

WORKER LONGEVITY IN HARVESTER ANTS (*POGONOMYRMEX*)

BY D. M. GORDON* AND B. HÖLLDOBLER

Museum of Comparative Zoology, Harvard University,
Cambridge, Mass. 02138, USA

Most studies of worker longevity in ants have been made in the laboratory (Haskins and Haskins 1980; Porter and Tschinkel 1982). In the field, increased energy expenditures, predation, and environmental fluctuations may all contribute to shorten the life of a worker ant. In the few existing studies of worker longevity conducted in the field, the lifespan of exterior workers was found to be extremely short. For example, Schmid-Hempel and Schmid-Hempel (1984) found that the half-life of *Cataglyphis* foragers, after they were marked, was only 6 days.

In harvester ants of the genus *Pogonomyrmex*, the only existing field study of worker longevity demonstrated that the average life expectancy of foragers and defenders (ants emerging from the nest in response to a disturbance) of *P. owyhee* is 14 days (Porter & Jorgensen 1981). Here we show that these results for *P. owyhee* cannot necessarily be generalized to other species in the genus, and that longevity results for the exterior workers engaged in one activity, such as foraging, may not apply to exterior workers that do other tasks.

METHODS

P. barbatus

Longevity data were collected near Rodeo, New Mexico in July–August 1987, in the course of other studies of polyethism in *P. barbatus* (Gordon, in prep.). Ants from 38 mature colonies were marked. In each colony, 50–100 workers were marked from each of the activities under study. Foragers were collected while travelling towards the nest on a trail carrying a food item; patrollers were collected while circling the nest area in a characteristic, zig-zag fashion, and after contacting at least 2 other workers with antenna;

*Current address: Centre for Mathematical Biology, University of Oxford, 24-29 St. Giles', Oxford OX1 3LB, England

midden workers while sorting or repiling the colony refuse pile; and nest maintenance workers after they had come out of the nest entrance with a piece of sand, put it down, and turned to go back into the nest (see Gordon 1986 for detailed description of the four activity types). Individuals were marked in the field using Pactra "hot fuel-proof" model airplane paint; ants of each activity were marked with a unique color. In the course of the field season, a total of 3521 individuals were marked: 307 midden workers, 1169 foragers, 895 patrollers, and 1150 nest maintenance workers. Colonies were checked once daily, usually between 8 and 8:30 a.m., for the presence of marked ants.

P. rugosus

Observations were made near Rodeo, New Mexico in July–August 1986. In one colony, 173 foragers were collected on the foraging trail, and marked in the field using Testors PLA paint. On 27 subsequent days, the colony was checked twice daily for marked ants, once between 700 and 1000 and once between 1600 and 1800.

RESULTS

Table 1 shows the numbers of marked ants observed each day subsequent to marking. Exterior workers survive up to 33 days after marking (nest maintenance worker, *P. barbatus*).

Figure 1 shows the longevity data for *P. barbatus* according to activity when marked. As a result, the number of colonies observed and the total numbers of marked ants both varied as a function of number of days since marking. The data in Figure 1 are normalized to take this variation into account. Shown are the ratios of numbers of ants observed to the numbers of marked ants theoretically available to be observed on that day. For example, there were 12 colonies that were observed 11 days after marking, and these colonies contained a total of 819 marked foragers. A total of 10 marked foragers were observed on the eleventh day after marking. The number shown in Figure 1 is $10/819$, or 0.0122, that is, the proportion of all ants marked that were observed. It appears that marked nest maintenance workers outlasted marked foragers, which outlasted marked patrollers.

Table 1. Numbers of marked ants observed as a function of days elapsed since ants were marked. M = midden workers, PT = patrollers, F = foragers, NM = nest maintenance workers.

Days since marking	<i>P. barbatus</i>				<i>P. rugosus</i> F	
	M	PT	F	NM	a.m.	p.m.
1	—	—	—	—	6	2
2	—	—	—	—	7	4
3	—	—	—	—	—	3
4	7	7	4	6	1	4
5	4	7	12	14	2	7
6		4	7	12	3	3
7	0	4	12	5	3	4
8	2	4	3	3	—	4
9	2	1	6	4	1	0
10	7	2	17	13	3	—
11	4	1	10	17	2	1
12	3	3	6	16	8	2
13	0	3	3	8	—	0
14	0	9	2	15	3	3
15	0	1	6	7	0	4
16	1	2	3	3	0	0
17	1	1	3	7	5	6
18	0	1	0	8	3	—
19	2	0	2	6	—	0
20	0	1	0	1	1	4
21	0	2	0	4	—	5
22	0	1	0	0	—	3
23	1	0	1	0	2	6
24	0	2	2	0	—	4
25	0	3	2	0	0	3
26	0	0	0	2	—	1
27	0	0	0	0	2	4
.						
.						
.						
33	0	0	0	1	—	—

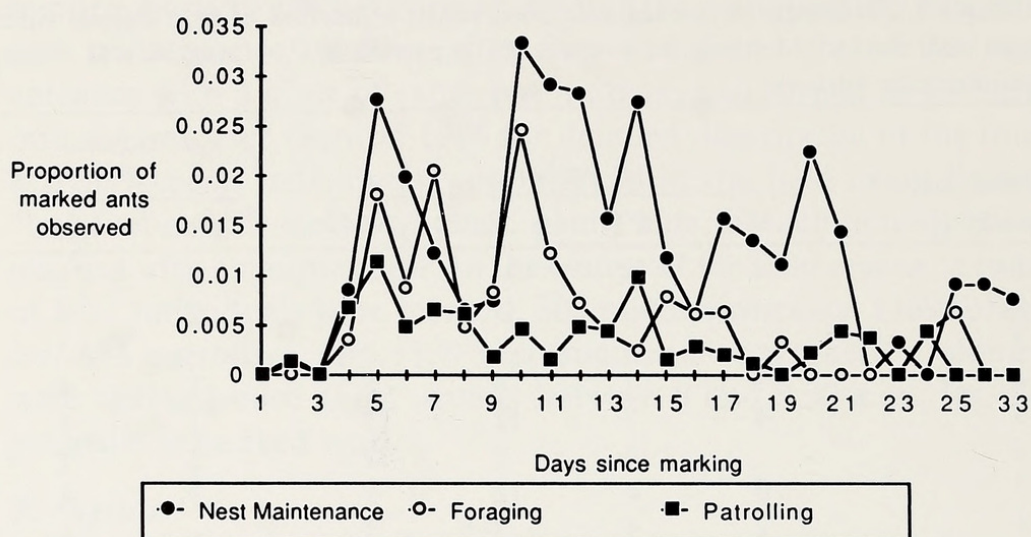


Figure 1. The abscissa shows number of days since ants in a particular activity were marked. The ordinate is the ratio of numbers of marked ants observed to total numbers of ants marked in the colonies under observation on that day (see text for explanation).

DISCUSSION

The main result of this study is to extend the known lower limits on how long a *Pogonomyrmex* worker can live. The results show that in *P. barbatus* and *P. rugosus*, exterior workers can clearly live longer than 14 days after marking.

Figure 1 suggests that activities may be ranked as follows in the order of decreasing longevity: nest maintenance, foraging, and patrolling. Other results indicate that at a given time in a mature *P. barbatus*, there are three distinct groups of workers: one group of individuals that do nest maintenance, one that does foraging, and one that does both midden work and patrolling (Gordon, in prep.; also Gordon, 1984 for *P. badius*). Marked patrollers may disappear the most quickly because they lead the most dangerous lives; it is the patrollers that respond most actively to intrusions by other workers, and the numbers of patrollers increase when artificial disturbances are created (Gordon 1987). Patrollers as defined here probably correspond to the "first defenders" described by Porter & Jorgensen (1981) to be longer-lived than foragers. The latter authors elicited defenders by experimental perturbations, while in the present study patrollers were observed in undisturbed colonies.

Foragers are less likely to engage in confrontations than patrollers are, but they are subject to predation by horned lizards (*Phrynosoma* spp.). Nest maintenance workers, which appear to be the longest-lived, stay closest to the nest. Their task is in some sense the safest of the three. In addition, nest maintenance workers may be younger than the others, if this species adheres to the usual sequence of age polyethism in ants, in which younger ants work inside the nest and then move on to exterior tasks. Nest maintenance workers may be in transition from interior tasks to exterior ones such as patrolling and foraging.

There are two important sources of uncertainty in this study: the paint used for marking can wear off, and marked individuals may still be alive inside the nest. Both these factors would lead us to underestimate worker longevity. More extensive studies are needed to determine how the expected lifespan of a harvester ant worker depends on its task, and how mortality rates vary in different *Pogonomyrmex* species.

SUMMARY

Exterior workers were marked in the field, in colonies of the harvester ants *Pogonomyrmex barbatus* and *P. rugosus*. Some marked workers survived up to about 30 days after marking. These results extend the known limits on how long an exterior *Pogonomyrmex* worker can live. It appears that longevity may depend on worker task, with the following tasks in order of decreasing longevity: nest maintenance workers, foragers, and patrollers.

ACKNOWLEDGMENTS

B. Cuevas, K. Roth, M. Allinei and H. Graham provided invaluable assistance in the field. We thank N. Carlin for comments on the manuscript. The work was supported by National Science Foundation grants BNS-8701480 to D. M. Gordon, and BNS 8521575 to B. Hölldobler.

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<https://doi.org/10.1155/1987/63930>.

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DOI: <https://doi.org/10.1155/1987/63930>

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