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Identification of introduction routes of invasive ants of *Tapinoma nigerrimum* complex into French localities

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Introduction

Worldwide, ants are among the most invasive animals, with one of the greatest impacts not only on biodiversity, but also on the global economy (agriculture, control or eradication, etc.)¹

The *Tapinoma nigerrimum* complex comprises four ant species, all of which originate from the Mediterranean basin (Fig. 2). Among these species *T. darioi*, *T. ibericum*, *T. magnum* are three invasive species that are very present in anthropised environments and could spread through the transport of ornamental plants as others invasive insects^{2,3}.

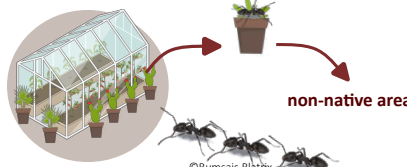


Fig. 1 : Hypothetical way of spread of invasive *Tapinoma* species

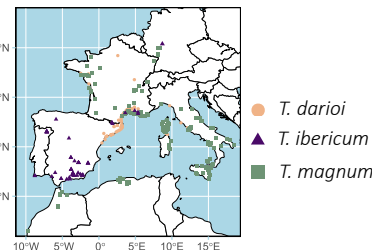


Fig. 2 : Colonies of invasive *Tapinoma* species sampled in western Europe and North Africa

Aim : The aims of this study are 1) to identify the invasive species of the *Tapinoma nigerrimum* complex in **ornamental plant sales outlets (OPSOs)** and understand the role of OPSOs as a way of introduction of these species and 2) to identify the origin of the populations present in OPSOs in French localities.

Methods

Colonies of *Tapinoma* were sampled in OPSOs of seven French departments (Fig. 3). In each department a single sample was collected by OPSO except in Hérault where several samples were collected.

Workers were identified and genotyped using 15 microsatellite markers. The role of OPSOs in introductions was assessed by comparison with a dataset recording the proportion of these species in Hérault³. The genotypes obtained were compared with the genetic profiles of populations from different **localities** of Europe and North Africa, to investigate the areas of origin of the OPSOs populations (Fig. 2).

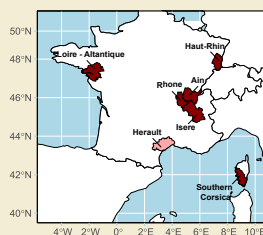


Fig. 3 : Location of departments in which OPSOs were sampled

Results & discussion

1 - Invasive species of the *Tapinoma nigerrimum* complex in 24 Hérault OPSOs

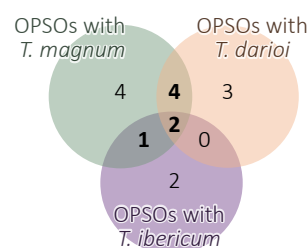


Fig. 4: Venn diagram of occurrences and co-occurrences of *T. magnum*, *T. darioi* and *T. ibericum* in 24 Hérault OPSOs

The species the most present in the Hérault OPSOs is *T. magnum* with 11 occurrences, followed by *T. darioi* with 9, then *T. ibericum* with 5. Overall, *T. darioi*, *T. ibericum* and *T. magnum* have 2, 83 and 30 times more occurrences respectively in the Hérault localities³.

In addition, 7 OPSOs have been colonised by several invasive species of the complex (Fig. 4).

2 - Potential source populations of *T. darioi* and *T. magnum* sampled in OPSOs

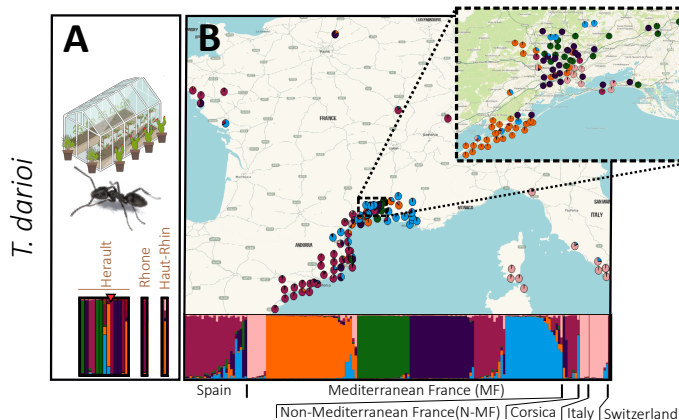


Fig. 5 : (A) Admixture model of *T. darioi* collected in the OPSOs and (B) *T. darioi* collected in different localities (K = 6, represented by different colours). The red triangle indicates several populations within a single OPSO.

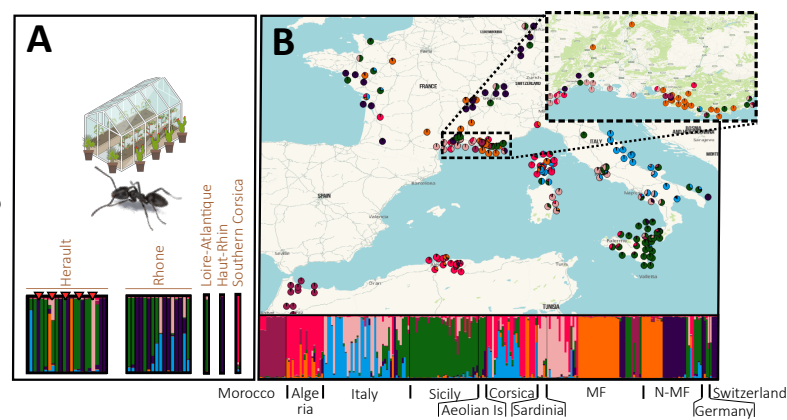


Fig. 6 : (A) Admixture model of *T. magnum* collected in the OPSOs and (B) *T. magnum* collected in different localities (K = 7, represented by different colours). The red triangle indicates several populations within a single OPSO.

The OPSOs in the three departments seem to be colonised by *T. darioi* populations from **north-east Spain** or the **Mediterranean France** (Fig. 5).

One of the Hérault OPSOs has been colonised by 2 different populations of *T. darioi* (Fig. 5A)

The OPSOs of the continental departments seem to be colonized by *T. magnum* populations from **Sicily** or **south-east Italy**, and the OPSO of Corsica by colonies from **Algeria** (Fig. 6).

Five of the Hérault OPSOs has been colonised by 2 or 3 different populations of *T. magnum* (Fig. 6A)

Conclusion : The trade in ornamental plants in Europe could increase the invasive potential of *T. darioi*, *T. ibericum* and *T. magnum*. It is therefore necessary to study the routes of introduction of these three invasive species in detail in order to limit their spread.

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