

Wojciech CZECHOWSKI

A raid of *Formica sanguinea* LATR. (Hymenoptera, Formicidae) on a conspecific colony

Abstract. An attack by *Formica sanguinea* LATR. on a neighbouring colony of the same species, containing numerous slave workers and pupae of *F. polyctena* FOERST. is described. The raid was recorded in the Gorce Mts. (Western Carpathians; southern Poland) in August 1989.

INTRODUCTION

Formica (Raptiformica) sanguinea LATR. is a Palaearctic social parasite that practises slavery. Ants of the subgenus *Serviformica* FOR. are typical slaves of this species. Colonies of *F. sanguinea* occasionally contain slaves of the subgenera *Coptoformica* MÜLL. and *Formica* s. str. (CZECHOWSKI 1989), and even of the genus *Camponotus* MAYR (GALLÉ, pers. comm.).

For several years the Gorce Mts. (Western Carpathians, Western Beskidy; southern Poland) have been the study area for investigations on the artificial colonization of red wood ants in the National Park there (PISARSKI, CZECHOWSKI 1990a,b). A new method of colonizing *F. polyctena* FOERST., through *F. sanguinea*, is being tested at present, and this method takes advantage of the phenomenon of autonomization of slaves (CZECHOWSKI 1991). The situation described here sprang into notice on this occasion.

DESCRIPTION OF THE OBSERVATIONS

The observations were carried out at Ochotnica Górna in 1989. The study area was an open part of a steep slope with a southeastern aspect overgrown with a plant community similar to the pasture association *Lolio-Cynosuretum*, and here and there grew young spruces. This area, situated at 740-780 m above sea level, was surrounded with a spruce forest. The habitat was settled by a population of *F. sanguinea* consisting of 8 colonies. The nest density was 0.2/100 m². All the colonies contained *F. cunicularia* LATR. and (or) *F. fusca* L. slaves. In one extreme case the share of slaves reached 40% (*F. cunicularia* - 33%, *F. fusca* - 7%) of the mixed swarm.

Some colonies were artificially enriched with various numbers of *F. polyctena* pupae. The workers emerged from these became slaves of *F. sanguinea*. The colony to be described, its symbol was SP-VI, received about 30,000 *F. polyctena* pupae on

30 July. It had previously contained natural slaves (*F. cunicularia* and *F. fusca*), but their number did not exceed a few per cent (for each species) of the entire swarm. Towards the end of August workers emerged from the major part of *F. polyctena* pupae. The rapid increase in the abundance of Colony SP-VI caused a speedy enlargement of the nest at first, and then the mixed swarm moved out. About 20 August the ants began to settle in an empty nest with a soil mound (probably deserted by *F. cunicularia*), located 2.5 m from the previous one. Within a few days almost all *F. sanguinea* workers (initiators of the removal) and their natural slaves went to the new nest. Most of the *F. polyctena* workers and a great part of the remaining slave pupae were also carried there. No transportation or presence of any offspring of *F. sanguinea* was recorded. A permanent ant route between the old nest and the new one (SP-VI') was established. It had a small ground foraging station, situated at a colony of aphids on a root of the closest small spruce.

The removal of Colony SP-VI virtually coincided with the establishment of Colony N-III of *F. sanguinea* that had suddenly appeared from nowhere and settled 3 m from Nest SP-VI'. Its nest was built under a stone, in a place where *Lasius flavus* (FABR.) had nested. The colony of *L. flavus* had been evicted without any trace. The new arrivals were visibly different from the rest of the local *F. sanguinea* population. Their workers were bigger and very light-coloured (with orange alitrunks). They were extremely aggressive. Colony N-III contained 19% of slaves: *F. fusca* - 15% and *F. cunicularia* - 4%.

On 27 August, a cool and wet day, Colony N-III attacked Nest SP-VI' in a way typical of raids of *F. sanguinea*. The observations of the conflict were begun at 10.45. At that time the combat was going on at a distance of 60 cm from the edge of the nest attacked, and it was unusually fierce. Later this place was merely a 1000 cm² patch of vegetation burnt by formic acid. As the conflict developed, the defense of the nest involved the whole *F. sanguinea* swarm and the older slave individuals of *F. polyctena*. On the battlefield the numerical ratio of these species (only from Colony SP-VI) was about 2:3. At 11.45, in spite of the desperate defense, the front line had moved directly to Nest SP-VI' and by then only very young (colourless) *F. polyctena* workers, workers of *F. cunicularia* and some *F. fusca* stayed in both nests (SP-VI and SP-VI') of the attacked colony - the rest of the swarm found itself on the battlefield. Thus the communication between the nests practically ceased to exist. Many *F. fusca* individuals (from both colonies) actively took part in the conflict. The same cannot be said about *F. cunicularia*.

For a long time the ants that had remained in Nest SP-VI' (and even more so those from SP-VI) did not react to the events happening close by. Only when the front line touched the foot of the nest did they begin to carry pupae outside - and left them on the nest surface. Within a few minutes the whole surface of the mound was thickly covered with pupae. It was clear that young, inexperienced and physically awkward workers of *F. polyctena* were completely helpless in the situation that had arisen. They carried pupae from one place to another and milled with them all over the surface of the nest.

At about 12.00 the first aggressors reached the edge of Nest SP-VI' - and their attack was stopped there for a few minutes. Separate *F. sanguinea* individuals found themselves in a mass of young *F. polyctena* workers. The latter, although physically weak, resisted the attack fiercely when acting in a great number and

faced with an immediate threat to the nest. This saved the pupae. It was only now that young workers began to carry them outside the nest. In the first phase, however, it was a panicky scurry in various directions. The pupae carried out of the nest were placed directly on the ground over a considerable area within a radius of 0.5 m from Nest SP-VI'. *F. fusca* and *F. cunicularia* ants, according to their wont, climbed with pupae up the grass growing round the mound. Young *F. polyctena* workers seemed to know nothing about the existence of the safe Nest SP-VI nearby. No wonder. Most of them had just emerged in the new nest and had never left it, or they got there in a passive way, carried by *F. sanguinea*. On the other hand, their nestmates that had remained in the old nest seemed to know nothing about the dramatic conflict in the vicinity.

At 12.15 *F. sanguinea* and the slaves from Colony SP-VI that had been taking part in the fight suddenly, as if signalled, had left the still vast battlefield at the foot of the nest. They run up the mound and immediately joined in the rescue operation for the pupae. A moment later the whole SP-VI' nest was taken possession of by the attackers. However, there practically were no pupae (and defenders) in it.

The pupae were saved, no doubt, by the mass return of the *F. sanguinea* swarm from the battlefield. These ants, unlike the helpless slaves, caught pupae and promptly went resolutely to Nest SP-VI. In this way they organized and directed the preciously chaotic evacuation. Two distinct ways to SP-VI were formed: one direct and one through the foraging station. At the station the pupae were left and taken over by other ants. The moment the contact with Nest SP-VI was resumed ants from that nest joined the operation, and this made it more efficient.

After capturing Nest SP-VI' the aggressors searched it, and then moved over next 30 cm while fighting with the defenders retreating to SP-VI. About 13.00 *F. sanguinea* from Colony N-III began the withdrawal to its own nest.

The course of the conflict is illustrated in Figure.

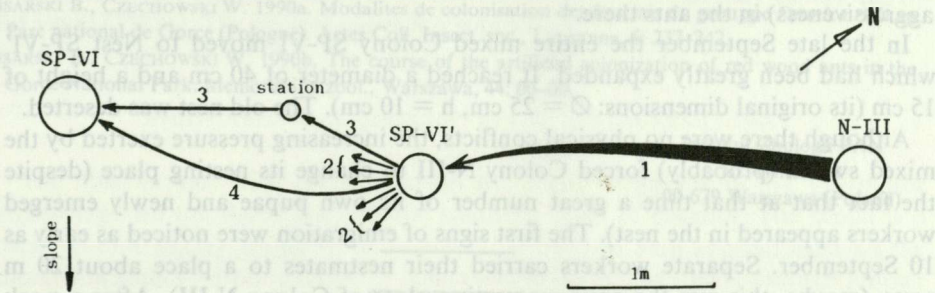


Fig. Situation of the nests of Colonies SP-VI and N-III of *F. sanguinea* and the course of the conflict between them (1 – route of the raid of Colony N-III; 2 – directions of the panicky scamper of young slaves with pupae; 3 & 4 – ways of the organized evacuation of the mixed colony, directed by *F. sanguinea* workers).

The aggressors managed to capture only about 100 pupae. The losses of each side in the conflict are estimated at about 500 casualties. The corpses were carried to the nests even during the fight. The last phase of the conflict revealed the special role of natural slaves: *F. fusca* in Colony N-III, and *F. fusca* with *F. cunicularia* in Colony SP-VI. The former captured and the latter rescued far more pupae than could be predicted from their numerical shares in the mixed colonies. At the

moment *F. sanguinea* started the seizure of Nest SP-VI' it still contained some pupae, but they did not attract the attacking *F. sanguinea* ants that were engrossed in their fight with the defenders. However, their slaves, *F. fusca* (*F. cunicularia* had remained in the nest), were not involved in direct combat. Neither were they attacked by *F. sanguinea* from Colony SP-VI or their slaves. These ants unrestrainedly penetrated the foreign nest in search of pupae. They even snatched some away from weaker *F. polyctena* workers. After seizing a pupa, ant *F. fusca* immediately headed for its (N-III) nest.

At the same time, while *F. sanguinea* and *F. polyctena* were still defending the nest, the pupae that remained on (or in) it were carried away mainly by *F. cunicularia* and *F. fusca*. Even later, when the nest had been captured by the attackers and deserted by the defenders, these slaves returned to the nest. Manoeuvring among alien *F. sanguinea* these ants carried separate overlooked pupae out of the nest.

On the following day *F. sanguinea* from N-III penetrated the area almost up to the foot of nest SP-VI'. The nest itself was virtually empty, but on it there were several *F. sanguinea* and *F. polyctena* workers from Colony SP-VI. The next ten days were cold and rainy. The searching activity of ants ceased altogether. Yet it was a period that probably decided the further fate of the conflict and the eventual success of Colony SP-VI. It changed the configuration of forces – new slaves had emerged of the pupae saved, and thousands of juvenile *F. polyctena* individuals had matured enough to undertake tasks outside the nest. As a result of this the deserted nest SP-VI' was re-settled before 10 September. There was a great increase in the dynamic density of workers penetrating the area round the nest, and also in their range. New foraging stations were founded root aphids. In mid-September ants from SP-VI' (*F. polyctena* and *F. sanguinea*) reached almost up to Nest N-III itself. There were no conflicts. What is more, individual *F. sanguinea* workers from Colony N-III, experimentally carried onto Nest SP-VI' generated only curiosity (no aggressiveness) in the ants there.

In the late September the entire mixed Colony SP-VI moved to Nest SP-VI' which had been greatly expanded. It reached a diameter of 40 cm and a height of 15 cm (its original dimensions: $\varnothing = 25$ cm, h = 10 cm). The old nest was deserted.

Although there were no physical conflicts, the increasing pressure exerted by the mixed swarm (probably) forced Colony N-III to change its nesting place (despite the fact that at that time a great number of its own pupae and newly emerged workers appeared in the nest). The first signs of emigration were noticed as early as 10 September. Separate workers carried their nestmates to a place about 20 m away (maybe, this was the previous nesting place of Colony N-III). After a week the removal activities were much more intensive and by 21 September the nest of the recent aggressors was almost completely empty.

A random sample (n = 83) taken on that day (by means of a vacuum cleaner) from Colony SP-VI revealed the following composition of the swarm: *F. polyctena* – 83%, *F. sanguinea* – 15%, *F. cunicularia* – 1%, *F. fusca* – 1%. On the basis of the known number of *F. polyctena* pupae supplied to the colony (and assuming that there had been losses of over a dozen per cent caused by *F. sanguinea* devouring some pupae and by the conflict described) the abundance of *F. sanguinea* alone could be estimated approximately at 5,000 individuals. The abundance of the *F. sanguinea* swarm in N-III was, in a rough comparison, about twice as high.

DISCUSSION

No doubt, the phenomenon described is interesting in itself. The question of its origin, however, has not been solved. Alternative questions can be asked:

1. Was Colony SP-VI attacked by *F. sanguinea* as a conspecific one, or did the scouts from Nest N-III find it a weak, unstable colony of *F. polyctena*?

2. What was the reason for the raid – an attempt at obtaining slaves or at getting rid of a food competitor (see: CZECHOWSKI 1975, 1977), and did the fact that some pupae were robbed only reflect the behavioural ritual of *F. sanguinea*?

It is impossible to answer these questions. Yet the fact remains that *F. sanguinea* attacked another nest of *F. sanguinea* and carried its pupae away. Only minutes decided that there were a hundred pupae stolen, not thousands. If the attacked nest had contained not only slave pupae, but also *F. sanguinea* one (and such a situation cannot be ruled out) the latter would have been captured as well. Attention therefore must be drawn to intraspecific relations in *F. sanguinea*. It is quite possible that there occur cases of intraspecific social parasitism.

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Instytut Zoologii PAN
ul. Wilcza 64
00-679 Warszawa (Poland)

STRESZCZENIE

Raid *Formica sanguinea* LATR. (Hymenoptera, Formicidae) na mrowisko konspiracyjne

W końcu sierpnia 1989 r. w Gorcach (Beskidy Zachodnie) zaobserwowano raid *Formica sanguinea* LATR. na jedno z dwóch gniazd zajmowanych przez inne społeczeństwo tego gatunku. Znaczną część zaatakowanego mrowiska stanowiły niewolnice z gatunku *F. polyctena* FOERST. Napastnicy zmusili mieszany rój do ucieczki do drugiego gniazda i zrabowali niewielką liczbę niewolniczych poczwerek. Po dwóch tygodniach mieszany rój, wzmocniony wieloma nowo wylęglymi robotnicami *F. polyctena*, powrócił do opuszczonego gniazda i bierną presją zmusił niedawnych napastników do zmiany miejsca gniazdowania.