

## Nest competition between *Camponotus vagus* (SCOPOLI, 1763) and *Camponotus herculeanus* (LINNAEUS, 1758) (Hymenoptera: Formicidae) in the Białowieża Forest (Poland)

Wojciech CZECHOWSKI

### Abstract

A conflict for a nesting site between two dendrophilous ant species, *Camponotus vagus* (SCOPOLI, 1763) and *C. herculeanus* (LINNAEUS, 1758) in the Białowieża Forest (Poland) is described. A colony of the former unsuccessfully tried to take over a log dwelled by a colony of the latter and its plesiobiotic partner, a colony of *Formica fusca* LINNAEUS, 1758. A competitive basis and a course of the conflict are discussed.

**Key words:** Ants, *Camponotus vagus*, *Camponotus herculeanus*, *Formica fusca*, competition, plesiobiosis

Prof. Dr. Wojciech Czechowski, Museum and Institute of Zoology, Polish Academy of Sciences, 64 Wilcza Str., 00-679 Warsaw, Poland. E-mail: wcz@miiz.waw.pl

### Introduction

Both *Camponotus vagus* (SCOPOLI, 1763) and *C. herculeanus* (LINNAEUS, 1758) are dendrophilous species, oligotopes of coniferous forests that also enter some mixed and deciduous forests. The former, a Euro-Siberian species, inhabits mainly light and warm forests where it prefers open places, especially old clearings, nesting in dry rotten stumps, in and under fallen wood, and among tree roots. The latter, a boreo-montane species, inhabits mainly shaded forests, but is also seen in sunny clearings, nesting in rotten stumps, in and under fallen logs and, occasionally, mining stems of living trees. In Poland, *C. vagus* is a very rare species, recorded only from a few dispersed sites, mainly in eastern regions of the country, whereas *C. herculeanus* occurs mainly in north-eastern regions and in the mountains (CZECHOWSKI & al. 2002). In the three-level interspecific competition hierarchy in ants, *Camponotus* species are placed on the medium level, being aggressive non-territorial forms defending their food sources (VEPSÄLÄINEN & PISARSKI 1982, SAVOLAINEN & VEPSÄLÄINEN 1988, 1989, PISARSKI & VEPSÄLÄINEN 1989, SAVOLAINEN & al. 1989).

As the ecological needs of *C. vagus* and *C. herculeanus* coincide with each other to a large extent one can expect intense competitive interactions between them, where these two species co-occur. An interesting case of such interference competition for a nesting site is reported in this paper.

### Study area and methods

The observations were carried out in the managed part of the Białowieża Forest, northeastern Poland, in 2003. Both *Camponotus* species are fairly abundant there, especially *C. herculeanus*. The study site comprised the outskirts of two forest divisions together with the border line between them. The colony of *C. vagus* nested in an insolated thinned area within a neglected thick spruce plantation at a distance of ca. 60 m from a mid-forest division route. The nest was under and in a decaying spruce log 65 cm long and 45 cm in diameter, abandoned during a previous timber felling. This site seemed to be the only suitable for *C.*

*vagus* within a radius of at least 50 m. The colony of *C. herculeanus* nested right behind the route in an adjacent division on the edge of a spruce-oak forest under and in a decaying fallen spruce log ca. 3 m long and 35 - 60 cm in diameter. The area was inspected almost every day (around noon) during a period of more than two weeks in August. Hot and rainless weather prevailed at that time. Then this place was re-visited in late September.

### Results

The conflict between the colonies of *C. vagus* and *C. herculeanus* was first noticed on 2 August. It could have been going on for some time, but was still in its incipient phase, judging by the ensuing evolution of attitudes of the parties. There was a two-way path of *C. vagus* workers leading from its own nest to the log with the nest of *C. herculeanus*. Traffic intensity was 1 - 3 individuals (almost exclusively major and medium workers) per minute either way. All the time, simultaneously with the conflict, *C. vagus* was carrying on a routine diffuse search of its around-nest area, visiting aphids on young spruces.

Throughout the observations, the conflict developed exceptionally sluggishly. Not more than about a dozen *C. vagus* workers were moving about in the immediate vicinity of the *C. herculeanus* log at any given time, and not more than a few were penetrating the surface of the log, entering each crevice or hole. At the same time, no more than a few to about a dozen workers of *C. herculeanus* (only major forms) were patrolling the entire length of the log, sometimes – at times of increased activity of *C. vagus* – congregating near their own nest entrances. However, *C. herculeanus* individuals usually operated alone, while *C. vagus* workers tended to move in small groups (usually of 2 - 3, rarely more individuals).

This situation continued throughout the period of observation. Changes over time were only seen in the numerical proportions of the species at the site of the conflict and the responses of ants meeting non-conspecifics. Changes in the abundance of the parties were erratic and ap-

peared to be random, with the two species taking turns to prevail numerically on the *C. herculeanus* log. On the other hand, the mutual attitude of the species changed in time in a more regular fashion. Upon encountering an enemy during the first few days, the ants would usually avoid a fight and would most often jump away if they touched one another. It could be seen, however, that *C. herculeanus* was the species that pushed for such encounters as its workers penetrated the log, obviously in search of intruders and would occasionally attempt to attack a *C. vagus* individual they bumped into. Such individual fights lasted 1 - 2 seconds, following which the ants dispersed or fell from the log onto the ground, where they would separate without any harm to either of them.

Mutual aggression increased in time. *Camponotus vagus* no longer stepped out of the way of *C. herculeanus*, there were more and more fights, which now took longer to end with more individuals of one or the other species joining in. Victims were also recorded, first on 10 August, when four dead individuals (two of either species) locked in combat were found on the ground near the *C. herculeanus* log. Some *C. vagus* workers coming back to their nest were maimed (lacking an antenna or part of a leg), and others walked with the head of a *C. herculeanus* attached to their antenna or leg. Similar signs of fighting could also be seen in some of the *C. herculeanus* workers patrolling the environs of the threatened nest. An individual with the head of a *C. vagus* ant on its antenna was seen on the log for a few consecutive days. *C. vagus* individuals carrying a dead *C. herculeanus* into their nest were seen sporadically. The vast majority of the victims were left where they lay and did not raise much interest on the part of workers of either species. Sugar baits placed at the site of the conflict were totally ignored by the *Camponotus* ants.

After 10 August the conflict escalated even more. *C. vagus* ants were evidently hunting their opponents, who still operated individually. For example, on 15 August a grouping of several *C. vagus* workers was seen on the ground next to the log when some of these workers were killing a *C. herculeanus* individual, with three other individuals of the latter species already dead. Within the next 15 minutes or so the *C. vagus* ants captured and killed two more *C. herculeanus* workers, which, however, did not alarm the local colony or even provoke a response from its individuals operating nearby.

The observations were discontinued on 17 August, when the conflict was still far from resolution. A follow-up inspection was undertaken after 5 weeks, in late September. It was already cold then and the ants were not active outside their nests. The *C. vagus* colony could not be found at the place where its old nest had been. It is not known where it had moved. *Camponotus herculeanus* retained its nest; there were numerous nesting chambers under the log jam-packed with old inhabitants. At the same time a plesio-biotic strong colony of *Formica fusca* LINNAEUS, 1758 nesting together with *C. herculeanus* was revealed. The chambers of both species were only separated by thin walls of earth and sawdust.

## Discussion

There are no doubts that the conflict between *C. vagus* and *C. herculeanus* was over the nest of the latter, or rather

the nesting site. Such situations are frequently reported in the literature, e.g., feuds between *Lasius niger* (LINNAEUS, 1758) and *Myrmica rugulosa* NYLANDER, 1849 or *M. rubra* (LINNAEUS, 1758) (CZECHOWSKI 1979, 1985). The most likely reason for the activity of *C. vagus* against *C. herculeanus* was the inability of the former to expand their own nest to meet the needs of the developing colony (the scope for wood nest expansion is limited) and lack of a suitable site for a new nest nearby. When the attempt at taking over a foreign nest failed, the colony of *C. vagus* must have found another, perhaps even more distant site before the growing season ended, as indicated by the abandonment of its old nest.

The conflict could not have been over inadequate food resources in the environment. This possibility appears to be unlikely due to, first, the surprisingly long distance between the *Camponotus* nests and, second, the total ignorance of the baits on the part of both species and little interest in freshly killed victims. At some other time and elsewhere within the Białowieża Forest, *C. vagus* was very keen to use sugar baits, engaging in active competition with *F. fusca* (Czechowski, unpubl.). It is also known that *Camponotus ligniperda* (LATREILLE, 1802), a close relative of *C. herculeanus*, can become a specialist myrmecophage when other food is lacking (CZECHOWSKI & PISARSKI 1988). The observation presented in this paper, despite being confined to a single incident, shows that *C. vagus* and *C. herculeanus* are contest competitors (at least for nesting sites) in zones where the respective ranges of their habitat tolerance overlap.

The course of this interspecific conflict was interesting in its own right, since it did not at all resemble the cruel and massive ant competitive "wars" involving *Formica*, *Lasius*, or even *Myrmica* species (e.g., MABELIS 1979, CZECHOWSKI 1985, 1990a, b). Despite the involvement of considerable forces (an over 60 m trail, with high intensity of traffic for this species), *C. vagus* attacked, as it were, half-heartedly. *Camponotus herculeanus*, in turn, mustered a minimal number of individuals only to avert the assault, just like *C. ligniperda* in a conflict situation (CZECHOWSKI & PISARSKI 1988), and these individuals did not succour one another when in danger. This helped the potentially very dangerous conflict (compare the intraspecific conflict in *C. ligniperda* in CZECHOWSKI & PISARSKI 1988) to resolve using practically only skirmishers, with a minimal toll of victims.

The associated finding of social symbiosis between *C. herculeanus* and *F. fusca* represents a model example of plesio-biosis, both in terms of location of nests (under a cover), as well as taxonomic (different genera) and biological (different behaviours, foraging strategies and positions in interspecific competitive hierarchy) dissimilarities between the partner species (WHEELER 1926, WUORENINNE 1958, HÖLDOBLER & WILSON 1990).

## Zusammenfassung

Ein Konflikt um den Nestplatz zwischen zwei dendrophilen Ameisenarten, *Camponotus vagus* (SCOPOLI, 1763) und *C. herculeanus* (LINNAEUS, 1758), im Wald von Białowieża (Polen) wird beschrieben. Eine Kolonie der ersteren Art versuchte erfolglos, einen Baumstamm, der von der letzteren Art zusammen mit ihrem plesio-biotischen Partner *Formica fusca* LINNAEUS, 1758 bewohnt wurde, zu über-

nehmen. Die zugrunde liegende zwischenartliche Konkurrenz und die Entwicklung des Konflikts werden diskutiert.

## References

- CZECHOWSKI, W. 1979: Competition between *Lasius niger* (L.) and *Myrmica rugulosa* NYL. (Hymenoptera, Formicidae). – *Annales Zoologici* 34: 437-451.
- CZECHOWSKI, W. 1985: Competition between *Myrmica laevinodeis* NYL. and *Lasius niger* (L.) (Hymenoptera, Formicidae). – *Annales Zoologici* 39: 153-173.
- CZECHOWSKI, W. 1990a: Intraspecific conflict in *Formica exsecta* NYL. (Hymenoptera, Formicidae). – *Memorabilia Zoologica* 44: 71-81.
- CZECHOWSKI, W. 1990b: Aggression of *Formica aquilonia* YARR. to *Camponotus ligniperdus* (LATR.) (Hymenoptera, Formicidae) under the conditions of artificial colonization. – *Memorabilia Zoologica* 44: 83-91.
- CZECHOWSKI, W., RADCHENKO, A. & CZECHOWSKA, W. 2002: The ants (Hymenoptera, Formicidae) of Poland. – *Muzeum i Instytut Zoologii PAN, Warszawa*, 200 pp.
- CZECHOWSKI, W. & PISARSKI, B. 1988: Inter- and intraspecific competitive relations in *Camponotus ligniperdus* (LATR.) (Hymenoptera, Formicidae). – *Annales Zoologici* 41: 355-381.
- HÖLLDOBLER, B. & WILSON, E.O. 1990: *The Ants*. – The Belknap Press of Harvard University Press, Cambridge, MA, 732 pp.
- MABELIS, A.A. 1979: Wood ant wars. The relationship between aggression and predation in the red wood ant (*Formica polyctena* FÖRST.). – *Netherlands Journal of Zoology* 29: 451-620.
- PISARSKI, B. & VEPSÄLÄINEN, K. 1989: Competitive hierarchy in ant communities (Hymenoptera, Formicidae). – *Annales Zoologici* 42: 321-329.
- SAVOLAINEN, R. & VEPSÄLÄINEN, K. 1988: A competition hierarchy among boreal ants: impact on resource partitioning and community structure. – *Oikos* 51: 135-155.
- SAVOLAINEN, R. & VEPSÄLÄINEN, K. 1989: Niche differentiation of ant species within territories of the wood ant *Formica polyctena*. – *Oikos* 56: 3-16.
- SAVOLAINEN, R., VEPSÄLÄINEN, K. & WUORENRINNE, H. 1989: Ant assemblages in the taiga biome: testing the role of territorial wood ants. – *Oecologia* 81: 481-486.
- VEPSÄLÄINEN, K. & PISARSKI, B. 1982: Assembly of island ant communities. – *Annales Zoologici Fennici* 19: 327-335.
- WHEELER, M.W. 1926: *Ants, their structure, development and behaviour*. – *Bulletin of the American Museum of Natural History* 20: 347-375.
- WUORENRINNE, H. 1958: Muurahaisten lajienvälisistä suhteista. – *Annales Entomologici Fennici* 24: 19-28.