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Mixed Colonies in Ants: Third Report

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

There are two species of ants with deep clypeal fossae, belonging to the *rufa* group of the genus *Formica,* found in the region around the Iowa Lakeside Laboratory in northwestern Iowa. One of these, *Formica fossaceps* Buren, is almost hairless, especially on the dorsal surface, while the other, *Formica obscuriventris clivia* Creighton, is very hairy all over, with hairs even on the scapes. The latter species was reported erroneously as *Formica oreas comptula* Wheeler in our earlier papers on mixed colonies (King, '49; King and Sallee '51). We have recorded large worker ants with vestigial wings in both species, and have compared the winged workers with normal workers and females in the two species (King and Sallee, '52; King, '55).

Since there is a bare possibility that these two nominal species may represent two forms of a single dimorphic species, *clivia* will be referred to as "hairy," and *fossaceps* as "hairless." Whatever the final decision the two forms are readily separable in the workers, females and males. During the last 11 years nearly forty-one thousand ants have been examined as follows: in 40 pure colonies of hairless, 5,847 workers, 154 females and 168 males; in 16 pure colonies of hairy, 5,049 workers, 220 females and 70 males; in 15 mixed hairy-hairless colonies, 25,902 workers, 889 females and 2,654 males. As will be apparent later one may never be sure that a "pure" hairless colony will not turn out to be mixed until sexual forms, especially males, have been collected from that nest.

The 15 mixed colonies (Table 1) are arranged in order of percentage of hairless workers present. In the parentheses following the nest designation are the years during which the colony has been under observation. Nest XU is of particular interest because of the extensive collections made.

When first found in 1945 it was mixed, but no collections are now available. In 1946, 38.2% of the workers were hairless, and 33 hairy males were collected; in 1947, 28.5% of the workers were hairless, and six hairy males were collected; in 1948, 41.3% of the workers were hairless, and 26 hairy males were collected. In 1949, 27.9% of the workers were hairless, and all the males (221) were hairy; in 1950, 23.4% of the workers were hairless, and all the males (38) were hairy; in 1951, 27.6% of the workers were hairless, and all the males (324) were hairy; in 1952, 22.2% of the workers were hairless, and all the males (126) were hairy; in 1953, 22.3% of the workers were hairless, and all the males (113) were hairy. In 1954,

Table 1
Mixed Colonies of Ants Observed at Iowa Lakeside Laboratory, 1945-1956

	Workers			Males			Females		
Nest	Hairy	Hairless	Percent Hairless	Hairy	Hairless	Percent Hairless	Hairy	Hairless	Percent Hairless
X (45-53)	0	468	100.0	11	79	87.8	—	—	—
G3 (49-51)	0	641	100.0	69	196	74.0	—	—	—
M (47-56)	0	1001	100.0	18	0	0.0	0	75	100.0
NRW (55-56)	8	2190	99.6	16	180	91.8	0	84	100.0
SI (45)	9	42	82.4	—	—	—	—	—	—
GI (50-56)	649	2446	79.0	46	1	2.1	194	308	61.4
XV (46-48)	125	167	57.2	1	0	0.0	—	—	—
IN (46-56)	1085	1020	48.5	29	36	55.4	86	79	47.9
XU (46-56)	6468	2328	26.5	1376	0	0.0	—	—	—
MW (55)	441	139	24.0	—	—	—	—	—	—
52J (52-53)	666	194	22.6	151	4	2.6	63	0	0.0
TB ((55-56)	344	33	8.8	168	0	0.0	—	—	—
48K (48-56)	4776	283	5.6	273	0	0.0	—	—	—
T (54)	293	7	2.3	—	—	—	—	—	—
S (50)	78	1	1.3	—	—	—	—	—	—

20.8% of the workers were hairless, and all the males (136) were hairy; in 1955, 26.2% of the workers were hairless, and all the males (143) were hairy; in 1956, 21.6% of the workers were hairless, and all the males (210) were hairy. In 1951 and 1952 many (44) of the larger hairless workers in next XU had vestigial wings; none of the hairy workers were so equipped. The long continued mixed condition of this colony with its relatively constant proportion of hairless and hairy workers is most remarkable. Conditions in colony IN, also found in 1945, are similar, but with approximately equal numbers of hairy and hairless workers, females and males.

It is not intended to give an exhaustive discussion of these data at the present time, as more information to be obtained in the future may clarify the situation. However, there are three possibilities which may be mentioned briefly: first, the probable presence of more than one egg-laying female in a colony. One of these females may be a "foreigner" adopted into the colony; this was suggested in the first report on mixed colonies ('49). Second, trophogenic influences might be acting; for instance, both hairy and hairless males might develop normally in a community dominated by hairless workers (colonies X, G3, and NRW), while hairless males might fail to mature in an environment dominated by hairy workers (colonies XU, TB and 48K). Third, that hybridization might be the answer, at least in part, was suggested in the second report ('51). The whole set of genes for hairless might be dominant to that for hairy; it might be expected that intermediate males should be found, but this has not happened. The hybridization hypothesis could be further explored. If "H" represents the gene(s) for hairless, and "h" for hairy, then

hairless females would be HH or Hh, and hairy females hh. The hairless males would be H and the hairy, h. The males are, of course, haploid. There would be six classes of matings:

1 HH x H, with all hairless offspring, pure colonies.

2. HH x h, with all hairless offspring, pure (?) colonies.

3. Hh x H, workers and females hairless, some hairless and some hairy males.

4. Hh x h, workers, females and males of both kinds.

5. hh x H, all workers and females hairless, all males hairy.

6. hh x h, all offspring hairy, pure colonies.

Colonies X and G3 would be examples of class 3; colonies G1 and IN of class 4, and colony M of class 5. Colony NRW would belong in class 3 with the few hairy workers caused by non-disjunction or other chromosome aberrations.

Probably no one of these suggestions alone offers an explanation for the mixed colonies of *Formica fossaceps* and *Formica obscuriventris clivia*. Every new mixed colony offers new data for consideration, but experimental work, relatively arduous and often unrewarding, must be undertaken. Much of our information about colony founding in these forms is tentative and formal, rather than observational or experimental.

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