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TEXAS AGRICULTURAL EXPERIMENT STATION

A. B. CONNER, DIRECTOR
College Station, Brazos County, Texas

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DIVISION OF ENTOMOLOGY

The Control of Fire Ants in the Lower Rio Grande Valley

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
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**In cooperation with U. S. Department of Agriculture.

†As of November 1, 1931.

The fire ant does severe damage to young citrus trees in the Lower Rio Grande Valley. The control of this pest is one of the major factors in the development of a citrus grove in this region.

Calcium cyanide, applied to the ant nests, has given satisfactory control of these insects. Paints and washes incorporating crude carbolic acid, creosote, or creolin compounds are not recommended for application to the citrus tree.

Poisoned baits, using arsenicals as the poison ingredient, have not given satisfactory control of fire ants. Where thallium sulphate has been used as the active poison, the baits have proved very satisfactory when applied to the nests in the proper manner. Two ounces of thallium sulphate per gallon of sugar syrup has proved to be the weakest solution which can be used in the bait to secure satisfactory control.

As reinfestations will occur at intervals, frequent inspections and treatment are necessary.

Thallium sulphate and calcium cyanide are very deadly poisons, and the handling of these materials should be entrusted only to those who are thoroughly familiar with their dangerous properties.

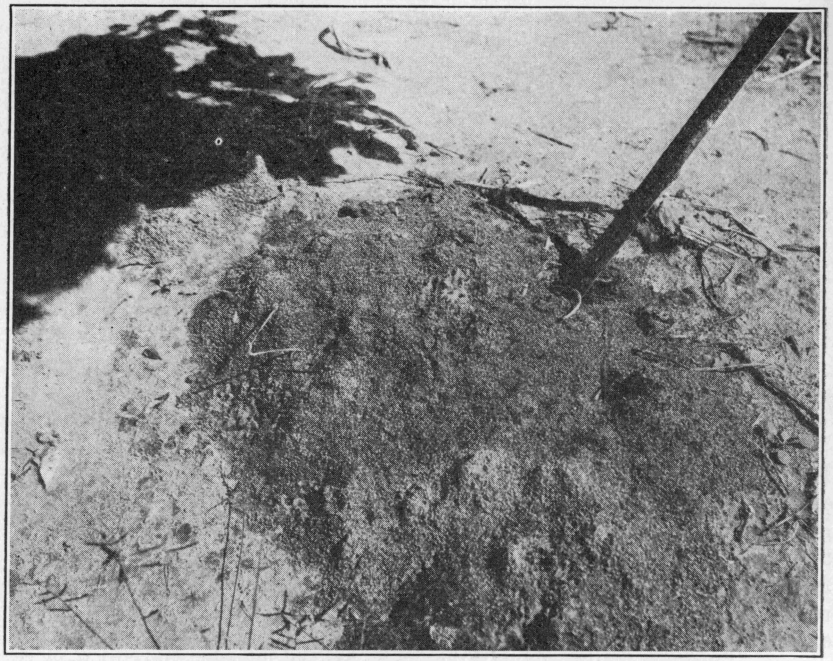

Fig. 1.—Nest of the fire ant—Solenopsis geminata (Fabr.)

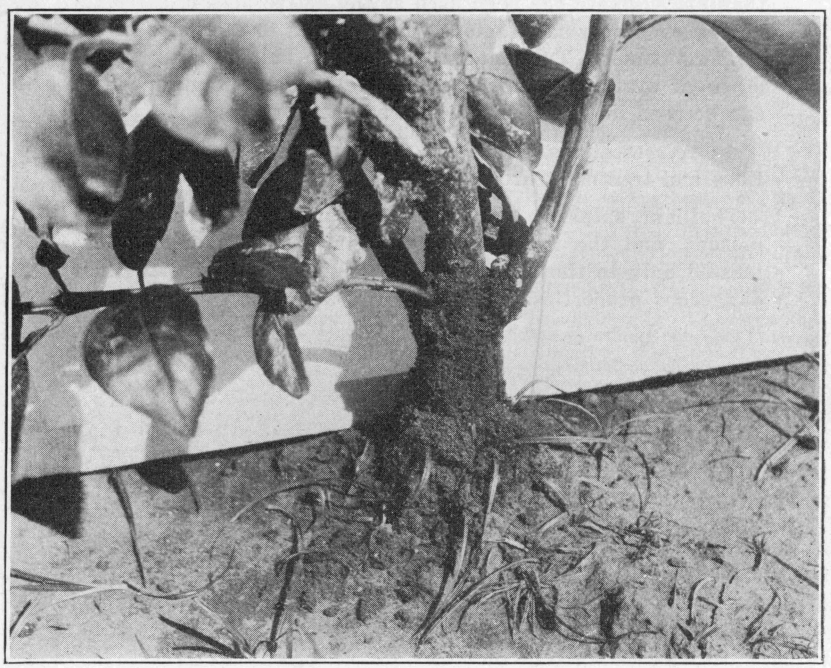

Fig 2.—Nest of the fire ant at the base of citrus showing the feeding areas plastered with dirt.

BULLETIN NO. 435 NOVEMBER, 1931

THE CONTROL OF FIRE ANTS IN THE LOWER RIO GRANDE VALLEY

S. W. CLARK

The fire ant, *Solenopsis geminata* (Fabr.), causes severe injury to young citrus trees throughout the whole Lower Rio Grande Valley. This species is tropical, subtropical, and temperate, ranging from South and Southwestern United States into tropical America. On the Pacific Coast it ranges northward into British Columbia. Severe damage to commercial crops often occurs in all sections where this species is present. Its food consists of portions of various plants, including the leaves, bark, and tender twigs, larvae of many insects, honey dew from aphids and scale insects, and various kinds of seeds. It has been reported as feeding on citrus from Porto Rico, California, Arizona,* and Texas.†

ECONOMIC IMPORTANCE

In Texas the fire ant builds its nests at the bases of citrus trees (Fig. 2) and feeds on the bark or young tender branches and causes severe injury to the tree (Fig. 3). Oftentimes the ants will completely girdle the tree and thereby cause its death. The species ranks first in importance as a pest of young citrus and is the third most important pest of citrus in this section. One extensive operator has stated that he lost more trees from fire-ant injury during 1930 than he lost in the freeze of 1929-30. Thousands of dollars have been expended during the last six years on fire-ant control, and thousands of trees have been killed during this period by fire ants and from the use of various mixtures. Arsenical poisons, various disinfectants, and paints have all been tried by various growers, and in most cases the materials gave little or no control and many times were disastrous to the trees.

DESCRIPTION OF THE SPECIES

The fire ant is a small ant, varying in length from 1 mm. in the smaller workers to 5 to 6 mm. in the larger winged forms. The color of the workers is pale-yellowish or reddish with a blackish abdomen. To the casual observer they appear to be entirely reddish in color. The larger forms may be entirely red or black. They construct rather large nests, which may be distinguished by the extensive mounds of earth which are deposited about the openings (Figs. 1 and 2). The ants

*E. O. Essig, 1930. Texas Citriculture, July, 1930, p. 15.

†S. W. Clark, 1929. Texas Citriculture, September, 1929, p. 36.

are very pugnacious and, when the nest is disturbed, rush out and attack anything within reach. The bite is very painful, giving rise to the common name for the insect.

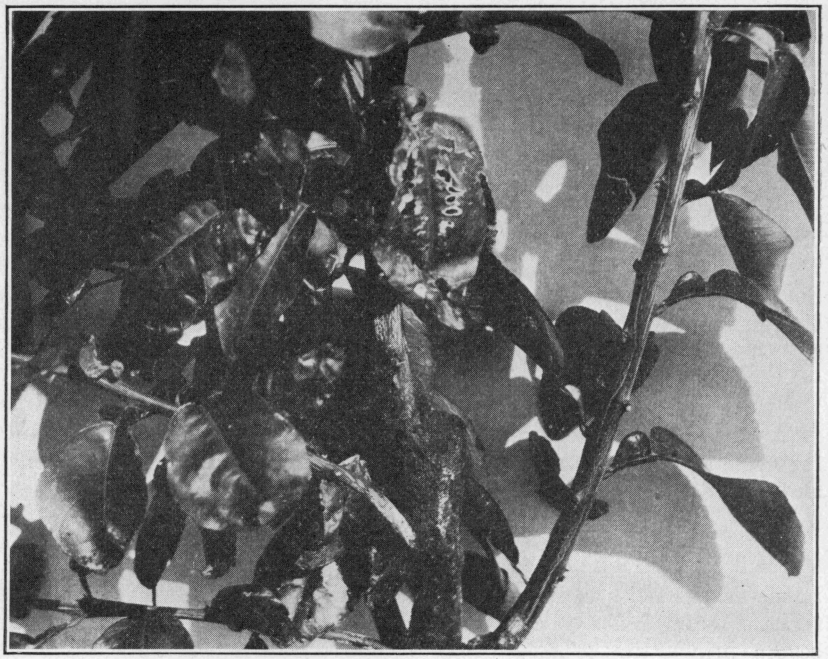

Fig. 3.—Fire-ant injury to young citrus tree showing gum exudation and injured bark.

CONTROL INVESTIGATIONS

In 1925 a number of materials were tested in the control of fire ants, and at that time it was first proved that calcium cyanide could be used to good advantage in controlling these pests in the Lower Rio Grande Valley. The following table shows the results with various compounds during the season.

Table 1. Results in fire-ant control by the use of poisoned bait, repellents, and fumigants in 1925.

Materials	Efficiency	Remarks
Paradichlorobenzene	Ineffective	Later proved to cause severe injury to tree.
Sodium fluoride	Partially effective	Number of ants reduced and some repellent action.
Corn meal and arsenate of lead	Ineffective	Some ants killed.
Tobacco dust	Ineffective	Few ants killed.
Sulphur-naphthalene	Ineffective	Later proved to cause severe injury to tree.
Calcium cyanide dust	Effective	Control 100 per cent in two applications. No injury to tree if used properly.

Later tests conducted, utilizing carbon bisulphide, miscible carbon bisulphide, and calcium cyanide applied to the nests, showed the cyanide to be the cheapest and most effective material. Many tests with concoctions of poison baits, incorporating several arsenical poisons and many different types of carriers, such as corn meal, syrups, greases, and cooked breads, gave negligible results.

Sulfur washes and Bordeaux paints, applied to the trees, had no repellent effect on the ants. Paints, washes, and emulsions, incorporating crude carbolic acid, creolin, creosote, and the like, were not tried, as they are considered too hazardous to the tree in the hands of most operators.

Experience has shown that arsenical dusts or sprays should never be used near or upon a citrus tree.

Tests in 1930. In the fall of 1930, tests with baits, using the poison, thallium sulphate, gave most promising results. Thallium sulphate was first used in poison baits for ants by C. H. Popenoe* in 1926, and was first recommended for use against fire ants by E. O. Essig† in 1930.

Table 2 gives the results of initial tests utilizing this material. Baits were placed at the nests of 46 colonies on October 27, and these baits were renewed November 4. Frequent observations were made thereafter until November 6, upon which date the colonies were dug out and thoroughly examined for live ants.

It was noted that the ants carried the poisoned syrup into the nests. The older ants usually died within the nest; however, numbers of sick ants were noted wandering over the surface of the ground. Those ants dying within the nest would be carried to the surface by the workers and deposited in some convenient location. Many times, when the nests were dug out, large quantities of dead ants would be noted within the burrows. It was apparent that, since the thallium sulphate was a slow-acting, cumulative poison, it took some time to be effective and the ants had ample opportunity to carry it to the nest and feed it to the young.

Table 2. Control of fire ants with poison bait, using thallium sulphate, Fall 1930

Treatment	Strong Colonies		Medium Colonies		Weak Colonies		Check		Total	
	Number treated	Number exterminated	Number treated	Number exterminated	Number treated	Number exterminated	Number Checks	Number exterminated	Number Colonies	Number exterminated
3.2 ounces thallium sulphate per gallon sugar syrup.....	28	23	14	12	4	4	4	0	46	39
Per cent control...	82.1		85.7		100		0		89.3	

It will be noted in Table 2 that of the 46 colonies treated only seven survived. It is believed that these colonies would have been killed in a few more days, but the bait boxes were accidentally destroyed. The boxes used for the bait were ordinary pill boxes and were too small

*C. H. Popenoe, 1926. A New Use for Thallium Compounds, Am. Jour. Pharm., 98:693.

†E. O. Essig, 1930. The Fire Ant, Texas Citriculture, July, 1930, p. 15.

Table 3. Strengths of thallium sulphate per gallon of sugar syrup and effects on fire ants, 1931.

Treatment	Strong Colonies			Medium Colonies			Weak Colonies			Totals		
	Number treated	Number exterminated	Per cent control	Number treated	Number exterminated	Per cent control	Number treated	Number exterminated	Per cent control	Number Colonies	Number exterminated	Per cent control
3½ ounces thallium sulphate per gallon sugar syrup...	2	2	100	5	5	100	0	0	0	7	7	100
3 ounces thallium sulphate per gallon sugar syrup....	6	6	100	0	0	0	1	1	100	7	7	100
2½ ounces thallium sulphate per gallon sugar syrup....	6	6	100	1	1	100	0	0	0	7	7	100
2 ounces thallium sulphate per gallon sugar syrup....	5	5	100	1	1	100	1	1	100	7	7	100
1½ ounces thallium sulphate per gallon sugar syrup....	7	6	85.7	1	1	100	3	3	100	11	10	90.9
1 ounce thallium sulphate per gallon sugar syrup....	4	3	75	0	0	0	0	0	0	4	3	75
½ ounce thallium sulphate per gallon sugar syrup....	3	2	66.7	1	1	100	0	0	0	4	3	75
Sugar syrup, no poison, check.....	4	0	0	0	0	0	0	0	0	4	0	0
	5	0	0	1	0	0	1	0	0	7	0	0

for the purpose at hand. The containers should be large enough to hold sufficient bait to kill out a single colony. Sponges cut to fit the bait boxes were used to enable the ants to readily obtain the syrup. The bait used in this test was made of the following ingredients: sugar, 12 pounds; honey, 2 pounds; water, 11 pints; thallium sulphate, ½ pound.

Tests in 1931. In view of the exceptional results obtained during the fall of 1930, it was deemed advisable to conduct further tests in order to determine the weakest solution of poison it would be possible to use and obtain satisfactory results. Table 3 shows the results of these tests. It will be noted that some control was obtained with as little as one ounce of thallium sulphate per gallon of syrup. All nests were dug out eight days after the treatment. The stock syrup was made as follows: sugar, 5 pounds; honey, ½ pound; water, 4½ pints. This made one gallon of solution, to which was added poison of various strengths. The syrup was poured on sponges which had been placed in one-half-pint ice cream containers. This type of container was superior to the smaller boxes, as frequent refilling was unnecessary. A small opening was cut in the side of the container (Fig. 4.) This type of container was waterproof and durable and proved to be very satisfactory.

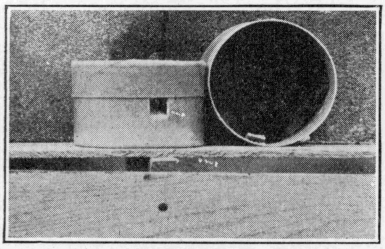

Fig. 4.—Type of poison bait box used in the later tests with thallium sulphate baits.

In order to determine the effectiveness of thallium sulphate baits during the summer season, tests of three strengths of poison were conducted during August. The summarized results of these tests are presented in Table 4.

Table 4. Effect of different strengths of thallium sulphate baits on fire ants during the summer, 1931.

Treatment	Strong Colonies		Medium Colonies		Weak Colonies		Total	
	Number treated	Number exterminated	Number treated	Number exterminated	Number treated	Number exterminated	Number colonies treated	Number colonies exterminated
1½ ounces thallium sulphate per gallon sugar syrup	7	4	9	8	10	10	26	22
Per cent control	57.2		88.9		100		84.6	
2 ounces thallium sulphate per gallon gallon sugar syrup	8	5	8	6	10	10	26	21
Per cent control	62.5		75.0		100		80.8	
2½ ounces thallium sulphate per gallon sugar syrup	4	3	2	2	4	4	10	9
Per cent control	75.0		100		100		90.0	

It will be noted in Table 4 that the control with all three strengths of poisoned bait was very satisfactory. The bait boxes were placed at the nests on August 14 and were removed on August 19, or slightly

more than four days. All nests were dug out August 20 to determine the condition of the colony. A recheck one week later confirmed the results as given in Table 4.

The trees used in this test were in an orchard which had been previously treated for fire ants by the owner. A proprietary thallium-sulphate-syrup mixture had been used but did not give satisfactory control. There were several factors which influenced the effectiveness of this treatment. The small quantity of poisoned syrup used, the excessive amount of absorptive material, and the small openings in the containers contributed to the poor results obtained.

In view of the fact that liquid syrups with thallium sulphate were giving excellent results in fire-ant control, but were subject to a certain amount of evaporation, sugar candies were made up, utilizing various strengths of thallium sulphate. All the baits gave a certain degree of control. The bait of the weakest strength, which contained 2½ grams of thallium sulphate per unit, gave the highest degree of kill. The candy used in these tests was made as follows: sugar, 4 cups; water, 1 cup; vinegar, 1 teaspoonful. The ants did not take to the candies as readily as to the syrup, and a longer time was necessary before any control was noticeable.

RECOMMENDATIONS

It is apparent that success in controlling fire ants, feeding upon citrus trees, depends upon several factors. Frequent inspections of the grove are necessary, regardless of treatment used. If thallium sulphate syrup is used, suitable containers are a necessity. The entrance of the ants into the boxes should be facilitated by making a large opening in the container (Fig. 4). Sufficient bait should be placed in the container so that there is no interruption to the feeding of the ants. It is necessary that the boxes be placed so that the ants may have no difficulty in carrying large quantities of the syrup into the nest.

At certain times and under certain conditions it will be noted that the ants may prefer their natural food to the poisoned syrup. Presence of scale insects or aphids upon the trees or other plants will necessitate control measures for them before the ants can be satisfactorily controlled. Under other conditions, when the ants refuse to eat the syrup, calcium cyanide should be used.

Fire-ant nests in the tree rows or away from the trunks of the trees should be treated with calcium cyanide.

It has been noted that while the weaker solutions of poisoned syrup will effect control in a period of time, the stronger solutions will give quicker results. However, as the poison is the most costly ingredient, the cost increases in proportion to the amount of thallium sulphate used.

Fire ants, when feeding in boxes, will carry small particles of dirt into the box and deposit them around the opening, both inside and out. This does not affect the toxicity of the material but facilitates the feeding of the ants and should cause the grower no concern.

By the judicious use of a combination treatment of calcium cyanide and thallium sulphate syrup, the average grove may be practically rid

of fire ant colonies and subsequent injury. Reinfestations will occur and frequent inspections and treatment are necessary.

Preparation of Thallium Sulphate Bait and Its Use

The formula suggested for preparation of the bait is as follows:

Water	4½ pints
Thallium sulphate	2 ounces
Sugar	5 pounds
Honey	½ pound

Dissolve the thallium sulphate in the four and one-half pints of water. This may be boiled to accomplish the purpose. Use precautions against breathing the fumes during the process. After the poison is in solution, add the sugar and honey and stir until the sugar is dissolved. Add enough water to bring the total to one gallon.

Cut a piece of sponge to fit the container to be used and soak the sponge thoroughly in water, squeeze the sponge dry, place in the container, and pour at least four tablespoonfuls of the poisoned bait over it. The bait is then ready for use. Non-resinous excelsior may be used instead of the sponge and is to be preferred because of its cheapness.

Place the box containing the poisoned bait in the center of the nest and tap lightly with the finger until the ants emerge and climb up the bait box. Where the nest is very large, two bait boxes should be used.

After the ants are killed, the trunk of the tree should be scraped free of mud and gum and painted with Bordeaux paste. The Bordeaux paste should be prepared with dry Bordeaux and water, being mixed to the consistency of house paint. The boxes may be refilled and used again. Dirt which has been plastered over the opening should be removed.

CAUTION. Thallium sulphate* is very poisonous and is without taste, smell, or other warning property. The preparation of syrups containing this material should be entrusted only to persons who understand its dangerous qualities and will exercise extreme care in handling it. As the fumes of thallium sulphate are poisonous when breathed, do not prepare the poison bait indoors. The poison may be absorbed through the skin, and rubber gloves should be used in all handling of this material Do not place this bait where children, irresponsible persons, or domestic animals will have access to it.

ANTIDOTE. *Call a physician.* Induce vomiting by inserting finger in the throat or by the use of emetics, such as mustard or salt in warm water. After the stomach has been emptied, the patient should take Epsom or Glauber salts; milk of magnesia is also recommended.

Calcium Cyanide Dust and Its Use

Calcium cyanide, when it comes into contact with moisture, gives off fumes which are deadly to life. Therefore, it is necessary to use precautions against breathing the gas.

*J. C. Munch and J. Silver. The Pharmacology of Thallium and Its Use in Rodent Control. U. S. D. A. Tech. Bul. 238:1931.

Fire ants may be effectively controlled by this material (Table 1). When applying calcium cyanide near the trees, always use a dust gun. The nests of ants should be thoroughly disturbed with a bar of some kind (Fig. 1), and as the ants rush out, the dust should be applied as a light covering over the surface of the soil. Where the nests are some distance from the tree, the material should be stirred into the nest and covered with soil. Where the nest is located near the tree, the cyanide should not be covered but should be allowed to remain exposed to the air. Use great care to avoid getting any quantity of the material on the trunk of the tree, particularly if it has been previously painted with Bordeaux mixture.

CAUTION. The fumes from calcium cyanide are very poisonous when breathed and all precautions must be used to prevent any quantity from being taken into the lungs. This poison should be kept from the hands of careless or irresponsibe persons.

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SUMMARY

1. The fire ant, *Solenopsis geminata* (Fabr.) causes severe injury to young citrus trees in the Lower Rio Grande Valley of Texas.

2. Calcium cyanide dust applied to the nests will give a good measure of control; however, there is some danger to the tree where nests are close to the base, and when the material is in the hands of inexperienced or careless operators.

3. Poisoned baits, utilizing arsenicals as the active poison ingredient, were ineffective in fire-ant control under the conditions of these tests.

4. Crude carbolic acid, creosote, and creolin compounds are not recommended for use in protecting citrus trees from ants.

5. Poisoned bait, incorporating thallium sulphate as the active poison, was very efficient in control of the fire ant under the conditions of these experiments.

6. The per cent of poison in the syrup suggested in this publication is the lowest which should be used to obtain satisfactory control. Extermination may be hastened by increasing the percentage of poison in the mixture.

7. After the ants have been killed, the wounded areas of the trees should be cleaned and Bordeaux paint applied.

8. Thallium sulphate is a deadly poison, and great care should be exercised in handling it. Do not place the bait where children or animals will have access to it.