

AN ECOLOGICAL NOTE ON THE MICROCLIMATE OF THREE SPECIES OF ANTS*

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This field study was conducted in a small valley in Hocking County, called Neotoma Valley.

SPECIES OBSERVED

Formica exsectoides Forel.—This is a pugnacious species, rushing from its nest at the slightest provocation to bite and eject formic acid into the wound inflicted. Its nest was mounded against a utility pole located on the valley floor (fig. 1). The nest was exposed to full sunlight except for the periods when the sun was behind one or the other of two ridges which border the valley, their longitudinal axes running northwest and southeast.

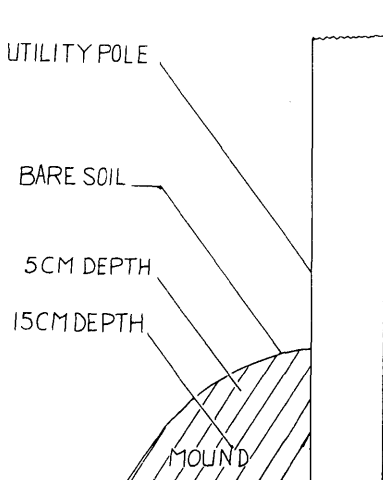


FIGURE 1. Diagrammatic sketch of the nest location of *Formica exsectoides* Forel.

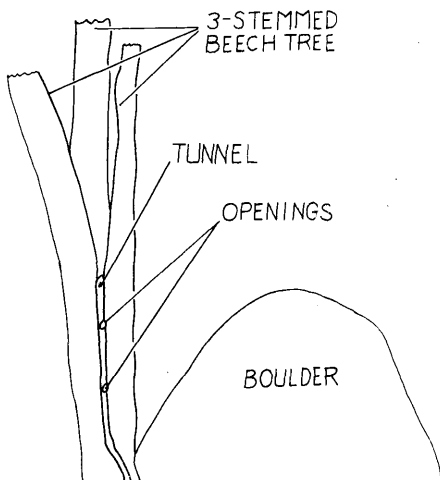


FIGURE 2. Diagrammatic sketch of the nest location of *Camponotus ferrugineus* (Fab.).

Camponotus ferrugineus (Fabricius).—This species belongs to the “dairy farmer” type. Its nest was located on the Mixed-Oak or southwest facing slope in the soil underneath a huge Blackhand sandstone boulder. An earthen tunnel led from the soil underneath the boulder up a three-stemmed beech tree to a height of about 60 cm (fig. 2). There were two openings in the tunnel, the first about 20 cm from the ground level, the other about 20 cm above the first. These openings were used by the ants when taking unidentified species of aphid out to “pasture” on the beech tree, usually to an area very near the tunnel.

Lasius nearcticus Wheeler.—This is a very small, pale yellow form with degenerate eyes, rather secretive, and seldom seen above ground during the day. Its nest was about 5 cm down in the soil on the Mixed-Mesophytic or northeast facing slope (fig. 3).

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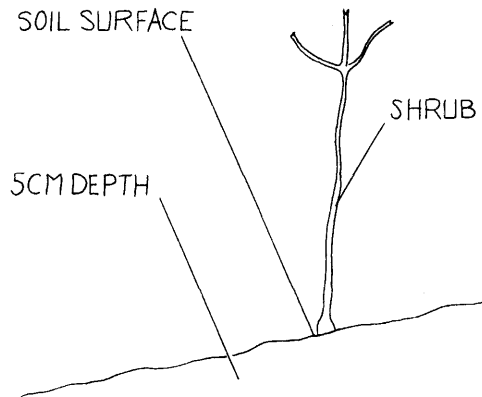


FIGURE 3. Diagrammatic sketch of the nest location of *Lasius nearcticus* Wheeler.

METHODS, EQUIPMENT, PROCEDURES

A series of temperature measurements was taken in and around the nests during the months of August and September, 1959. Temperatures were recorded by using a Leeds-Northrup portable potentiometer with copper-constantan leads, operated by a dry cell battery, and a Leeds-Northrup Speedomax strip-chart recorder.

The work with *Camponotus* was terminated at the end of August as a result of a heavy rain which destroyed the tunnel. Nest temperatures for this species were not taken because of the inaccessibility of the nest under the boulder, and the uncertainty of knowing whether the thermocouple junction was in the nest proper or only at its periphery. The temperature measurements were taken at the following places:

For *Camponotus ferrugineus*

1. *Air temperature*: 30 cm laterally from and on a level with the first opening in the tunnel.
2. *Surface*: 1 mm away from the bark of the beech tree adjacent to an area where the ants pastured the aphids.
3. *Inside the tunnel*: Between the lower and upper openings.
4. *In the soil*: 15 cm in depth.

For *Formica exsectoides*

1. *Air temperature*: 30 cm laterally from the nest, about 20 cm above the soil.
2. *Surface*: 1 mm above the bare soil of the mound.
3. *In the soil*: Inside the mound at 5 and 15 cm depths respectively.

For *Lasius nearcticus*

This is not a mound- or external edifice-building species. There is in practice no apparent evidence of the ants' working environment being commonly above ground. Measurements of the soil surface and air temperature therefore seemed unwarranted. The pale yellow color and the degenerate eyes indicate that the species is predominantly soil inhabiting or nocturnally active, or both.

In view of the above consideration, the temperature was recorded only at a point 5 cm inside the nest.

DISCUSSION

The data (table 1) are grouped to illustrate the variation in temperature between each ecologically corresponding area of each habitat of a given species

with either of the other two species, and to give an indication of the variation in temperature between each area of a given habitat for that particular species.

There may be an objection that temperatures inside the tunnel of *Camponotus* should not be compared with the 5 cm soil temperature of *Formica* and *Lasius*. However, they are ecologically equivalent. As stated previously, the 15 cm soil area temperature of *Camponotus* was not recorded due to the presence of the boulder. The figures given are soil temperatures representative of the Mixed-Oak community at the depths in which the nests were located.

TABLE I
Temperature recordings—1959

Date	Valley Floor <i>Formica exsectoides</i>				Mixed Mesophytic <i>Lasius nearcticus</i>	Mixed-Oak Community <i>Camponotus ferrugineus</i>			
	Air	Surface	5 cm in soil	15 cm in soil	5 cm in soil	Air	Surface	Inside Tunnel	15 cm in soil
Aug. 1	87	110	82	70	72	75	72	70	67
2	72	106	80	70	73	77	73	68	66
3	72	98	77	72	70	73	70	70	67
4	78	102	79	70	—	75	73	70	66
6	83	118	84	75	—	77	73	70	66
7	94	126	86	77	—	81	75	70	67
8	75	88	81	70	68	72	72	70	67
10	84	124	88	70	72	79	72	70	67
11	84	127	86	70	69	77	73	68	66
12	88	126	91	79	72	86	81	70	66
13	79	91	91	82	68	80	77	73	66
14	84	122	90	79	69	84	77	70	66
17	75	79	77	75	69	73	73	70	67
18	75	79	75	73	73	75	73	70	66
20	91	138	79	73	74	84	79	72	66
21	91	122	82	75	71	82	79	73	67
27	86	111	82	82	75	82	79	73	67
29	81	95	75	73	69	79	77	73	66
Sept. 1	81	108	75	72	72				
3	75	88	77	75	71				
5	75	86	84	84	68				
7	84	140	73	70	64				
8	86	128	80	76	67				
9	75	84	76	70	72				
11	88	136	81	73	73				
13	64	80	72	70	70				
14	64	72	68	66	70				
16	80	120	79	64	60				
19	70	91	66	63	60				
20	72	95	68	61	47				
21	67	78	74	65	53				
22	68	77	73	65	53				

The data indicate that *Camponotus ferrugineus* live and work in a very stable temperature environment. This environment is partially effected by the ameliorating influence of the Mixed-Oak community, and partially through the presence of the boulder. During the period from the fall of the leaves to the time the canopy closes at the end of spring the boulder receives the incident sun rays and is probably warmed considerably above the ambient temperatures. It would serve as a source of heat, or at least an effective insulator, thus playing an important role in the microclimate of this species.

It can be seen at once that in contrast to *Camponotus* in the Mixed-Oak community, *Formica* on the valley floor is subjected to some extremes in temperature and to some sharp variations in temperature. Visualize *Camponotus* going out to pasture its aphids on August 20, leaving an area where the temperature was 72° F and moving into one of 79° F. Yet on that same day, at almost the same moment *Formica* moved from an environment of 79° F to one of 138° F, while *Lasius* experienced a temperature of 74° over on the Mixed-Mesophytic slope. But, *Formica exsectoides* was seen day after day moving in and out of the nest tending to the business of ants, without any apparent impediment that might be consequential to so sudden and extreme temperature variations.

The data show that *Lasius nearcticus* is subjected to a temperature variation that is much less than that of either of the other two species, at least at the 5 cm soil level. Temperatures of the Mixed-Mesophytic community are characteristically less variable than those of the other two habitats (Wolfe, Wareham, Scofield, 1949). Whereas the less variable temperature of the microclimate of *L. nearcticus* may be partially accounted for by the location of its nest in this community, this stability of microclimate temperatures is probably more accurately attributed to the behavior of this species, i.e., a subsurface dweller.

Dr. Richard Gorham did a study of the ants in the vicinity of Oxford, Ohio, and collected this species only twice, noting in each instance that it was found in the soil around roots or rotted logs, in a Beech-Maple type forest (personal communication).

SUMMARY

It appears that during the month of September *Lasius nearcticus* lived in a cooler and less variable microclimate with respect to temperature than did *Formica exsectoides*. During the month of August the microclimatic temperature was cooler and less variable for the former species than for either *Formica exsectoides* or *Camponotus ferrugineus*. This difference is partly accounted for by the macroclimate in which its microclimate is found, namely the Mixed-Mesophytic community, and partly by the ant's inherited behavior, that of being a subsurface soil-dweller. It can be inferred that *L. nearcticus* would be more intolerant of high fluctuating temperatures than would either of the other two species of ants.

LITERATURE CITED

- Wolfe, J. N., R. T. Wareham, and H. T. Scofield. 1949. Microclimates and macroclimate of Neotoma, a small valley in central Ohio. Ohio Biol. Surv. 41: 267 pp.
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