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NOTES ON THE COEXISTENCE OF THE SUPERCOLONIAL *LASIUS NEGLECTUS* VAN LOON, BOOMSMA ET ANDRÁSFALVY 1990 (HYMENOPTERA: FORMICIDAE) WITH OTHER ANT SPECIES

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Abstract. *Lasius neglectus* is an invasive species known for about ten years. This species excludes other ant species from the areas of its supercolonies and causes much trouble for people by intruding to their houses. Apart from these, there is not much we know about the ecology of *L. neglectus*. The aim of my paper is to compare ant communities living in the border and in the centre of the *L. neglectus* colonies. As my experiences show *L. neglectus* reaches a quite high abundance in the centres of the supercolonies at the expense of the abundance of other ant species. It was proved using the χ^2 test, that the distribution of the *L. neglectus* in the centre area and the border was significantly different ($p<0.95$). We have also demonstrated that the Shannon diversity of the centre assemblage is significantly smaller than the diversity of the border ($p<0.95$). This can be explained by the polygynous strategy, which is characteristic for *Lasius neglectus*.

Keywords: Lasius neglectus, *supercolony, colony formation, ant communities, coexistence, aggression*

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Introduction

Lasius neglectus van Loon, Boomsma et Andrásfalvy, 1990 was described as an invasive species in Hungary (van Loon *et al.* 1990). Former field studies clearly show that deeper ecological knowledge of this species could be important in many respects. Presumably this is an invasive species of the Hungarian fauna, which is able to colonise many different habitats and successfully excludes the indigenous ant species from large areas (van Loon *et al.* 1990, Tartally 1999, 2000). It is also worth to mention that most of its supercolonies are in human settlements. The huge amount of *L. neglectus* cause a lot of inconveniences for people living in infected houses. The fact that in 1998 the species was described of a 2 km^2 supercolony (van Loon *et al.* 1990). In that time this species was known in three localities in Budapest. Since then the number and the size of known Hungarian supercolonies increased (Tartally 1999, 2000) and supercolonies from Spain (Espadaler 1999), from Rumania (Markó 1998) and Czechia by Seifert (personal comm. by S. Csősz), have been recorded. *L. neglectus* has an ecological plasticity, it is able to successfully colonise in different wooded and unwooded habitats, and 29.7% of the Hungarian ant fauna (Gallé *et al.* 1998) was found on the edge of *L. neglectus* supercolony areas (Tartally 1999, 2000). Colonies of *L. neglectus* contain several queens. Another polygynous species, the *L. sakagamii* Yamauchi and Hayashida 1970, known in the *Lasius* subgenus, occurs in Japan (Yamauchi and Hayashida 1970, Yamaichi *et al.* 1981).

The publications so far on *L. neglectus* (van Loon *et al.* 1990, Boomsma *et al.* 1990a, 1990b, Seifert 1992, 1996, Gallé *et al.* 1998, Markó 1998, Espadaler 1999) are concerned with the taxonomy and distribution. The aim of this paper is to compare ant assemblages living in the border and in the centre of the *L. neglectus* colonies.

Materials and methods

A supercolony of *L. neglectus* was studied (Tartally 1999, 2000), in the Botanical Garden of Kossuth Lajos University, Debrecen, Hungary in 1998. The area of this colony is 0.07 km^2. This is the most natural area in Hungary, where *L. neglectus* supercolony has been found. Grassland patches and planted trees (*Thuja occidentalis, Juniperus virginiana, J. communis, Chamaecyparis lawsoniana, C. pisifera, Buxus sempervirens, Picea abies, Pinus strobus, P. mugo, Sorbus aucuparia, S. borbásii, Acer pseudoplatanus, Fraxinus excelsior, Abies concolor, Magnolia kobus, Pyrus pyraster, Quercus robur*) alternate in the area. The dendrology map of the garden is given by Papp (1997). Three types of sites were differentiated:

(1) The area where the workers venture out during food searching is the border of the colony. (2) Where the mosaic of *L. neglectus* and other ant species nests alternates is called the edge of the colony. (3) The centre of the colony is the area rarely occupied by other ant species nests.

No aggressive behaviour was observed between the workers from the different parts of the site, therefore I regarded all the nests to belong to the same supercolony.

On the area of the supercolony in Debrecen I did the following assays:

(1) I chose two 5×5 m grassy areas, on the edge and in the centre of the colony, where the nests of various ant species were mapped with an 1×1 m frame divided by 10×10 cm squares. The squares contained at least one exit we marked with different characters depending on the species (Fig. 1a, b). If the owner species of the exit was not active, I dig till I found workers. The 10×10 cm squares were reasonable choices because no any square contained exits of different species.

The distribution of the *L. neglectus* in the centre area and the border was compared by the $\div^2$ test. The diversity of the ant assemblages of these areas was compared by the Hutcheson test of the Shannon diversities using the NuCoSA package (Tóthmérész 1993).

(2) The centre of the colony is crossed by a road with flower-beds on both sides, considered as a homogeneous habitat. A transect line along the flower-beds, consisted of 34 sample points (one in every five meter) was employed through the colony. It was 170 meters long. I used the following sampling methods on the transect:

(a) The transect was divided 5 meter long sections with the sampling points in the middle and I counted the numbers of 10 cm long parts of the sections between the road and the kerb (which is 2 centimetres wide) where the exits of the ant species were found (Fig 2a).

(b) Pitfall traps were settled on the sampling points for ten days. I used 3 cm in diameter boxes filled with ethylene glycol. I counted the numbers of individuals from all the different ant species that fell into the trap.

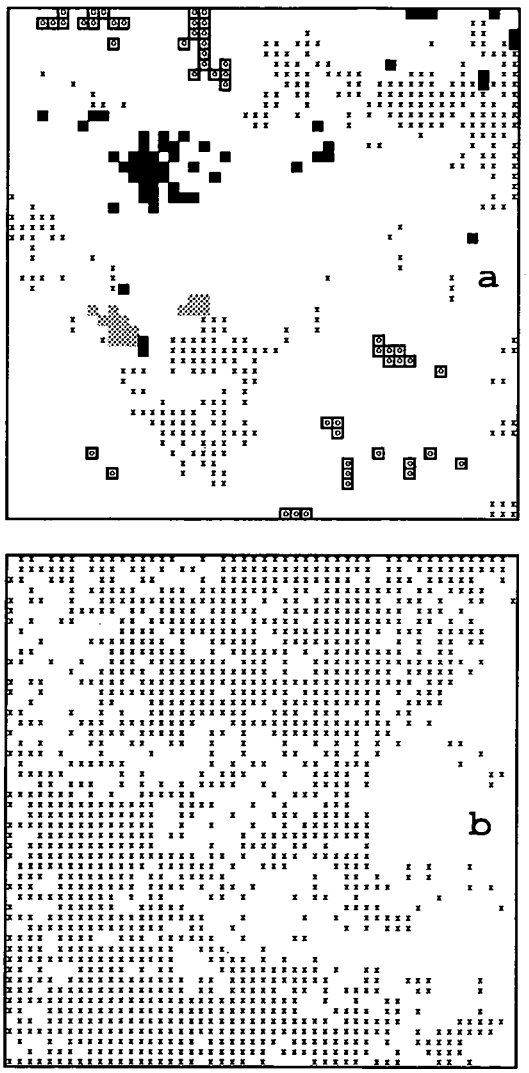

Fig. 1. 5 x 5 m areas, one in the edge of the colony (a), and in the centre (b). These represent 10 x 10 cm areas by characters that include exits of certain species. X: *Lasius neglectus*; O : *Lasius niger*; ■: *Polyergus rufescens*; ■: *Tetramorium caespitum*.

(c) Baits also were placed on the sampling points on 14. 6. 1998. at four o'clock. Thirty minutes later I estimated the number of individuals on the baits. As baits I used discs with the diameter of 7.7

cm fixed with a nail to the ground, in the middle honey and meat paste were placed. Only the number of ants right on the discs were estimated, I ignored the other individuals around the bait discs.

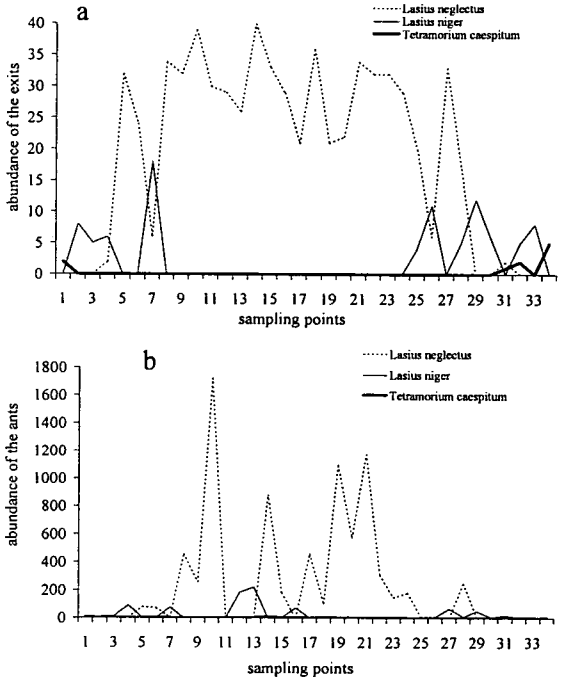

Fig. 2. The abundance of different ant species abundance on the basis of exits counted (a), pitfall traps (b) and baits (c).in the sampling points of the transect (170 m) crossing the *Lasius neglectus* supercolony

Results

At the edge of the colony exits of *L. neglectus* have been found, among other ant species' exits such as *Tetramorium caespitum* (Linnaeus, 1758), *Lasius niger* (Linnaeus 1758) and *Polyergus rufescens* (Latreille 1798) with *Formica rufibarbis* Fabricius, 1793 and *Formica cunicularia* Latreille, 1798 slaves (Fig. 1a). 40 metres further is the centre of the colony, exclusively consisting of the exits of the *L. neglectus* supercolony (Fig. 1b). The difference between the exit density of the two sampling sites (Fig. 1a,b) is also visible and proved by χ^2 test ($p<0.05$). We have also demonstrated that the Shannon diversity of the centre assemblage is significantly smaller than the diversity of the border ($p<0.05$).

The distribution of the exits is more equal than the individuals in traps and at the baits. There is a 50 metre long section (sampling points from 17 to 26) where *L. neglectus* existence and predominance is proved with all three sampling methods (Fig. 2a-c).

A relatively large number of *Lasius neglectus*, *L. niger* and *Tetramorium caespitum* were trapped (Fig. 2b). Occasionally *Formica rufibarbis*, *F. cunicularia*, *Tapinoma erraticum* and *Solenopsis fugax* workers were collected, too. It is also worth mentioning that on the base of maximal individual number from one soil trap the most abundant species was the *Lasius neglectus* (1719 individuals); *L. niger* follows it on second place with 219. The almost eight times larger maximal individual number of *L. neglectus* is thought-provoking.

Discussion

A characteristic feature of the strategy of the ants of *Lasius* subgenus is the less intraspecific aggression against individuals from other colonies, but they display a dominant position in the competitive hierarchy in the interspecific aggression and ascendancy in the number of individuals (Gallé 1980, 1985, 1994). The strategy of *L. neglectus* is similar in the centres of the colonies.

My previous unpublished results (Tartally 1999 2000) demonstrated the dominant position of *L. neglectus* in competitive hierarchy in many different habitats outcompeting all the other species in the centre of the supercolony.

According to the opinion of Gallé (1985, 1994), the existence of *L. niger* and similar species in the community raises the diversity to a limited level (plus one species), though afterwards the diversity will be reduced by the competitive exclusion.

On the edges of the colony the *L. neglectus* seems to avoid the meeting with other ant species. It ensues from this that interspecific aggression is less on the edge of the colony than in the centre. *L. neglectus* aggression may increase in colony centres, and the growing number of ant individuals also adds to this. *L. neglectus* rarely fell into the same soil traps with *L. niger* and/or *Tetramorium caespitum*. It shows that there are well defined colony and penetration area borders of these ants. The situation is different with *Formica rufibarbis* and *F. cunicularia*, because these two ant species sometimes have been found in the soil traps placed in the centre of the colony during my research. Unlike *L. niger* and *T. caespitum* the daily activity of *F. rufibarbis* and *F. cunicularia* are different from *L. neglectus* (Tartally 1999, 2000). This could be explained that these two species can venture far into the colony centres without meeting any *L. neglectus* individuals. However in Budatétény, these two species disappeared from the centre of the 2 km^2 sized *L. neglectus* supercolony (van Loon *et al.* 1990, Tartally 1999, 2000).

Long lifetime of polygynous supercolonies is their other advantage over monogynous species. In the centre of the colony there is no chance for other species' females to establish a colony successfully.

L. neglectus is probably an invasive, foreign fauna member in Hungary and it excludes other native species from colony centres. Due to its small size, the supercolony of the botanical garden doesn't really have a colony centre, so everything previously written are true to a greater extent for the supercolony in Budatétény which size is beyond 2 km^2. Presumably, *L. neglectus* also affect soil invertebrate communities, as it can exclude even *Paravespula* sp. from food sources (Tartally 1999, 2000).

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