

NOTES ON THE ABOVE-GROUND ACTIVITY AND
A MATING FLIGHT OF *POGONOMYRMEX*
BADIUS (LATR.)

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During the course of field work (under the supervision of the Department of Biology, University of Florida) in the years 1948-1950 on the Welaka Reserve, Florida, observations were made on the conspicuous and rather common ant, *Pogonomyrmex badius* (Latr.). The nesting site of this active ant is almost always in open sand or in areas of short grass, and the dome-shaped mound, barren of vegetation, which covers the nest chambers, makes the colony readily observable. A pattern of nest opening, individual and nest activity, and nest closing was noted, and a record of these activities to verify the pattern was begun on a selected nest.

If this nest was typical, *Pogonomyrmex badius* in northern peninsular Florida does not maintain a nest opening over any considerable time. In August, 1949, as observations were begun, the nest opening was moved about three feet from its former site. Again, in early December, within a diameter of one and one-half feet, nine new openings were made over a period of three days. However, none of these new openings were used for long; within a few days all of them were plugged, and the original opening was being used. In February, the ants finally closed their previous opening and emerged from another approximately a foot away. In each of these instances, it is certain that some of the old chambers and galleries remained in use.

Characteristically, when a new opening is made in a grassy area, the ants are quick to begin cutting the vegetation around the new opening. When the vegetation has been reduced to a stubble by use of the mandibles, sand is brought out of the new nest opening and placed on the stubs of the grass. In this way a new mound is begun.

Speculation as to why new openings are produced periodically lead to several distinct hypotheses which will have to be tested. It may be that there is actually a necessity for producing a new nest opening. For example, the support of living vegetation may be needed for the galleries and chambers of the mound, especially those galleries near the nest opening. Once the vegetation has been cut and buried by the ants, the roots die and decay and new support is sought. Again, disposition of various substances, such as waste products, may make a part of the nest untenable. Still again, the number of chambers may become inadequate because of an increase in numbers or an increase in stored materials. In either case new galleries and chambers are opened, and the nest opening is moved to a more centralized or more convenient position. On the other hand, accident, rather than

necessity, may be involved. Traffic in a certain gallery near the surface may be very heavy; the roof may be made thin or collapse, and a new quicker access to the surface found. It is noteworthy that in a very short time the original opening is closed, and it is very rarely that *Pogonomyrmex* nests have more than one opening. If a nest does maintain several openings, there are usually no more than three, all within an inch of one another.

Pogonomyrmex may move its nest opening from time to time for any one of the above reasons, or a combination of them. It is certain, however, that no factor of the weather has a direct effect on the movement. Above-ground activity, on the other hand, could be correlated in certain instances with weather conditions. To ascertain the extent of the correlation, surface temperature, temperature at three inches depth in the soil, relative humidity at the surface, and the number of workers emerging from the nest within a period of two minutes were recorded daily for 8:30 A.M., 11:30 A.M., 2:30 P.M., and 5:30 P.M., with other observations as required.

Of the two weather conditions recorded, temperature had the greatest effect on activity, although it cannot be divorced from relative humidity. Table 1 shows the recorded values for representative warm and cold periods. The greatest activity occurred in August when the surface temperature reached 30-40°C. or higher; and in November when the surface temperature reached 15-25°C. or higher. Associated with these high temperatures was a relative humidity below 60 percent in August, and below 45 percent in November. However, if, for a period of many hours, the humidity became extremely low and the temperature very high (above 50°C.), a cessation of above-ground activity occurred. An interesting relation presented itself on August 15, when the temperature at the surface rose to 49°C., while the relative humidity was below 25 percent; a large amount of activity was recorded. But these conditions remained for only a short period, with the temperature dropping to 37°C. and the humidity rising to 35 percent.

Of note also are the records of August 12 when no ants were seen above ground. Although the temperature of this day was not excessively cool for Florida, the relative humidity remained at 100 percent, and most of the day was rainy. Other *Pogonomyrmex* colonies have been noted to continue excavation during light rain, but when rain drops became constant, activity stopped.

In relation to this instance of no activity is the observation that higher relative humidities (50 percent and above), along with lower surface temperatures, had a delaying effect on the opening of the nest in the morning, and, along with decreasing surface temperatures, tended to increase the speed with which the nest was closed at night. This condition, however, did not always prevail. On August 14, the relative humidity remained at 100 percent after the time when closing normally began, and activity persisted for almost two hours during this high humidity. As is mentioned below, other factors had a bearing on the continued activity here.

The temperature at three inches below the surface of the soil showed a more direct correlation to closing. During August and September, the nest under observation was both opened and closed at a three inch temperature of about 27°C., as indicated in the table. In the winter, however, most of the temperatures were below 27°C., and during this period opening began at a three inch temperature of about 10°C., whereas closing started at about 16°C. Thresholds of surface temperature in regard to opening and closing the nest were not apparent.

In addition to temperature and relative humidity, the opening and closing processes are influenced by other factors such as the presence of wind, rain, or the approach of daylight or the descent of darkness. At 5:30 P.M. on August 14, when closing operations had usually begun during this month, a short, but heavy shower occurred. Workers emerging after the shower carried characteristic large, loosely organized pellets of wet sand. In this instance closing was delayed in order that sand loosened by seepage might be removed from chambers and galleries. Darkness seemed to have the final effect on halting activity. In any case, the importance of any one factor in stimulating or discouraging above-ground activities and the opening and closing of the nest should not be overestimated. Rather, the tendencies which each factor produces on nest activity are important and ought to be observed. From these observations controlled experiments may be set up and a more thorough analysis of colony activity obtained.

No matter what the exact stimuli for closing the nest may be, all closing operations followed a typical pattern. Certain of the workers initiated the procedure by transferring pellets of sand from the outer portions of the mound to the nest opening. Some carried this sand between their mandibles, and others pushed the pellets backwards with their hind legs. Once at the opening, the workers packed the sand into the orifice wall. Very little sand from within the nest was used. The whole activity was not concentrated, and many individuals became occupied elsewhere. The opening, however, was gradually made smaller, and in addition to sand, some of the ants brought pieces of grass and small twigs which acted as supports. During this whole activity, other ants were bringing pellets to the surface.

When the openings were finally closed, there remained a small area (two inches in diameter) cleared of sand pellets which surrounded the pile of sand at the opening. Although the outside was closed, movement of sand at the site of the former opening indicated that the ants were still packing sand into the passageway from the inside. The pile of sand over the opening sometimes became very large, reaching on one occasion a height of one-half inch and a diameter of one-half inch. This turret contained no passageway. Ants coming in from foraging after the mound was closed remained outside the nest during the night, hidden in nearby grass.

Another aspect of colony activity was observed on June 20, 1950. At 10:00 A.M. an intra-nest mating of males and females took place. While some workers were carrying on usual nest activities of bringing

TABLE 1. Number of *Pogonomyrmex* active during a warm and during a cold period.

DATE AND TIME	TEMP.(°C.)AT		REL. HUM. (%)	NO. IN 2 MIN.	REMARKS
	3"	SURF.			
8/12/49 8:30 a.m.	.....	21	100	0	Overcast
11:30 a.m.	.....	19	100	0	Rainy
2:30 p.m.	.....	20	100	0	Rainy
5:30 p.m.	.....	19	100	0	Rainy
8/13/49 8:30 a.m.	.....	24	87	0	Cloudy
11:30 a.m.	.....	39	57	118	Windy, clear
2:30 p.m.	.....	41	42	152	Clear
5:30 p.m.	.....	22	94	0	Windy, clear
8/14/49 8:30 a.m.	25	38	46	0	Clear
11:30 a.m.	30	39	50	180	Opened 9:45 a.m.
2:30 p.m.	35	40	51	235	Clear
5:30 p.m.	31	24	100	204	Rainy
6:00 p.m.	30	23	100	180	Clear
6:30 p.m.	29	23	100	68	.....
7:00 p.m.	27	23	100	4	.....
7:20 p.m.	27	23	100	0	Sunset
8/15/49 8:30 a.m.	27	36	35	128	Activity began abruptly at 8:20 a.m.
11:30 a.m.	33	49	25-	288	Clear
2:30 p.m.	35	37	35	150	Clear
5:30 p.m.	32	30	62	136	Closing began at 5:30 p.m. closed at 6:15 p.m.
11/17/49 8:30 a.m.	10	18	45	48	Clear; activity sluggish
11:30 a.m.	16	25	35	50	Moderately active
2:30 p.m.	20	27	37	52	Moderately active
5:30 p.m.	18	10	75	1	Sluggish
5:35 p.m.	18	9	83	0	.....
11/18/49 8:30 a.m.	8	10	55	0	.....
11:30 a.m.	13	18	25-	44	Clear, sunny
2:30 p.m.	19	24	25-	51	.....
5:15 p.m.	16	8	65	0	Sunset, clear
11/19/49 8:30 a.m.	7	10	75	0	Clear
11:30 a.m.	11	17	25-	25	Sunny
2:30 p.m.	18	21	25-	57	Activity moderate
5:30 p.m.	16	6	89	3	Closing began at 5:15 p.m.
5:50 p.m.	15	5	100	0	Sunset
11/20/49 8:30 a.m.	8	12	65	0	Clear, sunny
11:30 a.m.	13	27	25-	100	Moderately active
2:30 p.m.	19	30	25-	49	.....
5:30 p.m.	17	11	97	28	Closing began at 5:30 p.m.
5:45 p.m.	15	9	100	0	.....

seed husks and sand pellets to the surface, others were attending the mating individuals. These males and females were two feet to one side of the nest opening, in an area about two feet in diameter. The males ran very speedily over the ground, or else flew for two or three seconds six inches to a foot above the mating area. They were

probably equal in abundance to the combined numbers of females and workers within the area. Three or four males in some instances approached a given female at one time. Within a matter of seconds one of the males had entered into copulation with the female. The period of copulation lasted up to one and one-half minutes. Many females mated with three or four different males. Because the males were so very quick in their movements, it can only be supposed that a given male mated more than once. During the matings, the fast moving workers could be seen tugging at the males wherever they happened onto one. They pulled them away from the females, even during copulation, and when a male wandered toward the nest opening, he was carried or pulled away. Probably the same rejection stimulus was involved in all of these activities of the workers.

After each mating, each female stroked her antennae with her forelegs, and examined the tip of her abdomen with her mouthparts. When several matings had taken place, each female began a slow flight upward. The males, which had been flying swiftly around the area, also gradually disappeared into the air. The whole activity lasted about half an hour.