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Population of a Colony of *Formica Rufa Melanotica* Emery

By ROBERT L. KING AND FRANCIS WALTERS

The observations recorded here were made during the course of a series of studies on the activities of *Formica rufa melanotica* Emery. In this species all the workers are deeply infuscated with black: the smallest workers are entirely black; the largest workers are very dark with clear red head; between these two is a series of intermediate forms with dark head. It has already been established that most of the workers engaged in moving a colony to a new nest were red-headed major workers (Sallee and King, 1947), and observations indicated that most of the workers attending aphids were black-headed minors. This brought up the question of the degree of differentiation and relative numbers of workers in a colony of this species.

Ant colony XP was selected for study, because it was large, vigorous and easily accessible. The nest was circular, about nine or ten inches high, three feet in diameter at the base and two feet in diameter at the top. An area about one foot in diameter in the center of the top of the nest was made up of thatch, with an outer rampart of earth on which grew blue-grass. On the evening of July 9, 1947, cyanogas was poured into several holes made in the nest by thrusting a sharpened broom stick deep into the thatch. The next morning, July 10, all the dead ants on the top of the nest were preserved in alcohol. Then all of the thatch was taken out; the thatch extended down into the nest about one foot; at which depth it was about 18 inches in diameter. This part of the mound contained several gallons of the thatch materials, dried grass stems, twigs, together with many dead ants, pupae and larvae. After all the thatch had been removed, the side walls of earth were removed with part of the lower passageways of the nest, below this level there were many ants still alive. Ants, pupae and larvae were sorted out from less than half the heterogeneous material collected and preserved in alcohol; this tedious work took up the greater part of two days' work by thirteen students. The actual number of adult ants in the colony was probably at least twice the number sorted out which was about 25,000. This was estimated by measuring the total volume of ants, and measuring the volume of a known number of ants picked at random from the whole collection after mixing thoroughly. Weber (1935) has estimated the population of a colony of the nearly related *Formica rufa obscuripes* at 19,000

about $\frac{1}{2}$ or $\frac{1}{3}$ the numbers in this colony of *F. r. melanotica*. Approximately 2,000 larvae and pupae were preserved at the same time and counted in a similar way. There were many ants left in the nest: the day after the digging many ants were observed about the disturbed mound, which they eventually rebuilt, so that within two weeks the colony was apparently going ahead with food-getting and other activities.

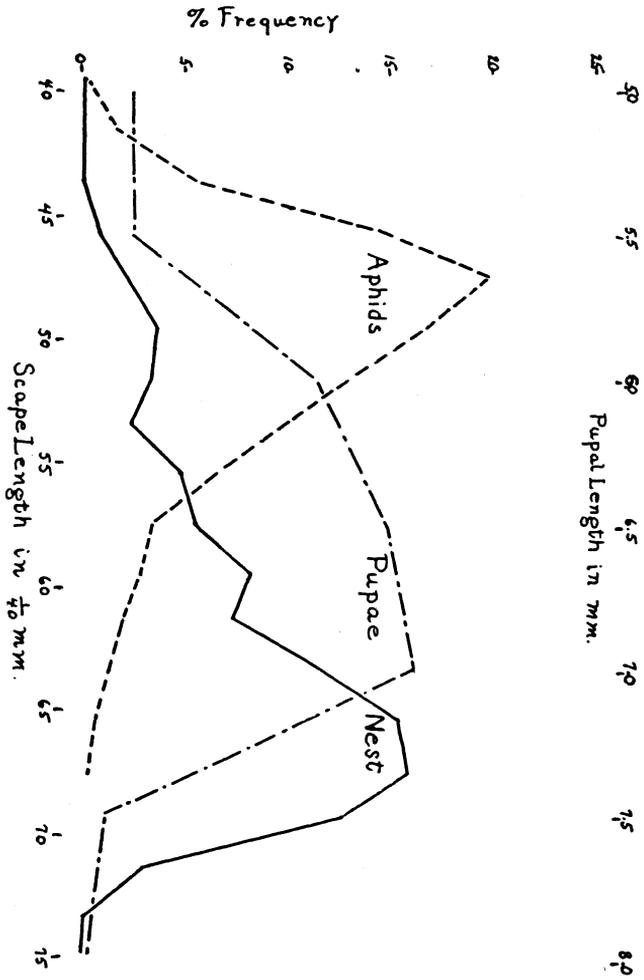
Body length of ants is extremely difficult to measure accurately because of distortion. Measurements on undistorted ants had shown that the body length was approximately 4.25 to 5.10 times the length of the scape, with a tendency for the scape to be relatively longer in smaller ants. Therefore, size of ants is measured in terms of scape length: the right antenna was removed, and the scape measured under the compound microscope with an ocular micrometer, of which one division was equal to 25 microns. Two samples of 500 ants each were removed from the collection, after thorough mixing to insure fair sampling, for classification as to color and for measurement. Each ant was classed as black-headed, dark-headed or red-headed; its scape was measured and recorded. Since the two lots were essentially similar, the results are reported together. There were 700 red-headed workers (majors) with scape length varying from 51 to 73 units, average: 65.83 ± 0.14 (standard error); 226 were dark-headed, varying from 47 to 66 units, average: 56.47 ± 0.27 ; and 74 were black-headed workers (minors) varying from 40 to 57 units, average: 49.62 ± 0.37 . The average scape length for the entire 1000 ants was 62.52 ± 0.20 units; the graph marked *nest* in figure 1 shows their distribution. There is only a slight suggestion of a peak for the black-headed minor workers at about 50, and even less evidence for dark-headed medias. The graph, if representative of the entire population, shows, apparently, a tendency for the largest individuals to be much more numerous in this large, populous colony.

Two hundred and two pupae, selected at random from those preserved, gave an average length of 6.48 ± 0.04 millimeters; their distribution is shown under the graph marked *pupae*. It is to be noted that this is very similar in general shape to that for the ants from the nest, with many more individuals in the larger size classes than in the smaller.

By August 1 the colony XP was reorganized and there was extensive aphid tending on the thistles near the nest. Three thistles were selected, and together with the ants were collected by placing a large cloth bag over the thistle quickly; the stalk of the plant was

cut and the bag tied tightly. The bag was then placed in a large can with cyanogas in order to kill the ants. There were 160 ants on the first thistle, 185 on the second thistle, and 158 on the third; a total of 503 ants. Of these 53.5% were black-headed with average scape length of 47.52 units, 38.9% were dark-headed with average scape length of 52.66; and 7.6% were red-headed with average scape length of 62.44 units. Two other thistles with aphids attended by ants from two other nests were likewise collected, the ants classified and measured, in order to check the results obtained from XP. There were 250 ants, of which 59.2% were black-headed with average scape length of 46.73, 33.2% were dark-headed with average scape length of 52.93, and 7.6% were red-headed with average scape length of 59.00 units. These results were so similar to those from the colony which had been dug out that they are lumped together in the graph over *aphids*. In all there were 753 ants taken from the thistles: 55.4% were black-headed, average scape length 47.34 ± 0.13 ; 37.0% were dark-headed, average scape length 52.64 ± 0.20 ; and 7.6% were red-headed, average scape length 61.56 ± 0.45 units. The average scape length for the entire 753 ants was 50.41 ± 0.18 units. Most of the ants attending aphids are black-headed minor workers which remain at the thistle gathering honey-dew from the aphids all day and apparently all night as they were observed still on the plants as late as midnight. But most of the ants travelling on the trails leading to the thistles seemed to be red-headed major workers. A collection of 90 ants was made along the trail leading to a thistle where aphids were being attended by ants; of these only one was black-headed with a scape of 47; 14 (15.5%) were dark-headed with average scape length 61.21 ± 1.15 ; and 75 (83.3%) were red-headed with average scape length 65.03 ± 0.36 units. Many of the major workers returning to the nest along the trail had distended gasters apparently caused by the honey-dew received from the workers attending and collecting from the aphids. Some transfer of honey-dew was observed at the base of the thistle.

If we compare aphid attendance with activities during moving, we find that the average scape length of ants moving between the old and the new nest were as follows: ants being carried, 60.52 ± 1.34 ; ants carrying other ants, pupae or larvae to the new nest, 67.63 ± 0.23 ; unloaded ants, 66.94 ± 0.55 . Only when ants are collected directly from the old nest when moving is almost finished is there an adequate sample of the smaller ants present: scape length average, 52.43 ± 0.96 .



Ant colonies which are of reasonable size have become favorite subjects for population studies. A recent study by Talbot (1948) has shown an average population of adult ants in the *Formica pallidefulva* group to be slightly less than 1000. But the much larger colonies of the *rufa* and *exsecta* groups of *Formica* present many difficulties: the nests often extend deep into the earth and may contain over 200,000 workers. One colony of *Formica exsectoides* Forel counted by Cory and Haviland (1938) had a total of 238,510 ants of which 1407 were females. Aside from the inherent difficulty of counting such numbers, the census destroys the colony so that no further studies may be made of its activities. For such large colonies a relatively accurate method of estimating population would be of great value. Forbes (1938) has suggested that the number of ants in *Formica exsectoides* colonies might be roughly proportional to the cube of the height of the nest. However, Young (cited from Bodenheimer, 1937, and Andrews, 1929) found no correlation between the number of adult inhabitants and size of nest in the European *Formica rufa*.

Literature Cited

- Andrews, E. A. 1929. Populations of ant mounds. *Quart. Rev. Biol.* 4:248-257.
- Bodenheimer, F. S. 1937. Population problems of social insects. *Biol. Rev.* 12:393-430.
- Cory, E. N., and E. E. Haviland. 1938. Population studies of *Formica exsectoides* Forel. *Ann. Ent. Soc. Amer.* 31:50-57.
- Sallee, R. M., and R. L. King. 1947. An ant colony which moved over two hundred feet. *Proc. Iowa Acad. Sci.* 54:349-352.
- Talbot, M. 1948. A comparison of two ants of the genus *Formica*. *Ecology.* 29:316-325.
- Weber, N. A. 1935. The biology of the thatching ant, *Formica rufa* obscuripes Forel, in North Dakota. *Ecological Monographs.* 5:165-206.

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