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## On the Half-Life of Nests of *Formica obscuripes* Forel.

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## On the Half-life of Nests of *Formica obscuripes* Forel.

By R. L. KING AND R. M. SALLEE

In these Proceedings for 1953 (p. 656) we discussed the duration of nests of *Formica obscuripes* Forel. We now have data for two additional years which establish certain facts only indicated earlier. The survey was started during the summer of 1945 on the grounds of the Iowa Lakeside Laboratory in Dickinson County, Iowa. Nests of the thatching ant were marked with metal tags on wire stakes and were plotted by compass readings from conspicuous features of the surroundings. The survey was repeated each summer; new nests were located and marked, and the loss of old nests recorded. The data are presented in table 1.

Table 1.

Year found	Number surviving in										Deserted
	'45	'46	'47	'48	'49	'50	'51	'52	'53	'54	
1945	110	94	73	63	55	47	43	39	26	20	90
1946		32	29	26	22	21	18	16	12	9	23
1947			22	19	17	17	16	13	10	9	13
1948				8	8	8	7	7	5	5	3
1949					13	11	9	8	8	6	7
1950						7	6	5	3	3	4
1951							11	11	6	6	5
1952								5	3	3	2
1953									14	12	2
Total	110	126	124	116	115	111	110	104	87	73	149

It may be noted that 222 nests were present in the area, of which 110 were found in 1945, and 112 were new nests established since that year. If new colonies of *Formica obscuripes* start as temporary social parasites, some indication (mixed colonies with a host species) should have been found among the new nests. No mixed colonies including the thatching ant with a host species have been found, either among the 112 nests here recorded, or in the many other nests observed by us. Since all the new nests are relatively large when found, or rapidly increase in size, it is believed that these new nests represent either colonies which have moved to new locations, or are the result of swarming from old colonies. Swarming is possible because of the polygynous habit of *Formica obscuripes*; we have noted many instances of the desertion of an old nest and the establishment of a new one, sometimes more than one, from an old nest.

Table 2.

Year	Survived	Deserted	Total	Chi-square	% survival
'45-'46	94	16	110	0.008	85.5
'46-'47	102	24	126	1.751	81.0
'47-'48	108	16	124	0.507	87.1
'48-'49	102	14	116	0.712	87.9
'49-'50	104	11	115	2.544	90.4
'50-'51	99	12	111	1.436	89.2
'51-'52	99	11	110	2.050	90.0
'52-'53	73	31	104	18.382	70.0
'53-'54	73	14	87	1.052	84.0
Totals	854	149	1003	28.442	85.1

Probability < 0.0005 for 8 d.f.

Table 2, extracted from table 1, shows the number of nests deserted and surviving during the years '45-'46 to '53-'54. The survival rate varies from 90.4% for '49-'50 to 70.0% for the year '52-'53. These have been tested by the chi-square method, and give a probability of less than 0.0005 for eight degrees of freedom. Clearly the survival rate varies from year to year, if we disregard the nest age.

For the first time we have statistically acceptable evidence that older nests have a lower survival rate than do younger nests. For this purpose the nests have been divided into two age classes: four years and younger vs. five and older. Since the nests found in 1945 are of unknown age, it is necessary to exclude all of these before the year '49-'50, and to include '49-'50 to '53-'54 as older than five years. The nests are also listed from two areas: the relatively uniform 40 acre area known as "the north 40" and the rest of the laboratory grounds. The latter or "outside" area includes open woods, marshes and some grassland, either relatively low or with scattered trees. These data are presented in table 3, where it may be noted that the survival rate of nests five years old or older in the north 40 is approximately the same as that for nests four years old or younger in the outside area. The chi-square test shows that the material is heterogeneous: the younger nests from the north 40 and the older nests in the outside area contributing most of the heterogeneity. The half-life for each of the components has been calculated, using the compound interest method:

$$\text{Half-life} = \frac{2.3 \log 2}{\text{desertion rate}}$$

For the north 40: four years old and younger, the half-life is 7.8 years; five years and older, it is 4.5 years; for the outside area: four years old and younger, the half-life is 4.9 years; five years and older, it is 3.1 years.

Table 3.

Location	Age in Years	Survived	Deserted	Total	Chi-square	% survived
North 40	4 or less	175	17	192	4.472	91.1
	5 or more	209	38	247	0.296	85.0
Outside	4 or less	116	19	135	0.002	85.9
	5 or more	69	20	89	5.031	77.5
Totals		569	94	663	9.801	86.0

Probability < .03 for 3 d.f.

A total of 148 nests have been marked in the north 40, 84 in 1945 and 64 since; in the outside area a total of 77, 26 in 1945 and 51 since. This indicates a greater overturn in the outside area than in the north 40; within the north 40 there is also heterogeneity: there is less overturn in the areas with a greater number of nests per acre. These facts are thought to be a reflection of the fitness of the environment: colonies of *Formica obscuripes* Forel are more stable in areas which are peculiarly fitted for their presence.

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