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HABITAT PREFERENCE OF THE ALLEGHENY MOUND ANT

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ABSTRACT

Nesting mounds of the Allegheny mound ant (*Formica exsectoides*) were counted in 3 different habitat areas (forest, brush, and open) to determine habitat preference. A significant difference was found between the numbers of mounds located in each area ($P < 0.001$), but not the average mound size in each area ($P = 0.007$). Only the brush and open areas contained mounds and their sizes were very similar. It is concluded that the Allegheny mound ants prefer to establish their colonies in open habitat areas where sunlight is readily available.

Keywords: Allegheny mound ant, ant mounds, insects, Formica exsectoides

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INTRODUCTION

The Allegheny mound ant (*Formica exsectoides*) can be found along the Atlantic coast from Novia Scotia to Georgia. Also known as the field ant, this species varies between brown and black in color and may easily be mistaken for the carpenter ant (Weaver and Smith 1993). Although they are only 3 to 6mm in length, they can build nesting mounds up to 1.5m tall (GreenShare, 2001). These mounds are composed of soil that accumulates from excavating burrows and chambers that can range from 0.61 to 1.2m in depth, depending on the age of the mound and the size of the population inhabiting that particular mound. Sand, dead twigs, and leaves may also be used to construct the mound, which can remain active for up to 30 years (Weaver and Smith 1993). These mounds are very important to the ants because they not only house the colony, but also serve to incubate their eggs. The diameter of the mounds can be directly related to the size of the colony occupying it. The longer a colony is in occupancy, the larger the mound will become. In general, mounds 0.15 to 0.46m in diameter can house between 500 and 3,000 ants, mounds 0.46 and 0.9m house between 1,000 and 6,000 ants, and mounds 0.91 to 1.5m in diameter can contain a colony as large as 10,000 ants (GreenShare, 2001).

Allegheny mound ants are most active during the spring and early summer. During this time, new colonies are developing and foraging for food. Colonies may develop by "budding", or when ants form a new mound that is joined to an existing mound by a subterranean connection. Also during the spring, queens lay their eggs. This species of ant is unique because they have more than one queen (GreenShare, 2001). Once the queen lays her eggs, the ants will carry them to the walls of the mound where they will incubate and develop in 2 to 3 months. In this short time, the eggs metamorphose into adults signaling the beginning of their life cycle (Weaver and Smith 1993).

These ants are aggressive. They inject formic acid into their prey and will kill plants and vegetation near the mound. Formic acid injected into a tree girdle, for example, can cause its cells to coagulate, preventing food from moving up the tree. In some areas, all vegetation in a 40 to 50 foot area around a mound has been eliminated except for large trees. By reducing the vegetation around the mound, the ants provide themselves with optimal sun exposure for incubation of the eggs. In this way, the mound acts as a "solar collector" for the eggs and the larvae (GreenShare, 2001).

Allegheny mound ants are on a mission to reproduce and build. It was hypothesized that they most effectively complete this mission by building mounds in open areas containing few to no trees or other vegetation. This hypothesis is based on the fact that direct sun exposure is essential for egg incubation, and therefore optimal placement of the mound should be in open versus as shaded, forest areas. This would reduce the time needed to eradicate the sun-blocking vegetation and allow more time for building and foraging.

FIELD SITE

On April 6, 2004, mounds built by Allegheny mound ants were identified and analyzed approximately half a mile away from Westminster Woods Drive in Huntingdon, Pennsylvania. These mounds were found in a section of forest that was cleared in order to erect telephone poles. Both the forest and the cleared area were included in the field site. The cleared area was approximately 30m wide from forest edge to forest edge and contained random patches of brush about 1m high.

METHODS AND MATERIALS

The study site was divided into 3 habitat areas: forest (densely populated, deciduous area), brush (1m high, covering over 75% of an area), and open. From each area, three $15m^2$ plots were randomly chosen and the ant mounds within these plots were assessed. Observations such as the number of mounds found in each plot, their height (measured from the base of the mound to its highest point), diameter (measured across the widest portion of the mound), and activity were recorded. Activity was determined by lightly tapping on the side of the mound causing ants in an active mound to come pouring out.

RESULTS

Height and diameter measurements of the mounds found in brush and open areas were found to be similar (Figure 1). No mounds were observed in the forest areas. The total number of mounds found in the open areas (N = 14) was greater than the number found in the brush areas (N = 6). Observations of mound activity in relation to area showed that the mounds located in open areas were all active while those located in brush areas were evenly split between active and inactive (3 active and 3 inactive) (Table 1).

Table 1. Measurements of the height and diameter (m) of Allegheny ant mounds taken. N represents the number of mounds measured in each area. The activity of the mounds is also recorded as the number of mounds in each category for each area. Data were collected in Central Pennsylvania in mid April 2004.

	Height (m)	Diameter (m)	N	Activity	
				Active	Inactive
wooded	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
brush	0.47	1.25	2	1	1
	0.45	1.17	3	1	2
	0.35	1.20	1	1	0
open	0.54	1.39	5	5	0
	0.36	1.25	5	5	0
	0.44	1.03	4	4	0

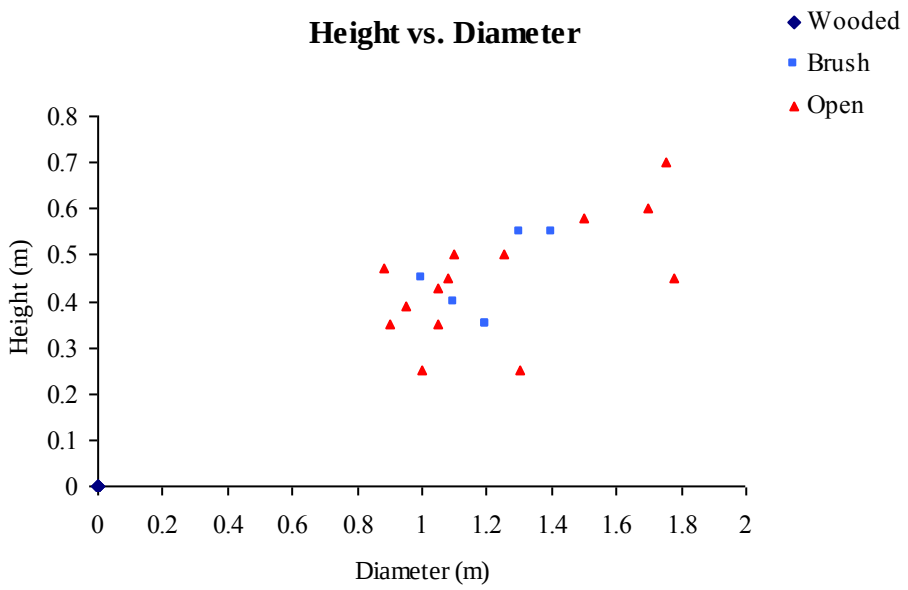

Figure 1. Diameter versus. height of Allegheny ant mounds in all 3 study areas. Data were collected in Central Pennsylvania in mid April 2004.

Height and diameter of the mounds did not vary significantly between brush and wooded habitats where they occurred (Figures 1 and 2). However, the density of mounds did vary significantly with habitat ($F = 37.00$, $P < 0.001$; Figure 3).

One-way ANOVA: height versus diameter

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Source     DF       SS       MS      F      P
diameter    5  0.39901  0.07980  36.21  0.007
Error       3  0.00661  0.00220
Total       8  0.40562

S = 0.04695   R-Sq = 98.37%   R-Sq(adj) = 95.65%


                              Individual 95% CIs For Mean Based on
                              Pooled StDev
Level  N     Mean    StDev  ----+---------+---------+---------+-----
0.00   3  0.00000  0.00000  (---*---)
1.03   1  0.44000        *                    (------*------)
1.17   1  0.45000        *                    (-------*------)
1.20   1  0.35000        *                 (------*-------)
1.25   2  0.41750  0.08132                    (----*----)
1.39   1  0.54000        *                        (------*------)
                              ----+---------+---------+---------+-----
                                0.00      0.20      0.40      0.60

Pooled StDev = 0.04695
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Figure 2: One way ANOVA test performed using the Minitab. Shows comparison of height and diameter between each habitat.

One-way ANOVA: N versus habitat

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Source  DF      SS      MS      F      P
C1       2  32.889  16.444  37.00  0.000
Error    6   2.667   0.444
Total    8  35.556

S = 0.6667   R-Sq = 92.50%   R-Sq(adj) = 90.00%


                          Individual 95% CIs For Mean Based on
                          Pooled StDev
Level  N    Mean   StDev  -----+---------+---------+---------+----
1      3  0.0000  0.0000  (----*----)
2      3  2.0000  1.0000            (----*----)
3      3  4.6667  0.5774                      (---*----)
                          -----+---------+---------+---------+----
                             0.0       2.0       4.0       6.0

Pooled StDev = 0.6667
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Figure 3: One-way ANOVA test performed using the Minitab. Comparison of habitat versus number of mounds (N).

DISCUSSION

The Allegheny mound ant prefers to build mounds in open, sunny areas. There was a significant difference in habitat preference ($p<0.001$) with more than twice the number of mounds found in the open areas than in the brush areas and no mounds found in the forest areas. This suggests that the ants prefer not to build in shaded areas or around a large number of trees that may reduce sunlight exposure of the mound. As previously mentioned, sunlight is required to incubate the eggs in the mound. With increased levels of sun exposure, the probability of egg survival and maturation is increased. In the brush areas, only half of the number of mounds observed were active. This may be a result of rapid brush growth that could not be controlled by the ants, resulting in shading of the mound. The shading could have caused the colony to either relocate or be killed due to reduced egg maturation. Predation may also be a cause for abandoning a mound. Meanwhile, all of the mounds found in the open areas were active, suggesting that these areas had the highest sun exposure, which increased the survival rate making it the best area to live in.

The height and diameter of the mounds were similar between the brush and open areas. The mean height and diameter for the mounds in the brush area were 0.423 m and 1.20 m respectively, and for the open area 0.446 m in height and 1.22 m in diameter. The difference in mean height between the brush areas and the open area was 0.023 m and the difference in diameter was 0.02 m. This similarity suggests that even though there were not as many colonies in the brush areas as in the open areas, their populations were just as large.

Suggestions for new research include focusing on how the mounds change between the seasons. Since the ants are most active in mound building during the spring and early summer months, observations of the number of mounds found compared to our results would be interesting. If the literature is correct, the mean number of mounds should increase during those months. Also, the height of the mounds could be measured and compared with our measurements to determine if they have increased in size on account of increasing populations.

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