

Queen Recruitment in an Orphaned Colony of *Formica polyctena* Foerst. (Hymenoptera, Formicidae)

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Abstract. In June 1989, in the Gorce Mts (southern Poland) a nest of a highly polygynous *Formica polyctena* Foerst. colony was excavated and all the queens found there (128) were removed. An alien conspecific colony was experimentally established nearby, containing about 50 fecund queens. The orphaned workers invaded the queenright colony and abducted a lot of queens to their own nest.

Key words: *Formica polyctena*, polygyny, queen adoption, intraspecific competition

Wood ant species (or rather their local populations) differ in social structure and organization of their colonies. Some forms are monogynous and (naturally) monodomous, other are polygynous and, potentially, polydomous. The type of social structure, being generally connected with ecological conditions, determines a life strategy of a given society (Mabelis 1994). The life strategy of polygynous wood ants is, among other things, directed at maintaining the longevity of their colonies, which is conditioned by a possibility of constant renewal of the reproductive caste in their nests (Pisarski, Czechowski 1994). The phenomenon of polygyny is very "inconvenient" for the theory of the evolution of eusociality. The hypotheses about its origin vary from

the assumptions about the society-level selection to the concept of the intraspecific parasitism of queens (Keller 1993, Rosengren *et al.* 1993). However, irrespective of the theoretical controversies, it remains a fact that after their nuptial flights new queens enter (though not without restraints) some already existing colonies. It is not yet clear which of the two parties – the queens or the workers from the adopting colony (and maybe both of them) is active in this process (Fortelius *et al.* 1993). The present report throws some light on this matter, however the event described here may look astonishing.

During studies connected with the colonization of wood ants in the Gorce Mts (the Western Carpathians, southern Poland) (Pisarski, Czechowski 1990, 1991, Czechowski 1992, Żurek 1992) in the spring of 1987, Colonies M-I and M-IV of *Formica*

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rufa L. were artificially founded in the field at a distance of about 50 m from each other (there were no contact between them). Both of them must have been queenless because during the two following seasons they were transformed into colonies of *Formica polyctena* Foerst., which was the result of a spontaneous adoption of queens of this species (Czechowski 1993). [An orphaned colony of *F. rufa* practically dies out within 2 years. Evidence of this was provided by another queenless nest of this species (Y-I; see Czechowski 1993) founded artificially in the same area. That nest originally contained numerous pupae of workers. Only few individuals lived till the beginning of the third season of existence of the orphaned colony]. *F. polyctena* species purity of Colonies M-I and M-IV recorded in 1989 has been revealed directly by morphometric analyses (Czechowski 1993).

In summer 1989 (after certain experiments; see Yamauchi *et al.* 1994), both nests were excavated: M-IV (almost the whole of it) on 22 June, M-I (the whole nest) on 23 June. Colony M-IV contained some brood, but no queen was found there. Most probably, that was a monogynous colony [this being suggested by the big size and aggressiveness of the workers (cf Pisarski 1982, Pisarski, Banert 1982)]. In Colony M-I, 128 dealated queens were found¹ and since all of them were taken away, the colony was left virtually orphaned.

On 24 June, 10 m from either of the nests that had been dug out a microcolony of *F. polyctena* was established. Each of them contained about 1000 workers and about 50 fecund (old) queens. They had come from a polycalic society situated 4 km away from both Colonies M. The workers from the microcolonies were mass-marked with silver spray for leather (Magi-Dyes) and the microcolonies were called "silver-I" and "silver-IV", respectively.

The silver-IV colony made some contacts with the M-IV ants (26 June), then increased the distance to 15 m but that did not prevent aggressive encounters. On the following day, however, Colony M-IV moved out of its destroyed nest and settled (for good) 33 m away from the silver-IV colony and its interest in the neighbour ceased. The latter disappeared within two years. Colony M-IV retained its

assumed monogynous character until 1992 and then it probably adopted many new queens (after the death of the old one?). Evidence of this was found out in June 1993 when it was recorded that the size of the nest and the abundance of the colony had increased considerably, the penetration range had increased several times, and the body size of the workers had distinctly decreased.

The relations between Colony M-I and its silver-I neighbours took a different course. On 26 June, the colonies made some contacts but the attitude of the residents to the newcomers was greatly varied. The character of particular encounters oscillated between quite friendly and fairly aggressive. On 27 and 28 June, the silver-I colony moved its bivouac twice and came as close as 8 m from Nest M-I. In consequence, the reconnaissance made by Colony M-I became more intensive, but the situation was still ambiguous. The silver-I ants, for their part, showed no tendency to integrate into the stronger society. Very soon, though, Colony M-I must have undertaken a decisive step because, on 30 June, the following situation was recorded. The area of the last bivouac of the silver-I ants was invaded by M-I workers. The silver-I colony with some of its queens was building a new bivouac which, this time, was farther away from Nest M-I (15 m). On the surface of the mound of Nest M-I there walked a lot of, obviously abducted, queens. Nearly 20 of them were seen at any given time. They kept going in and coming out, so their total number must have been much higher. Even if any resident queens had been overlooked during the excavation of the nest it is impossible that so many of them could have been left. Moreover, the colony had been observed every day since the time of the nest digging and no queen had been seen on the mound or in its vicinity.

The queens were later (the same day) gradually carried inside and never appeared on the surface again. Additionally, three workers marked in silver were noticed on the mound of M-I; they seemed uncertain and were treated brusquely. However, no casualties were recorded. During the same season, Colony M-I produced a new generation of workers. It rebuilt its nest almost in the old place and has been living there until now (1994). The silver-I colony has vanished.

¹ In a previous paper (Czechowski 1993) a number of queens found in Colony M-I was mistakenly given as about 160.

It is known that in polydomous colonies of wood ants female producing nests "open" themselves to receive new queens only for a very short time during the period of nuptial flights (Fortelius *et al.* 1990, 1993). In the above-mentioned case the nuptial flights had taken place a month earlier and the adopted queens were not newly-mated. However, there is no reason to assume that they were, in any way, particularly closely related to the workers of the colony that had adopted them and thus represent a case with interacting monodomous colonies. On the other hand, however, it may very well be expected that the orphaned workers undertook some special course of action in order to obtain the queens. This initiative may be considered a manifestation of active competition for queens between alien colonies of *F. polyctena*.

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