Contents and Structure of *Atta texana* Nest in Summer[1]

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ABSTRACT

A large nest of *Atta texana* (Buckley) in central Louisiana was partially excavated in August 1960. Twelve dormancy, 5 detritus, and 93 fungus-garden cavities were found. Fungus-garden cavities near the surface outnumbered those at lower depths and contained most of the fungus material and brood. Inquilines were most numerous in detritus cavities. Dormancy cavities are described as new to science. They resemble fungus-garden cavities, but differ in that the cavity is irregular in shape, the substrate is tightly packed and has a silage-like odor, and workers and inquilines in them are torpid.

This paper describes a nest of the Texas leaf-cutting ant, as delineated by partial excavation with a bulldozer.

Though this fungus-culturing ant, *Atta texana* (Buckley), is a serious pest of farm and forest crops throughout its range in west Louisiana and east Texas, the literature about its nests is scanty. Size of the nest and labor costs prohibit extensive hand excavations, such as several South American researchers have undertaken for other species of *Atta* (Stahel and Geijskes 1939; Jacoby 1952 and 1955). Cutting a swath through the center with a bulldozer takes a substantial sample of a nest, and does it rapidly and economically enough to permit replicate excavations. Small features, such as galleries, are crushed and obscured, but the large cavities can readily be measured and studied even though they are often collapsed by the machine.

To succeed, a bulldozer operation must be carefully planned and carried out rapidly and with very close coordination among entomologists, mappers, and tractormen. The excavation described here was made after experience had been gained in earlier trials; some information from the other excavations is included to show similarities or differences among nests.

Activities of the ant vary considerably in different seasons. For example, fungus gardens are almost all below 8 feet in winter, while they are relatively close to the surface in summer. This paper primarily relates aspects of a nest in summer.

THE STUDY NEST

The nest was about 23 miles southwest of Alexandria, Louisiana. It was moderately large; excavation mounds and spoil averaged almost a foot deep and covered an oval area about 35 by 50 feet. External signs indicated that it was at least 4 years old. Two empty methyl bromide cans near the center of abandoned excavation mounds suggested that an attempt had once been made to fumigate it.

The soil was Ruston fine sandy loam, well drained, and in an area of rolling topography—a typical site for the ant. Where the swath was cut, the topsoil was a black, sandy organic layer about 1 foot deep. Underlying was about 18 inches of sandy clay of moderate permeability. From 2½ feet to the bottom of the excavation the soil was a reddish sandy loam with excellent drainage. The nest center was on a small rise. Bluestem grass and scattered small pines were the chief vegetation in the vicinity (fig. 1).

The excavation[2] was on August 10 and 11, 1960. The swath was cut through the center, as indicated by active excavation mounds. It was about 7½ feet wide and 100 feet long (fig. 2). Each pass of the bulldozer cut down about 4 inches. The bottom of the nest was not reached, as vertical galleries were still found at a level of 12 feet, where excavation was halted for fear that the sides of the cut would collapse.

Surface soil temperature in the shade was about 35° C.: subsurface temperatures were 26°, 24°, 21.5°, and 20.5° at 1-, 4-, 8-, and 12-foot depths, respectively.

Positions of cavities were mapped by using a staff compass to determine bearings on two range poles set 100 feet apart and parallel to the swath. Dimensions, depth, and contents were recorded for each cavity.

The bulldozing did not destroy the colony. About 60 days later, new, active excavation mounds were found about 15 feet to one side of the trench, which had been backfilled at the close of the operation.

FUNGUS-GARDEN CAVITIES

Ninety-three fungus-garden cavities were uncovered (fig. 3). Size and shape varied slightly at different depths. Those near the surface were like an inverted mixing bowl, and about 1 foot in diameter. Deeper cavities were somewhat larger and less regular in shape.

Fifty-two cavities (table 1) contained some fungus, 24 were empty, and 17 were partially or completely filled with sand. Most gardens were in cavities in the upper 5 feet; cavities below this level were usually empty. Most gardens rested on the bottoms of the cavities, but in the deepest cavity a small garden was clustered around tree roots that penetrated the ceiling and apparently served as support (fig. 4). Weber (1956) described similar gardens for *Atta cephalotes* L., and postulated that they represented early stages of development.

Temperatures were taken within 5 medium-sized fungus gardens immediately after they were exposed

[1] Accepted for publication March 30, 1962.

[2] International Paper Company furnished the bulldozer.

Table 1.—Number of fungus-garden cavities, by depth and contents.

Depth of cavity	Containing fungus gardens			Empty	Containing sand
	Full or nearly full	Partially full	Trace		
Feet	*Number*				
1-2	11	11	3	2	1
3-4	6	5	1	2	5
5-6	0	8	4	6	8
7-8	0	2	0	7	3
9-10	0	1	0	7	0
Total	17	27	8	24	17

by the bulldozer. The range was from 28° C. for a garden at 0.5-foot depth to 23.5° C. for one 6 feet down. Surrounding soil was from 0.5° to 2° cooler. It appears, then, that the metabolic processes of the fungus cause a slight rise in temperature. The fungus can tolerate considerable variation in temperature; some gardens excavated in winter at a depth of 12 feet registered 18° C.

The ants chiefly use sections of fresh-cut leaves to make substrate for the fungus. New green material was found only in cavities with active gardens, usually in small amounts, but was absent from 28 of the 52 active gardens. This lack is difficult to explain, because in other excavations most gardens were amply supplied.

Most sand-filled cavities were at medium depths. There was an isolated cluster on the periphery of the nest. Their function is unknown, but perhaps they are merely abandoned garden cavities convenient for deposition of excavated soil.

Twenty of the 52 active gardens contained worker larvae and pupae. Generally, these forms were most abundant in the larger gardens and in the upper 2 feet of the nest, where temperatures were warmest. Apparently the sexual brood is reared only in winter.

Cavities containing many larvae and pupae were numbers 1, 2, 4, 5, 9, 10, 11, 12, 20, and 21. Those with few were 13, 14, 16, 19, 22, 23, 25, 28, 29, and 93 (fig. 3).

FIG. 1.—Surface of nest prior to bulldozing. Dotted lines mark bulldozed swath.

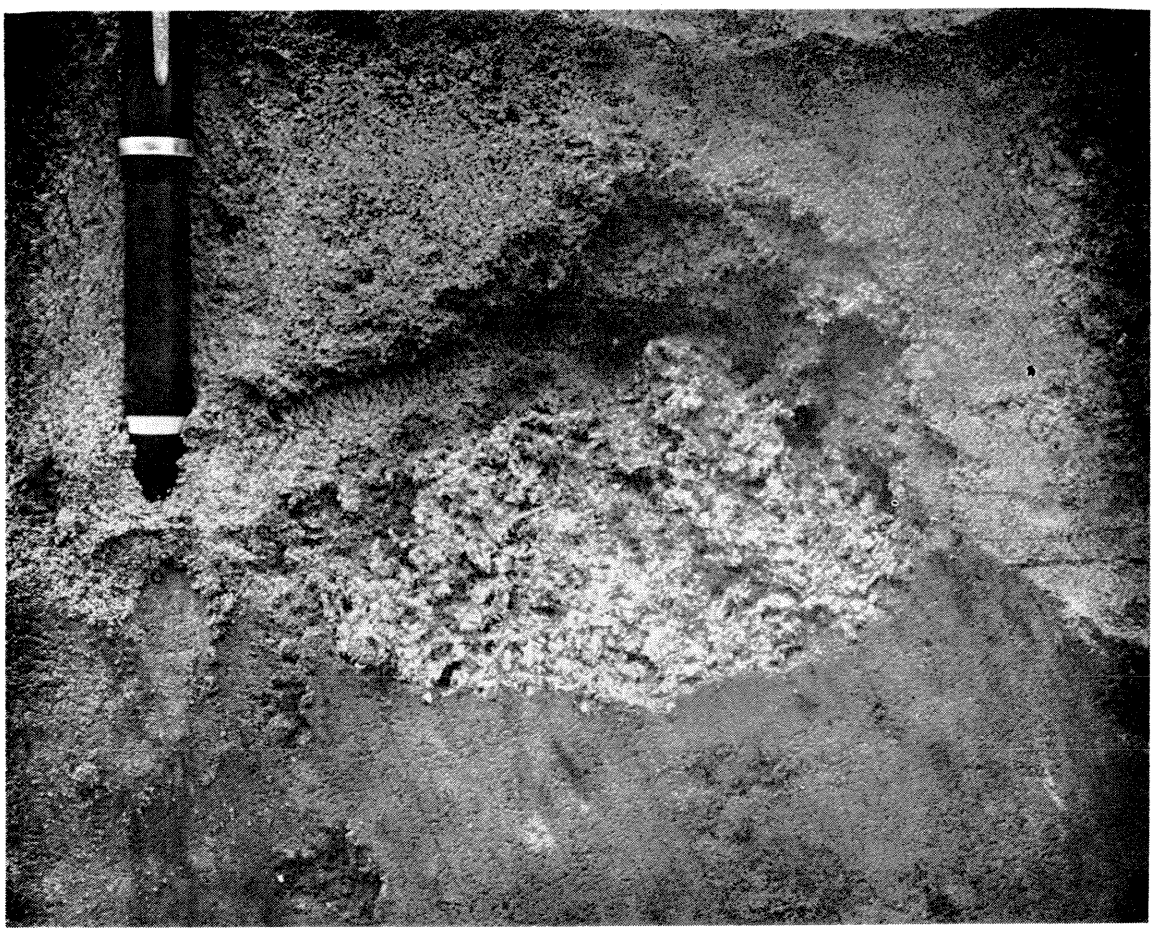

FIG. 5.—Dormancy cavities are irregular in shape and packed tight with fungus and substrate; leaves; worker adults, larvae, and pupae; and sometimes inquilines.

One (H-10) held nothing but brown substrate devoid of fungus; another (H-8) contained no substrate but was packed with torpid workers. Fresh leaves were found in five cavities. Inquilines were absent but have been found in dormancy cavities during other excavations. Eight cavities with substrate had numerous worker larvae and pupae.

Dormancy cavities with many immature ants were within 2 feet of the surface; and, except in one cavity, 50 to 75 percent of the ants were teneral. Dormancy cavities containing only a few immature ants were 3 to 5 feet deep and had less than 10 percent tenerals.

The behavior patterns leading to the formation of these cavities and the function of ants in them are unknown. No such cavities are reported in the literature.

DETRITUS CAVITIES

Five scattered detritus cavities were uncovered. Two (D-1 and D-4) were irregular-shaped holes probably dug specifically for disposal of depleted substrate, two others (D-2 and D-5) were portions of galleries, and one (D-3) was an old fungus-garden cavity. In D-4 the detritus was dry, but in the others it was fresh and damp. All except D-2 had some inquilines. The cavity shown in figure 6 is typical, though it was uncovered in another excavation.

Numerous adult histerid beetles of the genus *Saprinus*[6] were found in the detritus of cavities D-1, D-3, and D-4. In D-3 some larvae and adults were present in the detritus, but most larvae and all pupae were in loose sand beneath the cavities. Six *Saprinus* larvae were brought to the laboratory and placed in sand where they burrowed, formed cells, and pupated. Adults emerged and came to the surface in 18 to 21 days. Two larvae that formed pupal cells against the inside wall of the plastic container were observed to pupate in 12 days.

The alleculid beetle, *Lobopoda subcuneata* Casey, was among the residents of D-1, D-3, and D-4.

[6] A new species being described by R. L. Wenzel, Chicago Natural History Museum.

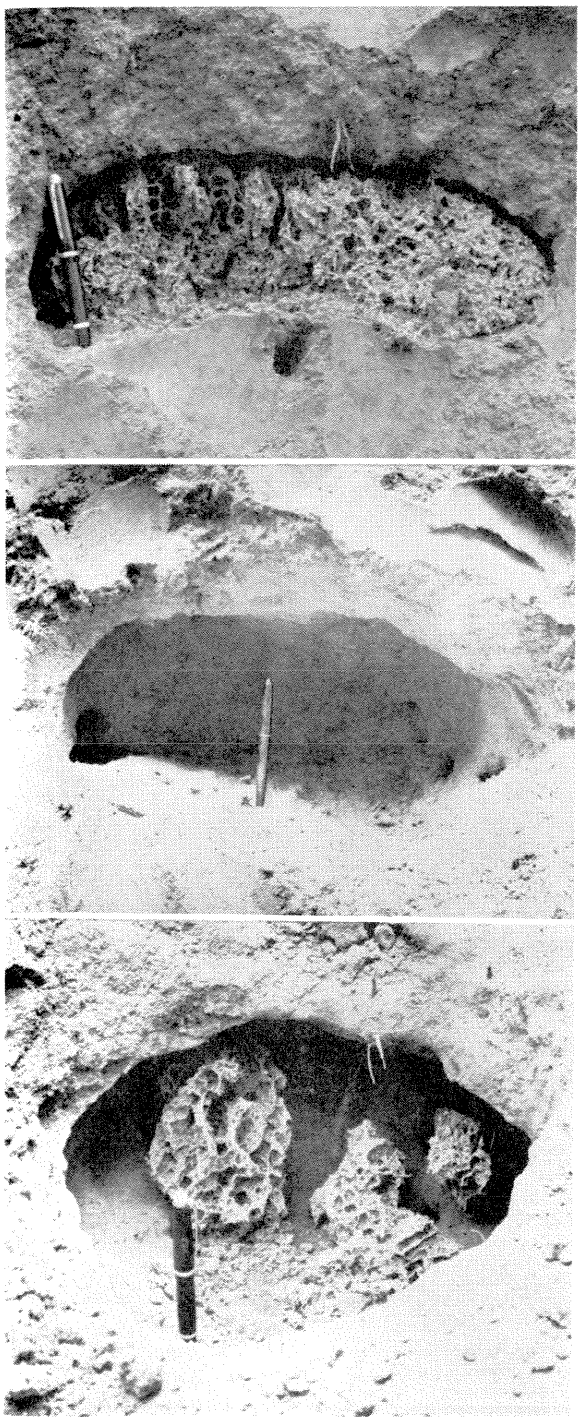

FIG. 4.—*Top:* Typical cavity filled with fungus garden. Fungus is spongy at top and dense at bottom; it rests firmly on the floor of the cavity without touching the top or sides, and is attached to roots. *Middle:* Empty cavity. Galleries usually enter cavities from the side, sometimes from the bottom, and almost never from the top. *Bottom:* Lowermost garden of the nest, and presumably still forming. The gardens are clustered around large roots. These cavities are Nos. 44, 62, and 68 of figure 3.

Almost all adult workers were in galleries and in cavities containing gardens. A few were located in 6 of the 24 empty cavities. Cavities containing sand were devoid of ants.

Teneral workers were present only in gardens containing the brood. In gardens with many immature forms, 50 to 75 percent of the workers were tenerals; gardens with few immature forms had less than 25 percent tenerals.

The only inquilines seen in cavities containing fungus gardens were a staphylinid beetle in cavity 46 and a silverfish in cavity 50. The cockroach *Attaphilia fungicola* Wheeler, usually abundant in gardens, was not seen, but eggs or very young nymphs may have escaped observation, because a month later small nymphs were found in several large nests.

An early-instar nymph of a cave cricket (*Ceuthophilus* sp.), a female ant-loving cricket (*Myrmecophila* sp.),[3] and two staphylinid beetles were in empty cavities 61, 82, and 88, respectively.

A small colony of army ants, *Neivamyrmex fallax* Borgmeier,[4] was in cavity 85 at the periphery of the nest. Also in the cavity were numerous small diplurans (prob. *Metajapyx* sp.)[5] and silverfish which scurried away as soon as they were exposed to light.

No fertile queen was found in this nest, and only one has been discovered in 11 others nests excavated by bulldozers. Large nests may, however, contain more than one queen, for as many as seven (five from a single cavity) have since been taken from a nest by hand probing into upper cavities during April. In Texas, Walter et al. (1938) found three queens in a single cavity, but Eidmann (1935) and subsequent workers state that only one queen exists in nests of South American species of *Atta*.

DORMANCY CAVITIES

Dormancy cavities are much more irregular in shape than are fungus-garden cavities (fig. 5). They contain tightly packed leaf substrate or sand, fungus, adult workers of all sizes, worker brood in summer but rarely in winter, occasionally sexual larvae in winter, and species of inquilines associated with fungus gardens. All workers and inquilines in these cavities are torpid, although they revive in a few seconds and behave normally when exposed to fresh air. Contents have a distinctive, silage-like odor; fungus gardens smell sweetish. In summer the cavities are intermingled with fungus-garden cavities in the upper parts of the nest. During winter they are larger than in summer, farther below the surface, and apparently dispersed more widely.

Twelve dormancy cavities were found in this excavation. All were within 5 feet of the surface, and 8 were in the first 2 feet. Ten contained fungus-bearing substrate, torpid workers, and brood in about the same proportions as in fungus gardens.

[3] Determination by A. B. Gurney, U. S. National Museum, who states that it may be a new species.
[4] Determination by M. R. Smith, U. S. National Museum.
[5] Determination by L. M. Smith, University of California at Davis, who states that it is a new species.

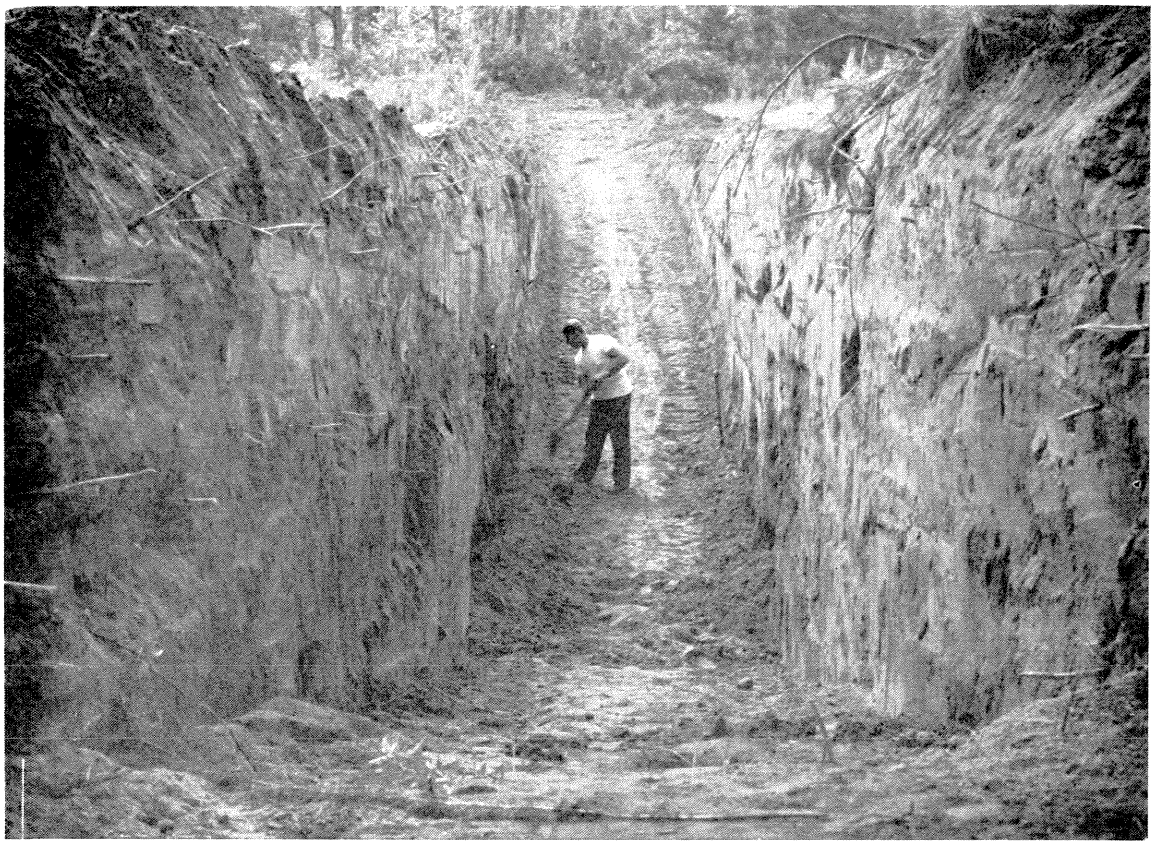

FIG. 2.—The cut at maximum depth.

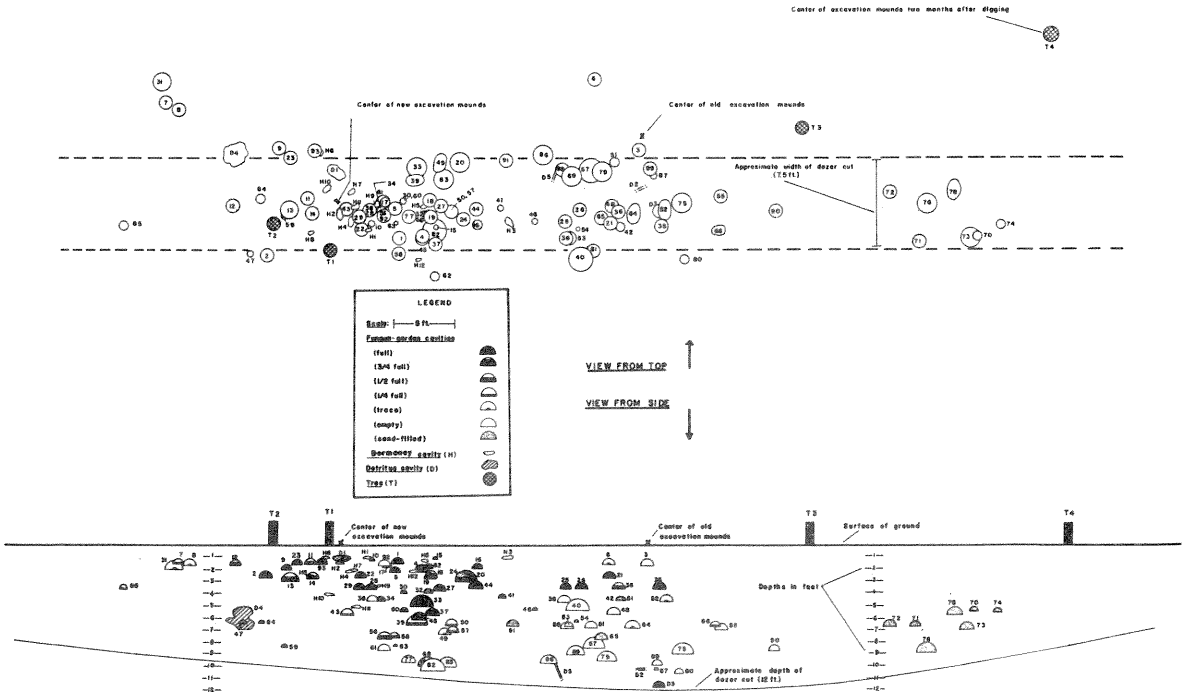

FIG. 3.—Horizontal and vertical sections of bulldozed swath.

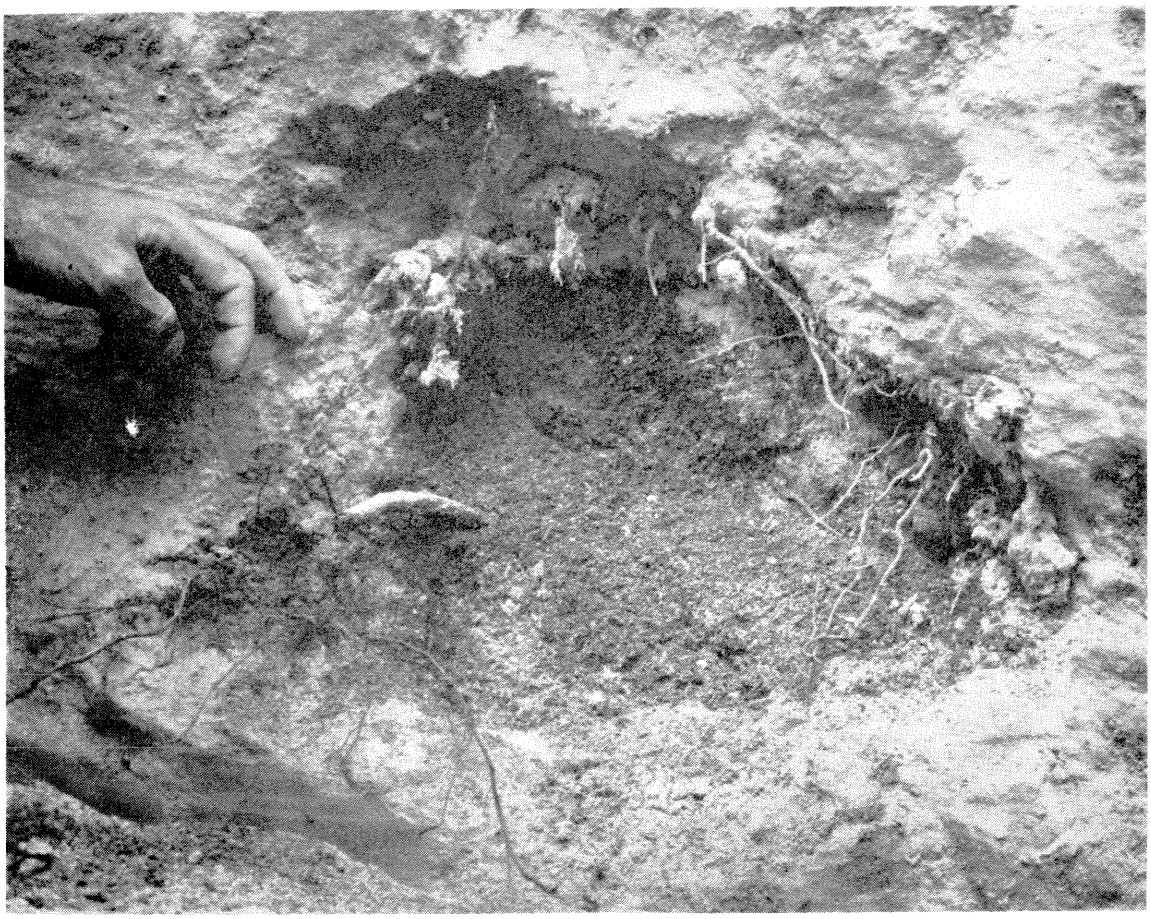

FIG. 6.—Detritus cavity.

Medium-sized and large larvae and teneral adults were found together in D-4. Pupae were in cells beneath the cavity.

One adult of the carabid beetle, *Tachyura dolosa* (LeConte),[7] was found in a detritus cavity. One elaterid larva, *Conoderus* (prob. *xysticus* Candeze[8]), was collected; this species may be a predator. Collembola of the species *Pseudosinella violenta* (Folsom) were numerous. There were a few staphylinid beetles, diplurans, earthworms, millipedes, and centipedes. The diplurans escaped, but appeared to be the same as those associated with army ants in the garden cavity. Several larvae of the milichiid fly, *Pholeomyia comans* Sabrosky, were in D-3; adults emerged from detritus a few days after it was taken to the laboratory.

D-4 contained numerous adults and many nymphs of a cydnid bug, *Tominotus unisetosus* Froeschner.[9] Though many members of the family are myrmecophilus, cydnids were not found in previous excavations.

[7] Determination by W. C. Stehr, University of Ohio.
[8] Determination by M. C. Lane, Tacoma, Washington.
[9] Determination by Richard C. Froeschner, U. S. National Museum.

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