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***Formica fossiceps* Buren and *Formica obscuriventris clivia* Creighton as Slaves of *Formica rubicunda* Emery**

By R. L. KING and R. M. SALLEE

Abstract. Observations on mixed colonies have shown that *Formica fossiceps* and *Formica obscuriventris clivia* both live as slaves for *Formica rubicunda* together with *Formica cinerea montana* and *Formica fusca*. *Formica obscuriventris clivia* may start its colonies as a temporary social parasite of *fusca*.

Nineteen mixed colonies of ants containing *Formica fossiceps* Buren and *Formica obscuriventris clivia* Creighton have been found in northwestern Iowa (King and Sallee, 1957). Five of such mixed colonies have been under observation for nine years or longer; the proportion of workers of each species has remained relatively constant from year to year in a given colony. All the workers and females of one colony (11 years) are *fossiceps* ("hairless"), but all the males are *clivia* ("hairy"). In another colony (9 years) 78.6 percent (range: 66-82 percent) of the workers, 62.2 percent of the females and 0.7 percent of the males are hairless. In still another, (10 years) 47.9 percent (range: 41-58 percent) of the workers, 47.9 percent of the females and 48.1 percent of the males are hairless. In yet another (13 years) 25.8 percent (range: 21-41 percent) of the workers are hairless, but all of the males are hairy; no females produced. Finally in the last colony (10 years) 6.0 percent (range: 2-11 percent) of the workers are hairless, all the males hairy; no females produced. The favored explanation is that "one species becomes resident with another due to indiscriminate adoption of newly fertilized queens by the established colony of another," (Wilson and Brown, 1958). Other explanations have not been completely abandoned, however.

In the summers of 1957 and 1958, we have found other colonies of interest: a *Formica fusca* colony from which were collected 27 *clivia* workers, some of which were neonate. Although it is generally assumed that colonies of the *Formica rufa* group start as temporary social parasites, such mixed colonies have been observed very rarely (Creighton, 1950). We have also found *F. fossiceps* and *F. obscuriventris clivia* as slaves in *F. rubicunda* colonies. No member of the *rufa* group has previously been reported as an established slave from North America. In Europe, however, although *Formica sanguinea* most often makes slaves of the common *fusca* forms in its environment, it sometimes uses species of the *rufa* group.

There are two species of slave-making formicine ants present in

northwestern Iowa: *Polyergus rufescens breviceps* Emery, and *Formica rubicunda* Emery. During the last 13 years we have collected from 9 nests of the former and from 71 nests of the latter. Of the *Polyergus* nests, eight (one under observation for nine years) had *Formica cinerea montana* Emery as slaves, and one (under observation for six years) had *Formica fusca* L. Of the 71 *F. rubicunda* colonies, 65 had enslaved a single species: 37 *F. c. montana*, 25 *F. fusca* and 3 *Formica lasioides* Emery. Of the six remaining, four had two different species as slaves: two with *F. c. montana* and *F. fusca*, one with *Formica pallidefulva nitidiventris* Emery and *F. fusca*, one with *F. c. montana* and *Formica fossiceps* Buren. The other two colonies had enslaved three species: one with *F. c. montana*, *F. fusca* and *F. fossiceps*; the other with *F. fusca*, *F. fossiceps* and *Formica obscuriventris clivia* Creighton.

The slave making colony known as "Three Spot" was found in 1957; extensive collections were made: 1,825 workers, of which 814 were *fossiceps*, 306 *montana* and 705 *rubicunda*; 78 females, all *rubicunda*. During 1958 collections included 1,280 workers. 897 were *fossiceps*, 28 *montana* and 355 *rubicunda*; 41 females, all *rubicunda*.

The colony designated "Welch North" was also found in 1957; the collections made totaled 516 workers, of which 162 were *clivia*, 31 *fossiceps*, 131 *fusca*, 192 *rubicunda*; and 27 *rubicunda* females. In 1958 the collections included 296 workers, of which 95 were *clivia*, 17 *fossiceps*, 10 *fusca* and 174 *rubicunda*.

The colony called "Rock Pile," found in 1958, yielded a sample of 696 workers, 21 *fossiceps*, 19 *fusca*, 33 *montana* and 623 *rubicunda*.

It is hoped that further data on *Formica fossiceps* and *Formica obscuriventris clivia* will help in the solution of their versatile behavior. This note establishes that both species live as slaves of *Formica rubicunda* together with *Formica cinerea montana* and *Formica fusca*, and that *clivia* may start its colonies as a temporary social parasite of *fusca*.

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