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First records of a supercolonial species of the *Tapinoma nigerrimum* complex in Belgium (Hymenoptera: Formicidae)

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Abstract

In the summer of 2014, a highly supercolonial *Tapinoma* was discovered in Ostend, Belgium. This was the first time a *Tapinoma* species with an invasive behaviour was discovered outdoors in Belgium. The ant belongs to the most widely distributed of four recognized species of the *Tapinoma nigerrimum* complex and is the only known species being invasive in areas north of the Mediterranean zone. In a first attempt to eliminate the species, a Demand 10CS insecticide solution treatment was initiated in 2015. First results illustrate that this treatment might be efficient, however a long-term monitoring of the site and its neighbourhood are suggested.

Keywords: Formicidae, *Tapinoma nigerrimum* complex, invasive species, new species for Belgium

Samenvatting

In de zomer van 2014 werd een superkolonie nest van een *Tapinoma*-soort ontdekt in Oostende, België. Dit was de eerste keer dat een *Tapinoma*-soort met een invasief gedrag in de vrije natuur in België werd gevonden. Het gaat om de meest verbreide soort van vier soorten van het *Tapinoma nigerrimum* complex die bovendien invasief is in gebieden ten noorden van de Mediterrane regio. In een eerste poging om deze soort te elimineren werd een Demand 10CS insecticide oplossing gebruikt in 2015. De eerste resultaten illustreren dat deze behandeling efficiënt lijkt. Niettemin suggereren we een lange-termijn monitoring van deze site en de onmiddellijke omgeving.

Résumé

Durant l'été 2014, une espèce de *Tapinoma*, espèce invasive qui fonde des super-colonies, a été découverte pour la première fois en Belgique, à Ostende. Cette fourmi est l'espèce la plus largement distribuée et la seule connue comme étant invasive dans les régions au nord de la zone méditerranéenne parmi les quatre reconnues appartenant au complexe *Tapinoma nigerrimum*. En 2015, une première tentative d'éradication de l'espèce a été testée par un traitement à l'insecticide (solution 10CS Demand). Les premiers résultats semblent prometteurs, mais une surveillance à long terme du site et de ses environs est suggérée.

Introduction

Recently, several records of tramp, exotic or cosmopolitical ant species new for Belgium were published (DEKONINCK & BROUCKAERT, 2011). Also in nearby countries, several introduced species were recorded in the last decade of which some were able to survive the rather cold winters outdoors (e.g., *Linepithema humile* in the Netherlands (BOER & BROOKS, 2009) and *Pheidole pallidula* in Germany (HELLER, 2011)). If these new outdoors established species are invasive, this can become a

Fig. 1. Large continuous ant trails of *Tapinoma sp. MAGN* workers on the footpath on the corner of the Bosbessenlaan and Perziekenlaan.

Fig. 2. Nestlocalities of *Tapinoma sp. MAGN* along the footpath of the Perziekenlaan.

major problem for native ant fauna. In this context, the invasive *Lasius neglectus* Van Loon, Boomsma & Andrasfalvy, 1990 has been the issue of debate in many European countries where it was introduced and discovered as a species altering the ant fauna locally (UGELVIG *et al*., 2008). This species is often transported from city to city in Europe. Its negative and sometimes drastic impact on ant communities and in a larger sense ecological communities is well known and studied (SEIFERT, 2000; REY & ESPADALER, 2005). Nevertheless, local adaptation and acceptance of myrmecophiles in *Lasius neglectus* nests was reported as well (DEKONINCK *et al*., 2007). Recently a Mediterranean *Tapinoma* species with supercolonial behavior (i.e. a colony that is so large that workers from distant nests within the same colony do not exhibit mutual aggression and with a high number of reproducing gynes) was observed in several more northern countries such as Germany (HELLER, 2011) and the Netherlands (NOORDIJK, in prep.). Another finding of a supercolonial *Tapinoma* species was discovered in Ostend in summer 2014. This colony must have settled already a time ago, as continuous trails of more than 100 m were observed on a footpath and smaller trails in gardens bordering the footpath (Fig. 1). We here discuss its discovery, biological properties, behavior and a recent treatment to eliminate this colony.

A new *Tapinoma* for Belgium in Ostend

In the summer of 2014, the second author discovered a large nest of a *Tapinoma* species in the Perziekenlaan and Bosbessenlaan (N 51°12'32.89"; E 2°54'33.72"). Along the footpath of these two roads and especially where those two roads encounter, large colons of *Tapinoma* workers have reshaped the footpath (Fig. 2). The worker caste of this *Tapinoma* was size-polymorphic. Besides normal minor workers, also large numbers of major workers were observed (Fig. 3a+b). This outstandingly large major caste suggested that this colony did not belong to both *Tapinoma erraticum* or *T. subboreale* - the two so far known outdoor living *Tapinoma* species in Belgium (DEKONINCK *et al*., 2012). At that time, the first two authors identified this new *Tapinoma* as *T. nigerrimum* (Nylander 1856) – a Mediterranean ant species with a polymorph worker caste (Fig 3). In order to evaluate if the species has really established a vital colony in Belgium, the first two authors waited until the next spring to see if the species was able to survive the winter. This test failed as the winter 2014/15 was much warmer than the 30-years mean.

In spring 2015, the colony was still present and even more vital than the summer before (Fig. 4). Again the typical nest entrances resembling small craters were found along the footpath and a high activity of *Tapinoma* workers was observed (Fig. 5). The third author was then contacted and confirmed the colony belonging to one of the four recognized species of the *T. nigerrimum* complex with the code designation "*Tapinoma sp. MAGN*". Three already described and one undescribed species of the *T. nigerrimum* complex could be deliminated by exploratory and hypothesis driven analyses of morphological data. According to mtDNA sequence divergence these species split-off from the early to the middle Pleistocene (SEIFERT *et al*., in prep.). Based on morphological data, the sample from Ostend is classified with p=0.9994 as *Tapinoma sp. MAGN* if run as wild-card in a four-class linear discriminant analysis and it is correctly allocated by hierarchical NC-Ward and non-hierarchical NC-k-means clustering (SEIFERT *et al*., 2013). *Tapinoma sp. MAGN* is the most widely

Fig. 3. a: Two minor workers (left) and one major worker (right) of *Tapinoma sp. MAGN* in Ostend. b: Three minor workers (right) and one major worker (left) of *Tapinoma sp. MAGN* in Ostend.

Fig. 4. Map of the Bosbessenlaan and Perziekenlaan in Ostend with the *Tapinoma sp. MAGN* nests localities marked with red lines.

Fig. 5. Characteristic nest entrances of *Tapinoma sp. MAGN* resembling small volcanoes were found along the footpath of the Perziekenlaan in Ostend.

distributed species of the complex in Europe and the only one known to be invasive in areas north of 48°N (SEIFERT *et al.*, in prep.). The geographic distribution indicates that the species is well able to survive in regions with a 30-years mean January temperature of –1°C. The five established populations in SW Germany survived here two severe winters including a 14-days frost period with mean air temperatures of –6.6°C and an absolute minimum of –15°C without any visible damage. Foraging of the German populations may start at sunny late-winter days at air temperatures of 8°C.

First treatment of the supercolony in Ostend with "Demand 10 CS"

As the colony in Ostend locally caused large-scale problems in houses and gardens and to prevent this invasive ant species to spread in the neighbourhood, the city of Ostend decided to start up a treatment of the ants. A first survey in the neighbourhood of the colony in Ostend learned us that where the population was foraging, other ant species were no longer present and that in a surrounding area of 3 km no other nests of the invasive ant were present.
In 2015, a first attempt to eliminate the species was initiated. At 02.VII.2015 the footpath was opened and later on 16.VII.2015 the soil was treated with a Demand 10CS insecticide solution. This is a concentrated liquid insecticide (Lambda-cyalothrine 100g/l) microencapsulated with a rather long persistence time. The active gradient remains protected from the environment within the microcapsules and this protection provides an extended duration of its effect especially on surfaces as cement. The capsule size is optimized so that insects moving over treated surfaces pick up microcapsules on their bodies. Once attached to the insect, the active ingredient rapidly moves out of the capsule and into the insect, providing a rapid knockdown effect followed by quick kill.
At that moment the nearby small park with only beginning infestation (small red lines at the bottom of Fig. 5) was not added in the treatment because of practical reasons. To do so also large trees and a small playground probably needed to be removed to have satisfying results and allow the insecticide to reach the queens in the nests underground. If this incomplete treatment will be successful needs to be evaluated during spring and summer of 2016. Nevertheless, the first results shows that actions undertaken in summer 2015 might be efficient, however a long-term monitoring of the site and its neighbourhood are suggested.
Besides a local monitoring of the infested and treated site in Ostend, also an information campaign to survey the presence of this species elsewhere in Flanders will be launched next spring. *Tapinoma sp. MAGN* might already have established large colonies in other places in Belgium, but left unnoticed because they might often be confused with the very common and also annoying *Lasius niger* an autochthonous species found in every garden and footpad in Belgium.

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