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FIRST OCCURRENCE OF *LASIUS NEGLECTUS* (HYMENOPTERA: FORMICIDAE) IN ZURICH, SWITZERLAND: DISTRIBUTION AND CONTROL MEASURES

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Abstract In July 2015 the Invasive Garden Ant, *Lasius neglectus,* was identified during control measures in an apartment house in the city of Zurich. This was the second finding of this species in Switzerland and the first finding in an inhabited area. In order to find out the distribution of the population, the surroundings were sampled for ants in October 2015. The population of *L. neglectus* was not considered to have strong invasive character yet. Knowing of the invasive potential of this species, the Urban Pest Advisory Service (UPAS) and the section Neobiota of the Environment Department Kanton Zurich nevertheless decided to carry out a survey to investigate the extent of the *L. neglectus* populations. The survey included a zone of 42 ha around the actual infestation and another 40 risk locations in the greater Zurich area. These included horticultural areas, demolition waste dumps, compost works, parks, cemeteries etc. In 2016, *L. neglectus* was only found in the infestation area of 4.2 ha, including parks with old trees, a school, apartment houses, small gardens, backyards and business buildings, but not in any of the other monitoring sites. In summer 2016 control measures were mainly taken outside, because by then ants were not a problem inside buildings. UPAS and the section Neobiota of the Kanton Zurich decided that eradication is a long-term objective and thus, the monitoring and control measures will continue in 2017.

Key words Invasive garden ant, tramp ants, eradication, control measures, ant survey

INTRODUCTION

Lasius neglectus (Van Loon, Boomsma and Andrásfalvy, 1990), known as the invasive garden ant, has its natural range in the area of Turkey, Iran and Uzbekistan. It was originally described from a population in the city of Budapest (Van Loon et al., 1990; Boomsma et al. 1990). It is a polygynous, unicolonial species without colony barriers and has no nuptial flight (Espadaler and Rey, 2001). Through movement of potted plants, turf peat, soil material etc. *L. neglectus* has unintentionally spread westwards to many European countries (ISSG, 2011; CABI datasheet *Lasius neglectus*). The most northern supercolony is in the city of Rostock (Germany), where two separate populations are actually expanding (Kai Gloyna, personal communication). *L. neglectus* has many of the typical tramp ant characteristics. It is often found in disturbed or highly degraded habitats, has many queens, disperses by budding, and has relatively small workers (Van Loon et al., 1990; Seifert, 2000; Espalader et al. 2004). Unlike the argentine ant *Lintpithema humile* (Mayr 1866), *L. neglectus* can tolerate cold winters with average temperatures of -5° C and therefore colonize more northern regions in Europe (Seifert, 2000). *L. neglectus* can be found in anthropogenic urban areas, from city streets to semi-urban lots with some natural vegetation or gardens. Honeydew producing aphids on trees and shrubs are a key food resource for the ants. However, *L. neglectus* may also invade homes and other buildings and can become a nuisance to residents, a pest in food preparation areas and it can occupy insulations, electrical conduits and installations, causing short-circuits or damage to electronic devices (Scholl, 2012; Boase, 2014).

In Switzerland, *L. neglectus* was found in industrial wasteland near Geneva in 2008 (Neumeyer, 2008). The workers had been detected by chance and were apparently not bothering anybody. Other ant-species were present on the sight. During a second inspection, no *L. neglectus* could be found (R. Neumeyer, I. Landau, G. Mueller, and M. Schmidt personal communication). Whether this population is still existing is unknown. The finding in Zurich is the second case of this invasive garden ant in Switzerland. In summer 2015, a local pest control technician took control measures against ants in an apartment building in the city of Zurich. Quick-witted he realised that these ants were smaller than the usually found *Lasius*-species and not bicoloured. The company sent some ants to the ant specialist Bernhard Seifert (Germany, Görlitz), who identified them as *Lasius neglectus*. Subsequently, the Urban Pest Advisory Service of the city of Zurich (UPAS) and the section Neobiota of the Environment Department Kanton Zurich (SNEKZ) were informed. These two involved departments decided to work together and coordinate all the necessary actions.

In order to acquire more knowledge of the dimension of the infestation in the city of Zurich as fast as possible, first inspections were already made in fall 2015 inside buildings and in the surroundings of the infested house that had no more ants in the apartments by that time. If extensive control measures were going to be taken, it had to be confirmed that the colony had a manageable dimension. The first focus was therefore not only to monitor the surroundings of the known infestation, but also other likely places where *L. neglectus* could have been introduced. Only if there was a single introduction of a population, the aim of eradication would be an option.

SNEKS wrote a letter to all pest control companies, explaining that a population of the invasive garden ant *L. neglectus* had been found in Zurich and asking them to be vigilant when facing ant problems. The companies were invited to send ant samples, because identification is difficult without good equipment and a lot of experience.

MATERIALS AND METHODS

Localities

Around the initial location three zones were defined: A *core zone* with the size of 4.2 ha, where *L. neglectus* was actually found, a *transition zone*, with the size of 18 ha, and a *safety zone*, with the size of 42 ha (Figure 1). The core zone included parks with old trees, a school and kindergarten, apartment houses, small gardens, backyards and business buildings.

In addition to the three zones, 40 risk locations were defined in the greater Zurich area. These risk locations included: Waste incineration plants, compost works, demolition waste dumps, horticultural plant producers, public parks, recycling centres, cemeteries etc. The locations were very heterogeneous in size and structure.

Ant Surveys

All people involved in the survey were trained in how to search, correctly identify ants to the genus-level in the field and collect and label ant samples. Since *L. neglectus* cannot be reliably distinguished from other unicoloured *Lasius*-species in the field, samples of every population found had to be collected and placed into labelled tubes for identification.

In order to define the infestation size of the *L. neglectus* colony, the UPAS conducted inquiries in 17 houses around the initial infestation site by going from door to door, asking the residents if they had seen any ants and checking the rooms for ant activity. The core zone was systematically surveyed by technicians of a pest control company in August and September 2016. In the transition zone all buildings (outside) were systematically surveyed in two occasions in August 2016. In the safety zone only ant-friendly sites were surveyed.

In the 40 risk locations, searching points were defined for each location. The focus was to find *L. neglectus*-suitable places, and sometimes points were chosen randomly. An instructed pest control technician searched and collected unicoloured ants within about 100m² for two hours. Some locations were very big (e.g. the zoo) and consequently searching time was extended to up to eight hours.

Control Measures

For the insecticidal control measures mainly bait gels were used: Advion Ant gel (0.05g/100g Indoxacarb) and Maxforce Quantum Gel (0.03g/100g Imidacloprid). A granulated formulation (Killgerm Spezial Ameisenmittel PM, 5g/kg Permethrin) was used for direct application. Additionally, the emulsifiable concentrate Mioplant Ameisengiessmittel (10 mg/g Permethrin) was diluted with water to a 1% solution either direct pouring into the nests with a watering can or with a compression sprayer.

Treatments were applied outdoors on eight occasions from July to September 2016 in all the places where *L. neglectus* workers were active. In total, the following amount of insecticidal products were used in 2016: 145g gel baits, 60g granulate, 15l of Permethrin emulsion, ready to use.

RESULTS AND DISCUSSION

Ant Surveys

Inquiries with the inhabitants of 15 buildings around the initial infestation site were made in December 2015 and April/May 2016. In December 2015 no ants were found. Inhabitants of seven buildings reported that they have had problems with ants in the previous summer. In April/May 2016 inhabitants of six buildings reported ant problems and at five of these buildings *L. neglectus* workers were found on the inside. During the summer no more ants were found in these buildings, and there were no complaints by inhabitants for the rest of the year. Ant trails and nest entrances were only found outside the buildings, along house walls and along tree-trunks, but also in a pile of bricks behind a garage and along small garden walls. A single nest was found in the bark of a tree, which was covered with small plant debris, making it difficult to discover.

The survey showed that *L. neglectus* only colonized the core zone of 4.2 ha in 2016 (Figure 1). Although we did not deliberately search for other ant species, we found *L. brunneus*, *L. emarginatus* and *L. niger* in almost all the locations. The nests of *L. neglectus* were not very big and the magnitude of ant trails were by no means as huge as described in places with big supercolonies, like for example in East Sussex, UK (Davies, 2016) or in Hidcote Manor Garden, UK (Boase, 2014). In the Northeast of Spain, a density of 800 workers per m^2 was found in the soil (Espalader et al., 2004). The colony in Zürich may have been introduced recently and may not have strong invasive character yet. Cremer et al. (2008) describe that it is typical for invasive species to reveal their destructive potential following a long, inconspicuous lag phase.

In 2016 the sampling of the transition and safety zones by a private pest control company showed that they were free of *L. neglectus* colonies. The survey in the 40 risk locations in the greater Zurich area did not reveal any invasive ants.

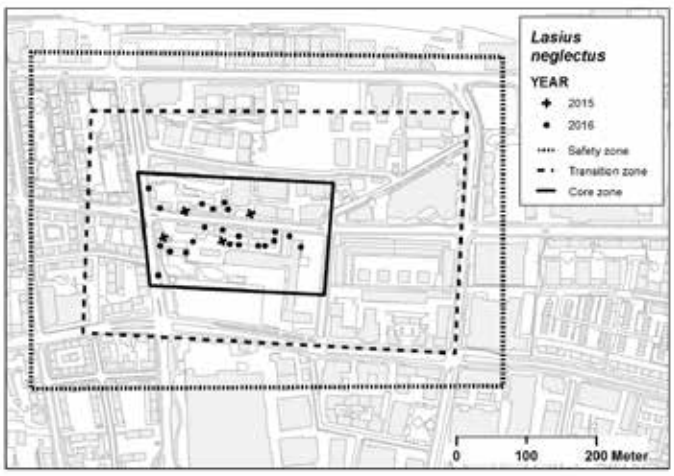

Figure 1. *Lasius neglectus* in city of Zurich 2015-2016; three zones around the infested area.

Control Measures

From July to September 2016, outdoor control measures took place on eight occasions, mostly along the buildings and along trees. Ant samples were always taken to ensure that only *L. neglectus* would be controlled. Gel baits were directly applied in nest entrances or along ant trails. We observed that ant trails were no longer there after a treatment, but the ant traffic at most nest entrances was still busy. After several treatments with gel, we decided to use a Permethrin emulsion in order to treat nest entrances directly.

End of September two pour applications were directly performed with a watering can on the visible nests on the bottom of trees and along the buildings. We also performed two spray applications on the tree trunks with ant trails and on a small hibiscus shrub with aphids that were frequently visited by *L. neglectus*. The following week the aphids and the ants had disappeared. With these spray applications we tried to interrupt the access to their food sources on the trees as described in Rey and Espalader, (2004). Due to the negative ecological impact, we did not consider applying insecticides on 10-20 m high trees.

In a pile of bricks behind a garage a nest site became visible when removing some bricks. On July 21, 2016 we found some alate: 3.5 – 4 mm long *L. neglectus* ants in this nest, probably males. At four occasions ant gel was applied directly in between eggs, larvae and pupae. After over a month of treatments it became obvious that gel was hardly consumed and the treatments did not lead to the decline of the colony. Permethrin granulate directly placed between the bricks was very effective: one week later little activity was observed. The ants were gone after a repeated application in the few active places between the bricks.

Effects of *Lasius neglectus* on Other Arthropod Species

After control measures with gel baits at the *L. neglectus* nest entrances on the outer east wall of a school building we found several dead sowbugs, *Porcellio scaber* (Latreille, 1804), some dead fire bugs, *Pyrrhocoris apterus* (Linnaeus, 1758), and one dead wood cockroach, *Ectobius vittiventris* (Costa, 1847) next to a lot of dead workers of *L. neglectus*. Nagy et al. (2009) found a negative effect of *L. neglectus* on different arthropod species. The reasons for the death of these specimens remain unknown. Either they fed directly on the bait or on the contaminated insects (*P. apterus* feeds on dead insects, too), or they were killed by *L. neglectus* and left behind, because *L. neglectus* workers were killed by the baits.

CONCLUSIONS FOR FUTURE ANT SURVEYS AND CONTROL MEASURES

Ant surveys as performed at the 40 sites in the greater Zurich are quite costly. Pest control technicians are not used to detect a particular ant species. Lack of qualified people resulted in lower chance to find *L. neglectus* within the given time. A small *L. neglectus*-population like the one found in Zurich can easily be overseen and therefore it is uncertain whether there are more undetected *L. neglectus* colonies in Switzerland. Around Lyon (France), 63 occurrences of *L. neglectus* were found when searching for native and invasive ant species (of the genera *Lasius* and *Tetramorium*) by students and ant specialists for a spatial distribution study (Gippet et al., 2016). In this location the distribution of the ants was favoured by roads. Two different expansion rates are possible: slow expansion by budding and (fast) long distance displacement, when small colony fragments are unintentionally moved by humans. Colony budding has been shown to be two to five orders of magnitude smaller (Espadaler et al., 2007) and even the budding expansion rate can differ a lot. Subsequently, small colonies can grow for years, before they are detected. In Rostock, where no authority could decide to start a costly eradication program, the infested area expanded from 6 ha in 2008 to 10.4 ha in 2013, which is an increase of 68 %. Outside of the infested area, in the botanical garden, two single nests of *L. neglectus* were found in 2008. Five years later, a population covering 2.7 ha was found (Schultz and Busch, 2009; Spiegelberg, 2014). Control measures are only taken in buildings where they are a nuisance to people.

There is one problematic fenced back yard (400 m^2) within the core zone in Zurich, where a house owner is storing old electronic and construction equipment. There was one *L. neglectus* nest at the outside of the fence in October 2015. However, no *L. neglectus* colonies were found in 2016. This back yard could not be accessed in 2016, so there is no knowledge on ant colonies present in this area. The house owner will have to be informed that access to survey that back yard is needed and that he is only allowed to move the stored equipment if the place is free of *L. neglectus*. The transition zone will have to be surveyed again in 2017. Additionally, information and education of pest control professionals and of the locally involved inhabitants will be important in the future.

For organisational reasons ant treatments could not start before July 2016 and at the end of the season we had only used a small amounts of insecticide. We plan to continue control measures with direct baiting, reducing the impact to the environment as much as possible. Other control strategies like controlling the ant's food sources (mainly aphids in trees and bushes), as applied in northeast Spain (Rey and Espadaler, 2004), are not planned. We strongly believe though that control measures have to be continued. The aim for the next season is to reduce the area where *L. neglectus* is found and an eradication of all colonies is planned for the near future. Waiting for the *L. neglectus* population to collapse, as reported for supercolonies in four European countries (Tartally et al., 2016; Lester and Gruber, 2016), is not an option for Zurich, because the mechanisms explaining the collapse of colonies are not yet understood.

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