained from filling stations, is used to saturate the ground where the colony is dug up. From 3 to 4 gallons will saturate the ordinary nest.

The towns that have eradicated Argentine ants in Mississippi have used diverse methods in accomplishing this. In the 21 areas investigated by the Bureau of Entomolgy, the total cost of eradication per block has varied considerably. Since the adoption of the paper cups, however, and cheaper methods of combating the ants, the average yearly cost for eradication work has not been more than $3 to $6 per block.

SUCCESS OF CONTROL AND ERADICATION WORK IN MISSISSIPPI

In the summer of 1933 the writer and L. C. Murphree undertook an appraisal of the work done in Mississippi to control or eradicate the Argentine ant. For this study the State Plant Board kindly made available its records and offered both suggestions and advice. Seventeen towns, having a total of 21 infested areas, were selected in different sections of the State—4 towns in the southern third, 11 in the middle, and 2 in the northern third—where the infestations had

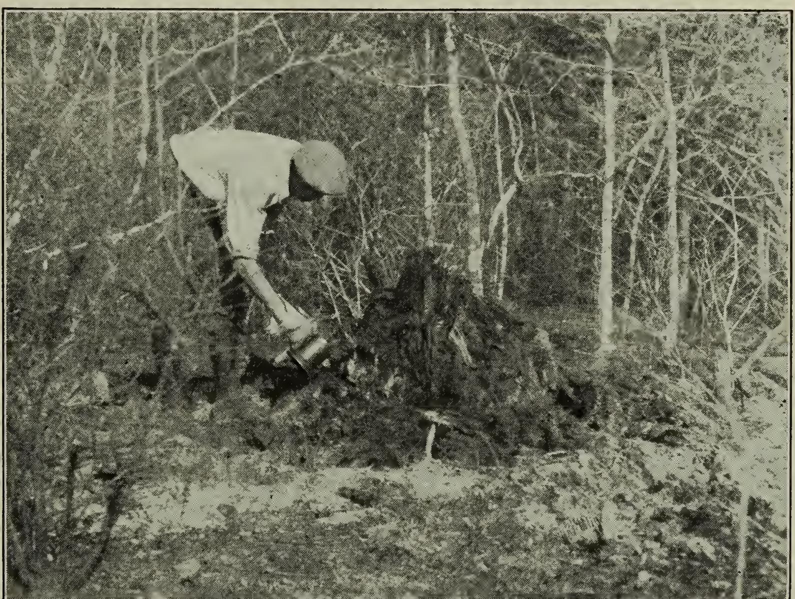

FIGURE 24.—Preparing to set fire to a stump heavily infested with Argentine ants.

been established for various periods of years, and the campaigns had differed both in measures and in the time required to destroy the ants. The infested areas ranged in size from 1 to 35 blocks. They also varied greatly in topography, quantity of vegetation, soil drainage, and density of human population. It seemed that, if the ants could be eradicated from such diverse habitats and under such adverse conditions, the methods employed in Mississippi might be recommended for general use elsewhere. In each area search for Argentine ants was made by foot-by-foot and block-by-block scouting. This work required from one to two man-days per block, and the entire task accupied from May 15 to September 17. As a result, 13 of the 21 areas, or 67.9 percent, were found to be free from the ants.

The plant board believes that at least 39 infestations out of the 245 known to have occurred in the State have been eradicated, and that this number would have been larger if more funds had been available for campaigns.

METHOD RECOMMENDED FOR THE CONTROL OR ERADICATION OF THE ARGENTINE ANT

The first step in the campaign is to delimit the infested area. Scouting for this purpose should be done late in the summer or early in the fall, and never when the temperature is below 65° to 70° F. In connection with the scouting a map of the infested area should be prepared which will not only be accurate, but clear to anyone using it. It should be drawn on such a scale that it can conveniently be used in the field. In addition to indicating the blocks and streets, it will prove helpful to note important landmarks, especially in those sections not represented by streets. The number of cups of poison required for each block can be indicated on the map.

The campaign should be put on in the fall or winter, when there is so little natural food available that the poison will prove attractive to the ants. For the comfort of the men it is best to do this in mild weather.

The poisoned bait recommended is the "standard Government-formula Argentine ant poison", which is a sirup containing sodium arsenite. Before being distributed it should be analyzed by a chemist, and if it does not meet the specifications it should be discarded.

The most satisfactory type of container for the poison is the paperoid cup. The most practical and economical method of filling the cups is in the field from tanks carried on the backs of the field crew. The cups should be placed from 20 to 25 feet apart, and they should be concealed as much as possible. On trees and posts they should be tacked as high as one can reach. On fences they are preferably placed low and, if the fence encloses domestic animals, outside the enclosure. Under houses that are open underneath, the cups can be put on the top of every third or fourth pillar, and under houses that are enclosed the cups can be fastened on the walls about 20 feet apart and as high as one can reach. Where there are no objects on which to tack the cups, they should be buried in the ground or placed in clumps of grass or bushes.

It is important to select the best type of labor available, as the success of the campaign is largely dependent on the thoroughness of the work. The men should be instructed before the work is begun and carefully supervised throughout the campaign.

On the completion of the campaign, an article should be prepared for a local newspaper explaining the nature of the poison, how it affects the ants, and the results that may be expected. Protection of the cups should be especially urged. An appeal to the children not to touch the cups can be directed through the superintendent of public schools. The aid of the Boy Scouts can also be enlisted.

The following summer the effectiveness of the campaign should be determined by questioning property owners, and the results of this survey published at once in the local paper. Later the margins of the entire infested area should be scouted to ascertain if the ants have spread since the previous fall or if any infested areas have been overlooked. The results of this scouting should be indicated on the same map that was used in the preliminary scouting. If the ants have spread, additional supplies should be included in the estimates for the second fall campaign; if not, the same quantity of supplies should be ordered. The second campaign should be handled in the same manner as the first.

If eradication is to be attempted, the summer following the second fall campaign a thorough scouting of the entire infested area should be made to determine the exact status of the ants. If the ants are rather generally distributed over the entire area and there are more than one or two colonies per block, the infested area should be repoisoned as in the previous fall. If, however, the ants have been nearly eradicated, it is only necessary to repoison within a radius of 50 feet from each colony located. This should be done immediately and again in the fall.

The following summer, if possible, the entire infested area should be thoroughly scouted. If time or funds do not permit, then those areas where colonies were previously found should be carefully examined. Often the ants have apparently been eradicated by the third summer, but in such a case the area should not be released as free until two additional annual scoutings have failed to disclose any ants.

The use of supplementary measures is often practicable when the abundance of ants has been reduced to a colony or less per block. Such colonies can be dug out and the ants burned with a torch, after which the ground should be well saturated with waste oil. Even at the beginning of the work, in wooded areas it is well to burn out as many colonies as possible by setting fire to logs and stumps and by gathering up all pieces of wood containing the ants and throwing them into a general fire. Every precaution should be taken to guard against forest fires.

SUMMARY

The Argentine ant, *Iridomyrmex humilis* (Mayr), is a pest of no little importance throughout the Southern States and in California. It is especially troublesome as a house-infesting insect, being present almost continuously throughout the year. Out of doors the ants feed on the honeydew produced by scale insects, mealybugs, and aphids, and do indirect damage to vegetation by fostering these insects. The ants also steal seeds from seed beds, kill young poultry and birds in their nests, destroy colonies of honeybees, and feed on the sap or fruit juices from certain trees and plants, particularly citrus.

The wide and rapid spread of this ant since its introduction sometime previous to 1891 has been accomplished chiefly by artificial means, the railroads being the principal means of dispersion. Natural spread is due mainly to crawling, which varies from a few feet to several hundred feet a year, but heavy rains, floods, etc., also play an important role. Flight is a negligible factor in the spread of this ant.

Argentine ants have been found in all types of soil and at elevations ranging from approximately sea level to nearly 4,000 feet. They seem to be affected by strong winds, and by moisture conditions in the soil. Although tropical insects, they can withstand more cold than most of our native ants.

It is estimated that the Argentine ant occurs over an area of at least 4,000 square miles in the United States. California and Louisiana are the most heavily infested States, and infestations also occur in Mis-

sissippi, Alabama, Georgia, Texas, South Carolina, Arkansas, North Carolina, Florida, Maryland, Tennessee, Arizona, Missouri, and Illinois (States listed in order of decreasing size of infested area). The size of the infestations varies from a single colony to areas containing several hundred square miles. Although as yet the ants are sporadically distributed over the States mentioned, except in Missouri, Maryland, and Illinois, where the infestations are of the indoor type, there is nothing to prevent them from occupying the entire area within their present boundaries and also from spreading to additional territory.

Efforts to control and eradicate the Argentine ant in Mississippi by poisoning campaigns have resulted in freeing 39 out of 245 infested localities, and reducing the infestations in nearly all the others. The method used in Mississippi is therefore described in some detail in this circular. The ants can be controlled by one thorough campaign, and by repeating the campaign each fall it is possible to eradicate them in from 2 to 5 years. The method consists, in brief, in making careful surveys of infested areas and then placing cups of sirup containing sodium arsenite at proper intervals throughout these areas. Where eradication is attempted, supplementary measures, such as burning and oiling colonies, expedite the work, although these should not be resorted to until the numbers have been greatly reduced. The cost of eradicating ants should not be more than 3 cents per cup of poison, or $3 to $6 per block.

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