Myrmecologische Nachrichten	9	21 - 25	Wien, Dezember 2006

Long term expansion of a supercolony of the invasive garden ant, *Lasius neglectus* (Hymenoptera: Formicidae)[1]

András TARTALLY

Abstract

This paper provides a map showing the area of the Debrecen supercolony of the invasive garden ant (*Lasius neglectus* VAN LOON, BOOMSMA & ANDRÁSFALVY, 1990) in 1998, 2000, and 2002. Vegetation types are marked on the map. The presence of different ant species' nest entrances was also mapped in 10 cm long sections along a transect through the *L. neglectus* supercolony in 1998 and 2002. The expansion of *L. neglectus* was not equal in the different directions and in the different years. It seems that *L. neglectus* spreads fastest on paths, and does not spread rapidly in shady and cool areas occupied by coniferous bushes. Records showing isolated localities of *L. neglectus* colonies confirm that this species is budding. The data suggest that the relative *L. niger* (LINNAEUS, 1758) is more impacted by the invasion of *L. neglectus* than *Tetramorium* cf. *caespitum* (LINNAEUS, 1758). Moreover, *Liometopum microcephalum* (PANZER, 1798) and *Lasius fuliginosus* (LATREILLE, 1798) were able to completely defend their territory against *L. neglectus*. From 1998 to 2002, the number of 10 cm long sections containing *L. neglectus* nest entrances doubled, and the number of sections unoccupied by any ant species decreased by half.

Key words: *Lasius neglectus*, invasive species, tramp ant, colony expansion, Hungary.

M.Sc. András Tartally, Department of Evolutionary Zoology and Human Biology, Faculty of Sciences, University of Debrecen, P.O.B. 3, H-4010 Debrecen, Hungary. E-mail: tartally@gmail.com

Introduction

The invasive garden ant (*Lasius neglectus* VAN LOON, BOOMSMA & ANDRÁSFALVY, 1990) was first described from the Hungarian capital Budapest (VAN LOON & al. 1990). This polygynous ant can form huge polydomous supercolonies (e.g., VAN LOON & al. 1990, CZECHOWSKA & CZECHOWSKI 2003, ESPADALER & al. 2004). *Lasius neglectus* is scored as an invasive pest species (e.g., VÖRÖS & GALLÉ 2002, DEKONINCK & al. 2002, SCHLICK-STEINER & al. 2003, REY & ESPADALER 2004), and shows the main characteristics of a tramp ant (PASSERA 1994). Several new *L. neglectus* localities were discovered from the central and eastern Palaearctic since the description of this ant species in 1990 (for a review ESPADALER & BERNAL 2006). Nineteen *L. neglectus* colonies are known from four settlements in Hungary (TARTALLY & al. 2004 and Cs. Nagy, pers. comm.). It seems that *L. neglectus* is established mainly by human introduction because it does not spread by mating flights (e.g., VAN LOON & al. 1990, ESPADALER & REY 2001, TARTALLY & al. 2004; but SEIFERT 2000 found winged males and females in a spider web in Bishkek which suggests occasional flying). Therefore the expansion of a supercolony by budding is the most important way of local spread. However, our knowledge about the local expansion pattern of *L. neglectus* is insufficient. ESPADALER & BERNAL (2006) are updating on the Web an animated figure about the expansion of a Spanish supercolony by marking the occupied blocks year by year. This provides details about the rate and pattern of the colony expansion, but the vegetation types are not marked in that map. However, as the expansion rate of *L. neglectus* differs in different populations (X. Espadaler & al., unpubl. manuscript), expansion rates could be restricted by different habitat characteristics. A better knowledge of the habitat preference of *L. neglectus* would be interesting, not only from an ecological perspective but also for biological control efforts. For example, an understanding of habitat preferences may help to predict how to slow down colony growth by modifying vegetation (see also REY & ESPADALER 2004 about insecticide treatments on a Spanish supercolony). This question is crucial to limit colony expansion near protected natural areas (e.g., there are three supercolonies in Hungary near protected areas; Cs. Nagy, pers. comm.; A. Tartally, unpubl.).

A map is published here showing the local expansion pattern of a Hungarian *L. neglectus* supercolony over four years. Vegetation types are marked. The expansion is also given along a transect which provides a more detailed view than the map.

Material and methods

The supercolony in the Botanical Garden of the University of Debrecen (47.52º N, 21.62º E; 130 m a.s.l) was mapped. The climate is subcontinental with a rather weak Mediterranean influence. The mean annual temperature is 9.9 ºC and the annual rainfall is 566 mm (http://met.hu/; more details about this supercolony: TARTALLY 2000).

Mapping was done in September (when most worker pupae had hatched but the ants were still active) in 1998, 2000, and 2002 on an unpublished dendrological map of the Botanical Garden (= DM in the followings; made by L. Papp in 1997; scale: 1: 500; available at the directory of the Botanical Garden and at A. Tartally). During mapping, clearly identifiable objects (i.e., bushes, trees and paths) on the DM were searched in the Botanical Garden. The objects on the DM were coloured (in three different colours for each of the three different years) when some *L. neglectus* workers and / or nest entrances were found on and /

[1] This work is dedicated to the memory of Stefan Schödl.

or under them. Location on the paths was identified based on the bushes and trees around them. The grassy areas and the flowerbeds were not clearly identifiable on the DM and were therefore not marked. The mapping was stopped in 2002 because: (1) the supercolony expanded out of the botanical garden and a similarly detailed map as the DM was not available for the surrounding vicinity; (2) the structure of the vegetation changed at some places which resulted in the DM becoming a bit outdated; (3) there was construction at the southern border of the botanical garden between 2003 and 2005 which may have influenced the spread of the ant (e.g., it was unclear if the ant arrived at the newly colonised areas by the spontaneous budding of the supercolony or by the moving of the soil at the building operations).

A scanned version of the DM is the background in Figure 1, which delineates the area of the infestation in the three different years. Five groups of the identifiable objects were designated: deciduous bushes, deciduous trees, coniferous bushes, coniferous trees and paths (only the paths crossing each other at the entrance were covered with asphalt, the others were unpaved; see Fig. 1). This rough grouping was chosen to show the distribution of vegetation types. The grouping was necessary to provide a clear figure because there are a total of 504 species, subspecies, and forms of trees and bushes listed on the DM. It was marked on the DM when a tree was occupied (in all the three years) by *Liometopum microcephalum* (PANZER, 1798) or *Lasius fuliginosus* (LATREILLE, 1798), because the strong colonies of these two ant species could influence the expansion of *L. neglectus.*

The exactitude of the DM was checked in the field using a 50 m tape measure. These measurements showed that the DM was not proportional everywhere. Consequently, an exact quantification of the expansion is not possible based on the DM. The expansion was measured therefore in another way: The centre of the supercolony is crossed by a path with flowerbeds on both sides, considered as a relatively homogenous habitat. A 185 m long transect starting from the entrance of the Botanical Garden was designated through the supercolony and the surroundings at the right side of the path (Fig. 1). The transect was divided into 10 cm long sections (= 1850 sections in total) and the presence of different ant species' entrances between the pavement and the right kerb (there was a c. 2 cm wide gap) was noted for each section in May 1998 and 2002 (Fig. 2). These samplings were carried out on sunny days following rainy days for a sure determination of the entrances used. This was possible based on the crumbs of soil carried up by the workers. The soil was opened by a penknife for searching ants when no workers were seen at an entrance. The division of the transect into 10 cm long sections proved to be a fortunate choice because there were no sections that contained entrances of more than one ant species.

Results and discussion

The *L. neglectus* supercolony obviously expanded during the four years of study (Figs. 1 - 3). There are some phenomena associated with expansion worth emphasising:

(1) The expansion was not equal in the different directions and in the different years (Figs. 1, 2; X. Espadaler & al., unpubl. manuscript; see also the animated figure of ESPADALER & BERNAL 2006 about the expansion of a Spanish supercolony). The causes of this differential expansion need further investigation.

(2) The deciduous bushes, deciduous trees and coniferous trees were easily colonised in this site. However, *L. neglectus* was found less frequently in the large areas with coniferous bushes (shady and cool), unless already established in the surrounding vegetation (Fig. 1). This confirms the observation of SCHULTZ & SEIFERT (2005) in a garden in Bishkek (Kyrgyzstan) where the density of *L. neglectus* declined when the vegetation became overgrown and the site became more shady and cool. Interestingly, *L. neglectus* was not found in coniferous trees in Central Asia but it was found on deciduous trees there (SCHULTZ & SEIFERT 2005). However, in Belgium, Germany, Georgia, and Spain *L. neglectus* was also found on coniferous trees (for a review SCHULTZ & SEIFERT 2005).

(3) The expansion along paths (both the covered with asphalt and the unpaved) was faster than in the surrounding areas with coniferous bushes (Fig. 1). This suggests that paths are corridors for *L. neglectus*.

(4) There were different isolated localities tens of meters (max. c. 30 m) far from the main colony in all the three years (Fig. 1). No *L. neglectus* specimens and / or nests were observed between the main colony and the isolated localities. The unoccupied areas between these isolated localities and the main colony were not always colonised by *L. neglectus* in the following sampling period (see, e.g., the southern border of the Botanical Garden at the bottom left of Fig. 1). These isolated localities could be the buds of the main colony (see also VAN LOON & al. 1990). Colony budding is the most likely way that *L. neglectus* colonizes new areas (e.g., ESPADALER & REY 2001, TARTALLY & al. 2004). Workers collected from the isolated localities and the main colony did not show any aggressive behaviour towards each other (A. Tartally, unpubl.) which could confirm that they belonged to the same supercolony. Although, it should be noted that aggression of *L. neglectus* between different populations is usually absent or low (DRIJFHOUT & CREMER 2004).

(5) Entrances of three ant species were found along the transect, these were: *L. neglectus*, *L. niger* (LINNAEUS, 1758) and *Tetramorium* cf. *caespitum* (LINNAEUS, 1758). The number of 10 cm long sections containing *L. niger* entrances reduced by half, but the number of sections containing *T.* cf. *caespitum* entrances did not change from 1998 to 2002 (Figs. 2, 3). Furthermore, there was an area occupied by *L. niger* in 1998, but in 2002, *L. niger* disappeared and *T.* cf. *caespitum* appeared in that area (Fig. 2: 40 - 45 m). Thus, it seems that the relative *L. niger* is out-competed more successfully by *L. neglectus* than *T.* cf. *caespitum.* However, it is likely that *T.* cf. *caespitum* was mostly displaced from the area of the supercolony centre (see Fig. 2: 45 - 135 m where only *L. neglectus* was found in both years) by the time the survey started in 1998 because *T.* cf. *caespitum* is a more common ant species at the surroundings of this *L. neglectus* supercolony. That is not an unknown phenomenon that the foreign *L. neglectus* can outcompete the native ant species from the supercolony centres (e.g., VAN LOON & al. 1990, TARTALLY 2000).

(6) Nevertheless, the area of (oak) trees occupied with *Liometopum microcephalum* and with *Lasius fuliginosus* was not colonised by *L. neglectus*, but the supercolony expanded around this area like an amoeba (Fig. 1). Similarly,

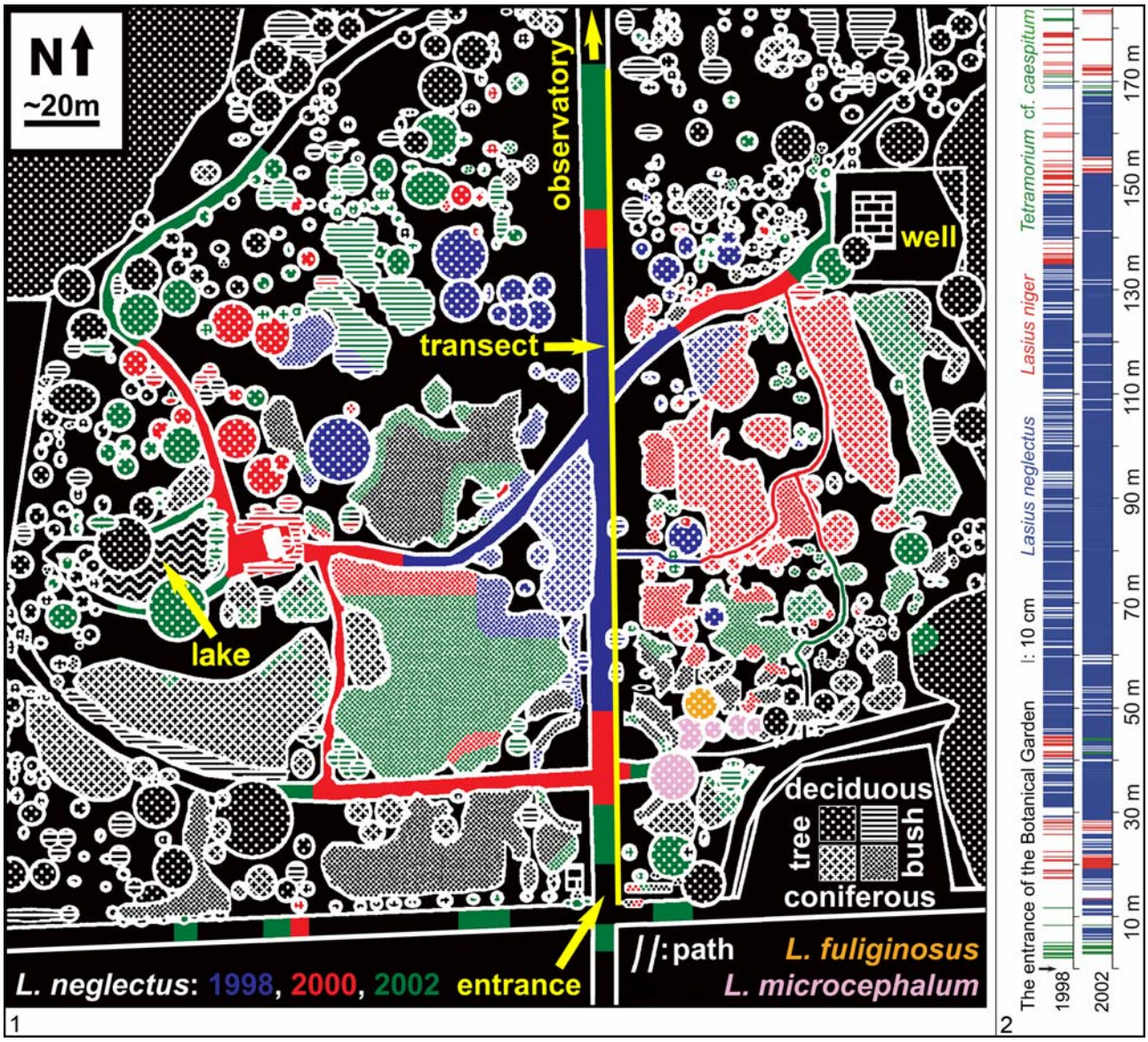

Fig. 1: Paths, deciduous bushes, deciduous trees, coniferous bushes and coniferous trees occupied by *L. neglectus* (viz. with some workers and / or entrances on and / or under these objects) in the Botanical Garden of the University of Debrecen (and at the adjacent southern paths) in 1998, 2000 and 2002 (the blue objects were also occupied in 2000 and 2002 and the red ones in 2002); (oak) trees occupied (in all the three years) by *Liometopum microcephalum* or *Lasius fuliginosus* are also shown.

Fig. 2: The presence of different ant species' entrances in the different 10 cm long sections along a 185 m long transect (see Material and methods, Fig. 1 for location of transect) in 1998 and 2002.

colonies of these two native ant species were observed in the centre of a *L. neglectus* supercolony in Budatétény in 2004 (A. Tartally, unpubl.). These studies show that these strong ant colonies can defend their territory against *L. neglectus* for years. However, this phenomenon needs more detailed investigation.

(7) The number of 10 cm long sections containing *L. neglectus* entrances doubled from 1998 to 2002 and the number of sections unoccupied by any ant species reduced by half during this time (Figs. 2, 3). Thus, the alien *L. neglectus* can take possession of almost all the potential nesting sites as time passes. An extremely large number of *L. neglectus* entrances and / or individuals was reported in other supercolonies (VAN LOON & al. 1990, DEKONINCK & al. 2002, CZECHOWSKA & CZECHOWSKI 2003, ESPADALER & al. 2004, SCHULTZ & SEIFERT 2005). The unusual ant abundance attained by *L. neglectus* can definitely have an impact on the native soil fauna, but this phenomenon was only scarcely studied (ESPADALER & BERNAL 2006).

(8) Between 1998 and 2002 the southern border of the supercolony moved 23.4 m south (= towards the entrance of the Botanical Garden; see Fig. 1) along the transect (5.85 m year^{-1}) and the northern border moved 0.8 m north during this time (0.2 m year^{-1}) (Fig. 2). At the same time the southern border of the colony centre (= where other ant species were first found) moved 0.6 m south (0.15 m year^{-1}) and the northern border of the colony centre moved 17.4 m north (4.35 m year^{-1}) along the transect (Fig. 2).

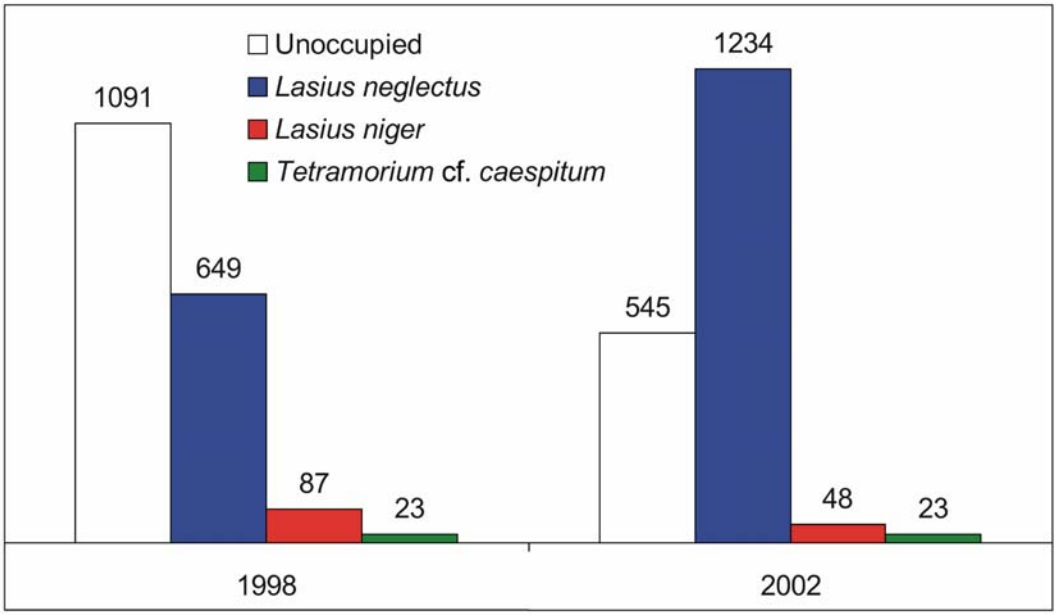

Fig. 3: The number of the 10 cm long sections with the entrances of different ant species and the number of the unoccupied sections along the 185 m transect (= 1850 sections totally) in 1998 and 2002 (see Fig. 2).

These results are different from the results on the same supercolony estimated by other methods (X. Espadaler & al., unpubl. manuscript). In this other study, the presence of *L. neglectus* was checked not only by seeking nest entrances but also the presence of workers, and the sampling was done not only in a 2 cm wide gap between the pavement and the right kerb but also on and around the path (similarly to Fig. 1). This method showed an average 13 m year^{-1} expansion of this supercolony. Three other supercolonies were also studied in the same study and those results showed that the expansion of *L. neglectus* supercolonies within a year may vary between few meters and 134 meters (X. Espadaler & al., unpubl. manuscript).

The results confirm that *L. neglectus* supercolonies can expand and have a negative impact on some native ant species. A thorough monitoring of the expansion of *L. neglectus* supercolonies in different habitats could provide useful knowledge on the biology of this ant and could help to devise management strategies against this invasive species. It would be worth testing if large, shady and cool areas without paths (potential corridors) were able to stop or delay the expansion. Moreover, more thorough studies are necessary on the influence of *L. neglectus* on native communities.

Acknowledgements

E. Tóth and P. Dombóvári helped with the mapping. M. Szabó and L. Papp allowed the work in the Botanical Garden and provided the DM. E. Tóth and X. Espadaler gave advice and suggested useful corrections on the first version and S. Cremer and an anonymous referee on the submitted version of the manuscript.

Zusammenfassung

Die Flächenausdehnung der Superkolonie der Invasiven Gartenameise (*Lasius neglectus* VAN LOON, BOOMSMA & ANDRÁSFALVY, 1990) in Debrecen in den Jahren 1998, 2000 und 2002 wird anhand einer Karte präsentiert. Auf der Karte sind die verschiedenen Vegetationstypen eingetragen. 1998 und 2002 wurde das Vorhandensein von Nesteingängen anderer Ameisenarten in 10 cm Abschnitten eines Transekts durch die *L. neglectus* Superkolonie verortet. Die Ausdehnung von *L. neglectus* erfolgte in unterschiedlichen Richtungen und Jahren unterschiedlich rasch. Offenbar breitet sich *L. neglectus* am schnellsten entlang befestigter Wege aus, nur langsam hingegen in schattigen und kühlen Bereichen, insbesondere unter Koniferen-Büschen. Nachweise von *L. neglectus* Kolonien an isolierten Stellen bestätigen, dass die Art Zweignestbildung betreibt. Die präsentierten Daten legen nahe, dass der Verwandte *L. niger* (LINNAEUS, 1758) durch die Invasion von *L. neglectus* stärker als *Tetramorium* cf. *caespitum* (LINNAEUS, 1758) beeinträchtigt ist. *Liometopum microcephalum* (PANZER, 1798) und *Lasius fuliginosus* (LATREILLE, 1798) waren in der Lage, ihre Territorien vollständig gegen *L. neglectus* zu verteidigen. Zwischen 1998 und 2002 hat sich die Zahl der 10 cm Abschnitte des Transekts, die Nesteingänge von *L. neglectus* enthalten, verdoppelt. Die Zahl der Abschnitte ohne Nesteingänge anderer Ameisenarten hat sich um die Hälfte verringert.

References

CZECHOWSKA, W. & CZECHOWSKI, W. 2003: Further record of *Lasius neglectus* VAN LOON, BOOMSMA et ANDRASFALVY (Hymenoptera: Formicidae) for Warsaw, with a key to the Polish species of the subgenus *Lasius* s. str. – Fragmenta Faunistica 46: 195-202.

DEKONINCK, W., DE BAERE, C., MERTENES, J. & MAELFAIT, J.-P. 2002: On the arrival of the Asian invader ant *Lasius neglectus* in Belgium (Hymenoptera Formicidae). – Bulletin S.R.B.E. / K.B.V.E. 138: 45-48.

DRIJFHOUT, F. & CREMER, S. 2004: To fight or not to fight – chemical profiles and aggression patterns of the invasive garden ant. In: BAER-IMHOOF, B., CREMER, S., MATHIASEN, S.,

NASH, D.R., POULSEN, M., THOMAS, J.M. & BOOMSMA, J.J. (Eds.): Closing symposium: integrated studies of social evolution. – University of Copenhagen, Copenhagen, p. 21.

ESPADALER, X. & BERNAL, V. 2006: *Lasius neglectus*, a polygynous, sometimes invasive, ant. – <http://www.creaf.uab.es/xeg/Lasius/Ingles/index.htm>, retrieved on 13 April 2006.

ESPADALER, X. & REY, S. 2001: Biological constraints and colony founding in the polygynous invasive ant *Lasius neglectus* (Hymenoptera, Formicidae). – Insectes Sociaux 48: 159-164.

ESPADALER, X., REY, S. & BERNAL, V. 2004: Queen number in a supercolony of the invasive garden ant, *Lasius neglectus*. – Insectes Sociaux 51: 232-238.

PASSERA, L. 1994: Characteristics of tramp species. In: WILLIAMS, D.F. (Ed.): Exotic ants: biology, impact and control of introduced species. – Westview Press, Boulder, pp. 23-43.

REY, S. & ESPADALER, X. 2004: Area-wide management of the invasive garden ant *Lasius neglectus* (Hymenoptera: Formicidae) in Northeast Spain. – Journal of Agricultural and Urban Entomology 21: 99-112.

SCHLICK-STEINER, B.C., STEINER, F.M., SCHÖDL, S. & SEIFERT, B. 2003: *Lasius austriacus* sp.n., a Central European ant related to the invasive species *Lasius neglectus*. – Sociobiology 41: 725-736.

SCHULTZ, R. & SEIFERT, B. 2005: *Lasius neglectus* (Hymenoptera: Formicidae) – a widely distributed tramp species in Central Asia. – Myrmecologische Nachrichten 7: 47-50.

SEIFERT, B. 2000: Rapid range expansion in *Lasius neglectus* (Hymenoptera Formicidae) – an Asian invader swamps Europe. – Mitteilungen Museum Naturkunde Berlin, Deutsche Entomologische Zeitschrift 47: 173-179.

TARTALLY, A. 2000: Notes on the coexistence of the supercolonial *Lasius neglectus* VAN LOON, BOOMSMA et ANDRÁSFALVY, 1990 (Hymenoptera: Formicidae) with other ant species. – Tiscia 32: 43-46.

TARTALLY, A., HORNUNG, E. & ESPADALER, X. 2004: The joint introduction of *Platyarthrus schoblii* (Isopoda: Oniscidea) and *Lasius neglectus* (Hymenoptera: Formicidae) into Hungary. – Myrmecologische Nachrichten 6: 61-66.

VAN LOON, A.J., BOOMSMA, J.J. & ANDRÁSFALVY, A. 1990: A new polygynous *Lasius* species (Hymenoptera; Formicidae) from Central Europe. – Insectes Sociaux 37: 348-362.

VÖRÖS, G. & GALLÉ, L. 2002: Ants (Hymenoptera: Formicidae) as primary pests in Hungary: Recent observations. – Tiscia 33: 31-35.