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TAPINOMA NIGERRIMUM COMPLEX - A CHALLENGE FOR PEST MANAGEMENT IN CENTRAL EUROPE

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Abstract For more than 20 years various invasive ant species cause tremendous problems in Central Europe. The *Tapinoma nigerrimum* complex (Formicidae, Dolichoderinae) was first detected in 2007 in nursery plants. Further discoveries followed in the following years. Because of their species-specific properties the control is often a challenge for PMP and has to break new ground. Using the example of a super-colony discovered 2019 in and around greenhouses in Langenfeld near Düsseldorf, Germany, ways of pest control management combined with the control of aphid occurrence are discussed.

Key words *Tapinoma nigerrimum*, invasive species, ants

INTRODUCTION

After the first discovery of the *Tapinoma nigerrimum* complex in Central Europe 2007 in South-West-Germany, the Netherlands, Switzerland, Belgium and Northeast France, 2012 nests of this species were detected in Germany in Ingelheim, Edesheim and Neustadt on the grounds of garden centers and in the immediate vicinity. Their origin was Tuscany in Italy (Sellenschlo 2012). Two years later this species was discovered in Ostend, Belgium (Dekoninck et al. 2015). The next heavy infestation was found in the early spring of 2017 in the basement of an apartment building in Frankfurt with broad trails (up to 10 lanes) leading through the apartments from the front to the back of the house. Nests were located in the ground at the foundations of the front and the terrace area. There was a garden center in close proximity. In April 2019 another established colony was discovered in an apartment building in Hesse, Germany, and a well established super-colony with a size of up to 1 hectare and emphasis in and around the greenhouses was found in Langenfeld near Düsseldorf, Germany.

In France, *T. nigerrimum* (Nylander 1856) is one of the harmful species in agricultural crops. In the original home in the Mediterranean this species is often eudominant. Often these ants were imported with large Mediterranean shrubs (palm trees, old olives and fig trees) from plantations which were transplanted into large tubs before being brought to Central Europe 2 years later. In its original range, the species lives in the ground outside of buildings. Like *Lasius niger* (Linnaeus 1758), it is also found along the foundations and under paving stones and floor slabs. However, there are numerous queens in the nests of *T. nigerrimum* and the species creates many satellite nests that are connected to the main nest, so that super-colonies can arise over larger territories. It can be assumed that this species displaces indigenous species due to the very diverse nests. While Workers live of honeydew and arthropods, larvae are fed seeds (Pospischil, 2017. Little information is available from the original distribution area about the way of life of this type and any control options.

In contrast to the native species of the *Lasius* genus (Fabricius 1804), *T. nigerrimum* does go into hibernation, but is also active at temperatures below 10 °C. Therefore, the animals migrate into buildings during the cold season in search of food and heat sources. To what extent *T. nigerrimum* also uses the external insulation of facades to create their nests is not yet known. However, it can be assumed that Styrodur and other insulating materials of this type can also be used as living space.

This species is of medical importance because the workers appear in large numbers (Pospischil, 2010) and inundate their area. Thereby they cause skin injuries through bites and skin irritation in the wounded area and release secretions including ketones and dialdehydes (Seifert et al., 2017).

MATERIAL AND METHODS

Individuals have been identified and assigned to the species *Tapinoma nigerrimum* (Nylander 1856) (originally *T. magnum* (Mayr 1861)). Different names were mentioned in the literature: Kutter (1977) describes the species *Tapinoma nigerrimum* (= *T. magnum* (Mayr 1861)) which is widespread in the Mediterranean area and *T. simrothi* (Krausse 1911) (*T. erratico-nigerrimum)* mainly found in North Africa, Sicily, Sardinia and Corsica. Seifert et al. (2017) divides those ants into at least 4 species: *T. nigerrimum, T. ibericum* (Santschi 1925), *T. darioi* sp.n. and *T. magnum.* Elsewhere Seifert (2018) trades those ants under the name *T. magnum.* Lebas et al. (2019) calls them *Tapinoma nigerrimum-simrothi* group. Due to these differences it was decided to call the present species found in Langenfeld *Tapinoma nigerrimum* complex (Dekoninck et al., 2015).

The examined area is located in a predominantly agricultural area. Only in the south there is a nature reserve beyond a road. The main infestation is concentrated in a nursery with a total of 7 greenhouses and a size of up to 1 hectare. Low activity was noted in the neighbouring mushroom growing substrate facility. The ant activity is noticeable due to the numerous ant trails, ejected earth material and entrances to the nests lying in the ground. Along the foundations of the greenhouses are broad ant trails with up to 10 lanes. After various interim uses the company premises had been leased since 2006 to a rarities garden center, specialized in the import of exotic and mediterranean, shrubs and trees, including container plants from southern Europe.

It can be assumed that this polygynous and polydomous species was brought in through the import of tub plants from the Mediterranean region. In the greenhouses the ants settled, left the tubes and developed the current super colony with many nests and the species typical exchange of brood with the other nests comparable to the Argentine Ant *Linepithema humile* (Mayr 1868) or the Invasive Garden Ant *Lasius neglectus*.

Common control strategies in Central Europe are bait stations at suitable locations such as ant trails or suspected nest entrances, targeted injection of long-term agents in the immediate nest areas or the application of ant-bait gel. An ant-gel bait with the active ingredient Imidacloprid was offered as test and gladly accepted by the workers. But due to the many nests with numerous queens and the seize of this super-colony, one single method seemed not enough to kill the infestation completely. Therefor a combination of different measures was discussed.

It would also be possible to treat the foundations along the total length on the inside and outside of all greenhouses and other infested areas with a long-term contact insecticide. In preparation the terrace slabs inside the greenhouses would need to be removed and the soil underneath would have to be treated with a long-term pyrethroid. Smaller groups of ants could then be additionally treated with ant-gel bait. The disadvantage of this procedure, however, is that the soil would become contaminated with active substance.

As an alternative the infested area could be treated with superheated watersteam at 97°C covered with a foam to keep the water temperature longer at a high level to get a better control. The foam in this environmentally friendly technique consists of maize and potato starch, palm kernel oil and coconut juice. Lances can be used mounted on a rack to apply the watersteam deeper into the ground. After this treatment ant-bait gel can be used to control the decimated super-colony. With this approach it can be expected that significantly less ant-bait gel will be required compared to non-combined measures.

RESULTS AND DISCUSSION

Ant species which are able to establish in a new country after introduction have to fulfill special requirements (Klotz et al., 2008; McGlynn, 1999; Pospischil, 2016). They can be spread by humans into non-native habitats and introduced by large Mediterranean shrubs, transplanted into large tubs before beeing brought to Central Europe two years later. In the new environment the ants create colonies. They colonize very different habitats without specific requirements for a nesting site. They occur mainly in open areas, in urban areas, inner cities or coastal strips. Nests were created in the sandy soil, under composite pavement paths and on foundations. Those species have low climatic requirements. Their nests are up to 1 m deep in the ground which is favouring the hibernation. For example, in 2009 activity was already observed at 7°C, activity in December still at 3°C and cloudy conditions and during sunshine at -2°C in the Netherlands. Hibernation at 6.6°C for 14 days and an absolute minimum at -14°C is possible without damage (Dekoninck et al., 2015). Workers are often of small size and inconspicuous color. The body length ranges from 3 to 5

mm and the colour is black. They appear uniform and the difference in seize between workers is much less obvious (Lebas et al. 2019). Both polymorphic workers and queens have high foraging mobility. Nuptial flights do not occur and reproduction takes place by budding which protects from dangers from outside. The colonies are polydomous and polygynous and contain many queens and in some cases one nest can have up to 350 queens. New nests can be established by creating offshoots from existing ones or existing colonies. Nests from *T. nigerrimum* are largely monodom, while *T. ibericum* (Santschi, 1925), *T. darioi* sp.n. and *T. magnum* create super-colonies with satellites. Therefore this kind of nest creation is very tolerant to flooding. Between the colonies there is a high level of compatibility. Fighting between the colonies' nests has not been observed. In many species members of different colonies are not aggressive. Tramp ants live close to people, but they do not expand actively (Klotz et al 2008, McGlynn 1999). Invasive species have a high dominance and displace native species (Giraud et al., 2002; Holway et al., 2002). They release toxic substances that kill practically all other species of ants (Ketones and dialdehydes) and also defeat *L. humile's* nests. With those abilities invasive ant species can displace the original ant fauna in their new habitat. Summing up *T. nigerrimum* fulfills all these requirements and has a high invasive potential.

Killing a super-colony of the *Tapinoma nigerrimum* complex established on a greenhouse area with a size of up to 1 hectare in Langenfeld near Düsseldorf, Germany, a combination of available partially novel pest control management methods has been tested. The application of a hot foam technique which works at 97°C indicates that by repeated application and combined with supplementary methods, like the use of ant-bait gel, a decimation of a super-colony could be achieved. To confirm these first observations, however, further tests would have to follow. Controlling super-colonies of invasive ant species, it seems necessary, to take also into account their food sources by targeting aphids in the vicinity of the super-colonies.

CONCLUSION

Against this backdrop risk awareness should be encouraged. Control on the export of plants, potted and tub plants should be implemented. Due to the species-specific properties, there are other conditions to control invasive species like ants which cannot be compared with methods used in native species. Before treating nests outside of the greenhouses at the base of the buildings, it has to be checked if the use of active substance-containing preparations is officially approved. Customs checks should be carried out on domestic imports and quarantine options be installed. In the case of infestation, the extent must be estimated and staggered control concepts with strong initial weakening of the colonies also by controlling food sources as aphid occurrences and targeted follow-up measures have to be developed until complete eradication.

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