UNIVERSITY OF COLORADO STUDIES

Series in Biology
No. 11

UNIVERSITY OF COLORADO PRESS
BOULDER, COLORADO
AUGUST, 1963
PRICE 50¢

THE NEST OF *LIOMETOPUM APICULATUM* MAYR HYMENOPTERA: FORMICIDAE

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The genus *Liometopum* consists of a small number of species of ants found in warm and rather dry portions of the northern hemisphere. In 1905, Wheeler reviewed the taxonomy of the North American forms of this genus, providing also the description of a new subspecies, and discussed in detail the known habits of these ants as well as the ecology of the European *L. microcephalum*. Creighton (1950) has also commented briefly on the habits of our native species, and has altered their taxonomy so as to make *luctuosum* a subspecies of *occidentale* rather than of *apiculatum* where it was originally placed by Wheeler. He raised *occidentale* to full species rank, whereas Wheeler regarded it merely as a subspecies of Mayr's *apiculatum*.

Liometopum apiculatum and *L. occidentale luctuosum* are fairly common ants in the foothills of Colorado, and I have added considerable amounts of data concerning their general ecological distribution in another publication (Gregg, 1963). Despite the information about their broad habitat requirements and such microecological data as feeding habits and their conspicuous

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tendency to follow trails and form well-organized foraging parties, the nature of their nests has remained obscure, owing, no doubt, to the fact that these nests are placed in situations that are very difficult to locate and in most cases totally inaccessible.

Wheeler described a huge nest of *L. apiculatum* that he discovered near Fort Davis, Texas, and said that it was located under a large flat stone. The nest consisted of a mixture of dried grass and twigs cemented together with earth and some glandular secretion produced by the ants, forming a mass of anastomosing trabeculae with coarse openings. The size of the mass measured about two feet long by one-and-one-half feet wide. The nest contained thousands of workers and enormous quantities of brood. Later he found a similar but smaller nest of this species near Alpine, Texas. In the region about Colorado Springs, Wheeler searched for the nests of these ants but was unsuccessful. As his accounts shows, the foraging trails disappeared underneath rocks, but when these were lifted only runways were revealed, or perhaps a small succursal nest. That these cavities could not be the true nest site was shown by the fact that no brood and no males nor females were found in them. The runways continued under adjacent rocks and finally descended beneath the roots of a large tree or perhaps under an immovable boulder.

In all our collecting over wide areas in Colorado, my wife and I have never unearthed the home nest of either species of *Liometopum*. However, in November of last year a nest of *Liometopum apiculatum* was accidentally uncovered by an excavating crew who were preparing the way for a new distribution pipe for the Boulder water system. Heavy earth-moving equipment had cut into a hillside and luckily exposed the nest without destroying it. Mr. Wallace N. McClure, Inspector and Field Engineer for the project, recognized the unusual nature of the material and later brought it to my attention. He also made photographic record of the site, lest it be damaged (Fig. 1). To reach the nest it was necessary to travel by jeep over rough back roads, and I am very much indebted to Mr. Thomas K. Glenn, also Field Engineer, who provided the transportation and helped me locate the exact spot.

The position of this nest was high on the south-facing wall of Boulder Canyon, approximately two road miles west of Boulder, Colorado, and at an elevation of 6,065 feet. It is close to the summit of the ridge and a little more than 500 feet above the canyon floor. The vegetation at this point is open ponderosa pine forest, and the surface of the ground is strewn with rocks and boulders of many sizes. The environment in general is warm and dry. As will be seen from the accompanying illustration, the nest occupied a hole well beneath the surface of the soil (14 inches to the top of the cavity) and underneath a

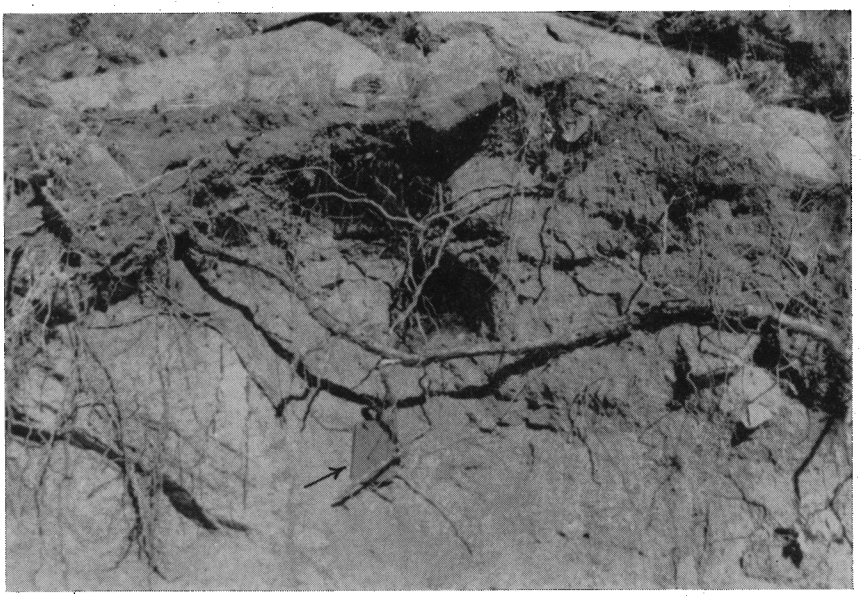

FIGURE 1. Excavated bank showing location of a nest of *Liometopum apiculatum* Mayr. Surveying-book below and to the left of the nest cavity. Photograph by Wallace N. McClure.

large, flat stone. The cavity itself measured 12 inches high by 15 inches wide, and was generally spherical in shape. At the time of my visit, there were no live ants in the nest, and according to Mr. McClure he observed no ants when the nest was first opened. It seems quite probable the ants had abandoned their nest. The cavity was nearly filled with a mass of carton trabeculae, a large portion of which now resides in the University of Colorado Museum. The remaining sizable sample of the nesting material occupied a depression on the floor of the cavity; it was carefully removed and has since been placed in our personal collection.

Examination of the nest structure under a binocular microscope reveals that it is composed mostly of mineral materials. Particles of sand and clay seem to be solidly cemented, and into this matrix are incorporated crystals of various substances, some of them appearing like flakes of mica. Since the location of the nest is beyond the area of sedimentary rocks and well within the granitic portion of the foothills, this composition is not surprising. Not only has this structure been fashioned by the ants, but the ingredients would seem to be held together by some secretion produced by the ants also, for whereas pieces are brittle and may be readily broken by handling, they do

not crumble spontaneously as would be true of earth after it dries out. Very small pebbles are occasionaly included in the construction, but the surface everywhere is moulded to a smooth and even texture. Over this surface is a thin layer of black carbonaceous material of unknown origin, though it is presumably placed there by the ants also; thus some organic substances are used as building components. Finally, a delicate web of what appears to be plant fibers clings to and encloses all structural elements. The fibers seem to be fine rootlets and even finer mycelial threads of some fungus. Whether they are normal constituents of an actively occupied nest, or represent invasions after abandonment by the colony, is, of course, not known. In view of the organic material mentioned above, I should favor the latter alternative.

The whole of the constructed material is organized into an irregular, honeycomb-like framework of interlacing and anastomosing trabeculae. These trabeculae are more or less circular in cross-section and vary from one millimeter up to four or five millimeters, or even eight millimeters, in diameter. The gaps or holes in the meshwork range from one millimiter up to five or ten millimeters in general, but in places the openings may be as much as two or two-and-one-half centimeters in diameter. These details are clearly shown in Figure 2.

After the contents of this nest were brought back to the laboratory, I inspected it carefully for dead ants, larvae, or pupae, and any fragments of the adult workers, but was completely unsuccessful in this attempt. This result strengthens the supposition that the colony of ants had departed the nest, leaving no trace of itself other than the astonishingly fabricated network of continuously interconnected apartments.

As Wheeler pointed out, the American species of *Liometopum* differ markedly in the selection of nesting sites from the Old World *microcephalum*. Our ants, so far as present observations go, always nest in the ground, and usually in places that are very hard to locate or to excavate. This has certainly been true with respect to experience in the Rocky Mountains. The ground-nesting behavior is doubtless associated with the semi-arid climate in those portions of western North American where these ants abide. Deep soil layers and especially the soil under rocks and boulders retain more moisture and for longer periods than other sites. A continuous source of moisture in some form is essential for ants, and the above-mentioned conditions probably regulate the local occurrence of these insects. In contrast, the European species is known to nest in hollow trees, and it is perhaps permitted to do so because of the generally higher climatic humidity. However, parts of southern Europe and Asia Minor where *L. microcephalum* occurs become quite dry at certain seasons, and it is altogether possible that this ant may have subterranean

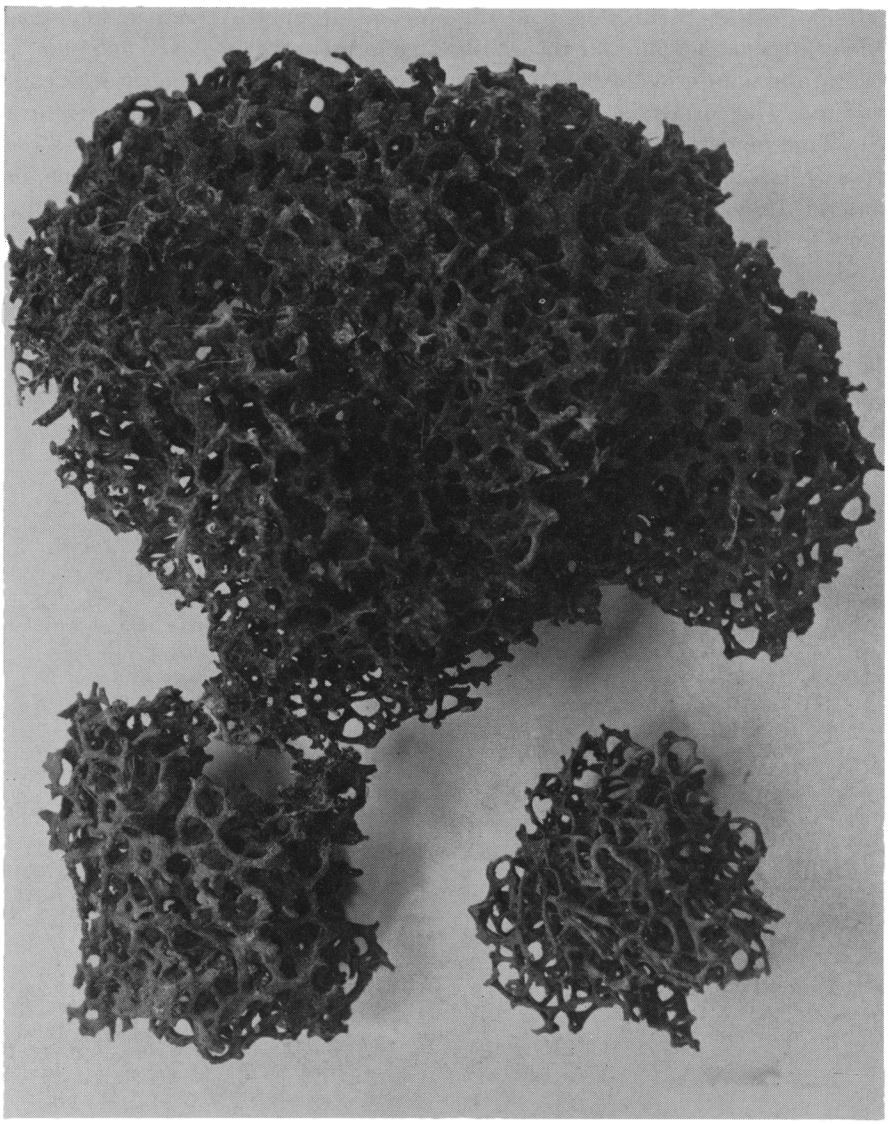

FIGURE 2. Network of earthy trabeculae representing a portion of the nest framework constructed by a colony of *Liometopum apiculatum* Mayr. Actual size of large piece measures 22 cm. in transverse diameter. Photograph by Floyd Walters, University of Colorado.

nests into which it can retreat at the onset of drought. A further difference between the American and the European representatives of *Liometopum* is seen in the nature of the substances from which the nest framework is constructed. The former, as shown by this report, utilize mineral matter to a very large extent, whereas the latter employs the woody fragments of the trees or logs in which it nests, cementing the pieces into a papier-maché, or material that might be described as a more typical carton. It seems quite likely that the composition of the nest trabeculae depends upon the materials available to the various species of *Liometopum*. Inasmuch as different species of ants in western United States inhabit rotting logs and stumps where sufficient moisture is present, it would not surprise me if *L. apiculatum* and the other forms of *Liometopum* were to be found eventually living in decaying wood in shady sites or in other situations where a dependable supply of soil moisture might exist.

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