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EXTRAIT

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The town ant, *Atta texana* (Buckley) is the northernmost representative of the most specialized genus of Attini, a New World tribe of fungus-growing myrmicine ants. Colonies are found in central Louisiana; eastern, central and southern Texas; and eastern Mexico as far south as Vera Cruz. They are restricted to sandy soils and are usually located on tops of ridges. Nest surfaces often cover areas of 1/5 ha, and excavations may reach a depth of 7 m. Fungus gardens are raised in cavities whose volumes average about 4 l. A large nest may contain 1,000 or more cavities.

This paper describes the annual series of flights from town ant colonies. At least 5 months of preparation are involved, and alates may spend weeks in nests waiting for favorable weather. When conditions are right, the ants perform a series of complex activities that culminate in a swarm just before dawn. Time of flight is so exact that it can usually be predicted within minutes.

Materials and methods.

More than 50 flights from about 20 nests were observed between 1959 and 1966. Surface observations were supplemented by bulldozer excavations to check brood development.

Each spring, nests in predetermined study areas in central Louisiana were watched for signs of impending flights. Just before flights, air and ground temperatures, relative humidity, soil moisture, cloud cover,

wind direction and velocity, and amount of moonlight were recorded at the nest. In addition, condition of the nest and activities of workers and alates were noted. Unsuccessful attempts were made to determine how far and in what direction alates flew, where and how they mated, and how many survived. Behavior of queens after landings was observed, and their new colonies were checked periodically for growth. The sperm in males and fertile females were counted.

Early preparations.

The nest exterior prior to nuptial flights is similar to that described for *A. sexdens* L. by AUTUORI (1956). About 1 month before flights, excavation by workers stops, and the mounds of excavated subsoil are quickly eroded by rain (fig. 1). The ants cover entrance holes with grass and pine straw during the day, giving the active portion of nest the appearance of a tiny village of thatched huts. Some medium sized nests are eroded and thatched only in a small area where take-off occurs. In some years, a large colony may produce no flights, in which case, excavation continues normally (fig. 2). For example, in 1961 3 of the 14 large colonies under observation did not swarm.

On most large nests, flights were from the center, but on some the flights originated from recent areas of excavation at one side; an occurrence similar to that described by AUTUORI (1947) for *A. sexdens*.

Alate broods. — Alate broods were reared either in lower cavities of nests during February and March, or in upper cavities during April and early May. Those found in lower cavities were in well-drained soil, and worker broods were never present. Some alate broods in upper cavities were mixed with worker broods. Rearing in upper cavities was observed later in the season than in lower cavities because a colony does not begin to move fungus gardens to surface cavities until April in Louisiana. It is not known whether alates are reared at both levels in the same nest.

Sexual broods were found in the lower cavities of three nests. One excavated March 2, 1959, contained several hundred mature larvae at depths of 5.5 to 6 m in irregular-shaped dormancy cavities. The cavities were much larger than those in summer nests (MOSER, 1963), and each held several liters of fungus substrate. A colony exposed on March 6 included 1,272 mature larvae, 211 male prepupae and pupae, and 206 female prepupae and pupae in large cavities at depths of 3.4 to 4 m. On March 24, a third excavation revealed several hundred mature larvae and pupae and a few teneral males in a large central cavity. The cavity was 2.4 to 3.7 m below the surface and held a fungus garden.

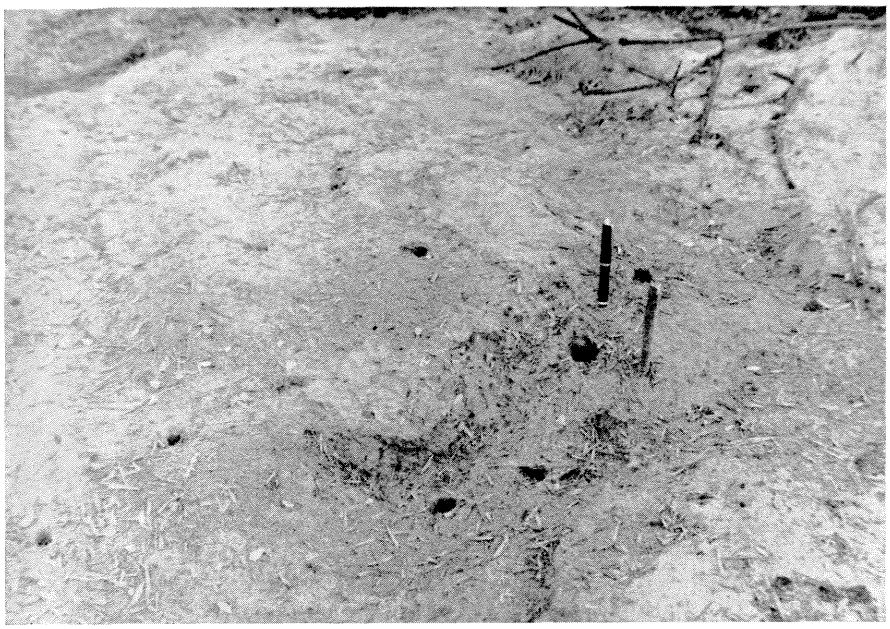

FIG. 1. — After a mating flight, the surface of a nest is strewn with twigs and grass blades clipped by workers. Excavation mounds have been eroded by rain, and entrances are enlarged.

FIG. 2. — Surface of large nest on which no swarming will occur.

Six nests opened by ECHOLS (1) in central Louisiana between April and May contained alate larvae, pupae, and teneral adults together with worker broods in cavities 0.3 to 1.2 m from the soil surface. All nests were in compact sandy-clay soil. ECHOLS found no alate broods in upper cavities of nests on sandier soil in the same area.

WALTER *et al.* (1939) found sexual larvae on March 14 and mature alates on April 1 in *A. texana* nests near San Antonio, Texas.

Amante discovered alate broods of *A. sexdens rubropilosa* Forel and *A. lævigata* (Fr. Smith) in upper and lower cavities, mixed with worker broods near Sao Paulo, Brazil. He found that worker broods were produced in all seasons, but alate broods only in winter (July and early August). In Surinam, GEIJSKES (1953) found alate broods of *A. sexdens* from November to January.

Alates prior to swarming. — Winged adults appear in the spring when the workers are constructing fungus gardens in upper cavities. The whole colony moves into the upper 2 m. of the nest in early to late April, depending on how quickly warm weather arrives. The first winged adults were found on April 4, and their numbers gradually increased until mid-May, when they became abundant. Usually, alates were more numerous in cavities filled with fungus gardens than in those that were partially full. They were never found in empty cavities.

Worker broods were always present in nests containing winged adults, but their number and stage of development varied from one cavity to another. There was no apparent correlation between number of alates in cavities and number or stage of worker broods.

The number and sex ratio of alates in a chamber varied greatly. In 1961, a total of 875 queens and 1,080 males were found in 26 cavities. There were averages of 42 ± 28 males and 34 ± 40 females in each cavity. Some chambers contained only one male or one female. The greatest numbers of each sex per chamber were 316 males (with 61 females), and 180 females (with 85 males). AUTUORI (1949) showed that males always greatly outnumbered alate females in nests of *A. sexdens*, *A. bisphærica* Forel, and *A. lævigata*.

Swarming conditions.

In temperate zones flights begin in spring. Thus, colonies of *A. sexdens* in Sao Paulo swarm in September, and colonies of *A. texana* in Louisiana swarm in May. In the tropics, flights coincide with the rainy seasons. GEIJSKES (1953) states that in Surinam *A. sexdens*

(1) An undated citation signifies that the information was obtained through personal communication. The author thanks ELPIDIO AMANTE of the Instituto Biologico, Sao Paulo, Brazil; Dr. P. S. CALLAHAN, U. S. Department of Agriculture, Southern Grain Insects Laboratory, Tifton, Georgia; H. W. ECHOLS, Oregon State University, Corvallis, Oregon; and Dr. N. A. WEBER, Swarthmore College, Swarthmore, Pennsylvania, for permission to quote from their field notes and interpret their data.

swarms during the minor rainy season in January, but *A. cephalotes* L. flies during the major rainy season in May.

The insects must be physiologically ready before preswarming begins. In addition, moisture, temperature, humidity, wind, and possibly light influence the time of flights. The conditions necessary for flight are discussed in chronological order.

Readiness. — Winged adults remained in upper cavities for 1 to 2 months before flying. Although environmental conditions appeared to be favorable earlier in the year, major flights seldom occurred until after May 19. One exception was a swarm of about 25 individuals on April 28, 1962. Another was a flight observed by WALTER *et al.* (1938) on May 10 in Texas.

One colony under observation did not start its series of flights until June 25, despite favorable weather on several nights in May and on June 14. Why alates remain in nests so long is obscure. They may have to « fatten » before flight. Colonies may not be fully transferred from lower to upper cavities until late May, and this may affect flight timing. Perhaps photoperiod is involved.

Rain. — Flight series were always preceded by a rain of at least 7 mm, i.e., enough to soak the nest surface. If rain was heavy, alates from a nest swarmed on 3 to 4 successive nights, until the ground dried. After a light rain, the alates often swarmed only 1 night.

When other conditions were favorable, swarming could be artificially induced by wetting nests. Probably, the water must be sprinkled over a period of about 1 hour; in two instances, apparently sufficient quantities of water were applied in about 15 minutes, and the ants did not respond.

Periods of alternate rain and drought are common in Louisiana in May and June. Normally, several flights are initiated from each nest after each rain. Swarming usually ceased by June 15, but in 1960 a few alates issued from one nest as late as July 7.

AUTUORI (1956) found that impending rain triggered flights of *A. sexdens*—that the surface of the nests did not have to be wet. AMANTE observed no flights of *A. sexdens* in 1963, a dry year. Apparently, flights were delayed until May of the following year. AMANTE also noted responses by *A. sexdens* and *A. lævigata* to alternate periods of rain and drought similar to those described for *A. texana.*

Prerevoada. — Immediately after a rain, major workers come out of the enlarged exit holes. If the rain ends during the day, workers mill around on nest surfaces that are shaded from the hot sun. By dusk, workers cover the nest and vicinity.

When foraging or excavating, workers are usually docile outside nests, but preceding flights they are irritable and run about with their mandibles open. They attack and cut almost anything, even sticks and leaves. Insects, frogs, and lizards that wander over the nest are

quickly dismembered. Armadillos and other large mammals are driven off. Major workers, which are rarely seen on trails, now become plentiful, and quickly draw blood from exposed skin of the hands, neck, and face. Shoestrings are sometimes severed, and worker heads often remain attached to khaki pants through several washings. On mornings after flights, vegetation on nests and surrounding areas appears as if cut by a lawnmower (fig. 1). Cut materials are usually not taken into the nests.

The process that causes workers to run about during preswarming is not known. A similar behavior is induced by exposing docile

FIG. 3. — Workers and alates on nest during preswarming.

workers to the contents of a crushed mandibular gland, but the distinctive odor of the gland contents was not detected on nests during preswarming.

Activities of alates appear to be independent of those of workers. Workers were never observed forcing alates into or out of nests. Shortly after dark (about 8 p. m.) alates started showing their heads at holes, and within an hour, a few appeared on the surface. When a major flight was forthcoming, 50 to 100 were out by 10 p. m. At midnight, as many as 2,000 were on the surface, and by 3: 30 a.m., 5,000 or more (fig. 3).

A photograph of numerous preswarming workers and alates of *A. sexdens* (AMANTE, 1964) indicates that their behavior is similar to that of *A. texana*.

Revoada.

Alates flew as early as 3:30 and as late as 4:15 a.m., but most flights were between 3:55 and 4 a.m.—about 15 minutes before dawn. Most alates on the nest surface flew within 2 to 3 minutes. A few individuals briefly, then most rose into the air with a roaring sound.

Alates of *A. texana* take off directly from the ground. In contrast, AUTUORI (1956) observed alates of *A. sexdens* taking off from twigs or bushes. Females took off first, followed by males shortly after 3 p.m. Flights of *A. sexdens* also seemed to be affected by wind direction. AMANTE says that alates of *A. sexdens* near Sao Paulo usually take off from 1 to 3 p.m., but occasionally as early as 10 a.m. He further notes that sexuals usually appear about 30 minutes after the start of the prerevoada. Alates do not take off en masse like those of *A. texana*. Instead, they arise individually for 3 to 4 hours. If a strong wind arises during this period, flight ceases and the remaining alates reenter the nest.

Callahan caught several male and female *A. mexicana* (F. Smith) on an August night at a black light near Vera Cruz, Mexico.

Swarming alates of *A. texana* were seen in moonlight once. At other times, their actions in the darkness were indicated by the low-pitched hum of their wings. During flights, relative humidity was always 98 to 100 % and there was little or no wind.

Preswarming by workers was observed only at temperatures above 12.5° C. At 13°, alates appeared at the holes, but none came to the surface. On one occasion, about 50 alates emerged when the temperature was 16°. Some fluttered, but none took off. On another night a few flew at 16°. Hence, 16° appears to be near the minimum temperature for flight. The maximum temperature was not determined, but one large flight occurred at 25.5°.

Although most alates on the nest surface take off, no more than half leave the colony in any one flight. Those that do not fly are inside when swarming takes place. On subsequent favorable nights about one-half of the remaining alates fly. As the ground dries, however, the number that fly is drastically reduced.

These conclusions are supported by observations of four nests during 1961. The first and largest of two flight series began on May 24, after a rain of 26 mm, and continued for 3 consecutive nights. About 2,000 sexuals flew from the largest nest, and about 500 from each of the three smaller nests on the first night. The next night, about 500 issued from the largest nest, and about 150 flew from each of the other nests. By the third night, the ground was almost dry and no more than 30 sexuals flew from all four nests. For the next few nights, the ground was dry, and the air temperature was 9.5°; not even preswarming activity by workers was seen. About 5,000 alates flew from all four nests during the first series of swarms.

The second series began on June 11 after a rain of 13 mm. Some rain fell almost every day thereafter, and the ground remained wet until August 1. About 800 alates flew from the nests the first night, 400 the second, 200 the third, 150 the fourth, 30 the fifth, and 10 the sixth. By the seventh night (June 17), the nests were almost exhausted and no sexuals flew, although some workers continued preswarming activities. The last evidence of swarming was on June 23 when two or three alates flew from the largest nest. About 10 other alates were also on the nest, but each had at least one wing missing. By July 1, all traces of preswarming by workers stopped on the largest nest. About 1,500 sexuals issued from all four nests during the second series.

Insecticide was applied to a nest just prior to swarming to determine what portion of the alates appeared on the surface on individual nights. About 10 p.m., 2.3 kg of 10 % heptachlor granules were broadcast over an area with a 10-foot radius at the center of a nest. Preswarming was heavy, and about 1,000 alates were already on the nest. Nine hours later, about 4 l of dead workers and 50 dead alates were on the surface. They were removed. The following night, another inspection was made when preswarming was in progress. The number of large workers was drastically reduced; only a few accompanied about 200 alates. On the third night, about the same number of workers and alates were seen, but 24 hours later only about 100 workers and 50 queens (but no males) were present.

Three weeks later, another rain triggered a second series of swarms in the area, but there was no activity on the treated nest. All holes had been closed by the rain. By October the colony was active again around a large excavation about 16.5 m from the original nest center.

It appears that most of the large workers but only a portion of the alates came to the nest surface on the night of the first swarm. Ants that touched the granules would certainly have died within 12 hours. The colony probably was maintained underground by minor workers, which rarely come to surface. Its vigor probably was renewed by large workers that subsequently emerged from the brood.

Alates are photonegative when they first appear outside, but thereafter become progressively photopositive. Before midnight, light makes them retreat into the nest. At 1 a.m., a floodlight will cause a few to fly several feet from the ground, and at 2 a.m. many will fly briefly. After 3: 30 a.m., a flashlight may cause premature swarming. Any visible light during the swarm, no matter how weak, attracted many alates. A dim red light elicited some response, but no ants were attracted to infrared radiation. After a flight, the few remaining alates on nests almost immediately become photonegative and quickly return underground.

Circadian rhythm. — Take off occurs about 15 minutes before dawn; it is probably initiated by a biological clock. Apparently, circadian

rhythm triggers all nests at the same time, because on several occasions alates from more than one nest swarmed at the same time.

The feeble radiation produced by astronomical and nautical twilight, which coincide with time of swarming, can be ruled out as possible stimuli to swarming for two reasons. First, swarming has been observed on schedule under a dense cloud cover that would filter out weak light, and second, swarming has occurred between 3: 55 and 4 a.m. under moonlight bright enough to read by—light more intense than nautical twilight.

How far alates fly has not been determined, nor has mating been seen. Several thousand queens from different nests were marked with paint, but none were recovered.

In the laboratory, queens and males taken from cavities were induced to fly in the daytime by blowing on their wings. They also flew after being tossed into the air. They usually rose vertically 60 to 90 m, then flew parallel to the ground at about 19.2 kmph.

One female with a thread glued to its thorax flew for 35 minutes, and others flew for shorter periods. Assuming a queen can fly a maximum of 35 minutes at 19.2 kmph, she has a range of 10.4 km. Apparently, alates cannot fly more than 50 km, because none have crossed the Mississippi Delta and infested the Southeastern United States. Since the air is usually calm at 4 a.m., wind velocity and direction normally do not influence dispersal.

Unlike alates of South American species of *Atta*, those of *A. texana* are almost impossible to find after flights. However, males and queens are strongly attracted to bright lights in the vicinity of nests. Apparently, the closer the lights are to a nest the sooner the ants are attracted, and the less chance they have to mate. When lights were within 0.8 km, only about 6 % of the females had a full spermatheca. When lights were at least 3.2 km from nests, 50 % of the females were fertilized.

Fertility was determined by dissecting 100 queens following flights and counting spermatozoa in the spermatheca. Mated queens with wings were never found in nest cavities or on the nest surface, and males were not attached to queens that landed at lights. It is concluded, therefore, that mating takes place in the air, and that 50 % or more of the females may be inseminated.

Predators and associates. — Many alates are eaten by birds and bats, which often appear during flights. Because of darkness, it has not been possible to identify most of the predators. A red bat, *Lasiurus borealis* (Muller), was caught in a mist net, and WARTER *et al.* (1962) found alates in stomachs of nighthawks, *Chordeiles minor* (Forster). Numerous unidentified species of birds were seen catching alates near artificial lights. DAGUERRE (1945) photographed many birds over a swarming colony of *A. sexdens*.

ARMADILLOS were observed eating winged ants before flights on

nests where preswarming by workers was moderate or light, but they rarely ventured on nests where preswarming was heavy.

Female roaches, *Attaphila fungicola* Wheeler, frequently ride on alates (MOSER, 1964) (fig. 4), and they have been found in new burrows made by queens. Occasionally, last instar nymphs are also phoretic.

Alates are relatively free of phoretic mites. About 30 deutonymphs of a uropodid, *Fuscuorpoda* sp. nr. *marginata* (Koch) (det. B. D. Ainscough) were attached with characteristic fecal tubes to a winged female taken from the surface of one nest. Several females of another uropodid, *Oplitis* sp. (det. B. D. Ainscough), apparently attached with first legs, were taken from queens. Sixty females of a new species of *Proctolælaps* (det. E. E. Lindquist) were found on

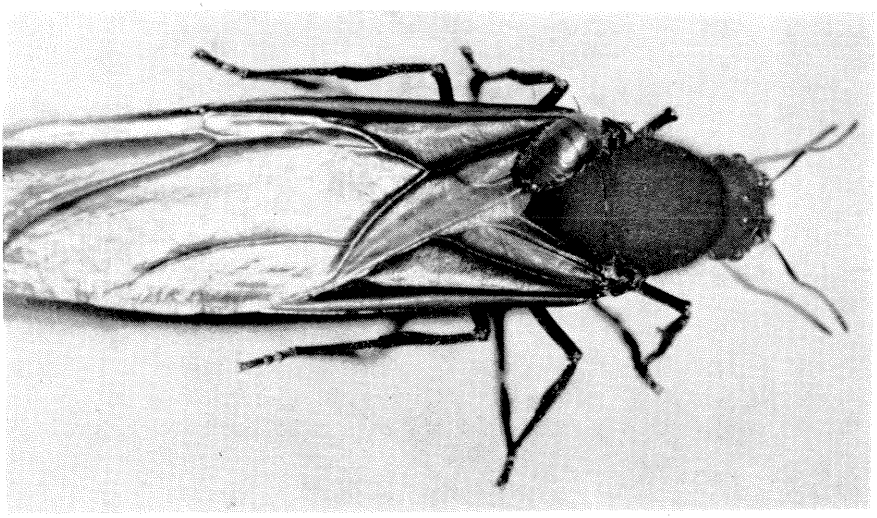

FIG. 4. — Female roach *(Attaphila fungicola)* phoretic on ant queen.

alates collected from the surfaces of several nests in 1966. About half the female alates and several males were infested. Only one mite was on most queens, and it was almost always on the thorax. In addition, two females of the same *Proctolælaps* were taken the previous year from queens that had landed near lights.

New nests.

Soon after landing, queens (but not males) broke off their wings one at a time with their hind legs (fig. 5). A leg was placed behind the wing which was then extended at right angles to the body and snapped off. By blowing air on them, virgin queens were induced to remove their wings. Queens reacted by flying briefly, landing,

walking around for a short time, then breaking off their wings. The behavior of the queen in figure 5 was induced in this manner.

Queens of *A. texana* dig the first burrow and rear the first brood in the same way as has been described for *A. sexdens* by AUTUORI (1942 *a*, 1956), and for *A. cephalotes* by WEBER (1937, 1947). The wingless queen digs a gallery at a 90° angle to the soil surface (fig. 6). Soil from this excavation is placed around the opening in a crescent-shaped mound about 13 cm in diameter (fig. 7). The mound is composed of pellets about 5 mm in diameter, considerably larger than the pellets formed by workers. The size of pellets and the shape of mound are

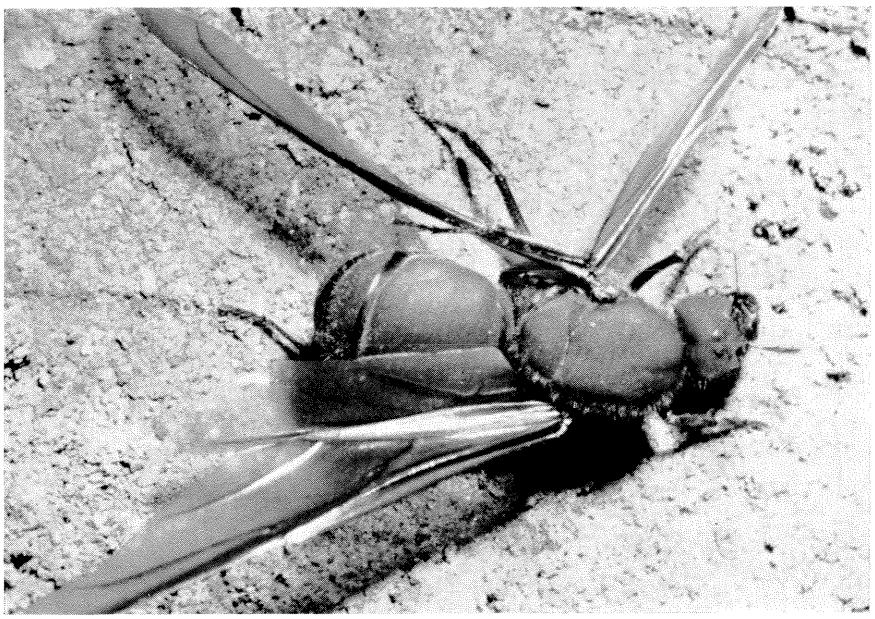

FIG. 5. — Queens break off their wing with their hind legs.

unique, and aid in identifying new nests. Since the small mounds are quickly washed away by rain, they must be found as soon as possible after a flight.

At a depth of 15 to 25 cm, the queen burrows to one side of the gallery and constructs a cavity about 5 cm in diameter and the shape of a walnut. Dirt from the cavity is used to plug the entrance hole and gallery.

Mated or unmated, winged or wingless, females burrow into the soil. After construction of the gallery, both fertile and virgin queens regurgitate a small ball of fungus and substrate, then lay eggs. AMANTE has observed smilar behavior for queens of *A. sexdens* and *A. capiguara* Goncalves.

In areas where many queens had been attracted to artificial lights,

FIG. 6. — Soon after landing, queens excavate a burrow.

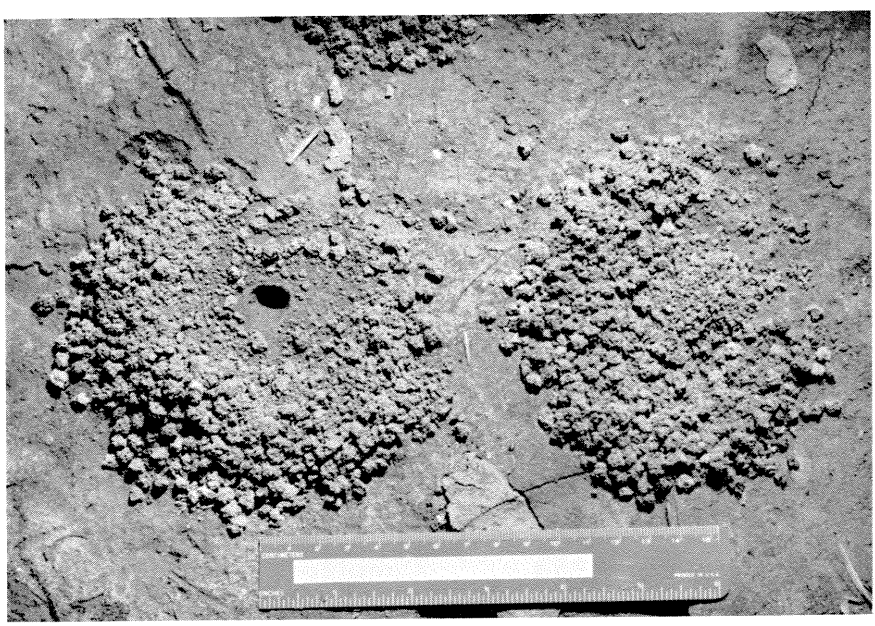

FIG. 7. — Crescent-shaped mounds constructed by queens. The entrance on the right has been plugged with dirt.

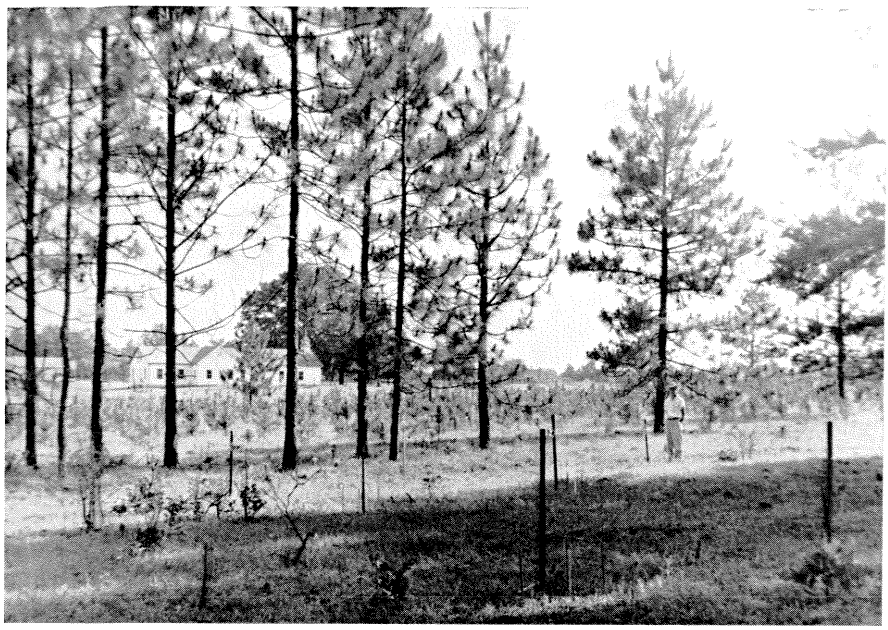

FIG. 8. — Large stakes mark the spots where individual queens landed after a flight.

FIG. 9. — A colony 56 days after establishment.
The queen (top) and her first workers are shown, along with eggs larvae, and pupae on the fungus garden.

as many as eight were found in a single burrow. Sometimes all queens participated in the excavation, but often only one individual worked.

Under natural conditions, queens and their newly plugged burrows were extremely difficult to find. Thus, it was impossible to determine the number of new nests established in relation to the number of alate-producing nests, or to learn how many of the new colonies persisted to produce workers. Occasionally, isolated burrows were found, but the only group located consisted of 10 mounds on 0.6 ha (fig. 8).

Only three colonies of the group survived. One was opened after 30 days, another after 43 days; both were opened before adult workers appeared. The remaining colony was left intact to study its growth. Each of the opened colonies contained a queen, a fungus garden, and broods in various stages of development. The gardens were white, saucer shaped, and about 2 cm in diameter; they contained no kohlrabi. AUTUORI (1942 *a*) states that kohlrabi does not appear in the initial gardens of *A. sexdens* until the 90th day. Until then, the queen, larvae, and new workers eat nutritive eggs laid by the queen. Weber states that kohlrabi appears much earlier than 90 days in new colonies of *A. cephalotes*.

In the nest excavated after 30 days, 36 eggs, 25 immature larvae, 9 mature larvae, and 1 pupa were found. The pupa was 3.5 mm long, indicating that the first worker would be medium sized. The second nest, opened after 43 days, contained 30 eggs, 25 immature larvae, 11 mature larvae, and 13 pupae. Pupae in the second colony ranged from 2.3 to 3.2 mm long, indicating that the first workers would be minor or medium sized (fig. 9).

On the 58th day, an excavation mound constructed by new workers was observed on the third nest. Workers from the colony had reached the surface sometime after the 44th day when the previous observation was made. The small mound was columnar, 3 cm high, and 7 cm in diameter. A medium-sized, non-teneral worker was observed on it. Ten days later, numerous workers were seen bringing leaves into the nest, and the mound had increased to 6 cm in height and 5 cm in diameter (fig. 10).

After 240 days (fig. 11), the mound was cone shaped; a form typical of new nests. About 5 cm^3 of detritus lay 7.5 cm from the entrance hole, an indication that workers may not construct underground detritus cavities until at least a second entrance hole is opened. ECHOLS (1966) found that new nests are often clustered around old nests, and postulates that amalgamation of these small colonies accounts for large colonies with multiple queens.

It appears that the first brood of *A. texana* develops faster than that of *A. sexdens*. AUTUORI (1942 *a, b*) found the first larvae after 30 days, the first pupae after 51 days, and the first adult after 62 days.

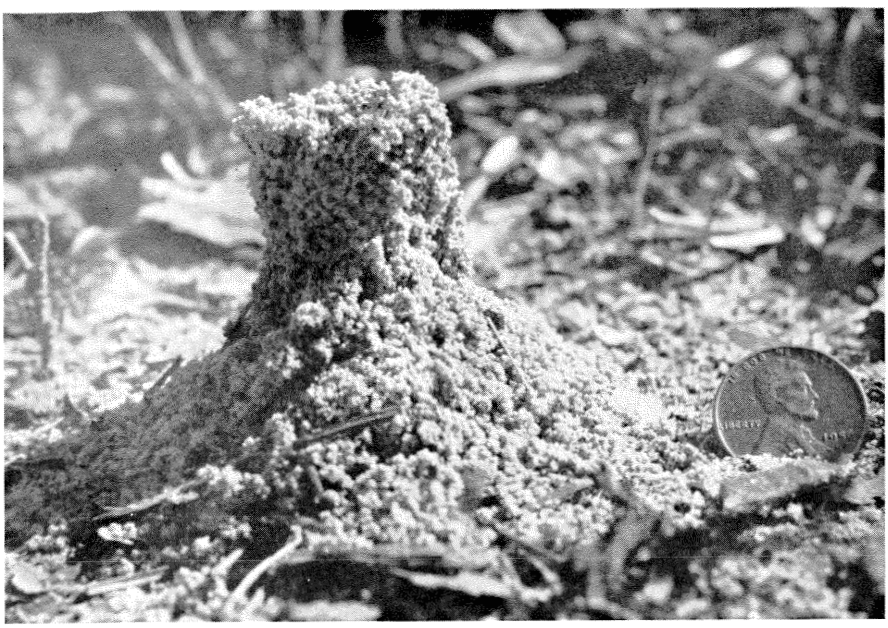

FIG. 10. — Town ant nest 68 days old.

FIG. 11. — Same nest as in figure 10, but 148 days old.

The first entrance hole was opened after 82 days. WEBER (1966) states that adults of *A. cephalotes* in Trinidad emerge 40 days to 2 months after flights.

Spermatozoa counts (1).

Spermatozoa were diluted in a 1 % starch solution and counted in a hemocytometer by the method of MACKENSEN and ROBERTS (1948). Numbers of spermatozoa in seminal vesicles of 16 males were 65.0, 82.5, 90.0, 91.0, 91.5, 94.0, 96.0, 99.0, 100.0, 102.0, 105.8, 108.0, 111.0, 111.5, 121.5, and 130.0 million-an average of about 100 million. Spermatozoa from spermatheca in each of 9 recently fertilized females caught at lights totaled, 69, 75, 85, 91, 97, 98, 122, 128, and 133 million-also an average of about 100 million. Numbers from 17 queens dug from separate one-mound nests (colonies 1-2 years old) were 0, 100, 117, 120, 121, 122, 123, 123 (i.e. two queens contained 123 million sperms), 124, 133, 139, 142, 144, 156, 159, 180, and 186 million. The average for the 16 females with full spermatheca was 137 million. Queens in multiple-mound nests contained 84, 105, 111, 114, and 140 million spermatozoa.

KERR (1961) found 44 to 80 million spermatozoa in males and 206 to 319 million in females of *A. sexdens*. He concluded that queens were inseminated by from three to eight males. For *A. texana* the data are less clear, but indicate that some queens may mate twice.

A wingless unmated queen was found by ECHOLS in a one-mound nest that also contained a normally fertilized queen. The wing muscles of the unfertilized queen were atrophied, an indication that she had been in the nest for at least 4 months. Some eggs were found in her vagina, but there was little ovary development.

Summary.

Alate broods are reared without worker broods in lower cavities of nests in winter, and with worker broods in upper cavities of nests in spring. Winged adults appear in early April, but swarming does not occur until late May. Flights issue yearly from most large nests. The alate sex ratio is about 1: 1. Before swarming will occur, nest surfaces must be soaked with at least 7 mm of rain; flights continue as long as nests remain wet and temperatures exceed 16°.

A circadian rhythm triggers swarming at about 3: 55 a.m., and most alates leave the nest surface within 2 minutes. Fertilized females contain from 69 to 186 million spermatozoa. Seminal vesicles of males contain 65 to 130 million spermatozoa.

(1) The author thanks S. J. TABER, U. S. Department of Agriculture Bee Laboratory, Tucson, Arizona, for his advice and help in sperm counting.

Zusammenfassung (1).

Geflügelte Nachkommenschaft wird im Winter in den unteren Hohlräumen des Nests ohne die Brut der Arbeiterinnen aufgezogen und im Frühling mit der letzteren zusammen in den oberen Hohlräumen des Nests. Geflügelte erwachsene Ameisen earschienen Anfang April, schwärmten aber erst Ende Mai. Flüge fanden jährlich von den meisten grossen Nestern aus statt. Bie den geflügelten Individuen war das Verhältnis der Geschlechter 1 : 1. Vor dem Schwärmen war die Nestoberfläche mit mindestens 7 mm Niederschlag durchnässt worden; Flüge wurden fortgesetzt solange die Nester feucht waren und die Temperatur 16° C überschritt.

Ein Tagesrhytmus löste das Schwärmen ungefähr um 3 Uhr 55 Minuten morgens aus, und die meisten geflügelten Ameisen verliessen die Nestoberfläche innerhalb von 2 Minuten. Befruchtete Weibchen enthielten zwischen 69 und 186 Millionen Spermatozoen; Samentasche der Männchen enthielten 65 bis 130 Millionen Samenzellen.

Resumen (2).

Durante el invierno, las cresas aladas son criadas en la ausencia de cresas trabajadoras en las cavidades inferiores de los nidos, pero durante la primavera, son criadas junto a cresas trabajadoras en las cavidades superiores de los nidos. Los adultos alados aparecen temprano en abril, pero los vuelos ocurren terde en mayo. Los sexos aparecen en proporció unitaria en los adultos alados. Los vuelos ocurren cuando las superficies de los nidos han sido humedecidas con 7 mm de agua y continúan ocurriendo mientras haya suficiente humedad y la temperature sobrepase 16° C.

Los vuelos son iniciados por un ritmo diario y comienzan alrededor de las 3 : 55 A.M. La mayor parte de los adultos alados emprende vuelo en un término de 2 minutos. Las hembras fecundadas contienen de 69 à 186 millones de espermatozoides; las vesículas seminales de los machos contienen de 65 a 130 millones.

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