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# Non-native ants of the Iberian Peninsula: a 2025 update

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**Abstract**

The Iberian Peninsula has witnessed a dramatic rise in non-native ant species over the past few decades. This study provides a comprehensive and up-to-date checklist of all introduced ants known from the region as of 2025, based on an exhaustive review of more than 600 published records, over 800 expert-verified citizen-science observations from the platform iNaturalist.org, and over 100 new field records contributed by the authors. All data were manually curated and georeferenced, resulting in the most complete database of non-native ants currently available for the region. A total of 40 non-native species are confirmed, nearly quadrupling the number reported in the last regional review from 2001. Among these, 13 are considered invasive, while the status of 16 others remains uncertain. Most species are associated with disturbed, lowland coastal environments, especially in southern Iberia. Together, the provinces of Barcelona, Sevilla, Cádiz, Almería, and Málaga account for just over half of all recorded occurrences. Although published records from Portugal remain scarce, a substantial number of recent observations from the Algarve and Lisbon regions highlight the growing contribution of citizen science in documenting range expansions across the western Iberian coast. Temporal trends show a sharp acceleration in introductions after 2000, with more species recorded in the 2000s and 2010s than in the entire previous century. Species summaries reveal differing levels of establishment success and potential impact, although most remain confined to human-modified environments such as urban gardens, irrigated parks, and coastal developments. For each species, we provide updated distribution maps, ecological notes, and all known Iberian records. Our findings highlight the need for improved surveillance, standardized data reporting, and long-term monitoring to better understand and manage non-native ant introductions in the region.


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## Introduction

Few invertebrates have spread as widely and caused as much disruption as invasive ants, whose negative impacts span biodiversity, agriculture, infrastructure, and public health (Holway, 2002; Gruber et al., 2022). Recent global assessments have documented at least 520 non-native ant species transported beyond their native ranges, with more than 60% successfully establishing populations in new regions (Wong et al., 2023). The number of known introduced species continues to grow, with no indication that this trend is slowing (Seebens et al., 2017; Wong et al., 2023). Although only a small fraction of non-native ants are considered invasive (i.e., those non-native species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services, EU 2014), these few species account for the vast majority of ecological and socioeconomic damage observed worldwide (Holway et al., 2002; Gruber et al., 2022), and have already begun to erode biogeographic boundaries and homogenize ant assemblages at a global scale (Aulus-Giacosa et al., 2024). These invasive ants can displace native species, alter mutualistic interactions such as pollination and seed dispersal, and interfere with human systems, with global economic costs estimated to exceed 50 billion US dollars (Angulo et al., 2022). Climate projections further indicate that suitable habitat for several high-impact taxa will expand under future warming scenarios (Bertelsmeier et al., 2015).

During the last three decades, the rate of non-native ant introductions into Europe, and particularly the Mediterranean Basin, has increased markedly (Blatrix et al., 2018; Schifani, 2019; Demetriou et al., 2023). Intensified trade, expanding transport networks, and urbanization facilitate repeated introductions of non-native ants into continental ports, urban centers, and greenhouses (Blatrix et al., 2018; Destour et al., 2025). Furthermore, border interceptions miss up to two-thirds of species with high invasion capacity, especially those associated with litter and soil (Wong et al., 2023).

The last review of non-native ants in Iberia, now 25 years old, reported 11 species and one additional unconfirmed record at the time (Espadaler & Collingwood, 2001). Some non-native species introduced many decades ago, such as *Linepithema humile* (Mayr, 1868), have continued to expand and are now widespread and well established (López-Collar et al., 2024). Others, such as *Brachymyrmex patagonicus* (Mayr, 1868), have arrived more recently and pose emerging threats (Cipollone-Pérez et al., 2023). While many of these species remain restricted to urban and suburban environments, some species such as *Wasmannia auropunctata* (Roger, 1863) show potential to penetrate into less anthropized ecosystems (Arcos et al., 2025; Pradera & Espadaler, 2025a). For many others, their ecological impact remains largely unknown. At the same time, other problematic species that have recently established in other parts of Europe, such as the red imported fire ant *Solenopsis invicta* Buren, 1972 (Menchetti et al., 2023) and the Asian needle ant *Brachyponera chinensis* (Emery, 1895) (Menchetti et al., 2022; Schifani et al., 2024b), may eventually reach Iberia as well.

This study aims to compile a curated dataset of non-native ant species in Iberia by reviewing historical and recent literature, as well as incorporating records from the citizen science platform iNaturalist and the authors' own observations. We also provide species-level summaries of biology and distribution, and offer a general overview of the current status of ant invasions in the region.

## Materials and Methods

The authors manually reviewed and verified over 600 bibliographic records of non-native ant species reported in Iberia, extracting all available metadata directly from the original sources. All records and publications up to June 2025 were taken into account in this study. For this study, we considered records from the Iberian Peninsula, including Spain, Portugal, Andorra, and Gibraltar (United Kingdom). When possible, we supplemented these records with additional details, including refined geographic coordinates, elevation above sea level, habitat descriptions derived from aerial imagery, and estimates of coordinate accuracy. This effort resulted in the most thoroughly curated database of non-native ants currently available for the region (Supplementary Material S1). To further enrich the dataset, the authors also incorporated more than 100 additional records from their personal collections (Supplementary Material S2).

We also included observations of non-native ants in Iberia from the citizen science platform iNaturalist (Supplementary Material S3). For each species treated in this paper, we downloaded available records and reviewed the accompanying photographs to confirm species identification. Only observations classified as "verifiable" on the platform (those including a valid date, geographic coordinates, and a photograph) were considered, excluding those labeled as "casual grade". Further filtering criteria were applied: observations had to be non-captive (an iNaturalist category, used here to potentially exclude pet ant colonies whose origin does not represent a natural or established occurrence in the area), with non-obscured locations, positional accuracy under 3000 meters, and photo quality sufficient to support confident identification. For some records listed as "all rights reserved", particularly those that significantly extended the known distribution of a species, we contacted the original contributors individually to request permission for use (see Acknowledgements). All remaining such records were excluded from the final dataset.

A total of 227 iNaturalist records were identified as *B. patagonicus*. Most of these originated from two urban areas: Sevilla city (171 records) and Mairena del Alcor, Sevilla (39 records). The spatial spread within each locality was less than two kilometers, suggesting a concentrated distribution. Due to the high redundancy of these records, we did not perform exhaustive individual verification. Instead, we selected the earliest and latest verifiable records from each locality as representative. All other records from these localities were excluded from further analysis and categorized under "*Brachymyrmex* duplicates". A similar approach was applied to *Paratrechina longicornis* (Latreille, 1802), of which 172 records were retrieved, more than 80 of them from Sevilla and Mairena del Alcor. Again, only the first and last verifiable records per locality were retained; the remainder were excluded as "*Paratrechina* duplicates".

iNaturalist data were downloaded on 3 May 2025. Of the 1,472 initial observations, 805 were retained in the final dataset. Reasons for exclusion were as follows: "*Brachymyrmex* duplicates" (n = 201), "ID cannot be confirmed by photo" (n = 168), "copyright, all rights reserved" (n = 136), "*Paratrechina* duplicates" (n = 88), "location obscured" (n = 29), "positional accuracy >3000 m" (n = 25), "ID is incorrect" (n = 11), "observation with no photo" (n = 7), and "captivity" (n = 1). Observations grouped under "ID can't be confirmed by photo" included those in which images were of insufficient quality or lacked key diagnostic features needed for reliable identification. In certain cases, we applied slightly relaxed photo-quality criteria to improve dataset sensitivity. Although such images may be difficult to interpret for non-experts, they displayed the necessary morphological traits to permit confident species-level identification by trained myrmecologists. Nevertheless, we emphasize the limited reliability of online observations compared to published records and caution against treating them as equally robust in future studies. The full list of evaluated records, along with exclusion reasons, is available in the Supplementary Material S3.

Numerous observations of ants belonging to the genus *Nylanderia* Emery, 1906 have been reported on the iNaturalist platform. Although these observations could potentially represent more than one species, photographic evidence alone is insufficient to confirm species-level identifications with confidence. For analytical purposes, we assume that most of these observations correspond to *Nylanderia jaegerskioeldi* (Mayr, 1904), the only species consistently recorded in the Iberian literature, with the exception of two isolated records: one of *Nylanderia vividula* (Nylander, 1846) documented outdoors in Barcelona, and another of *Nylanderia steinheili* (Forel, 1893) reported from an indoor environment in the same city. Consequently, all bibliographic records of *N. jaegerskioeldi* and iNaturalist observations classified by us as *Nylanderia* sp. have been integrated under the category *Nylanderia* sp. for the analytical purposes of this study, assuming the rare possibility that a portion of them could eventually turn out to represent another species.

To ensure traceability and facilitate data management across all occurrence records, each record of the database was assigned a unique identifier using a standardized code format: NNIP-XXXXXX. Here, NNIP stands for "Non-native ants of the Iberian Peninsula", and XXXXXX represents a randomly generated six-character alphanumeric string composed exclusively of visually distinct characters. This format was specifically designed to minimize errors during data entry, sharing, or referencing. The following characters were excluded from the code generation process to avoid confusion: letters that resemble digits (B, I, L, O, S, U, Z) and digits that resemble letters (0, 1, 2, 5, 8). Duplicate codes were avoided during the process.

Distribution maps were generated using the open-source software QGIS (version 3.22.2, https://www.qgis.org). Base cartographic layers, including political boundaries and topographic context, were obtained from publicly available sources such as Natural Earth (https://www.naturalearthdata.com) and the Gridded Population of the World (GPW v4, https://sedac.ciesin.columbia.edu/data/collection/gpw-v4) database. GPW has been used as a proxy for the level of urbanization. The dark gray patches represent urban areas with a high population density (≥1000 inhabitants per square kilometer), while the light gray patches represent less populated urban environments or peri-urban areas (>250 inhabitants per square kilometer). Species occurrence is shown using three types of points by data source: orange circles for literature records, green circles for iNaturalist observations, and yellow circles for our own personal collections. To ensure reliability, priority was given to records from our own collections and the literature; when multiple records coincided spatially, these points were rendered on top, which may partially or completely obscure underlying iNaturalist records.

For each species included in the checklist, invasiveness was assigned based on published evidence of ecological or socioeconomic impacts documented in the scientific literature. These impacts, together with the species' invasion history in other regions, are described and referenced in the individual species accounts provided in the Results section. The "invasive" status indicated in Table 1 therefore reflects existing knowledge from the literature, rather than an assessment of species-specific impacts within the Iberian Peninsula.

To identify non-native species with potential to reach Iberia in the future (Table 3), we filtered the global database of non-native ants compiled by Wong et al. (2023) to extract species already recorded in Western Palearctic countries but absent from Iberia.

To facilitate interpretation of species records and temporal trends, we classified all non-native ants in this study into three categories according to their status in Iberia: (a) clearly non-native species established outdoors; (b) clearly non-native species detected only indoors; and (c) likely non-native species for which a native origin cannot be ruled out with the currently available evidence. This scheme, supported by the species-level accounts in the Results section, helps separate taxa with genuine potential for ecological impact from incidental indoor detections or species of unresolved origin, thereby improving the clarity of subsequent analyses.

**Table 1.** Non-native ant species recorded in the Iberian Peninsula, including their invasive status, geographic origin, establishment status, typical habitats (indoors and/or outdoors), and the year or period of first collection.

| Species name | Invasive? | Origin | Established in Iberia? | Outdoors and/ or indoors | First collected |
|---|---|---|---|---|---|
| *Anochetus ghilianii* (Spinola, 1851) | No | North Africa | Yes | Outdoors | 1842 |
| *Aphaenogaster gemella* (Roger, 1862) | No | North Africa | Yes | Outdoors | 1954 |
| *Aphaenogaster splendida* (Roger, 1859) | No | Middle East | Yes | Outdoors | Unknown (prior to 1891) |
| *Brachymyrmex patagonicus* Mayr, 1868 | Yes | Central and South America | Yes | Indoors and outdoors | 2016 |
| *Cardiocondyla emeryi* Forel, 1881 | No | Afrotropical region | Yes | Outdoors | 2005 |
| *Cardiocondyla mauritanica* Forel, 1890 | No | North Africa, Middle East and South Asia | Yes | Outdoors | 1984 |
| *Cardiocondyla obscurior* Wheeler, 1929 | No | Indomalayan region | Yes | Outdoors | 2015 |
| *Crematogaster inermis* Mayr, 1862 | No | North Africa and Middle East | Yes | Outdoors | 2007 |
| *Hypoponera ergatandria* (Forel, 1893) | No | Indomalaya and Afrotropical regions | Unknown | Indoors | 2005 |
| *Hypoponera punctatissima* (Roger, 1859) | No | Afrotropical region | Yes | Indoors and outdoors | Unknown (prior to 1888) |
| *Lasius neglectus* Van Loon et al., 1990 | Yes | Asia Minor/Central Asia | Yes | Indoors and outdoors | 1985 |
| *Lepisiota capensis* (Mayr, 1862) | Unknown | Southern Africa | Yes | Outdoors | 2024 |
| *Lepisiota frauenfeldi* (Mayr, 1855) | Unknown | Mediterranean basin and Middle East | Yes | Outdoors | 1981 |
| *Lepisiota melas* (Emery, 1915) | Unknown | Eastern Mediterranean | Yes | Outdoors | 2019 |
| *Linepithema humile* (Mayr, 1868) | Yes | South America | Yes | Indoors and outdoors | 1890 |
| *Monomorium carbonarium* (Smith, 1858) | Yes | Nearctic | Yes | Outdoors | 1981 |
| *Monomorium exiguum* Forel, 1894 | Unknown | Tropical Africa and Arabian Peninsula | Unknown | Outdoors | 2022 |
| *Monomorium floricola* (Jerdon, 1851) | Yes | Tropical Asia | No | Indoors | 2022 |
| *Monomorium monomorium* Bolton, 1987 | Unknown | West Mediterranean | Yes | Outdoors | 2003 |
| *Monomorium pharaonis* (Linnaeus, 1758) | Yes | Likely tropical Asia | Yes | Indoors | Unknown (prior to 1925) |
| *Nylanderia jaegerskioeldi* (Mayr, 1904) | Unknown | Afrotropical region and Middle East | Yes | Outdoors | 2000 |
| *Nylanderia steinheili* (Forel, 1893) | Unknown | Central or South America | Yes | Indoors | 2023 |
| *Nylanderia vividula* (Nylander, 1846) | Unknown | North America | Unknown | Outdoors | 1999 |
| *Paratrechina longicornis* (Latreille, 1802) | Yes | Asia or Afrotropical | Yes | Indoors and outdoors | 1956 |
| *Pheidole indica* Mayr, 1879 | Yes | Asia / Indomalaya | Yes | Outdoors | 1981 |
| *Pheidole megacephala* (Fabricius, 1793) | Yes | Southern Africa or the Malagasy region | Yes | Indoors and outdoors | 2016 |
| *Pheidole navigans* Forel, 1901 | Unknown | South and Central America | Yes | Outdoors | 2021 |
| *Pheidole rosae* Forel, 1901 | Unknown | South America | Yes | Outdoors | 2025 |
| *Strumigenys membranifera* Emery, 1869 | Unknown | Africa | Yes | Outdoors | 1975 |
| *Strumigenys silvestrii* Emery, 1906 | Unknown | South America | Yes | Outdoors | 2008 |
| *Tapinoma melanocephalum* (Fabricius, 1793) | Yes | Southeast Asia | No | Indoors | 2002 |
| *Technomyrmex vexatus* (Santschi, 1919) | Unknown | North Africa | Yes | Outdoors | 2007 |
| *Temnothorax longispinosus* (Roger, 1863) | No | North America | Unknown | Outdoors | 1994 |
| *Tetramorium bicarinatum* (Nylander, 1846) | Yes | Southeast Asia | Yes | Outdoors | 2003 |
| *Tetramorium caldarium* (Roger, 1857) | Unknown | Afrotropical | Yes | Outdoors | 2004 |
| *Tetramorium immigrans* Santschi, 1927 | No | Southeastern Europe and Western Asia | Yes | Outdoors | 2007 |
| *Tetramorium lanuginosum* Mayr, 1870 | Unknown | Afrotropical | Yes | Outdoors | 2004 |
| *Trichomyrmex destructor* (Jerdon, 1851) | Yes | Africa or Asia | Yes | Indoors and outdoors | 2007 |
| *Trichomyrmex mayri* (Forel, 1902) | Unknown | South Asia | Yes | Outdoors | 2007 |
| *Wasmannia auropunctata* (Roger, 1863) | Yes | Central and South America | Yes | Indoors and outdoors | 2018 |

## Results

### 1. General overview

The current checklist includes 40 non-native ant species documented on the Iberian Peninsula based on 1,589 analyzed records. These come from bibliographic records (664, 43.2%), iNaturalist observations (817, 49.7%), and from our personal collections (108 records, 7.1%) (Fig 1). Until 1999 all detections came exclusively from the published literature. In 2008 iNaturalist began operating as a functioning online platform, contributing only 1.7% of total records in the 2000s (mostly old photos uploaded as fresh observations), 20.0% in the 2010s, and 79.6% between 2020–2025, underscoring the recent dominance of the citizen-science platform in the dataset (Fig 2).

The vast majority of records originate from Spain, which accounts for 85.0% of the data (1,351 records). Portugal contributes 13.2% (210 records), while Gibraltar (United Kingdom) provides 1.7% (27 records). Andorra is represented by just one record, making up 0.06% of the dataset. Within Spain, the provinces with the most records are Barcelona (233; 14.7%), Sevilla (207; 13.0%), Cádiz (137; 8.6%), Almería (120; 7.6%), and Málaga (111; 7.0%). Together, these five provinces account for approximately 50.8% of all records in the dataset. Other Spanish provinces contributed notable numbers, including Granada (67; 4.2%), Córdoba (60; 3.8%), and València (60; 3.8%). In Portugal, the provinces of Lisboa (74; 4.7%) and Faro (71; 4.5%) make up the majority of the country's records, together representing over 69% of Portugal's contribution.

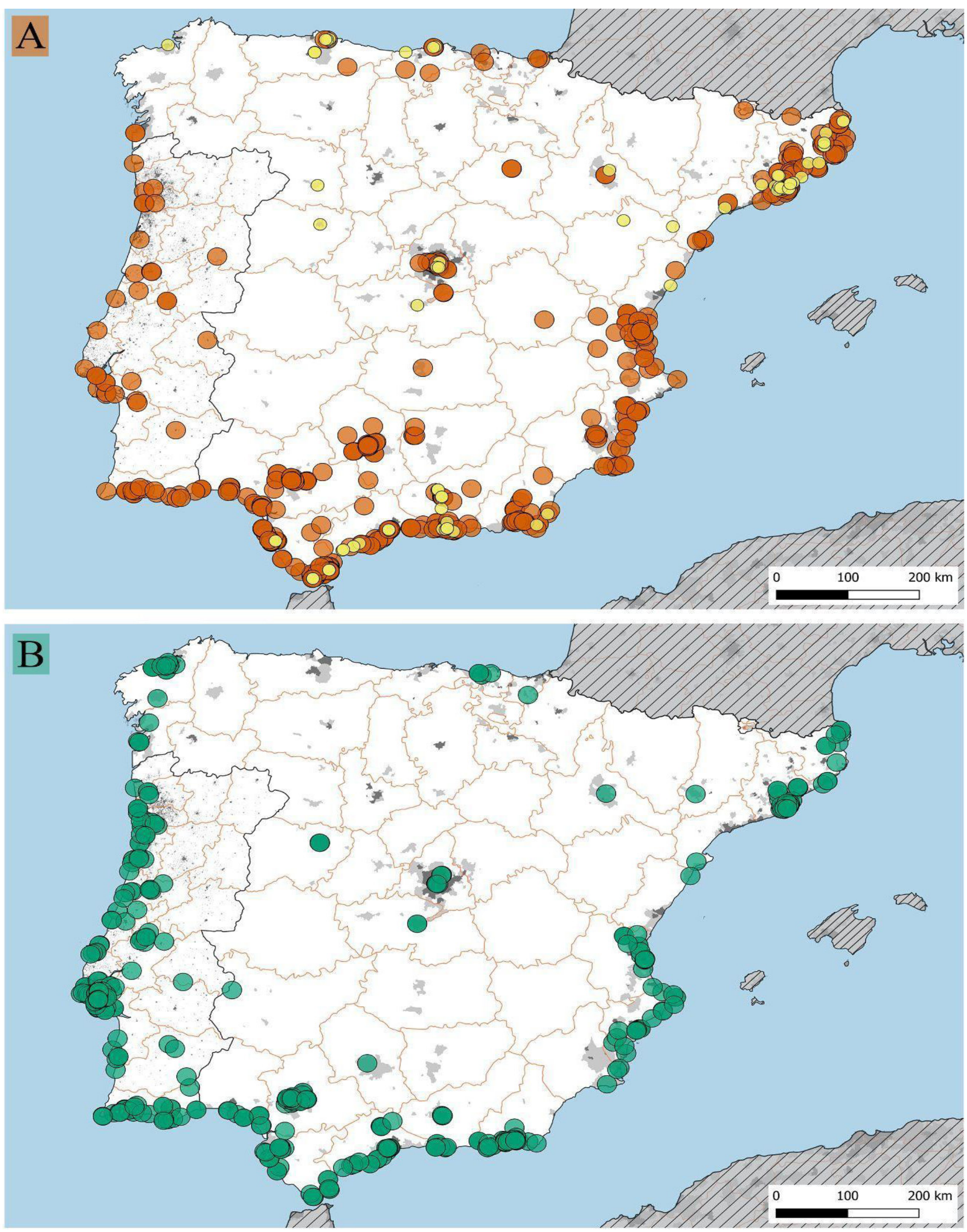


**Fig 1.** A: Geographic distribution of non-native ant records in the Iberian Peninsula from bibliographic sources (orange circles) and personal material (yellow circles). B: Distribution of the citizen science platform iNaturalist records (green circles). Grey patches correspond to the main urban areas.

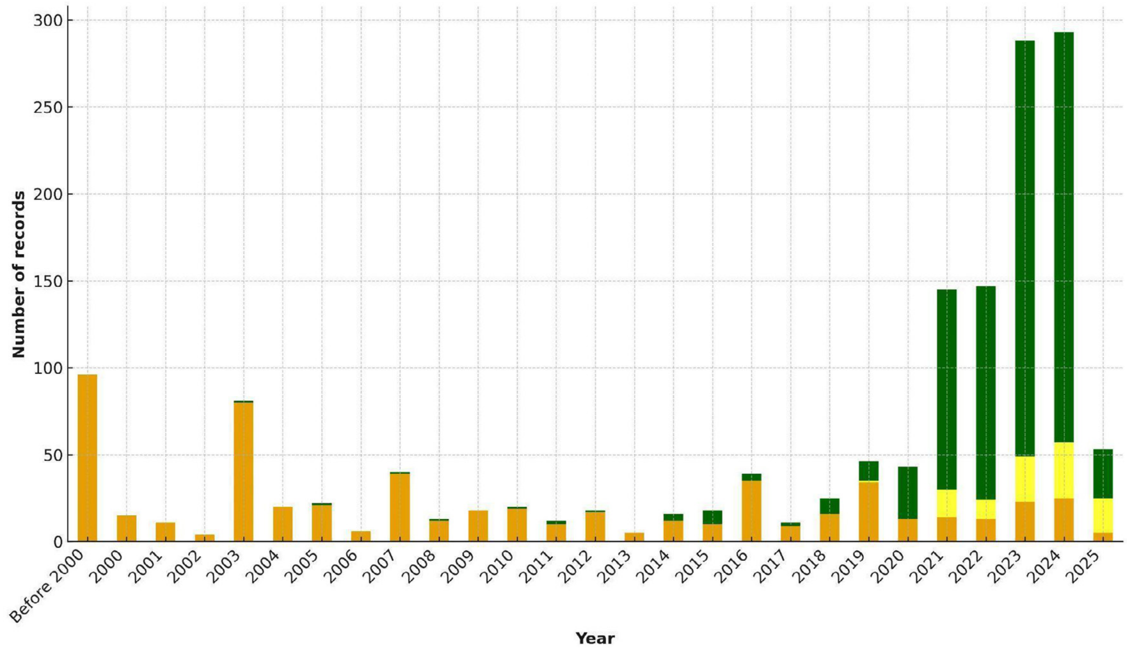


**Fig 2.** Yearly contribution of each data source to the total number of non-native ant records. Bibliographic records (orange) dominate the historical data, especially before 2000. In recent years, there has been a sharp increase in records driven by citizen science contributions from iNaturalist (green). Personal collections (yellow) provide additional observations in recent years.

Of the 40 recorded non-native ants, 13 species (32.5%) are considered invasive, 11 (27.5%) non-invasive, and 16 (40%) remain of uncertain invasive potential. The majority (34 species, or 85%) are confirmed as established in the region, while two are not known to be currently established and four lack sufficient data. These species are mainly found outdoors: 70% occur exclusively outdoors, 17.5% occur both indoors and outdoors, and only 12.5% are confined to indoor habitats such as greenhouses or buildings. Table 1 summarizes some individual characteristics of these ants.

Confirmed or most likely native origins span multiple biogeographic realms, with the Afrotropical region being the most represented (17.5%), followed by South America (15.0%) and North Africa (12.5%). Other origins include Asia, covering Asia Minor, Central Asia, the Middle East, and the Indomalayan/Southeast Asian region, as well as North America.

The temporal pattern of non-native ant detections in Iberia shows a slow accumulation of species until the mid-20th century, followed by a sharp increase in recent decades (Fig 3). At least four species were recorded before 1900 (*Aphaenogaster splendida* (Roger, 1859), *Anochetus ghilianii* (Spinola, 1851), *L. humile*, and *Hypoponera punctatissima* (Roger, 1859)), and another before 1925 (*Monomorium pharaonis* (Linnaeus, 1758)). The 1950s introduced two additional species (*P. longicornis*, and *Aphaenogaster gemella* (Roger, 1862)), bringing the total to at least seven by mid-century. After that, additions were comparatively sparse until the early 2000s, when a major surge occurred: at least 14 species were first documented in the 2000s, followed by six in the 2010s and six more in the 2020s (Fig 3).

The five most common species in the dataset by number of records were: *L. humile* (45.4%), *Cardiocondyla mauritanica* Forel, 1890 (7.6%), *Nylanderia* sp. Emery, 1906 (7.9%, including bibliographic records identified as *N. jaegerskioeldi* and records from iNaturalist identified by us as *Nylanderia* sp.), *P. longicornis* (6.5%), and *Monomorium carbonarium* (Smith, 1858) (4.8%). *L. humile* and *P. longicornis* are notably more represented in iNaturalist (59.9% and 10.6%, respectively) than in bibliographic records (29.1% and 2.0%) (Table 2). In contrast, *C. mauritanica* is far more represented in bibliographic sources (13.4% of all bibliographic records) than in iNaturalist (2.4% of all iNaturalist records).

**Table 2.** The five most common ant species in the dataset by global and source-specific percentages. *Nylanderia* sp. includes both *Nylanderia* genus-level records from iNaturalist and *N. jaegerskioeldi* from bibliographic sources, as most photo-based records likely refer to this species but cannot be confirmed from images alone.

| Species name | Global (%) | Bibliographic (%) | iNaturalist (%) |
|---|---|---|---|
| *Linepithema humile* (Mayr, 1868) | 45.44 | 29.07 | 59.85 |
| *Cardiocondyla mauritanica* Forel, 1890 | 7.61 | 13.40 | 2.45 |
| *Nylanderia* sp. Emery, 1906 | 7.93 | 4.52 | 10.89 |
| *Paratrechina longicornis* (Latreille, 1802) | 6.48 | 1.96 | 10.65 |
| *Monomorium carbonarium* (Smith, 1858) | 4.85 | 4.37 | 4.41 |


**Fig 3.** Timeline of first recorded introductions of non-native ant species in Iberia. Green labels indicate the exact year the species was first found, while yellow labels show the year of the publication. Species are ordered chronologically.

*Linepithema humile* stands out as the most widespread species, with confirmed records in 52 provinces or districts. Other broadly distributed species, including Gibraltar and Andorra in the counts, include *C. mauritanica* (19), *Nylanderia* sp. (14), and *H. punctatissima* (14). At the regional level, Málaga hosts the highest number of non-native ant species (21), followed by Cádiz (20) and Barcelona (20), all coastal provinces with high urbanization and port infrastructure.

Regarding habitats, most records among the ten most common species lack detailed habitat annotation, with entries marked as "unknown" dominating. However, among specific classifications, "urban park" and "urban" are the most frequently cited environments. Among the 1,531 records that included altitude data, the overall mean elevation was 112.4 ± 178.1 m (range 0–1987 m). For the top five most frequently recorded species, data were as follows: *L. humile* (132.9 ± 203.2 m, range 0–1987 m), *C. mauritanica* (141.4 ± 193.8 m, range 1–941.4 m), *P. longicornis* (35.1 ± 40.0 m, range 1.7–145.2 m), *Nylanderia* sp. (including *N. jaegerskioeldi*) (67.4 ± 91.9 m, range 2.3–787 m), and *M. carbonarium* (81.8 ± 165.5 m, range 0–1271 m). Among species with more than 10 altitude records, *Lasius neglectus* Van Loon et al., 1990 exhibited the highest mean elevation (257.2 ± 252.2 m, range 7–1009 m), while *P. longicornis* had the lowest (35.1 ± 40.0 m, range 1.7–145.2 m).

Table 3 lists species already recorded as non-native in nearby regions and potentially capable of establishing on the Iberian Peninsula, either in greenhouses or outdoors, if introduced.

### 1.1 Bibliographic dataset

A total of 664 literature records were evaluated, covering 40 unique taxa. According to published records only, the vast majority of non-native ant occurrences (89.5%) originate from Spain. Portugal accounts for 7.5% of the records, while the United Kingdom (Gibraltar) contributes 2.9%. Andorra is represented by a single confirmed record, making up 0.2% of the dataset.

At the provincial level, the highest numbers of records are reported from Cádiz (16.0%) and Barcelona (14.9%), followed by Málaga (8.9%), Córdoba (8.9%), and València (6.2%).

The most frequently reported species are *L. humile* (29.1% of all records), *C. mauritanica* (13.4%), *A. ghilianii* (6.8%), *Strumigenys membranifera* Emery, 1869 (6.2%), and *L. neglectus* (4.8%). These five species together still account for more than 60% of the dataset, highlighting the disproportionate dominance of a few non-native taxa within the published literature.

The spatial distribution of records reveals an almost continuous coastal corridor of detections extending from Catalonia to western Andalusia and the Algarve, particularly along the Mediterranean and southern Atlantic coasts. By contrast, inland and northern areas remain poorly represented. Several provinces in Castilla-La Mancha, Castilla y León, Extremadura and northern Spain (Asturias, Cantabria, La Rioja, Navarra) have few or no documented records of non-native ants. In Portugal, most published records are concentrated in coastal areas, chiefly the Algarve and Lisbon regions. No Portuguese districts appear among the top five provinces or regions in number of records. Despite low overall numbers, the distribution mirrors that of Spain, with non-native ants largely confined to disturbed lowland habitats (Fig 1A).

Normalised collection years or interpretable temporal annotations (e.g. "prior to 1924") are available for all records. The temporal range spans from 1842 to 2025, with a mean year of 2003. Altitude data are available for nearly all the dataset, with a mean elevation of 140 m above the sea level, reflecting a strong preference toward lowland habitats. Regarding spatial accuracy, about 40.8% of records are flagged as approximate, and among those with quantified uncertainty, the median geolocation error is 1,395 m, with values extending up to 200 km for some country-generic records.

### 1.2 iNaturalist dataset

A total of 817 records were evaluated, covering 22 unique taxa. Based on iNaturalist records, Spain accounts for 79.9% of observations. Gibraltar (0.5%) is proportionally less represented (although numerically superior compared to bibliographic records), while Portugal (19.6%) is more represented compared to bibliographic records. Notably, there are no iNaturalist records from Andorra, despite its presence in the bibliographic dataset (one record).

Geographically, the dataset is concentrated in a handful of provinces. The five most-sampled provinces are Sevilla (22.4%, 21 users), Barcelona (12.2%, 19 users), Almería (11.4%, 9 users), Lisboa (8.7%, 37 users), and Faro (6.9%, 18 users), together accounting for 61.6% of all observations. Sevilla and Almería show high individual effort (8.7 and 10.3 records per user, respectively), whereas Lisboa and Faro are characterised by broader but lower-intensity participation (1.9 and 3.1 records per user).

The iNaturalist dataset is heavily dominated by a few ant species, with *L. humile* accounting for 59.9% of all observations. *Nylanderia* sp. ranks second with 10.9%, followed closely by *P. longicornis* at 10.6%. These three taxa together now represent 81.4% of all records. Other well-represented taxa include *M. carbonarium* (4.4%), *B. patagonicus* (2.8%), and *C. mauritanica* (2.4%).

The dataset is top-heavy in user contribution: the two most active observers ("jpgsp" and "faluke") are responsible for 28.6% of the total dataset. The geographic distribution of records almost mirrors that of bibliographic records, with preference for coastal localities in eastern and south Iberia.

Because iNaturalist is a recent platform, records show a clear temporal trend. Although the earliest observation dates to 2003, only 5.6% of all entries were made before 2020. Contributions then rose sharply: 14.1% of records are from 2021, 15.1% from 2022, 29.3% from 2023, and 28.9% from 2024. Seasonally, activity is also skewed: 41.1% of all records were made in July (16.3%), August (12.5%), and September (12.4%).

**Table 3.** Non-native species not yet recorded in Iberia but present in other Western Palearctic countries. These species represent plausible candidates for future introduction in Iberia and may even be present but overlooked. Geographic origin and habitat (indoors and/or outdoors) is indicated.

| Species name | Western Palearctic countries | Origin | Outdoors and/or indoors (Western Palearctic) |
|---|---|---|---|
| *Brachyponera chinensis* (Emery, 1895) | Italy | Eastern Palearctic and Indomalayan | Outdoors |
| *Brachymyrmex heeri* Forel, 1874 | France, Germany, Ukraine | Neotropical (Central and South America) | Indoors |
| *Cardiocondyla wroughtonii* (Forel, 1890) | Italy, Netherlands | Indomalayan and Australasian | Indoors |
| *Linepithema iniquum* (Mayr, 1870) | Austria, Belgium, Germany, Ireland, Netherlands, United Kingdom | Neotropical (Central and South America) | Indoors |
| *Nylanderia bourbonica* (Forel, 1886) | Italy, Netherlands, United Kingdom | Indomalayan | Indoors |
| *Nylanderia fulva* (Mayr, 1862) | France | Neotropical (South America) | Indoors |
| *Nylanderia guatemalensis* (Forel, 1885) | Germany, Netherlands, United Kingdom | Neotropical (Central and South America) | Indoors |
| *Pheidole anastasii* Emery, 1896 | Denmark, France, Germany, United Kingdom | Neotropical (Central America) | Indoors |
| *Pheidole bilimeki* Mayr, 1870 | Austria, Belgium, France, Germany, Ireland, Netherlands, Norway, United Kingdom | Neotropical (Central and South America) | Indoors |
| *Pheidole punctatissima* Mayr, 1870 | Denmark, Netherlands, Norway, United Kingdom | Nearctic and Neotropical (Central and South America) | Indoors |
| *Plagiolepis alluaudi* Emery, 1894 | Austria, Belgium, Estonia, France, Germany, Ireland, Netherlands, Norway, Poland, United Kingdom | Afrotropical (Southeastern Africa) | Indoors |
| *Solenopsis abdita* Thompson, 1989 | Norway | Nearctic | Indoors |
| *Solenopsis invicta* Buren, 1972 | Italy, Netherlands | Neotropical (South America) | Indoors and outdoors |
| *Solenopsis geminata* (Fabricius, 1804) | Cyprus, Greece, Italy, Netherlands, Tunisia, United Kingdom | Nearctic (South United States) and Neotropical (Central and South America) | Indoors |
| *Strumigenys emmae* (Emery, 1890) | Netherlands, Poland, United Kingdom | Australasian | Indoors |
| *Strumigenys perplexa* (Smith, 1876) | United Kingdom (Guernsey, Channel Islands) | Australasian (Australia) | Outdoors |
| *Strumigenys rogeri* Emery, 1890 | Denmark, Germany, Norway, United Kingdom | Afrotropical (Central and Southeastern Africa) | Indoors |
| *Technomyrmex albipes* (Smith, 1861) | Austria, Czech Republic, Denmark, France, Germany, Ireland, Italy, Norway, Switzerland, United Kingdom | Indomalayan | Indoors |
| *Technomyrmex difficilis* Forel, 1892 | France, Netherlands | Afrotropical (Malagasy) | Indoors |
| *Technomyrmex pallipes* (Smith, 1876) | Italy, Netherlands, United Kingdom | Afrotropical (Central and South Africa) | Indoors |
| *Technomyrmex vitiensis* Mann, 1921 | Austria, Belgium, Czech Republic, Denmark, France, Germany, Netherlands, Norway, Switzerland, United Kingdom | Indomalayan | Indoors |
| *Tetramorium insolens* (Smith, 1861) | Austria, Czech Republic, France, Germany, Hungary, Netherlands, Poland, Switzerland, United Kingdom | Australasian | Indoors |
| *Tetramorium simillimum* (Smith, 1851) | Algeria, Denmark, France, Germany, Libya, Netherlands, United Kingdom | Afrotropical (Central and South Africa) | Indoors |

## 2. Checklist of non-native species

### 2.1 Clearly non-native species established outdoors

#### *Brachymyrmex patagonicus* (Mayr, 1868)

*Brachymyrmex patagonicus* is a minute (2–2.5 mm), monomorphic, dark brown ant species. Due to its small size and general appearance, it may be confused with native Iberian *Plagiolepis* Mayr, 1861 species, but it can be readily distinguished by its nine-segmented antennae (including the scape), in contrast to the twelve-segmented antennae of *Plagiolepis*.

The biology and ecology of *B. patagonicus* were comprehensively reviewed by MacGown et al. (2007), although a brief overview is provided here. In its native range, which includes Central and South America, this species nests in both natural and disturbed habitats and frequently infests human structures, including homes, hospitals, and restaurants. Nests are commonly located in soil, dead wood, and leaf litter. In urban environments, however, they are also found under bricks, in piles of refuse, and other sheltered artificial substrates. Workers primarily feed on honeydew but exploit sweet substances indoors, making them a nuisance in domestic settings. Hundreds of workers can cluster in small cavities, making accidental transport easier. *B. patagonicus* disperses naturally through nuptial flights, which facilitates its expansion on a local scale. Although not mentioned by MacGown et al. (2007), colonies can be facultatively polygynous (Eyer et al., 2020; 2021).

Outside its native range, *B. patagonicus* is highly synanthropic. In the United States, particularly in the southern half, it is rapidly spreading and is now considered a major pest (Guénard, 2018). The species has also been reported from several Pacific islands (Janicki et al., 2016; Guénard et al., 2017), Hong Kong (Guénard, 2018), Kobe, Japan (Ortiz-Sepúlveda et al., 2019), and northern European territories, where it survives indoors in residences and greenhouses (MacGown et al., 2007; Janicki et al., 2016; Guénard et al., 2017; Guénard, 2018).

In Southern Europe, *B. patagonicus* was first detected in 2016 in Almería, Spain (Espadaler & Pradera, 2016), marking its first record on the European continent. Since then, its expansion has been well documented (Reyes-López et al., 2024), with confirmed records in neighboring provinces such as Málaga, Granada, Cádiz, Murcia, Sevilla, Alacant and Almería (Fig 4). All findings are associated with human-altered environments, typically involving residential areas and gardens. As noted by Reyes-López et al. (2024), most records arise once colonies reach sufficient size to become a nuisance and are reported as pests. This likely means the actual date of introduction predates these detections by several years (Reyes-López et al., 2021). Observations from citizen science platforms such as iNaturalist corroborate the published distribution of the species, with one exception: a record from Marbella (Málaga), which falls within the species' expected expansion zone, as it had already been recorded in Málaga city, approximately 40 km away. To date, the species has not been recorded in Portugal, and no observations on iNaturalist appear to match its general morphologic appearance.

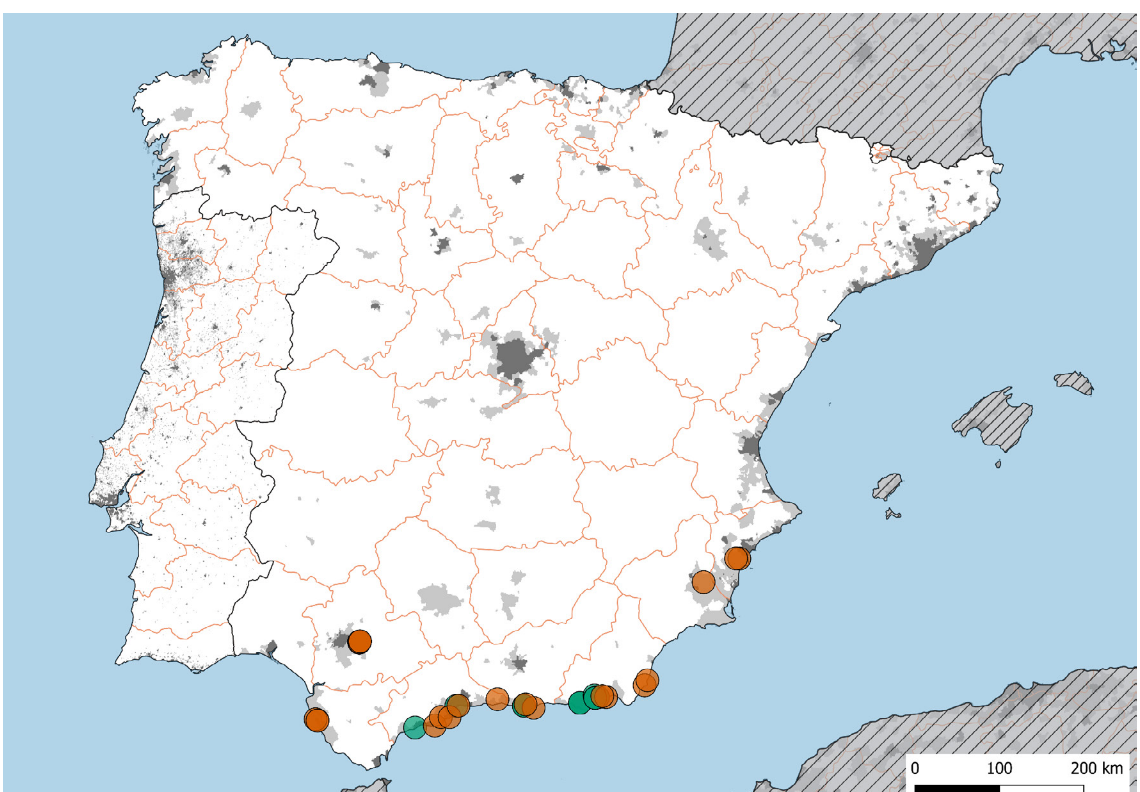


**Fig 4.** Iberian distribution of *Brachymyrmex patagonicus*. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

The impact of *B. patagonicus* on native ant diversity remains largely unknown, but several authors have reported an absence of native species in areas occupied by *B. patagonicus* as in Murcia and Almería (Pradera & Espadaler, 2024), and in the case of Sevilla, only the invasive *P. longicornis* was recorded in co-occurrence (Cipollone-Pérez et al., 2023). *B. patagonicus* does not bite, sting, cause structural damage, or appear to be involved in mechanical disease transmission (MacGown et al., 2007), but Keefer (2016) proposed that the species be considered a medically relevant pest. Laboratory studies suggest its potential role as a vector of *Escherichia coli* (Migula 1895), a concern particularly in hospital environments.

Seeing the rapid spread of the species across southern Iberia, we consider the species could establish in the following years across northern Mediterranean cities, and progressively become a common non-native ant in many Iberian cities.

***Cardiocondyla emeryi* Forel, 1881**

Commonly known as Emery's sneaking ant, *Cardiocondyla emeryi* Forel, 1881 is a minute (1.7–2.2 mm), monomorphic, bicolored ant with a yellowish body and dark brown gaster. This cosmopolitan ant is native to the Afrotropical region, but has successfully spread to numerous tropical areas, particularly the Gulf of Mexico basin, Central America, the Caribbean, and South America (Janicki et al., 2016; Guénard et al., 2017). Within the Palearctic realm, *C. emeryi* has been recorded in the Canary Islands, Morocco, various Mediterranean territories (Italy, Malta), and throughout the Middle East and Western Asia. It is also present in the Malagasy and Indo-Australian regions, as well as on several remote Pacific and Atlantic islands (Wetterer, 2012; Janicki et al., 2016; Guénard et al., 2017). In temperate and colder climates, the species is typically confined to greenhouses and other indoor environments.

Morphologically, *C. emeryi* closely resembles *Cardiocondyla obscurior* Wheeler, 1929 due to its coloration but differs in several traits, including less pronounced anterolateral corners of the postpetiole and other morphometric characteristics (see Seifert, 2003b). Colonies are polygynous (Frumhoff & Ward, 1992) and characteristically small, occupying inconspicuous nests located in the soil, often in superficial cavities with minute entrances (Creighton & Snelling, 1974). Gynes are winged and presumably capable of flight and dispersal (Seifert, 2003b).

It has been suggested that *C. emeryi* may benefit from the presence of other invasive species such as *Pheidole megacephala* (Fabricius, 1793), which may suppress native competitors while allowing the minute workers of *C. emeryi* to persist (Wetterer, 2012). Although data on its ecological impact are limited, the available evidence suggests it may exert low or negligible effects on native faunas, a pattern observed in other cosmopolitan species of the genus, such as *C. mauritanica* (Wetterer, 2012).

On the Iberian Peninsula, the presence of *C. emeryi* appears to be localized and its invasion process remains in an early stage. Since 2005, it has only been recorded three times (Fig 5): first in green urban areas in Málaga (Reyes-López et al., 2008), then in two separate urban gardens in Cádiz, once in 2016 (Taheri & Reyes-López, 2018) and again in 2023

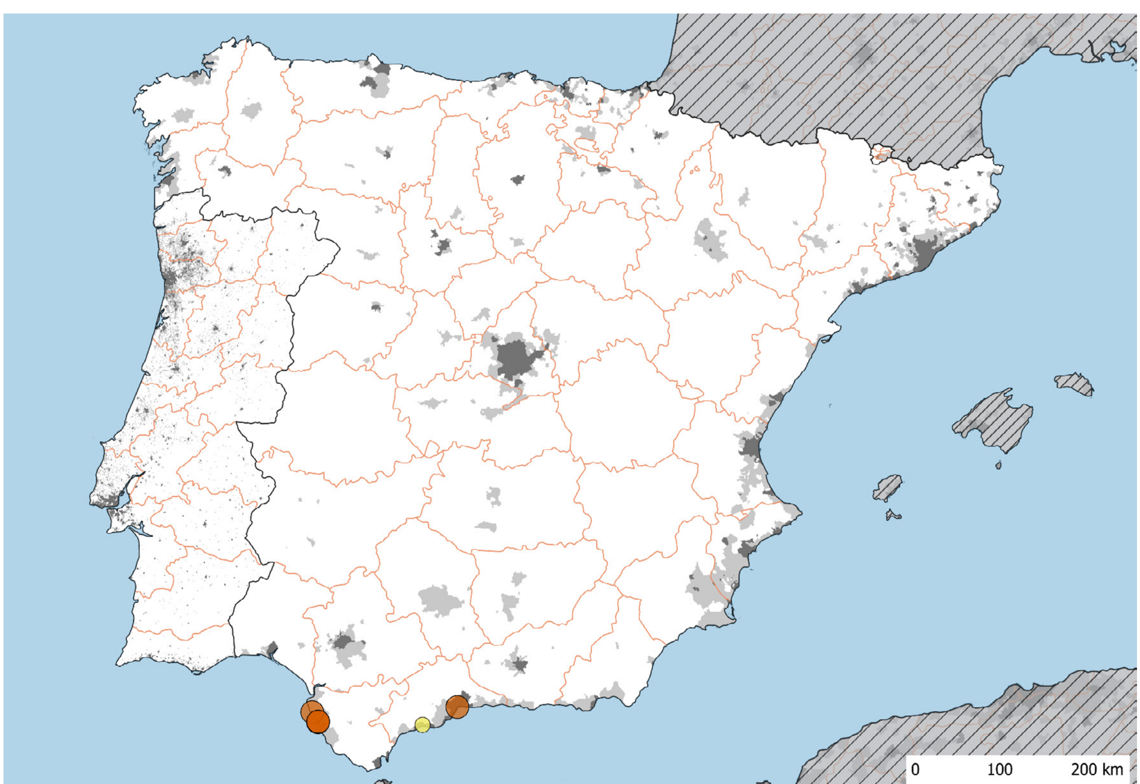


**Fig 5.** Iberian distribution of *Cardiocondyla emeryi*. Source of records: bibliographic (orange circles) and personal material (yellow circles). Grey patches correspond to the main urban areas.

(Reyes-López et al., 2024). We add here a fourth record from Marbella (Málaga). The temporal span of these records, coupled with the limited apparent expansion, suggests the species may be subject to ecological constraints that inhibit its spread. One possible factor is competition from the already abundant and morphologically similar non-native ant *C. obscurior*, which may be occupying the same ecological niche and thereby limiting the establishment of *C. emeryi* in the region.

***Cardiocondyla mauritanica*** **Forel, 1890**

The Moorish sneaking ant, *C. mauritanica*, is similar in general appearance to other members of the genus, but can be readily distinguished in the Iberian context by its overall brownish body, darker gaster, and the hexagonal shape of the postpetiole in dorsal view. Workers are small (1.7–2.4 mm), monomorphic, and brown in coloration with a distinctly darker gaster.

This species, native to North Africa, the Middle East-Western Asia, and South Asia (Janicki et al., 2016; Guénard et al., 2017), has been introduced to numerous tropical and subtropical regions, including the southern United States, the Caribbean, the northern Mediterranean Basin, the Philippines, and New Guinea (Janicki et al., 2016; Guénard et al., 2017; Seifert et al., 2017).

The first Iberian records date back to 1984 (Ortiz & Tinaut, 1988), and it is now widespread along the southeastern and southern coasts of the Iberian Peninsula, as well as the Atlantic coast of Portugal. Additionally, it has been recorded inland in Andalusia, particularly following the course of major river systems (Reyes-López & Carpintero, 2014).

*Cardiocondyla mauritanica* is typically associated with semiarid and xerothermic urban environments (Seifert, 2003b; Wetterer, 2012). In Iberia, it is found in anthropized and disturbed habitats, such as pavements, tree bases, wall crevices, parking lots, public gardens, seafronts, and other neglected urban environments. These sites are generally characterized by low vegetation cover and sandy or loose soils. Indoor records are rare. Colonies are polygynous and relatively small in size, and mating is primarily intranidal (Heinze et al., 1993). Winged gynes are capable of dispersal (Seifert, 2003b), and in Iberia, they can be observed outside the nest from early April through late July (J. Arcos pers. obs.).

Alongside *L. humile*, *C. mauritanica* is one of the most widely distributed and commonly encountered non-native ant species in South Iberia (Fig 6). These two species frequently co-occur, likely due to their shared preference for disturbed, open urban habitats and the ability of *C. mauritanica* to coexist with other dominant non-native ants (Wetterer, 2012). Although coexistence is common, interspecific encounters can be aggressive. Typically, *C. mauritanica* workers initially remain still upon contact, but will respond with repeated stinging if attacked by *L. humile* workers (Gómez & Espadaler, 2006). The species also extends through the Mediterranean coast to the northeast and has some records in coastal Portugal (Fig 6). Despite its widespread occurrence, *C. mauritanica* does not appear to exert a significant ecological impact on native fauna in the invaded range (Wetterer, 2012).

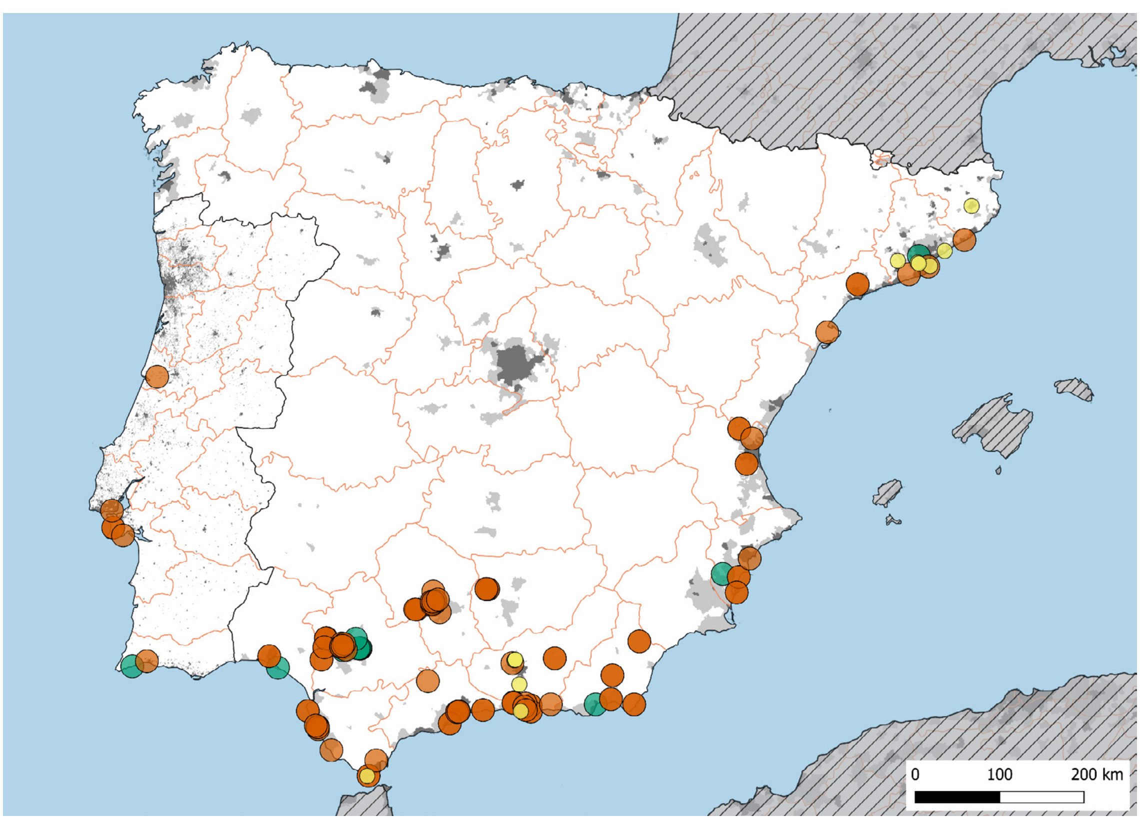


**Fig 6.** Iberian distribution of *Cardiocondyla mauritanica*. Source of records: bibliographic (orange circles), personal material (yellow circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

**_Cardiocondyla obscurior_ Wheeler, 1929**

Minute (1.7–2.2 mm) and yellowish ant with a contrasting dark brown gaster, originally native to the Indomalayan region (Janicki et al., 2016; Guénard et al., 2017). Among the Iberian fauna, it is morphologically similar to *C. emeryi*, and the two species are virtually indistinguishable without the aid of a stereomicroscope. *C. obscurior* has established populations across multiple tropical and subtropical regions, including the Gulf of Mexico basin, the Caribbean, South America, the Western Mediterranean, South and Central Europe, and various Pacific islands (Janicki et al., 2016; Guénard et al., 2017).

On the Iberian Peninsula (Fig 7), the species was first recorded in the province of València in 2015 (Sánchez-García & Espadaler, 2015), followed by subsequent detections along the southeastern coast, including Alacant in 2016 (Trigos-Peral & Reyes-López, 2016) and Málaga in 2019 (Trigos-Peral et al., 2020). It was also reported in Barcelona in 2018 (Espadaler & de Zugasti, 2019), where it has since been observed in multiple public gardens throughout the metropolitan area and is now common in the city (J. Arcos, pers. obs.). We also report in this paper the first confirmed record of the species from Gibraltar, based on a specimen collected by M.A. Logachev. Due to its small size, solitary foraging behavior, and the generally low number of individuals per colony, the detection of this species is often opportunistic, and it is likely to be underreported. It may, in fact, be more widespread in urban areas throughout the east coast of the Iberian Peninsula.

Unlike in other European countries such as France, Germany and the Netherlands, where *C. obscurior* has primarily been found indoors in greenhouses (Seifert, 2003b; Boer et al., 2018), Iberian records correspond exclusively to outdoor locations, particularly urban parks and landscaped squares. Across its introduced range, the genus *Cardiocondyla* Emery, 1869 is not generally associated with significant ecological disruption (Wetterer, 2012), and successful establishment is often attributed to its ability to coexist with dominant species (Heinze et al., 2006; Wetterer, 2012). In Iberia, *C. obscurior* has been found living in co-occurrence with several other non-native or invasive species, including *L. neglectus* and *L. humile* (Espadaler & Ortiz de Zugasti, 2019; Trigos-Peral et al., 2020), as well as *C. mauritanica* (Trigos-Peral & Reyes-López, 2016). This apparent tolerance and coexistence capability seem to be a general trait of the genus *Cardiocondyla* (Heinze et al., 2006), although the mechanisms behind it remain poorly understood. To date, no evidence indicates that *C. obscurior* negatively affects native ant diversity in its introduced habitats.

While *C. obscurior* is typically considered an arboreal species that nests in bark and other plant material (Heinze et al., 2006; Deyrup, 2017; Espadaler & de Zugasti, 2019), Iberian observations have also recorded it nesting in concrete crevices and exposed soil in shaded environments (Trigos-Peral & Reyes-López, 2016). Nuptial flights have been observed in July in Alacant, where numerous males were found in a patch of exposed soil (J. Arcos pers. obs.). Despite having fully developed wings, the males did not attempt to fly, instead

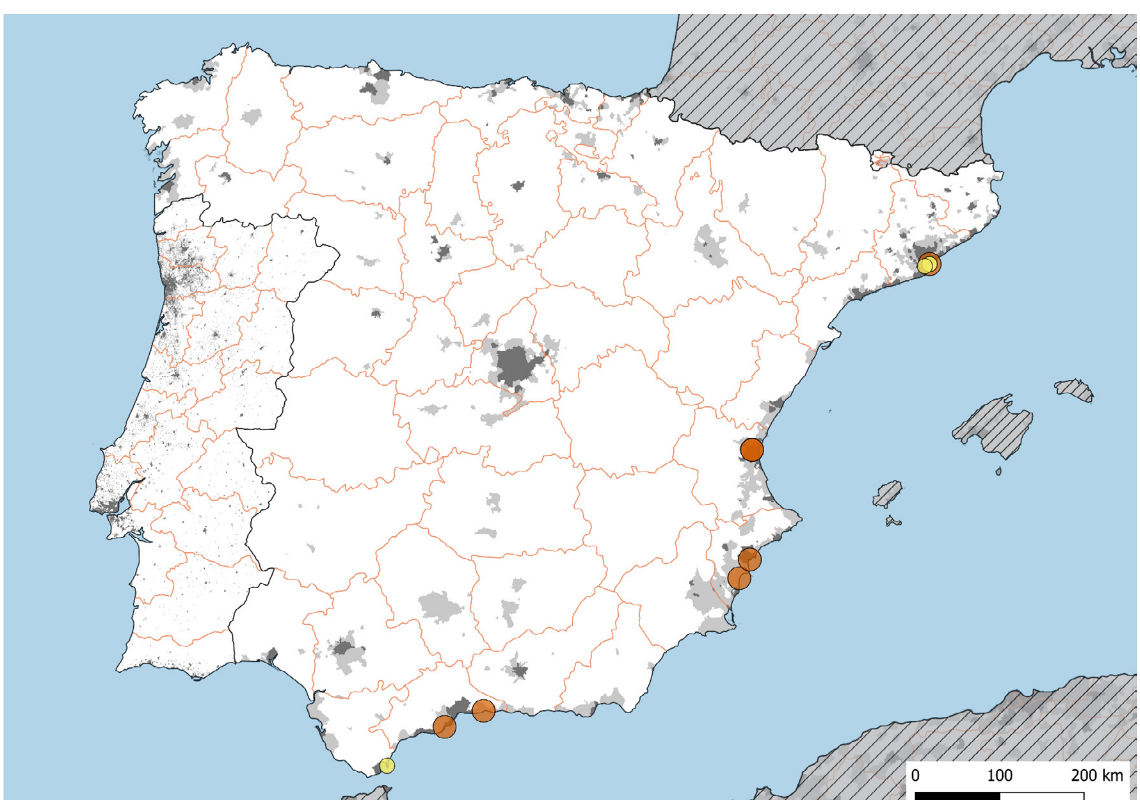


**Fig 7**. Iberian distribution of *Cardiocondyla obscurior*. Source of records: bibliographic (orange circles) and personal material (yellow circles). Grey patches correspond to the main urban areas.

engaging in local mating with queens, which either returned to the nest or were carried back by workers. Males are known to occur in both winged and wingless (ergatoid) forms, while gynes are winged and capable of flight and dispersal (Seifert, 2003b).

### *Crematogaster inermis* Mayr, 1862

*Crematogaster inermis* Mayr, 1862 is a dark brown ant with very short and blunt propodeal spines. Originally described from Egypt, the species has also been recorded in Cyprus, Iran, Israel, Syria, Yemen, Libya, Morocco and Spain (Janicki et al., 2016; Guénard et al., 2017; Borowiec & Salata, 2020).

On the Iberian Peninsula, it has been observed in two locations (Fig 8): València and Agost (Alacant) (Casiraghi et al., 2020). In València, individuals were observed tending aphids and nesting in a hollow area at a tree base. This introduction was likely associated with the importation of trees, and the population was confirmed to still be present as of July 2021 (J. Arcos pers. obs.). Another population, detected in 2007 in Agost, was found in a small palm grove of *Phoenix dactylifera* L. (Arecaceae) and was reportedly eradicated following the abandonment of cultivated land and cessation of irrigation (Casiraghi et al., 2020), suggesting that *C. inermis* may be dependent on consistent moisture levels.

Assessing the invasive potential of *C. inermis* in Iberia remains difficult due to limited knowledge of its biology. However, based on closely related species, it is likely to be strictly arboreal, forming monogynous colonies, reproducing through nuptial flights and exhibiting aggressive behavior when defending its territory, which are not typical traits of invasive ants.

### *Hypoponera punctatissima* (Roger, 1859)

*Hypoponera punctatissima*, commonly referred to as Roger's ant, is a small species (2–2.5 mm) characterized by its slender morphology and reddish to brownish coloration. It is native to mainland regions of the Afrotropical region (Janicki et al., 2016; Guénard et al., 2017), but has achieved a cosmopolitan distribution, being widely reported across Europe, the Malagasy region, the Americas, and several oceanic islands (Delabie & Blard, 2002).

On the Iberian Peninsula, *H. punctatissima* can be distinguished from other congeneric species as in the case of the native species *H. eduardi*, by a longitudinal impression extending from the clypeus to near the occiput on the dorsal head surface, as well as by specific morphometric traits related to the petiolar node profile and scape length (Bolton & Fisher, 2011). Its closest relative is *H. ergatandria*, from which it can be separated based on simple biometric traits in gynomorphic (winged) queens, particularly head width and scape length (Seifert, 2013). Females are mostly alate, although a wingless morphotype can occur, while males are ergatoid (wingless) and dimorphic (Hölldobler & Wilson, 1990).

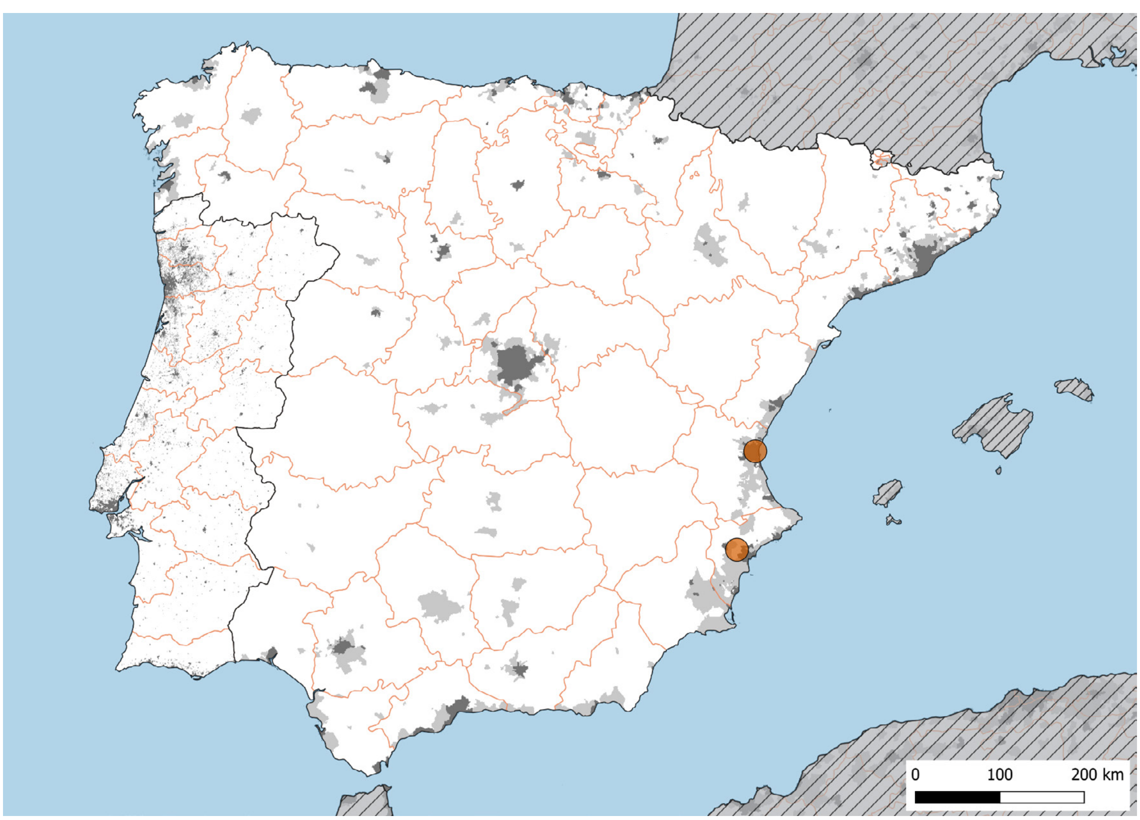


**Fig 8.** Iberian distribution of *Crematogaster inermis*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

Ecologically, *H. punctatissima* shows a preference for warm, humid microhabitats, frequently nesting in decomposing organic materials such as compost or manure heaps. These outdoor environments provide thermal buffering that supports survival through colder seasons. Seifert (2003a) notes that the majority of dispersing alates have been observed outside buildings, with 50% detected far from anthropogenic structures, even in remote natural areas such as isolated peat bogs. This evidence suggests that *H. punctatissima* has a significant capacity for natural dispersal and may have colonized northern temperate regions (above 48°N) independently of human assistance. However, anthropogenic activity appears to have amplified its local abundance, since it frequently occurs in warm, stable environments such as human dwellings, including healthcare settings. Large colonies have been reported in hospitals in both the United Kingdom and the United States (Gray et al., 1995).

In Spain, documented occurrences include persistent infestations in a hospital, where multiple stings were reported over consecutive days (Martínez-Ibáñez & Martínez de Murguía, 2011), as well as recurrent complaints of stings in private residences in Barcelona and Córdoba between 2018 and 2024 (Pradera & Espadaler, 2025b). Other records exist from indoor and outdoor settings in Iberia, especially in the south (Fig 9).

Despite its adaptability, *H. punctatissima* has a relatively narrow trophic niche, feeding predominantly on small arthropods. This dietary specialization could limit its broader synanthropic potential. On the other hand, the cryptic nature of *H. punctatissima*, characterized by its hypogeic behavior and specific ecological requirements in terms of microhabitat and diet, significantly hinders its detection. These traits likely contribute to an underestimation of both its actual distribution and population densities (Reyes-López et al., 2008). Given its increasing presence in urban environments and ability to adapt to indoor habitats, further cases of synanthropic occurrences are expected in Iberia.

### *Lasius neglectus* Van Loon, Boomsma & Andrasfalvy, 1990

*Lasius neglectus*, commonly known as the invasive garden ant, is a monomorphic, dark brown species, with workers measuring 2.5–3 mm in length (Schultz & Seifert, 2005). Workers are characterized by the absence of erect hairs on the scapes and by having a low number of mandibular denticles, often around seven (Seifert, 2018). Differentiating this species from native ants such as *Lasius psammophilus* Seifert, 1992 can be challenging. However, its supercolonial population structure and frequent occurrence in anthropogenic habitats can serve as initial indicators of its identity. For a safe morphometric characterization see Seifert (2020).

The species is a widespread invasive ant throughout the Palearctic region (Janicki et al., 2016; Guénard et al., 2017). Its native range is most likely Asia Minor (Seifert, 2020, Stukalyuk et al., 2020); however, definitive evidence is still lacking (Stukalyuk et al., 2020). The first European record of *L. neglectus* dates back to around 1973, and since then, it has been introduced to numerous regions probably through the transport of plants and soil materials (Van Loon et al., 1990; Seifert, 2018). Its non-native range now includes most of Southern, Central, and Eastern Europe, as well

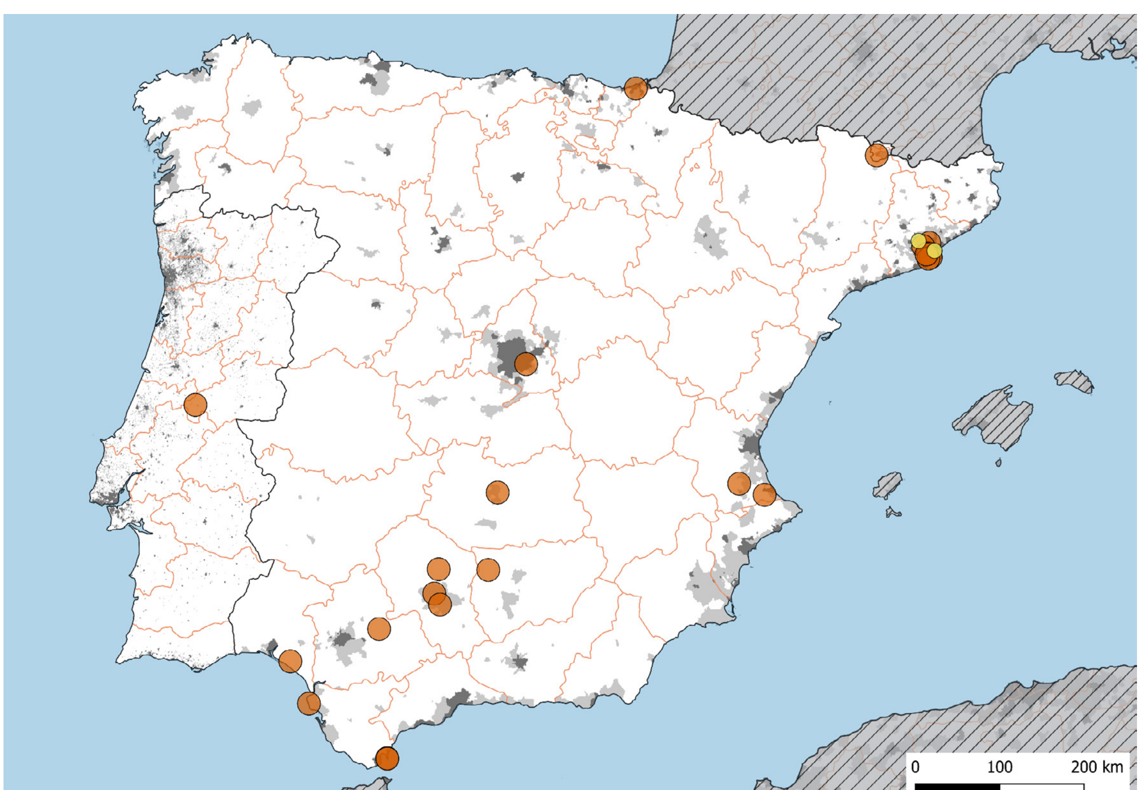


**Fig 9.** Iberian distribution of *Hypoponera punctatissima*. Note: a generic record from Portugal without locality is shown here. Source of records: bibliographic (orange circles) and personal material (yellow circles). Grey patches correspond to the main urban areas.

as the Middle East (Western Asia), extending eastward to Iran and Kyrgyzstan. Additionally, isolated records exist from Northern Europe (including the United Kingdom and Norway), the Canary Islands, Israel, and even New Zealand (Janicki et al., 2016; Guénard et al., 2017; Seifert, 2020; Stukalyuk et al., 2020).

On the Iberian Peninsula, *L. neglectus* was first detected in 1985 in Seva, Barcelona region, where it was reported as a "mild nuisance" (Espadaler & Rey, 2001). At that time, the species had not been formally described. Subsequent records from the region confirmed its presence and real range extension, and it soon became evident that the species was invasive (Espadaler, 1999). Currently, the presence of *L. neglectus* on the Iberian Peninsula appears to be limited to the north of Iberia (Barcelona, Girona and Bizkaia regions; Fig 10), where it is quite a common species in urban environments (J. Arcos pers. obs.). A small outdoor population was also reported in Gandia (València, Spain) in late 2015 and persisted through 2016 (Trigos-Peral et al., 2021; J. Arcos pers. obs.; Fig 10). However, a follow-up survey conducted in 2018 by the first author failed to detect any individuals, suggesting that the population had collapsed.

The invasive potential of *L. neglectus* results from a combination of traits commonly found in many cosmopolitan ant species. These include polygynous and polydomous nesting, which lead to the formation of expansive supercolonies, low levels of intraspecific aggression and intranidal mating (Van Loon et al., 1990; Espadaler & Rey, 2001; Seifert, 2018; Stukalyuk et al., 2020). In invaded habitats, this species often becomes ecologically dominant by monopolizing food resources (Paris & Espadaler, 2009) and exhibiting aggressive behavior toward native ant species (Van Loon et al., 1990; Cremer et al., 2006; Tartally, 2006; Seifert, 2018). *L. neglectus* also invades a variety of buildings, becoming an important household pest and even damaging electrical equipment (Espadaler & Rey, 2001). Within its introduced range, it primarily occupies anthropogenic environments such as parks, gardens, greenhouses, streets with tree lines and buildings. It can also spread into disturbed areas adjacent to urban or suburban zones, including forest patches and grasslands (Van Loon et al., 1990; Paris & Espadaler, 2009; Seifert, 2018). Moreover, the species displays a broad altitudinal tolerance, occurring at elevations up to 2000 meters above sea level (Schultz & Seifert, 2005; Stukalyuk et al., 2020). The expansion rates of supercolonies have been reported to range from 5.85 to 13 meters per year (Espadaler et al., 2004; Tartally, 2006). Interestingly, one study documented that large populations of *L. neglectus* can decline or even disappear entirely without human intervention, though the causes behind such collapses remain unclear (Tartally et al., 2016). New introductions of the species are often overlooked during the early stages of establishment, after which population sizes may increase rapidly (Seifert, 2018).

*Lasius neglectus* can be considered a generalist omnivore, capable of exploiting a wide range of food sources, though it primarily feeds on honeydew (Van Loon et al., 1990; Seifert, 2018). In northeastern Iberia, a supercolony of *L. neglectus* was found to collect an average of 2.09 kg of honeydew per tree over the course of a year, compared to only 0.82 kg per tree collected by the native *Lasius grandis* Forel, 1909 during

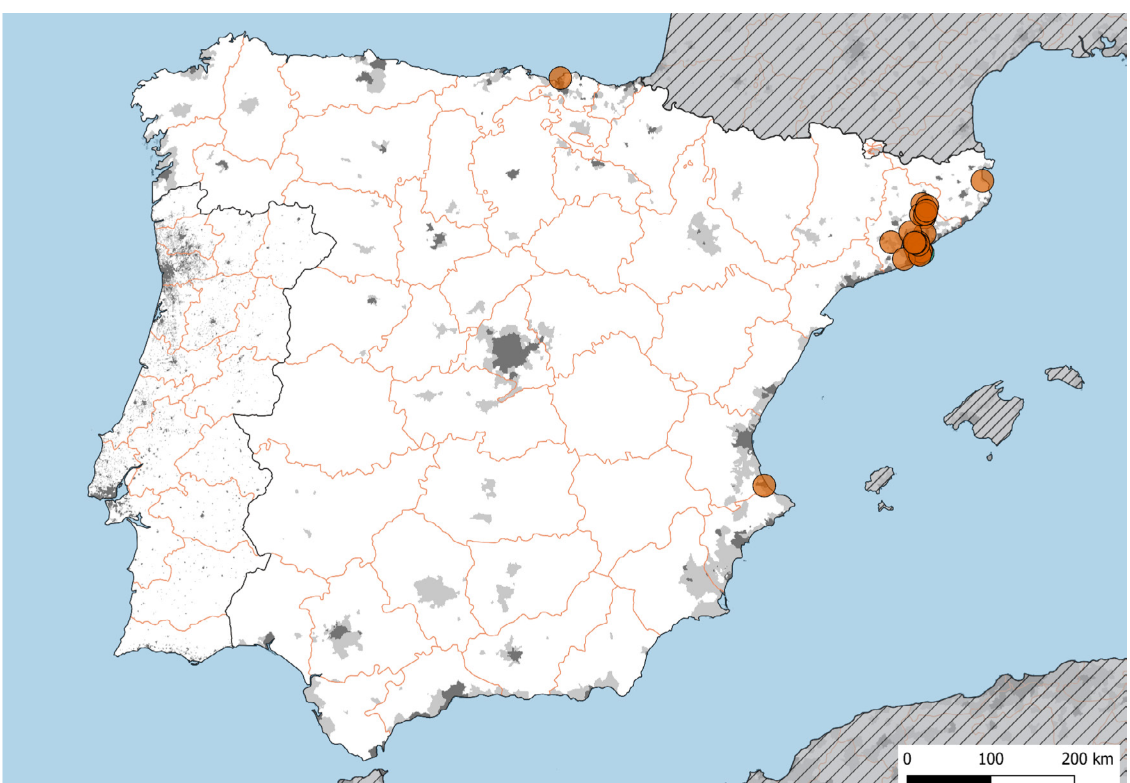


**Fig 10.** Iberian distribution of *Lasius neglectus*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

the same period (Paris & Espadaler, 2009). The species is also weakly insectivorous; Paris and Espadaler's (2009) study showed that its predation was mainly focused on Psocoptera Shipley, 1904 and Aphididae Latreille, 1802. Once a food source is located, *L. neglectus* can rapidly recruit large numbers of workers to exploit it efficiently (Seifert, 2018).

Nests are typically located on the ground, under stones, pavement, construction debris, at the base of trees, in dead wood, plant pots, walls, and crevices in buildings (Espadaler et al., 2004; Schultz & Seifert, 2005; Seifert, 2018). Queens are often situated only a few centimeters beneath the surface. In northeastern Iberia, a supercolony occupying 14 hectares was estimated to contain approximately 360,000 queens and a worker density of 800 individuals per square meter (Espadaler et al., 2004). Alates appear in nests between May and July (Seifert, 2018). In Barcelona, males are observed flying on warm evenings during this period, while queens remain inside the nest (J. Arcos pers. obs.). Often, hundreds of males can be seen surrounding one or more nest entrances with little or no worker protecting them in the exterior. Nuptial flights in the region tend to last for several weeks. However, other studies have reported the absence of flying males (Espadaler & Rey, 2001) or suggest that nuptial flights may occur only occasionally (Schultz & Seifert, 2005; Seifert, 2018). New colonies are typically established through budding (Tartally, 2006), though individual queens can also found new colonies independently and produce their own workers (Espadaler & Rey, 2001; Stukalyuk et al., 2022).

Additional unpublished data are available on an online page maintained by X. Espadaler and V. Bernal (2020) (http://lasius.creaf.cat/Ingles/distribution.htm), which includes notably interesting records from León city, in northeastern Iberia (approximately 600 km from the main Catalan populations) and from La Selva del Camp (Tarragona), south of Barcelona and closer to the core range reported in the literature. These and other online records have not been included in the present study and do not appear in the corresponding map, pending formal publication by the author.

### *Lepisiota capensis* (Mayr, 1862)

Three *Lepisiota* Santschi, 1926 species are currently known from the Iberian Peninsula, all visually similar and part of a taxonomically unstable species group (Espadaler et al., 2020b). The genus is very distinct within the subfamily Formicinae by the presence of an armed propodeum (Fisher & Bolton, 2016). *Lepisiota capensis* (Mayr, 1862) is distinguished by long erect dark setae on the mesosoma and propodeum, and long spines on the petiole. In contrast, both *Lepisiota frauenfeldi* (Mayr, 1855) and *Lepisiota melas* (Emery, 1915) lack or have very few erect setae and possess shorter petiolar spines. *L. frauenfeldi* has a smooth, shiny mesonotum (Arcos & García, 2023), whereas *L. melas* shows clear transverse striation (Espadaler et al., 2020b).

This species is considered native to southern Africa, where it is widespread (Guillem & Bensusan, 2022). Outside its native range, it has been recorded as non-native species in several Atlantic islands, including La Gomera (Espadaler & Fernández, 2014), Gran Canaria (Schifani et al., 2018), and Madeira (Guillem & Bensusan, 2022).

Its first record on continental Europe was reported in 2024 in Puerto Real, Cádiz (Fig 11), where several active colonies were found in recently established public gardens

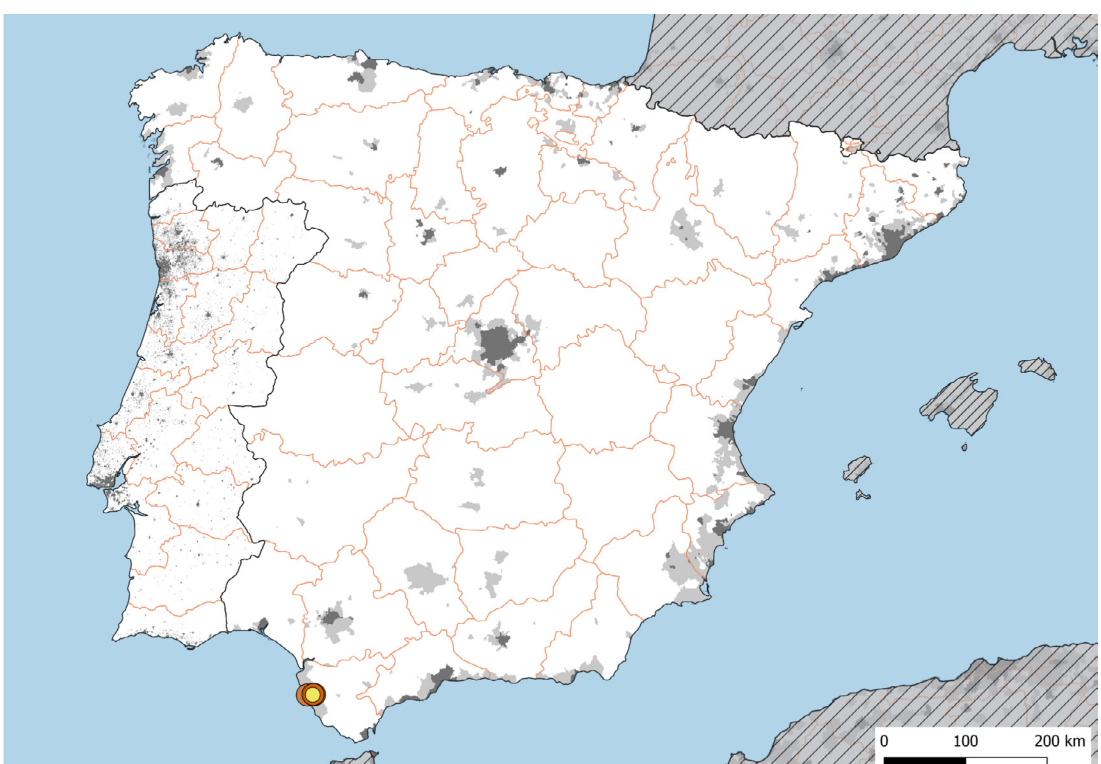


**Fig 11.** Iberian distribution of *Lepisiota capensis*. Source of records: bibliographic (orange circles) and personal material (yellow circles). Grey patches correspond to the main urban areas.

and domestic patios, with ants observed carrying larvae along persistent trails on the ground and tree trunks (Reyes-López et al., 2025). A second population was discovered in early 2025 in Cádiz city, occupying at least 7.2 ha across an urban block. Workers were seen foraging along walls and nesting under pavement tiles, confirming local establishment (Espadaler et al., 2025).

All Iberian records so far originate from coastal urban environments, and no occurrences have been reported from natural or semi-natural habitats. The species seems well adapted to human-modified areas and may benefit from the mild Mediterranean-oceanic climate of the southwestern Iberian coast (Espadaler et al., 2025). Although its ecological impact is unknown, its ability to establish in multiple localities within a short timeframe, and its co-occurrence with other non-native ants, suggests a potentially invasive profile that merits further monitoring (Espadaler et al., 2025; Reyes-López et al., 2025).

Some uncertainty remains regarding the species' identity, especially due to its morphological similarity with *Lepisiota validiuscula* (Emery, 1897). The material from Cádiz exhibits a relatively long antennal scape, a trait more consistent with *L. validiuscula* in some keys, raising the possibility of misidentification or synonymy within the group (Espadaler et al., 2025).

***Lepisiota frauenfeldi*** **(Mayr, 1855)**

Small (2.4–2.9 mm), slender, slightly polymorphic and blackish species, usually with a reddish spot in the middle of the mesosoma and sometimes with the whole mesosoma orangish. The native range of *L. frauenfeldi* appears to be the Mediterranean basin and Middle East (Western Asia), but it has been introduced to the Australasian region and numerous islands of the Afrotropical, Indo-Malayan and Nearctic region (Janicki et al., 2016; Guénard et al., 2017; Schifani et al., 2018; Hernández-Teixidor et al., 2020). Records from other regions such as India probably represent misidentifications (Wachkoo et al., 2021).

Its status as a native species in Iberia and the Balearics is dubious, as it has been recorded from very few and human-modified sites in Almería province (Fig 12). We have decided to consider it a potentially introduced ant, but further efforts are needed to clarify its status in the study region. In its known introduced range it is considered an invasive species with negative impacts on coexisting arthropods, including other native ants (Majer & Heterick, 2015; FAO, 2018), but reports of infestations are scarce and these have been often eradicated (Schifani et al., 2018). In Iberia it has been detected in some anthropogenic and coastal areas, including abandoned cultivated fields and less disturbed xerothermous habitats next to urban areas. Its first record was presumably in 1981 (Tinaut & Pascual, 1981), although we have not achieved access to this document.

Many different subspecies of unclear identity have been described throughout its range, making the identification and interpretation of its real geographic range complicated, which highlights the need for a modern taxonomic revision of what we call "*L. frauenfeldi*" and for the entire species group (Schifani et al., 2018; Borowiec & Salata, 2020).


**Fig 12.** Iberian distribution of *Lepisiota frauenfeldi*. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

Very little is known about its biology; both monogynous and polygynous colonies have been reported, and the species may have an independent colony foundation strategy (Martínez & Luque, 2017; Schifani et al., 2018). It behaves both as a predator and scavenger species (Martínez & Luque, 2017), and also tends to aphids (Aguirre, 1992).

### *Lepisiota melas* (Emery, 1915)

*Lepisiota melas* is a slender and blackish ant, usually with a reddish spot in the middle of the mesosoma (Espadaler et al., 2020b). This species can be differentiated from *L. capensis* by the presence of a few light erect hairs on the mesosoma and propodeum, and by having small petiolar spines (Reyes-López et al., 2025; Espadaler et al., 2025). Additionally, the mesonotum of *L. melas* is transversely striated in dorsal view, whereas in *L. frauenfeldi* it is punctuated or smooth (Agosti & Collingwood, 1987; Borowiec & Salata, 2022; Arcos & García, 2023).

Its native range comprises southern and southeastern Europe (Italy, Greece, Serbia and Turkey), as well as Western Asia (Iran and the Asian part of Turkey) (Janicki et al., 2016; Guénard et al., 2017; Borowiec & Salata, 2022). On the Iberian Peninsula, *L. melas* is considered non-native and is currently known only from an established population at the Port of Barcelona (Fig 13), where it nests under concrete structures and in pavement crevices (Espadaler et al., 2020b). As of April 2025, the species remains present and common in the same Port area, but has not expanded beyond the known limits of its occupied area (J. Arcos, pers. obs.), likely due to strong competition with *P. longicornis* and *L. humile*, which dominate the surrounding habitats.

To date, no modern revision of the genus *Lepisiota* has been conducted and the taxonomic status of many species, including *L. melas*, remains uncertain (Borowiec & Salata, 2022). Moreover, its biology and potential invasiveness are still largely unknown.

### *Linepithema humile* (Mayr, 1868)

The Argentine ant, *L. humile* is a widespread and highly invasive species with established populations across six continents. It ranks among the 100 most damaging invasive species globally, according to the Global Invasive Species Database (2025). A recent review of the ant has been published by Angulo et al. (2024), and the following is a summary of that review.

Native to the subtropical regions of South America, its global spread began in the mid-19th century. It is a small species (1.8–2.8 mm) of brownish body and slender appearance. It forms polygynous supercolonies characterized by minimal or no intraspecific aggression. These supercolonies can extend over hundreds of kilometres and are a hallmark of introduced populations. In the Iberian Peninsula, two genetically and behaviorally distinct supercolonies occur (Giraud et al., 2002), and this unicolonial structure, defined by the absence of aggression between non-nestmates, greatly enhances cooperative foraging and territory expansion.


**Fig 13.** Iberian distribution of *Lepisiota melas*. Source of records: a single bibliographic record (orange circle) is superimposed over two iNaturalist observations (green circles) in the same area. Grey patches correspond to the main urban areas.

Its success as an invader is attributed to its trophic flexibility, ability to monopolize resources, and polydomous nesting behavior, which facilitates rapid expansion. Trade and transportation have been primary drivers of its dispersal. The Argentine ant displaces native ants, alters local biodiversity, and disrupts ecological interactions, including native seed dispersal and pollination. In Iberia, the invasive ant frequently outcompetes native species, although some resilient taxa persist. *Tapinoma nigerrimum* (Nylander, 1856) and *Lasius niger* (Linnaeus, 1758) can show comparable competitive abilities under certain conditions (Blight et al., 2010; Cordonnier et al., 2020), while smaller or thermophilic species such as *Plagiolepis pygmaea* (Latreille, 1798), *Cataglyphis floricola* Tinaut, 1993, and *Cataglyphis tartessica* Amor and Ortega, 2014 may coexist through behavioral avoidance or temporal niche partitioning (Abril & Gómez, 2009; Angulo et al., 2011).

Its mutualistic relationship with honeydew-producing hemipterans like aphids and scale insects exacerbates agricultural pest issues, particularly in crops such as citrus, olives, and vineyards. Furthermore, its seasonal queen execution and polygyny enhance colony dynamics, contributing to its ecological dominance. The Argentine ant's ability to displace native ant species, reduce arthropod diversity, and disrupt soil ecosystems creates cascading impacts on trophic interactions and ecosystem functions. *L. humile* cannot tolerate high temperatures (with a critical thermal maximum of 38–40 °C) and requires high humidity and moisture levels for successful establishment.

Although it is notoriously difficult to eliminate, successful eradications of *L. humile* have been achieved in isolated settings, particularly on islands, where early detection, geographic isolation, and prevention of reintroduction are critical. In contrast, control in mainland areas focuses on containment and suppression, often using insecticide baiting combined with integrated pest management approaches.

Despite its widespread establishment, some populations that were once significant pests are reportedly collapsing in certain regions, highlighting variability in its long-term invasion dynamics. Nevertheless, ecological distribution models suggest that *L. humile* could still expand into suitable areas such as northern South America, parts of the Mediterranean basin, tropical Africa, and Southeast Asia (Roura-Pascual et al., 2004). The species' expansion may be further influenced by climate change, potentially enabling its spread into northern and higher-altitude areas. On the European continent, cities also play an important role as bioclimatic islands that facilitate their expansion inland and northward (López-Collar et al., 2024).

The first documented record of the species in our region dates to 1890 in Portugal and 1916 in Spain (Wetterer et al., 2009). In Iberia, *L. humile* is clearly the most significant invasive ant species, particularly in Mediterranean regions such as Catalonia, València, and Andalusia, but also in urban areas of Lisboa and across the Algarve region. For this paper we have reviewed >250 records from bibliography and additional >500 records from iNaturalist checked by us, demonstrating its dominance in comparison to other non-native ants in the region (Fig 14). Its distribution is predominantly coastal, and although its presence is less prominent in inland Iberia, cities such as Madrid harbor a significant number of colonies

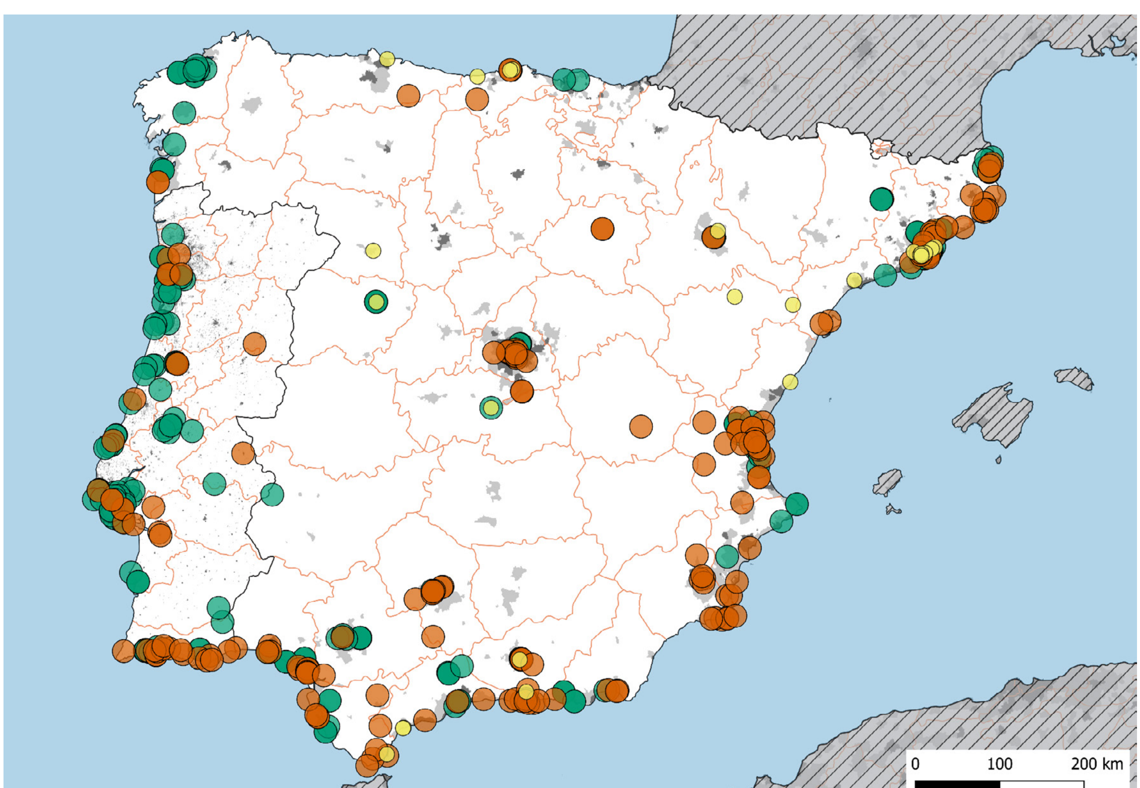


**Fig 14.** Iberian distribution of *Linepithema humile*. Source of records: bibliographic (orange circles), personal material (yellow circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

(López-Collar & Cabrero-Sañudo, 2021). Its expansion in Aragón since the first record (Blanco et al., 2012) has also been quite noticeable, reaching both natural and urban areas of the province (Rosado, in prep.). The species thrives all over the region in disturbed environments, including urban landscapes and agricultural fields, but it can also colonize less disturbed natural areas (Gómez et al., 2003).

***Monomorium carbonarium* (Smith, 1858)**

A minute (1.1–1.9 mm), monomorphic, entirely black non-native species. In Iberia, it can be confused with *Monomorium monomorium* Bolton, 1987 due to its similar size and coloration. However, *M. carbonarium* can be distinguished by its noticeably taller petiole. Additionally, workers of *M. carbonarium* are uniformly black, whereas *M. monomorium* tends to be dark brown – this difference in coloration is often visible even in the field.

*M. carbonarium* was thought to be native to the Azores and Madeira, but recent research points to its Nearctic origin (Seifert, 2025). From there, it has been introduced to several other regions, including Iberia, France, Germany, Netherlands, Egypt, and Iraq (Janicki et al., 2016; Guénard et al., 2017; Seifert, 2025). Records from other areas, such as Central America, the Caribbean, Yemen, Oman, India, and China, are more questionable and may refer to other species within the *Monomorium carbonarium* species group sensu Seifert (2025) (Arcos, 2021).

On the Iberian Peninsula, the species appears to be spreading rapidly, with its abundance increasing dramatically in some urban areas in recent decades, as evidenced by the surge in recent records. Despite this remarkable rise, *M. carbonarium* has received little scientific attention after it was first reported by Collingwood & Prince (1998) from a coastal village in northwestern Portugal. Since then, it has expanded along the coast between Lisbon and the northern region of the country, now occupying a strip of over 300 km (Fig 15). On the north-eastern side of the Peninsula, in Barcelona, *M. carbonarium* is now a common species in the metropolitan area, with populous nests containing hundreds of queens found in around thirty urban parks (J. Arcos, pers. obs.), compared to just four known locations in 2020 (Arcos, 2021). The species was first recorded in the city as recently as 2012. It has also reached other localities of Catalonia, including remote and sparsely populated areas, and appears to be in the early stages of invasion in some southern cities, such as Cádiz and Málaga, and Alacant (Fig 15). The only known inland city on the Iberian Peninsula where *M. carbonarium* has been recorded is Madrid, where it was first detected in 2019. It is currently present in a very localized form in several urban green spaces (D. López-Collar, pers. obs.).

The species typically relies on irrigated, shaded gardens for survival, and colonies are easily transported between infested areas. It can nest both indoors and outdoors (Espadaler & Castillo, 2014). Occasionally, colonies have

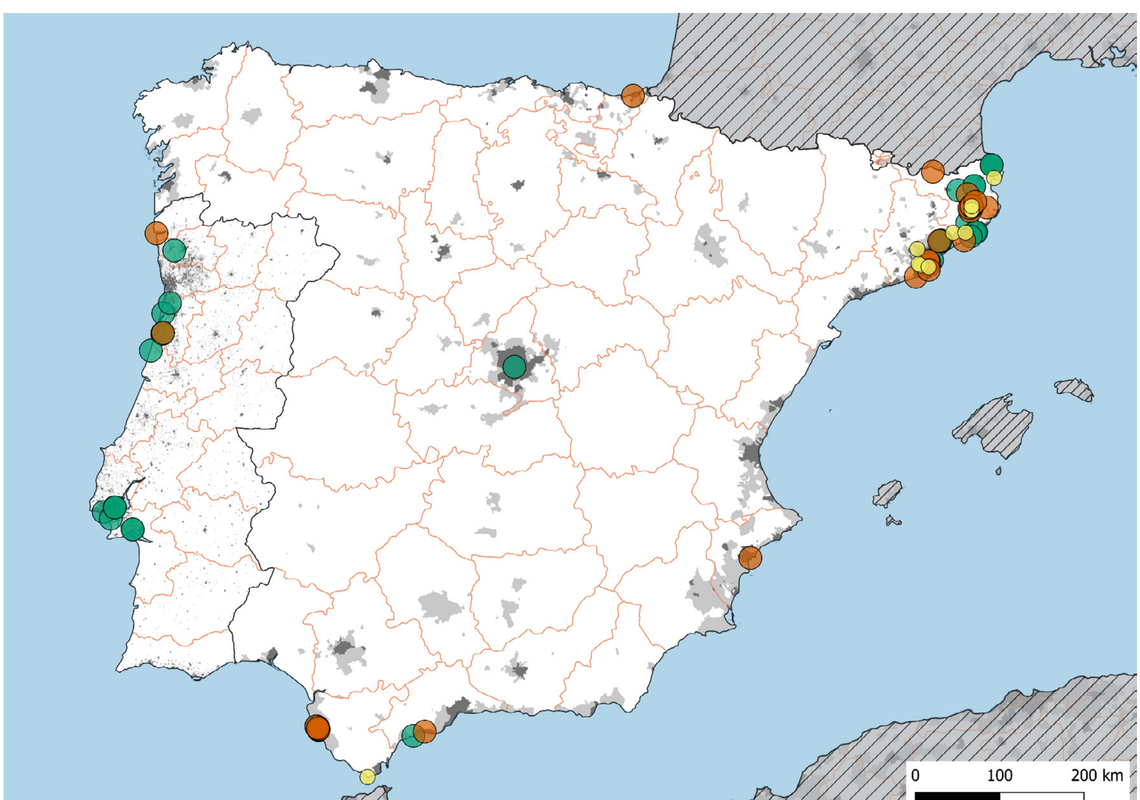


**Fig 15.** Iberian distribution of *Monomorium carbonarium*. Source of records: bibliographic (orange circles), personal material (yellow circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

been found in more naturalized environments, such as the riparian forest along the Tordera River (Barcelona). Nests are often difficult to detect due to the inconspicuousness of the nest entrance, but workers, queens, and larvae are usually found together in the same chamber at shallow depth in spring. Colonies are highly polygynous and polydomous, with workers forming long trails between nest entrances and frequently transporting larvae and queens between them, indicating that the species regularly relocates its nests. Mating likely occurs inside the nest, although the presence of both ergatoid and winged queens suggests that at least some may disperse and reproduce via flight (Arcos, 2021). New colonies are formed by budding (J. Arcos pers. obs.).

While its full invasive potential is still uncertain, the species has shown aggression toward native ants (Galkowski, 2008; Arcos, 2021). Its range is expected to expand across both Mediterranean and Atlantic regions of Iberia in the coming years.

### ***Monomorium exiguum* Forel, 1894**

Minute (1.3–1.9 mm), monomorphic and yellowish species that appears to be widespread across tropical Africa, Madagascar, and the Arabian Peninsula (Sharaf et al., 2018). At first glance, it may be mistaken for workers of the native genus *Solenopsis*, but this genus possesses a well-defined two-segmented antennal club, whereas *Monomorium exiguum* Forel, 1894 has a three-segmented club. It can also be distinguished from the native *Monomorium andrei* Saunders, 1890 by the presence of long hairs on the posterior corners of the head, which are absent or very short and sparse in *M. andrei*.

Outside its presumed native range, *M. exiguum* has been recorded from the Balearic Islands (Gómez & Espadaler, 2006) and, more recently, from Fuengirola (Málaga) (Espadaler & Ramos, 2022; Fig 16). The latter record is based on a single damaged worker and its identification should be considered tentative. As such, its presence in Iberia remains unconfirmed and requires further verification through the collection of additional material. Consequently, its status as either a temporary or established species in the region is currently unclear.

*Monomorium exiguum* occupies a wide range of habitats across its native distribution. Nests have been found in humid soil, under stones near trees, beneath bark, inside termite nests, in leaf litter, in cultivated fields, and in other anthropized environments (Sharaf et al., 2017; 2018). However, very little is known about its biology, and no information is currently available regarding its population structure, reproductive behavior, colony founding strategies, or invasive potential.

### ***Monomorium monomorium* Bolton, 1987**

Minute ant, measuring 1.5–2 mm, and characterized by its inconspicuous appearance and dark brown coloration. It closely resembles *M. carbonarium* but can be distinguished by its lower petiolar node and by its brownish body, rather than shiny black as in the second. *M. monomorium* appears to have a broad distribution, with records predominantly from the Indo-Australian and Palearctic regions. Its native range remains uncertain, though a West Mediterranean origin is plausible. In the northwestern Mediterranean, records are frequently associated with anthropogenic environments, and its status as native or non-native has been inconsistently addressed in the literature (Gómez et al., 2024).


**Fig 16.** Iberian distribution of *Monomorium exiguum*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

Reliable records in Iberia are scarce (Fig 17): Reyes-López et al. (2008) reported it from a garden in Córdoba, and a more recent occurrence was documented in a citrus grove on Gràcia Island, Deltebre (Tarragona) (Gómez et al., 2024). An older report from Gibraltar (Saunders, 1888) likely represents *M. andrei*, which is known from that area. This species has been observed tending honeydew-producing hemipterans (Gómez et al., 2024), and its colonies are polygynous. Given that all Iberian records originate from urban or human-modified habitats, we consider this ant non-native in the region, although more effort is needed to assess its current distribution and possible impacts on the ecosystem.

***Nylanderia jaegerskioeldi*** **(Mayr, 1904)**

Monomorphic and brownish species, with workers exhibiting numerous and characteristic thick macrosetae on the body profile. *N. jaegerskioeldi* can be distinguished from the similar non-native, outdoor-established species *Nylanderia vividula* (Nylander, 1846) by the presence of 12–31 macrosetae on the scape and a layer of pubescence on the gaster and thorax. In contrast, *N. vividula* typically has only 4–12 macrosetae on the scape and lacks the pubescent layer (LaPolla et al., 2011; Espadaler & Lozano, 2023).

It is considered native to the Afrotropical region and Middle East (LaPolla et al., 2011; Williams & Lucky, 2020; Janicki et al., 2016; Guénard et al., 2017), although the exact boundaries of its native range remain poorly defined (Schifani & Alicata, 2018). The species has been introduced into the Palearctic region primarily within the Mediterranean basin, including Morocco, Algeria, the Iberian Peninsula, the Balearic Islands, Sicily, Malta, Greece, Turkey, and Cyprus, as well as to Madeira, the Canary Islands, Syria, Iraq, and Iran (Janicki et al., 2016; Gómez, 2017; Guénard et al., 2017; Schifani & Alicata, 2018; Williams & Lucky, 2020). It has also been reported indoors in Poland (Salata et al., 2018). In its introduced range, the species is exclusively associated with anthropogenic habitats, such as urban parks and gardens, cultivated fields, agricultural areas, greenhouses and buildings (Collingwood et al., 1997; Obregón-Romero & Reyes-López, 2012; Gómez, 2017; Sharaf et al., 2018b). Its spread is likely facilitated by the trade of ornamental plants (Espadaler & Bernal, 2003).

The first confirmed record of *N. jaegerskioeldi* on the Iberian Peninsula dates back to 2000, when it was observed foraging on a *Broussonetia papyrifera* (L.) Vent. (Moraceae) tree in Níjar, Almería, Spain (Espadaler & Collingwood, 2001). Since then, the species has been reported in other southern Spanish provinces, including Alacant, Málaga, Cádiz, Huelva, Sevilla, and even in the inland city of Córdoba (Fig 18). Additionally, we present two new records from Motril (Granada province) collected by M. Logachev on 9.V.2025 along the road near Charca de Suárez, and on 6.VII.2025 in Parque de los Pueblos de América. The species has also been reported along the northeastern Mediterranean coast, in Barcelona (Espadaler & Ortiz de Zugasti, 2019). Outside of Spain, *N. jaegerskioeldi* was detected in Gibraltar in 2007 (Martínez-Ibáñez et al., 2007) and in the Algarve region of Portugal in 2012 (Obregón-Romero & Reyes-López, 2012).

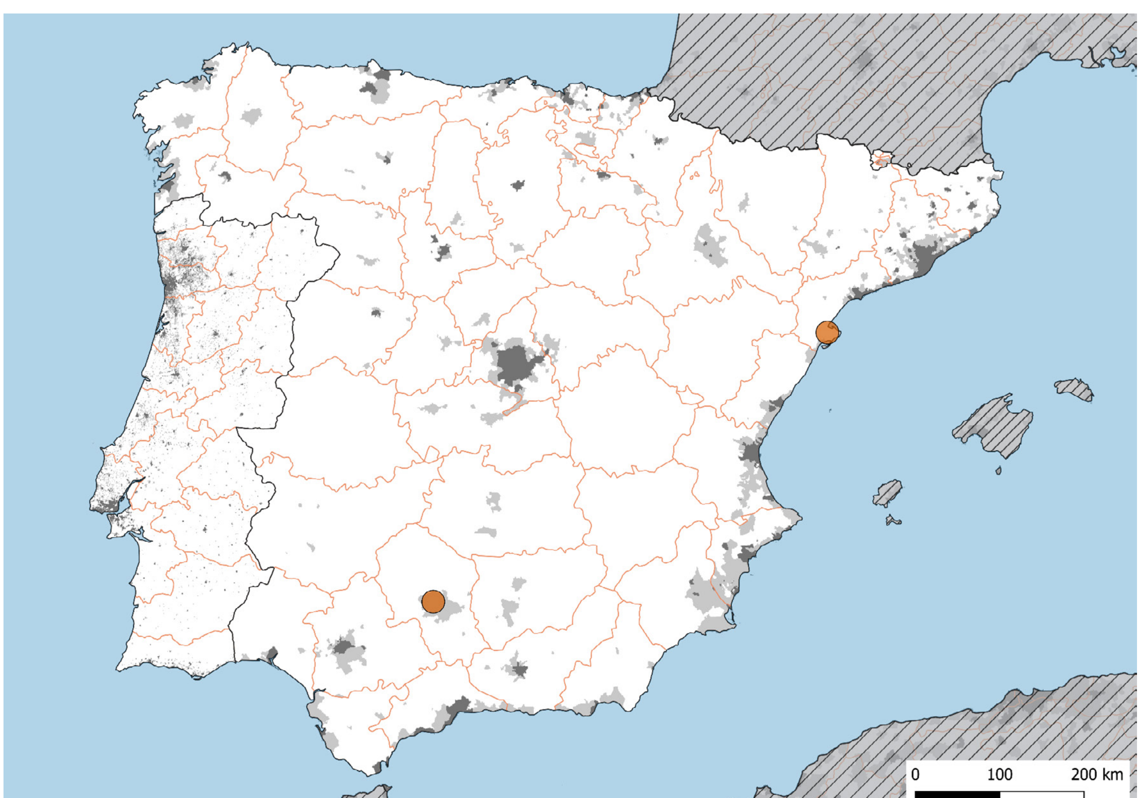


**Fig 17.** Iberian distribution of *Monomorium monomorium*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

At present, *N. jaegerskioeldi* exhibits a broad distribution across the south of the Iberian Peninsula, with a distinct preference for coastal environments (Reyes-López & Taheri, 2018; Fig 18). The typical habitat of *N. jaegerskioeldi* in Iberia includes irrigated gardens and lawns, where humidity is high and temperatures are warm. Casiraghi et al. (2020) in their work observed that in areas where irrigation is discontinued for extended periods, the ant populations tend to disappear. *N. jaegerskioeldi* colonies are usually found in moist soils, nesting directly on the ground, in leaf litter, inside flower pots, under grass, or at the base of palm trees (Espadaler & Bernal, 2003; Sharaf et al., 2018b; Salata et al., 2019). It has not yet been found in truly wild Mediterranean habitats (Gómez, 2017).

Despite its apparent abundance on the Iberian Peninsula, the biology of *N. jaegerskioeldi* is poorly studied. We have not found data regarding its colony structure; however, our observations in southeastern Iberia indicate that colonies can be both polygynous and polydomous (J. Arcos pers. obs). Alates have been recorded from May to September (Schifani & Alicata, 2018; Salata et al., 2019), though it is still unknown whether mating occurs via nuptial flights or intranidally. The ants are capable of rapid recruitment to food sources and may establish stable, long-lasting trails between nest entrances. Salata et al. (2019) also noted that *N. jaegerskioeldi* is diurnally active, with peak activity occurring during the hottest parts of the day.

The invasiveness of the species is dubious. Some authors do not consider it an invasive species (Gómez, 2017), but others have observed displacement of other native ants and an aggressive behavior towards them (Schifani & Alicata, 2018; Salata et al., 2019).

We found that most observations of *Nylanderia* on iNaturalist cannot be reliably identified to the species level. A significant number of these records are of males, which adds additional challenges for accurate identification. Therefore, all such records have been identified as *Nylanderia* sp., as they may represent other species within the genus. Exceptions have only been made in cases where species-level identification was confidently supported. We present these *Nylanderia* sp. records below in the same map.

### *Nylanderia vividula* (Nylander, 1846)

This is a brownish, bicolored species, with the head and gaster slightly darker than the mesosoma and legs (Kallal & LaPolla, 2012). It can be distinguished from other *Nylanderia* species found on the Iberian Peninsula by its lower number of macrochaetae on the antennal scape (4–14) and its shinier appearance due to significantly reduced pubescence (Espadaler & Lozano, 2023). Workers are also visibly smaller than those of the commoner *N. jaegerskioeldi* (Arcos & García, 2023).

Native to North America (Kallal & LaPolla, 2012), *N. vividula* has been recorded in various countries across Africa, Asia and Europe (Janicki et al., 2016; Guénard et al., 2017). On the Iberian Peninsula, its presence has only been recorded in Barcelona (Fig 19). Espadaler & Collingwood (2001) first detected a colony in 1999, it was established in concrete at the

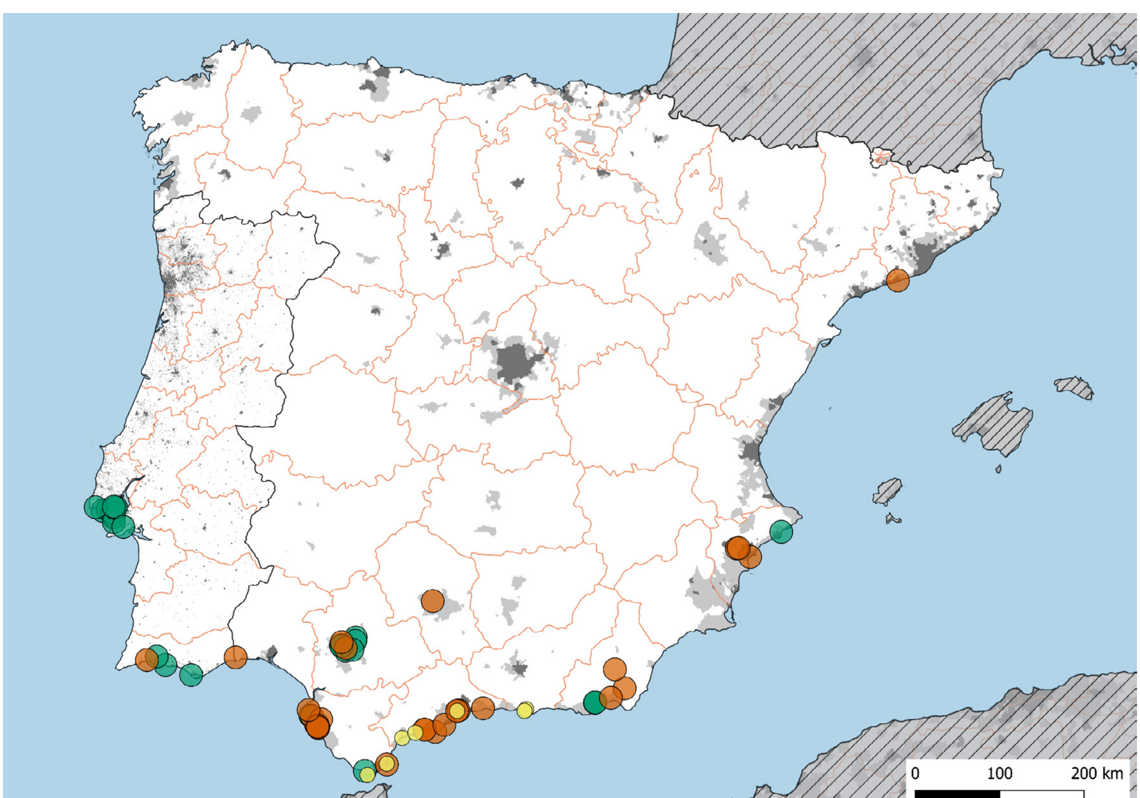


**Fig 18.** Iberian distribution of *Nylanderia jaegerskioeldi*. Source of records: bibliographic (orange circles), personal material (yellow circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

base of a Platanus tree. The colony was observed in June 1999 and again in July 2000, at the time identified as *Paratrechina flavipes* (Smith, 1874). The most recent observation of the species in the area occurred in May 2013 (Espadaler & Ortiz de Zugasti, 2019).

This ant is considered a non-native opportunist, with no known significant threat to the local fauna (Espadaler & Collingwood, 2001). Its limited presence in Iberia currently suggests a lower invasive potential compared to that of *N. jaegerskioeldi*.

***Paratrechina longicornis*** **(Latreille, 1802)**

*Paratrechina longicornis* is one of the most widely distributed ant species on the planet (Wetterer, 2008). Workers are small to medium sized (2.5–3 mm), with elongated scapes and legs and a black to dark brown coloration, being immediately noticeable for their fast, erratic movements upon being disturbed, which has coined the common name "black crazy ant" (Wetterer, 2008). It could be an asiatic species (Wetterer, 2008), but other authors suggest Afrotropical origin (LaPolla & Fisher, 2014). Its success is undoubtedly due to the species' abilities to utilise a broad range of nesting locations, including both natural and anthropogenic habitats (Wetterer, 2008). This has allowed the species to redistribute via intercontinental trade with ease, and likely began before the modern era with Emery (1893) unable to discern the species' home range due to being already established worldwide. Within cool temperate regions, *P. longicornis* is isolated to artificially heated environments such as greenhouses. It behaves as an invasive species with negative impacts on agriculture (Wetterer et al., 1999; Wetterer, 2008). It also can transmit pathogens in hospitals (Fowler et al., 1993).

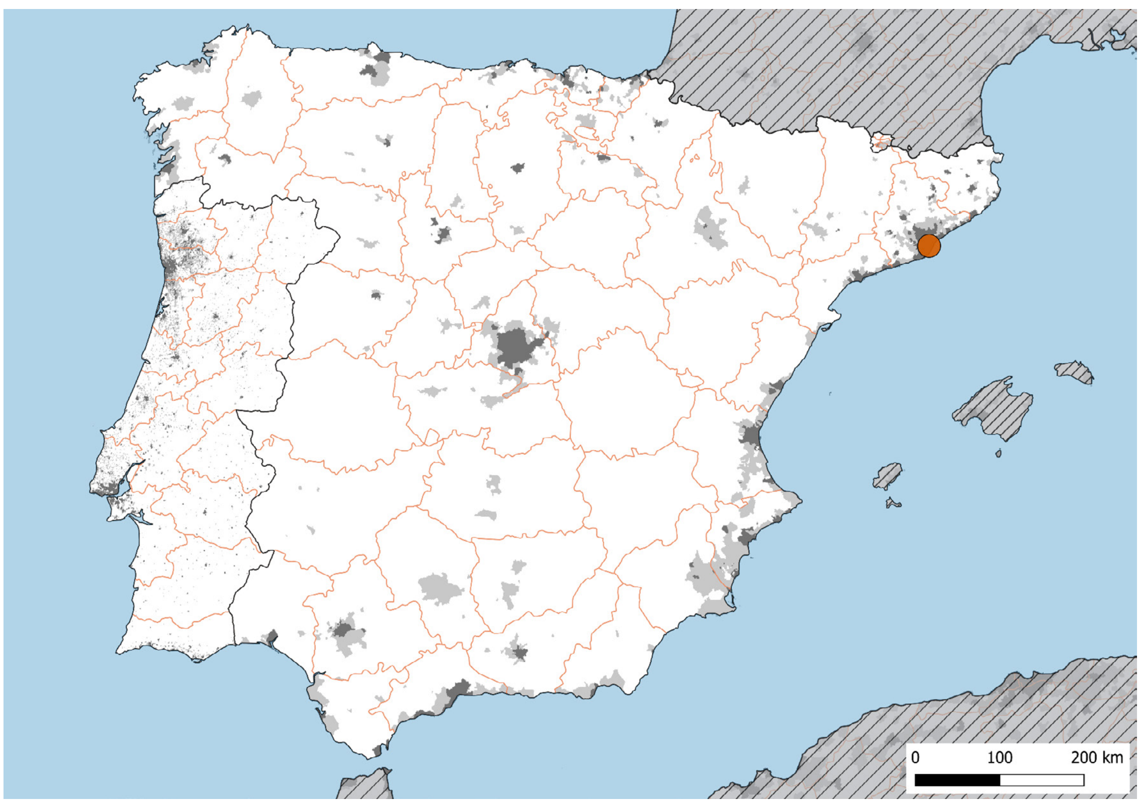


**Fig 19.** Iberian distribution of *Nylanderia vividula*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

In Iberia, the first record comes from an unknown location in Gibraltar in 1956 (Wetterer, 2008). Later, it was found in Almería in the year 2000 (Tinaut & Añó, 2000). Recently, new records have been reported for the region, extending its known distribution in the south and southeast of the Iberian Peninsula (Luna-Santamaría et al., 2022; Prieto-Lillo et al., 2024), with findings both outdoors and indoors (Fig 20).

In Barcelona, where the species was first detected in 2020 near the port (Espadaler et al., 2020b), an eradication attempt was carried out with initially positive results (https://desinsectador.com/2023/01/22/paratrechina-longicornis-hymenoptera-formicidae-avanza-por-la-peninsula-iberica/). However, as of April 2025, the population has grown significantly in size and has expanded its distribution across Montjuïc, the hill adjacent to the port where it was originally found, as well as into several urban streets, currently occupying an approximate area of 49.2 ha. A separate, isolated population was also detected in 2022 on a sidewalk across from Plaça Catalunya, and it has remained stable through 2025 (J. Arcos, pers. obs.). In Barcelona, workers can be seen ascending the trunks of plane trees in columns, feeding on honeydew produced by homopterans. The species is yet to arrive (or be detected) in Portugal.

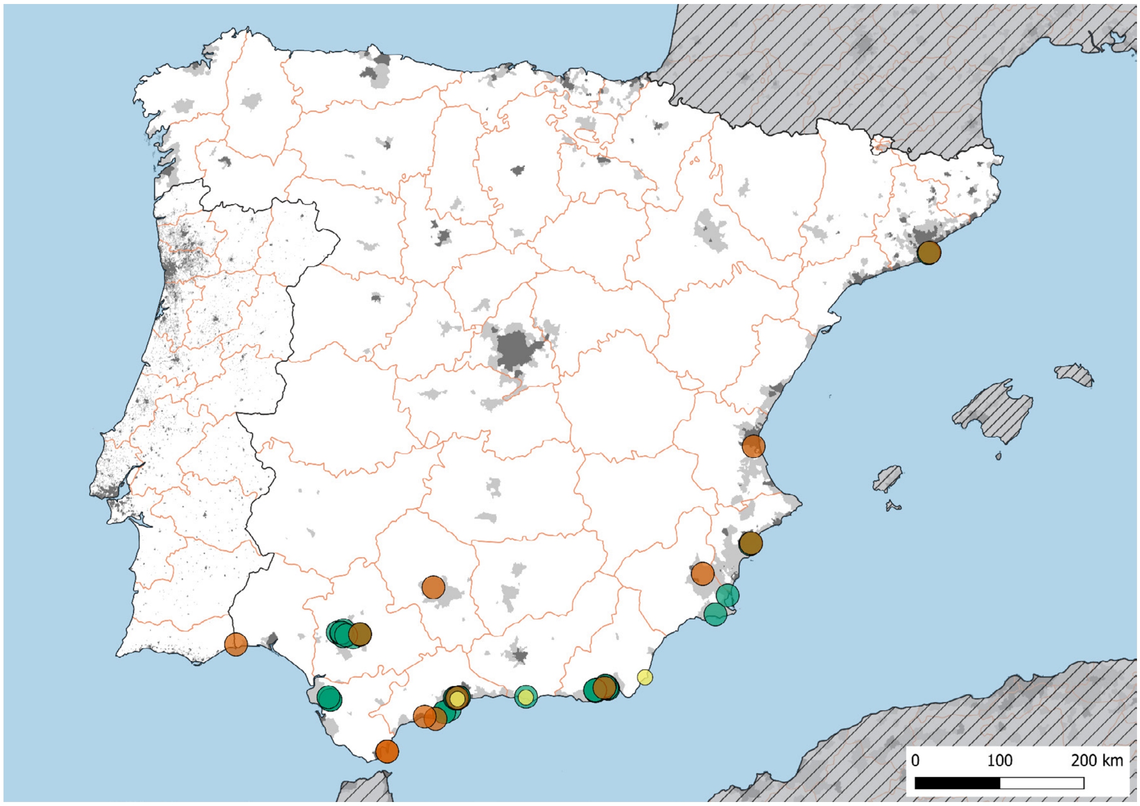


**Fig 20.** Iberian distribution of *Paratrechina longicornis*. Source of records: bibliographic (orange circles), personal material (yellow circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

***Pheidole indica*** **(Mayr, 1879)**

Small-sized dimorphic species (2–3.5 mm) with big-headed majors, similar to the native ant *Pheidole pallidula* (Nylander, 1849), but bigger and with a well-developed promesotonal process, which appears as a deep groove disrupting its profile outline (Fischer & Fisher, 2013). In the literature it has often been recorded as its junior synonym *Pheidole tenerifana* Forel, 1893.

The origin of *P. indica* is unclear (Wetterer, 2011a), some suggesting North Africa (Wilson, 2003; Collingwood et al., 2004) while others point to the Indomalayan region (Sarnat et al., 2015; Janicki et al., 2016; Guénard et al., 2017). It is considered an incipient cosmopolitan species (Wetterer, 2015) that has spread to many tropical and subtropical regions of the world, including parts of Southern California, the Caribbean, North Africa, the Mediterranean, the Middle East and Western Asia, Madagascar, South-Western Australia, and East Asia (Wetterer, 2011a; Sarnat et al., 2015; Janicki et al., 2016; Guénard et al., 2017).

*Pheidole indica* colonises anthropised and disturbed places and is more common in dry habitats and coastal areas (Collingwood, 1985; Gómez & Espalader, 2006; Wetterer, 2011a). Nests can be found under stones, directly in soil or at the base of urban trees, and workers usually forage on the ground or low vegetation (Espadaler & Bernal, 2003; Fischer & Fisher, 2013). The species is facultatively polygynous and polydomous (Martínez, 1992; Terayama et al., 2014), but is not yet reported to be unicolonial (Sarnat et al., 2015). Workers fed on dead insects, seeds, and sweet food, and they have also been observed tending aphids (Martínez, 1992; Shiran et al., 2013).

Although it has been regarded as an invasive species (Fischer & Fisher, 2013), *P. indica* is not considered a major pest to agriculture nor native ecosystems (Sarnat et al., 2015). However, it could have the potential to replace native arthropods (Collingwood et al., 1997; Sarnat et al., 2015), and it has been reported taking over nests of the non-native ant *L. humile* (Martínez, 1992). Its ecological impact seems to be less important compared to *P. megacephala* (Wetterer, 2011a).

The first Iberian record is from 1981 as *P. tenerifana* (see Acosta & Martínez, 1983), and since then it has progressively extended through warm and coastal cities along the east of the region (Fig 21). We expect it to continue its expansion in Iberia in the next decades, although it may be hindered by the commoner *L. humile*, which now occupies most of its ideal ecological niches in disturbed and anthropised habitats.

***Pheidole megacephala*** **(Fabricius, 1793)**

A notorious invasive species that has reached a pantropical distribution (Sarnat et al., 2015; Janicki et al., 2016; Guénard et al., 2017). It is likely native to southern Africa or the Malagasy Region (Wetterer, 2012). Workers are small-sized (2–3.5 mm) and dimorphic with large-headed major workers, similar to the native ant *P. pallidula* and the non-native *P. indica*. Minors and majors show convex ventral posterodorsal and anteroventral bulging in the post petiole

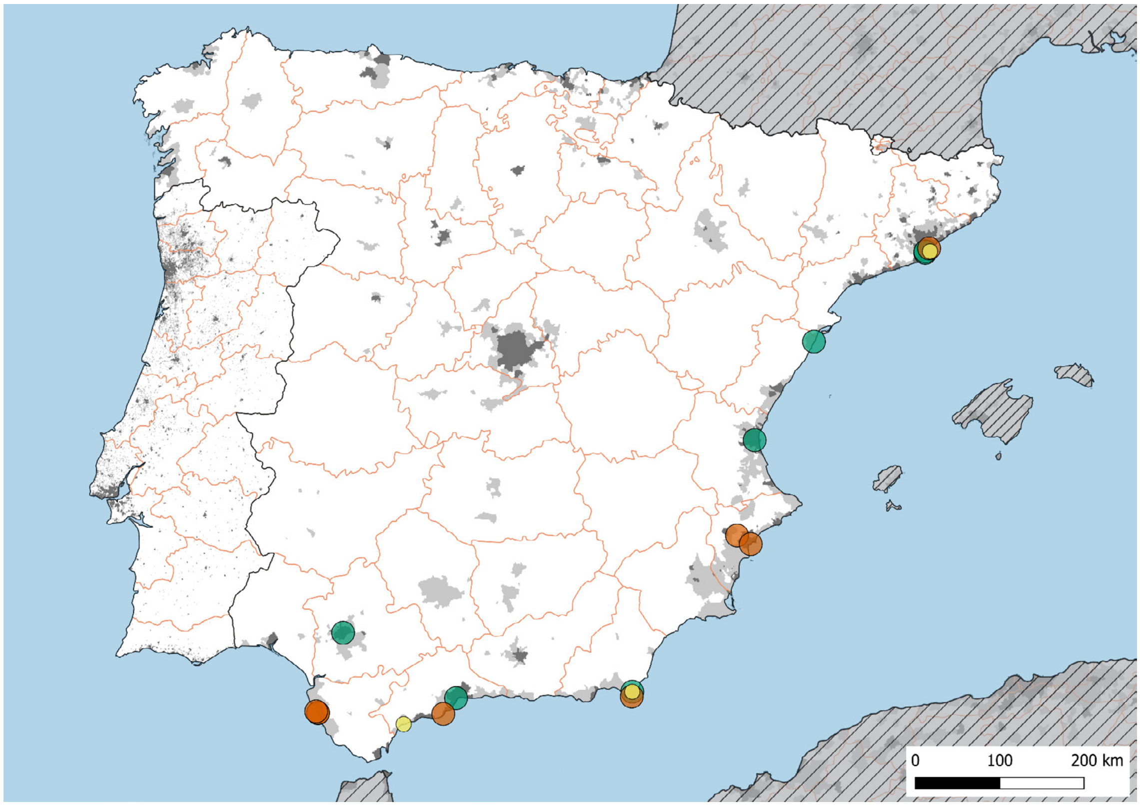


**Fig 21**. Iberian distribution of *Pheidole indica*. Source of records: bibliographic (orange circles), personal material (yellow circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

(Fischer & Fisher, 2013; Sarnat et al., 2015). Majors exhibit a heart-shaped head, which is more rectangular in the native *P. pallidula*.

*Pheidole megacephala* is among the top five invasive ant species and one of the world's 100 worst invasive species (Lowe et al., 2000; Fischer & Fisher, 2013). These rankings are attributable to numerous invasive behavioral characteristics the species shows. One such characteristic is its ability to survive and flourish in a broad spectrum of habitats that have differing food sources. For example, *P. megacephala* has been recorded from disturbed human-altered environments (e.g. urbanised and agricultural landscapes) to forests at mid-high elevations (Fischer & Fisher, 2013; Sarnat et al., 2015). Workers can rapidly recruit large numbers of nest mates to a wide variety of food sources, monopolise honeydew-producing Hemipterans and guard extrafloral nectaries (Hoffman, 1998; Wetterer, 2012; Sarnat et al., 2015). Colonies are polygynous and unicolonial (Hölldobler & Wilson, 1990; Hoffmann, 1998; Hoffmann et al., 1999) and could contain more than 10,000 workers (Sarnat et al., 2015). New colonies are founded through nest budding and can form supercolonies, allowing workers to dominate resources and outcompete other species. Colonies have been known to establish nests in a wide variety of sites, including under rocks, logs, bark, within leaf litter as well as within homes (Sarnat et al., 2015). In localities where it has been introduced, *P. megacephala* populations frequently lack intercolony aggression, occur at high densities, and commonly exhibit strong aggression toward other ant species (Wheeler, 1922; Fournier et al., 2009; Wetterer, 2012). The species is capable of dominating over a wide area, impacting native ant fauna; for example in Perth urban gardens, Heterick et al. (2000), using pitfall traps, found that 99.9% of ants collected were *P. megacephala*, and Callum and Majer (2009) estimated the biomass of the species outweighed "all other ant species combined by several orders magnitude". The wide-ranging nesting and feeding habits have made the species a significant economic pest, capable of infiltrating homes and dwellings, damaging wires and irrigation tubing (Chang & Ota, 1990). In addition, workers are frequently observed tending honeydew-producing Hemipterans, sometimes with high intensity. As a result of ant protection and tending, Hemipterans cause substantial crop damage by reducing nutrient uptake and proliferating viral and fungal diseases (Wetterer, 2012).

Although *P. megacephala* is clearly a dominant and important invasive species, individuals are apparently vulnerable to desiccation and are largely absent in significantly dry zones, seeming to prefer humid microhabitats (Sarnat et al., 2015). Populations are also apparently susceptible to crashes, with the widespread population apparent in the 19th century on Madeira has diminished significantly, with the species now only occurring in approximately 0.6% of the land area (Wetterer et al., 2006). Similarly, the large population of *P. megacephala* on Culebritia are now mostly extinguished (Torres & Snelling, 1997). Additional experimental studies have found *P. megacephala* to be competitively weak when compared to other invasive ant species (Bertelsmeirer et al., 2015).

Its presence in Iberia consists of two known populations (Fig 22), one in the city of Barcelona (Espadaler & Pradera, 2016), where it currently survives outdoors as late 2024 and also in 2025 (J. Arcos pers. obs. & Á. Rosado pers. obs., respectively), and one recent indoors record from Rota, Cádiz (Espadaler et al., 2024). All other bibliographic records in the region are potential misidentifications of *P. pallidula* (Wetterer, 2012), including records from Portugal (Fischer & Fisher, 2013; Janicki et al., 2016; Guénard et al., 2017). Old records of *P. megacephala* from Gibraltar represent misidentification with *P. pallidula* according to Sarnat et al. (2015).

### ***Pheidole navigans*** **Forel, 1901**

A member of the *Pheidole flavens* Roger, 1863 complex, *Pheidole navigans* Forel, 1901 is a small, dimorphic red-brown species that is potentially native to Neotropics but has spread to the Nearctic region, Hawaii, as well as the Canary Islands (Sarnat, 2015; Hernández-Texidor et al., 2020). Minor workers have a punctuated head sculpture, while majors have pronounced longitudinal head striae. It is likely a generalist utilising natural and man-made crevices, cracks, roots and leaves in which to construct their nests and scavenges for dead insects and seeds (Naves, 1985).

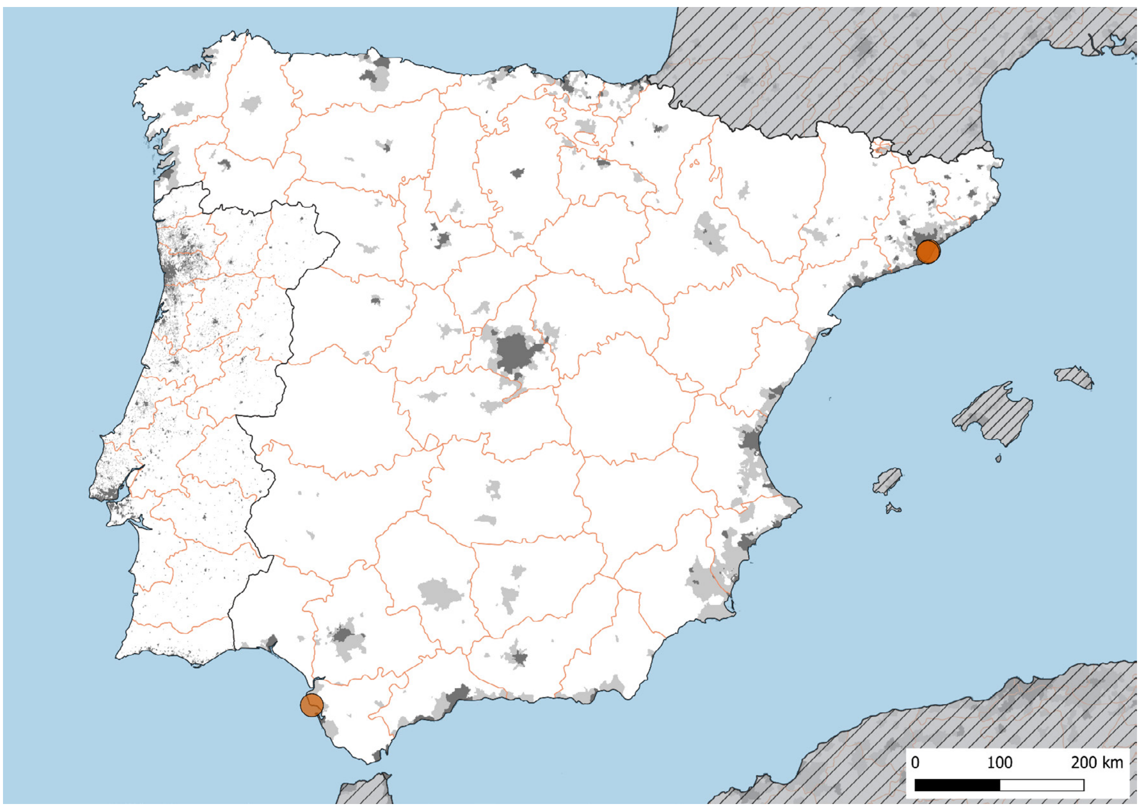


**Fig 22.** Iberian distribution of *Pheidole megacephala*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

In Iberia, *P. navigans* was reported by Reyes-López and Rodríguez-Reyes (2022) from Málaga within a residential area from two localities 20 km apart, nesting outdoors (Fig 23). The likelihood that the species has established between these two record locations is high (Reyes-López & Rodríguez-Reyes, 2022). In 2025, the ant was found in two other localities: Calahonda, Málaga (Pradera & Espadaler, 2025a), and, for the first time in Granada province, in the city of Motril (see Supplementary Material 3).

The genus *Pheidole* Westwood, 1839, comprising nearly 1000 species, is notoriously difficult to identify, particularly without major workers (Sarnat, 2015). The absence of majors led Reyes-López and Rodríguez-Reyes (2022) to use a provisional determination (cfr.) for the collected material. However, the availability of major workers later collected allows a safe assignment of the samples to this species (J. Reyes-López, University of Córdoba, pers. comm., June 2023).

### ***Pheidole rosae*** **Forel, 1901**

*Pheidole rosae* Forel, 1901 is a Neotropical species native to South America and newly detected in Europe, with a confirmed outdoor nest discovered in 2024 in Parc de la Pegaso, Barcelona (Espadaler & Vila, 2025). It is distinguished from the other *Pheidole* species detected in Barcelona by the presence of shallow antennal scrobes, forward-projecting frontal lobes, and a hypostomal margin with five well-developed teeth in majors, as well as transverse rugae on the pronotum and propodeum and a low scape index (SI < 100) in minors (Espadaler & Vila, 2025). Unlike *P. megacephala*,

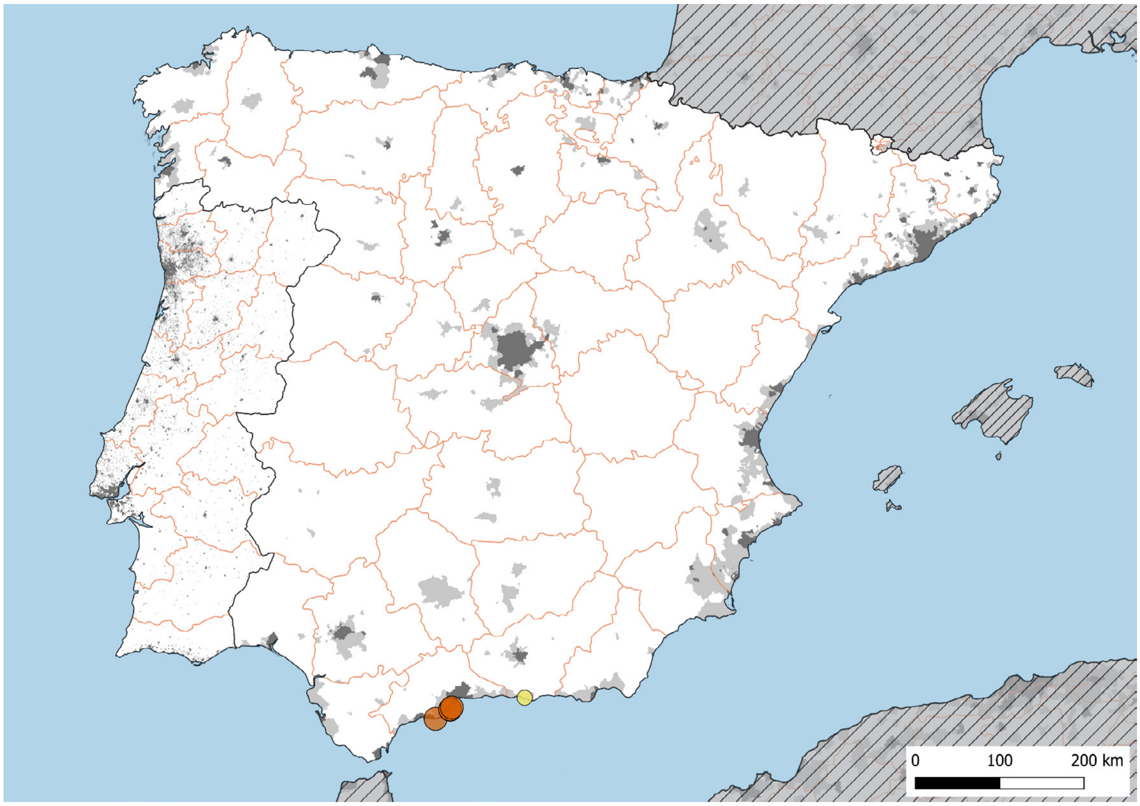


**Fig 23.** Iberian distribution of *Pheidole navigans*. Source of records: bibliographic (orange circles) and personal material (yellow circles). Grey patches correspond to the main urban areas.

it lacks an anteroventral postpetiole bulge; it differs from *P. indica* by its less extensive head sculpture and lower SI, and from *P. pallidula* by its more sculptured minors and defined scrobes in majors. The recently recorded *P. navigans* in south Iberia is easily separated by its punctuated head sculpture in minors and coarsely striated frontal area in majors, while it is shinier and unsculptured in both minors and majors of *P. rosae*.

In its native range, *P. rosae* is a soil-nesting species that has been recorded from southern Brazil, Paraguay, and Argentina (Wilson, 2003). According to Wilson (2003), it inhabits subtropical forested regions, but detailed ecological data on its habitat preferences remain scarce. There is no indication that the species exhibits ecological dominance in its native range, and its invasive potential remains unknown. However, its recent establishment in an urban park in Barcelona (Fig 24) suggests it may be capable of adapting to Mediterranean city environments.

***Strumigenys membranifera* Emery, 1869**

Small-sized (1.9–2.3 mm) and yellowish ant of cryptic lifestyle with a wide introduction range, mainly in tropical and subtropical regions, but also in temperate areas (Wetterer, 2011b). Its native range has been suggested to be Africa (Brown & Wilson, 1959), but other authors point to the need for more information to elucidate this (Bolton, 1983; Wetterer, 2011b).

It is recognizable by its piriform head, short triangular mandibles and membranous tissue surrounding the petiole and postpetiole. It differs from other native Iberian *Strumigenys* Smith, 1860 by the lack of long, erect hairs on the mesosoma profile, and also by the shorter mandibles. It is a specialised predator of Collembola and other soft-body arthropods (Brown & Wilson, 1959) and it may have an impact on the populations of these tiny animals, but the overall ecological impact of *S. membranifera* is largely unknown (Wetterer, 2011b).

It nests in dead wood and soil in a wide variety of habitats, ranging from moist forests to moderately dry agricultural fields (Wilson & Hunt, 1967). In its non-native range, *S. membranifera* is clearly associated with anthropogenic environments. Wetterer (2011b) reported the species as being more frequently encountered in urban gardens than in forested areas across the Caribbean islands. Similarly, in the Atlantic islands, all known records from Cape Verde and Madeira correspond to urban garden settings. Comparable patterns are found on the Iberian mainland (Fig 25). For instance, Ordóñez-Urbano et al. (2008) found *S. membranifera* in 21 out of 32 surveyed urban parks (66%) of Córdoba, Málaga and Cádiz, with no occurrences recorded in suburban sites. Guillem et al. (2009) also documented the species in secondary habitats characterized by anthropogenic disturbance in Gibraltar, often in association with non-native vegetation. In Madrid, *S. membranifera* queens have been recorded in urban parks through pitfall trapping during recent field surveys (D. López-Collar per. obs.).

The earliest Iberian specimen dates from 1975, when a single queen was collected in a temporary pond in a peri-urban

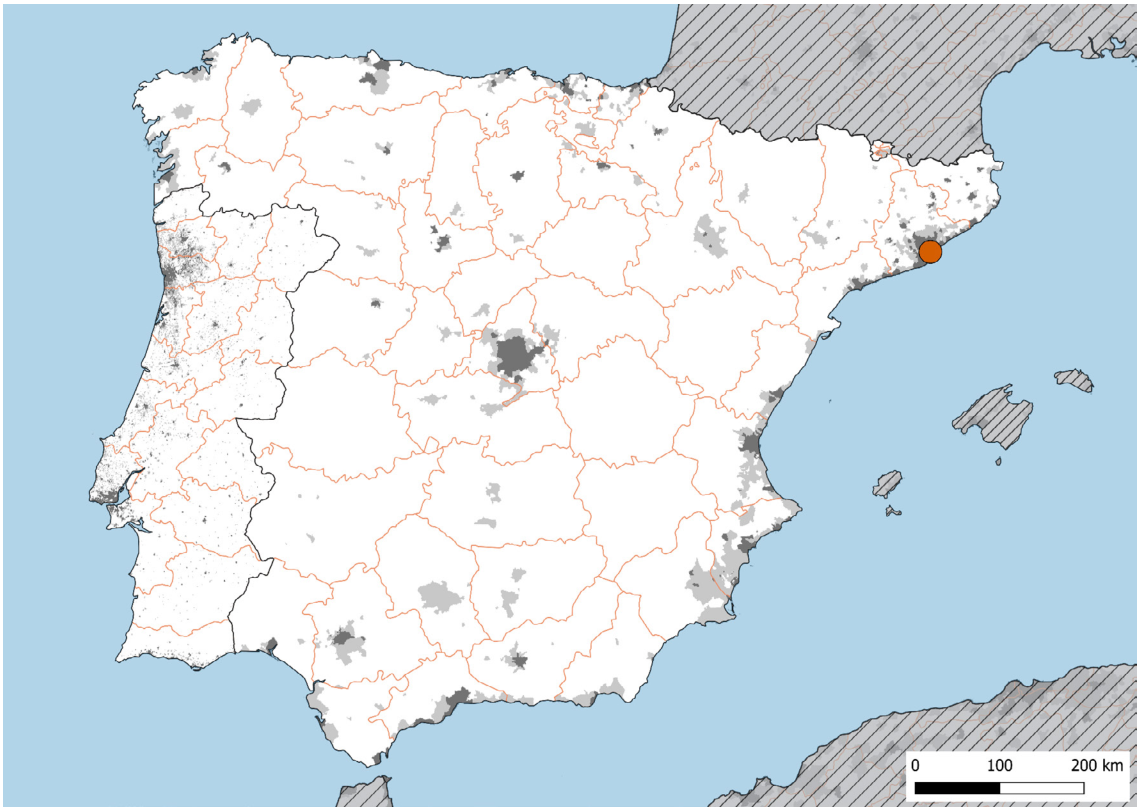


**Fig 24.** Iberian distribution of *Pheidole rosae*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

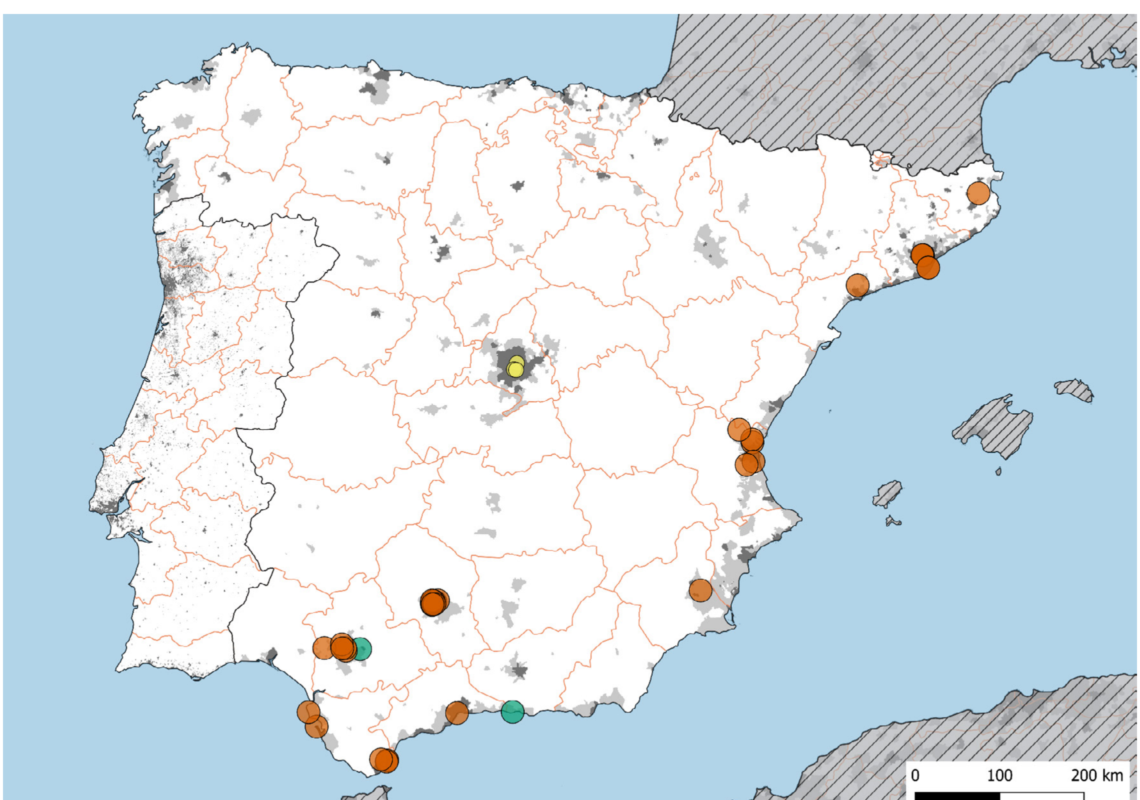


**Fig 25.** Iberian distribution of *Strumigenys membranifera*. Source of records: bibliographic (orange circles), personal material (yellow circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

location (Espadaler, 1979). Subsequent findings consistently link the species to anthropogenic settings, yet published records remain scarce, most likely due to inadequate sampling methodologies. It is plausible that *S. membranifera* is now widespread along the eastern Iberian coast and present in a substantial number of urban green spaces of inland cities.

### ***Strumigenys silvestrii*** **Emery, 1906**

*Strumigenys silvestrii* Emery, 1906 is a small trap-jaw ant, measuring approximately 1.6–2 mm in total length (Bolton, 2000). It is a member of the *Strumigenys silvestrii* group, characterized by the spatulate, stiff or remiform hairs on the first gastral tergite. Within the Western Palaearctic, *Strumgienys spp*. Smith, 1860 (both native and non-native species), *S. silvestrii* can be distinguished by two or more hairs directed toward the base of the antennal scape.

Native to South America, the species has expanded its range throughout the Neotropics and into the southern United States (MacGown et al., 2012). Within the Western Palearctic, *S. silvestrii* has been recorded in the Madeira Islands and at a single locality on mainland Portugal (Boieiro et al., 2009). Like many species within the genus *Strumigenys*, the natural history of *S. silvestrii* remains poorly understood. It is believed to prey on small, soft-bodied invertebrates such as springtails, using its specialized kinetic trap-jaw mandibles to capture prey efficiently (Booher et al., 2021). Individuals of this species exhibit slow and timid behavior, often remaining motionless when disturbed.

The single record of *S. silvestrii* for the Iberian Peninsula comes from Perdizes, Portugal, where a specimen was collected under a stone in scrubland surrounded by residential housing (Boieiro et al., 2009; Fig 26). Like in the case of *S. membranifera*, the ecological impact of introduced *Strumigenys* species remains largely unexplored. Few studies have assessed their effects on native fauna (Deyrup & Deyrup, 1999), and it is currently unknown whether the presence of *S. silvestrii* in Portugal poses any threat to the indigenous invertebrate communities of the Iberian Peninsula.

### ***Technomyrmex vexatus*** **(Santschi, 1919)**

The genus *Technomyrmex* Mayr, 1872 is primarily distributed in tropical and subtropical regions of Africa, Asia, and Oceania, although it includes several species with a global distribution. The only non-native species of the genus present outdoors in the Western Palearctic is *Technomyrmex vexatus* (Santschi, 1919), a medium-sized (3.1–3.4 mm), uniformly dark to light brown ant, native to Morocco (Guénard et al., 2017). Taxonomically, *T. vexatus* belongs to the *Technomyrmex gibbosus* Wheeler, 1906 species group, which includes only one other species, *T. gibbosus*, the two being geographically separated (Bolton, 2007; Janicki et al., 2016; Guénard et al., 2017). It is easily distinguished from the more widespread pantropical *Technomyrmex* species (mainly in the *Technomyrmex albipes* (Smith, 1861) group) by its shinier cuticle and the absence of setae across the dorsal surface of the body (Bolton, 2007).


**Fig 26.** Iberian distribution of *Strumigenys silvestrii*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

The first record outside its native range was documented in 2007 on Gibraltar (Fig 27) (Guillem & Bensusan, 2008). Its introduction is presumed to be anthropogenic, and it is now commonly found in and around the Gibraltar Botanical Garden (Jowers et al., 2015). From there, the species has spread into the dense maquis vegetation of the Upper Rock Nature Reserve, between 170 and 350 meters of elevation (Guillem & Bensusan, 2008). Additional records exist from Tarifa, Cádiz (Fig 27), where it inhabits similar maquis habitats (Guillem & Bensusan, 2019) and remains locally abundant (J. Arcos, pers. obs.). *T. vexatus* is currently the only species of its genus known to be established in the wild on continental Europe, while other *Technomyrmex* species recorded in the continent are confined to heated greenhouses and controlled environments (Guillem & Bensusan, 2008).

While no clear evidence exists of ecological harm, the species has been observed tending scale insects on *Olea europaea* L. (Oleaceae) (Guillem & Bensusan, 2008), a behavior that, in other non-native ant species, has been associated with economic impacts due to pest facilitation.

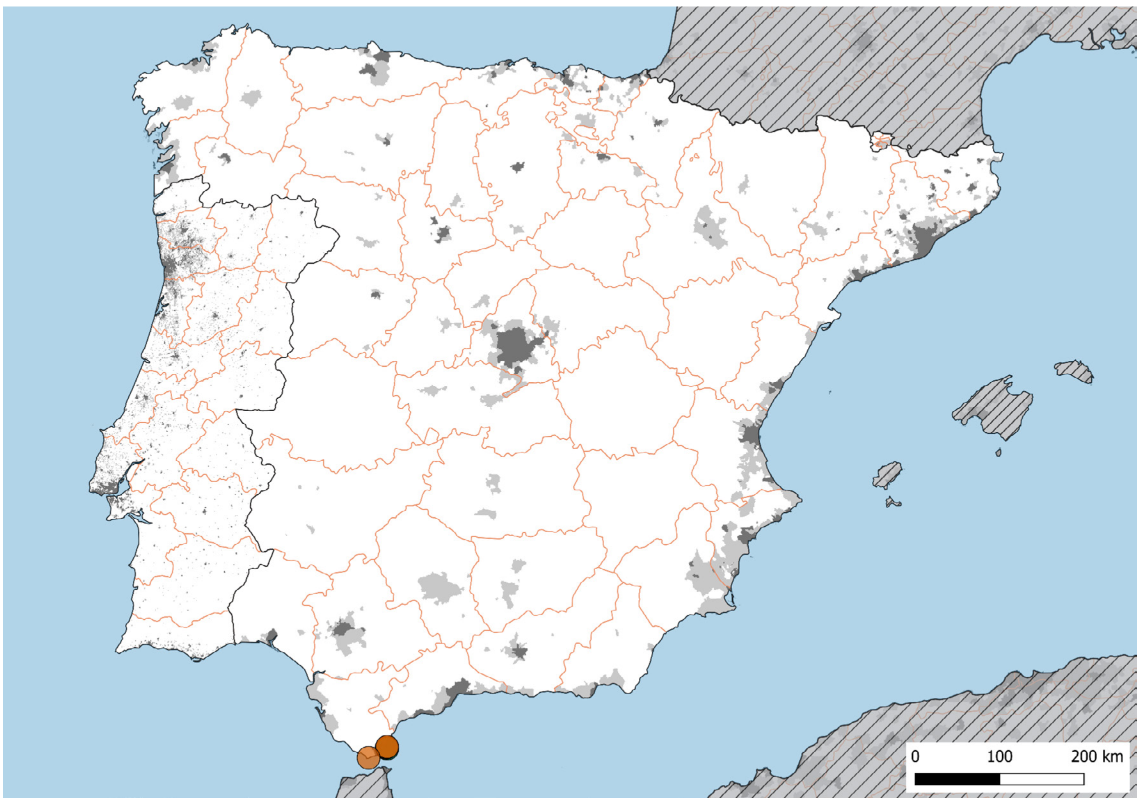


**Fig 27.** Iberian distribution of *Technomyrmex vexatus*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

### *Temnothorax longispinosus* (Roger, 1863)

*Temnothorax longispinosus* (Roger, 1863) is a small ant (2–2.5 mm) with a brownish coloration. It can be distinguished from other Iberian species of the genus by its propodeal spines, which are extremely long and broad at its base. Its native range includes the eastern United States and Canada (Janicki et al., 2016; Guénard et al., 2017). The following summary is based on MacKay (2000). This species nests in preformed cavities such as acorns, twigs, hollow stems, rotting logs, or in crevices in rocks and under bark. It typically inhabits forested environments, although it can also be found in well-drained open areas. Colonies are generally small and exhibit facultative polygyny and polydomy.

On the Iberian Peninsula, its presence is anecdotal, known only from a single record in a salt marsh in Huelva in 1994 (Espadaler & Collingwood, 2001; Fig 28). It has not been reported again since, and it remains unclear whether the species still persists at that locality.

### *Trichomyrmex destructor* (Jerdon, 1851)

Small-sized polymorphic species (1.8–3.5 mm) of bicolored and shiny body, with yellowish brown head and mesosoma and darker gaster. Workers have transverse striae on the posterior margin of head, pronounced mesopropodeal furrow and rounded propodeum without propodeal spines. In the older bibliography it appears under the name of *Monomorium destructor* (Jerdon, 1851), currently an obsolete combination of *Trichomyrmex destructor* (Jerdon, 1851). It is most similar to *Trichomyrmex mayri* (Forel, 1902), from which it is only separated by the body color, which is yellowish in *T. destructor* and brownish in *T. mayri* (Sharaf et al., 2016).

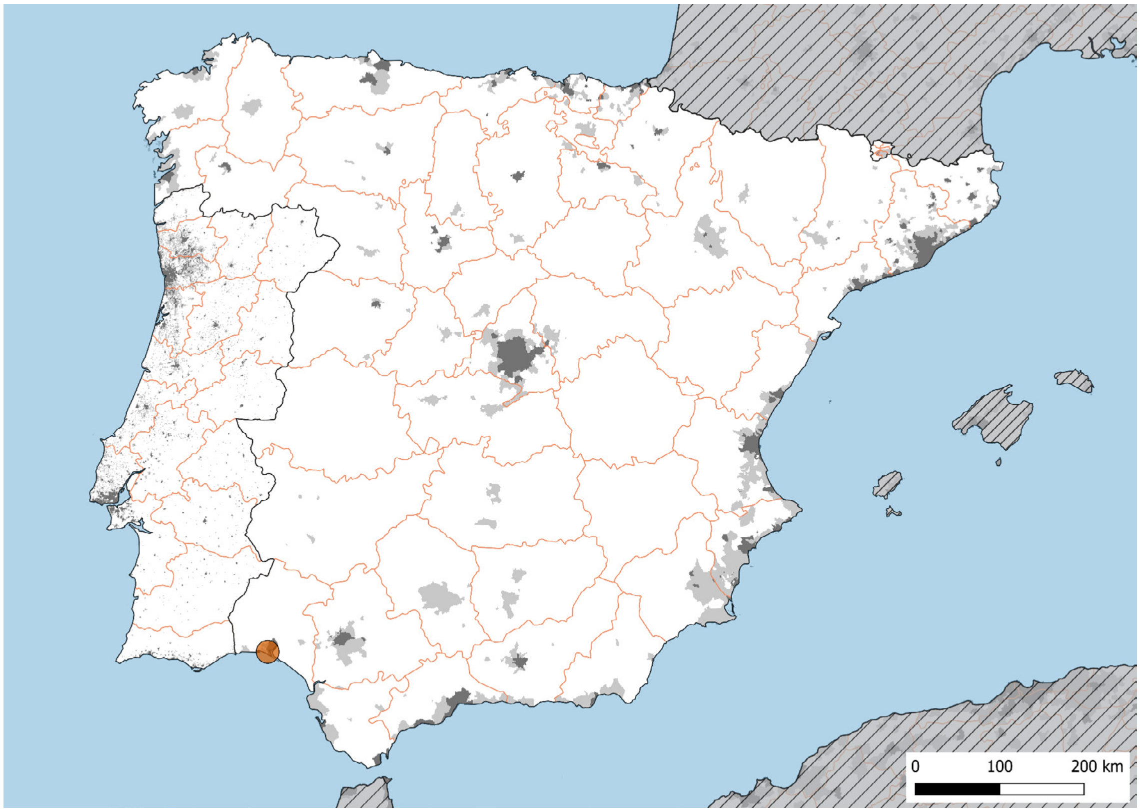


**Fig 28.** Iberian distribution of *Temnothorax longispinosus*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

The species is probably native to India, but has spread to numerous tropical and subtropical regions of the world (Wetterer, 2009a; Janicki et al., 2016; Guénard et al., 2017). In temperate regions, however, it is only able to survive indoors. The summary of the species that follows is adapted from Wetterer (2009a). *T. destructor* can be introduced to new areas via cargo transported by ships or planes. Colonies are polygynous, and workers forage in long, conspicuous trails. The species nests in a wide variety of locations, virtually anywhere that remains shaded, including wood, leaf litter, beneath stones, and even inside electronic devices. It can be found in parks, gardens, and within buildings. In infested areas, it may cause significant economic damage by chewing on wires, damaging structural materials, and in some cases, starting fires due to electrical malfunctions. Its ecological impact remains poorly studied. The species can also behave aggressively toward humans, invading homes and biting residents.

There are two published records from Iberia, one in Málaga city and the other in Agost (Alacant) (Reyes-López, 2019; Casiraghi et al., 2020; Fig 29). There is also one older interception of the species in the port of Barcelona (Espadaler, 2005), not shown in the map. Finally, we found an online mention of an infestation in 2021 of a building in Marbella (Málaga) (Pradera, 2021).

***Trichomyrmex mayri*** **(Forel, 1902)**

A species probably originating in the Indian subcontinent (Bolton, 1987), appearing identical to *T. destructor* except for the brownish homogeneous body. It is considered to have a lower invasive potential compared to *T. destructor* (Bolton, 1987). *T. mayri* has been mainly introduced in tropical areas such as west and northeast Africa, western Asia, the Indomalayan region and Australasia (Janicki et al., 2016; Guénard et al., 2017; Borowiec & Salata, 2019), where it occurs in a broad range of habitats (Sharaf et al., 2017), nesting under stones or directly in soil, in moist or dry substrates next to trees (Sharaf et al., 2016; Sharaf et al., 2017). It is one of the commonest ants in the Arabian Peninsula (Sharaf et al., 2013), where it is considered a non-native species. Its ecological impact in introduced areas remains largely unknown.

On the Iberian Peninsula, it was initially detected in a palm grove with constant irrigation in Alacant province, from which it reportedly disappeared after abandonment (Casiraghi et al., 2020; Fig 30). More recently, an established population has been documented in Fuengirola, Málaga (Espadaler & Ramos, 2022).

***Tetramorium bicarinatum*** **(Nylander, 1846)**

*Tetramorium bicarinatum* (Nylander, 1846) is a medium-sized (3–3.5 mm), monomorphic and brownish species.

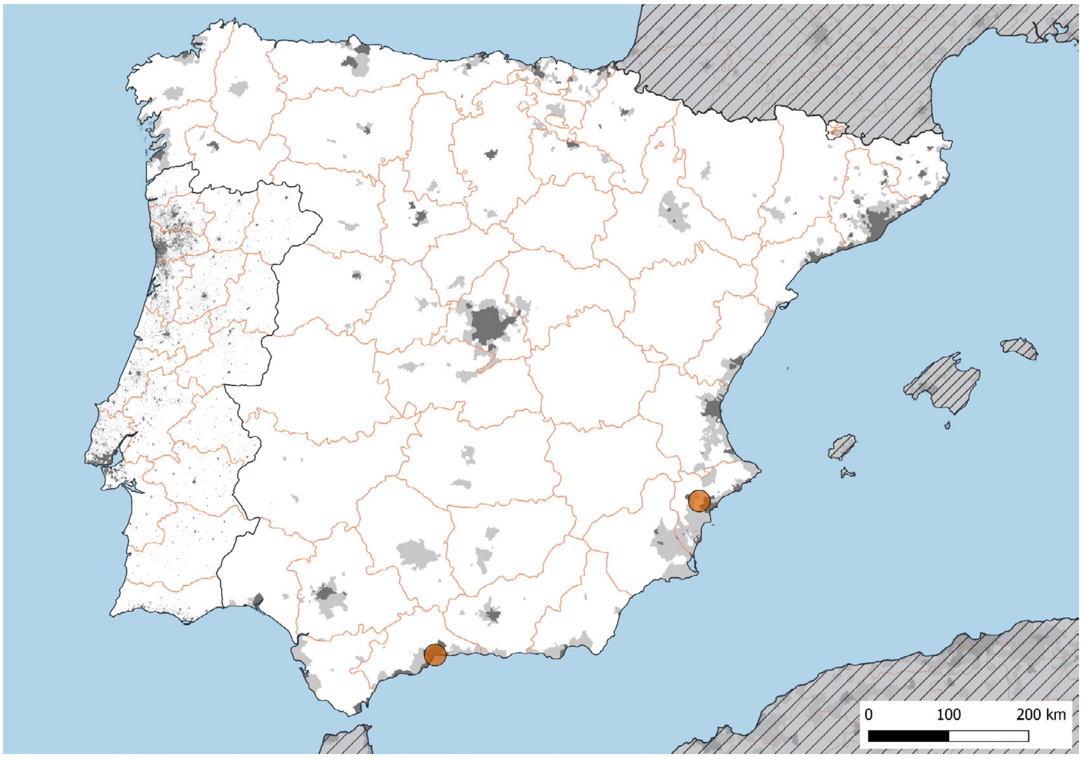


**Fig 29.** Iberian distribution of *Trichomyrmex destructor*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

Workers are slightly bicolored with a darker gaster. It is further characterised by its prominent frontal carinae that extend caudad and almost reach the posterior head margin, median notch in the anterior clypeal margin and well-developed sculpture (Hita Garcia & Fisher, 2011). Its common name is the penny ants (Wetterer, 2009b).

It is a successful and widespread non-native species in many tropical and subtropical regions of the Old and New World and has also established indoors in other areas of temperate climates (Wetterer, 2009b; Hita Garcia & Fisher, 2011). Records are especially abundant for Oceania and the West Indies, while its presence in Africa and western Asia

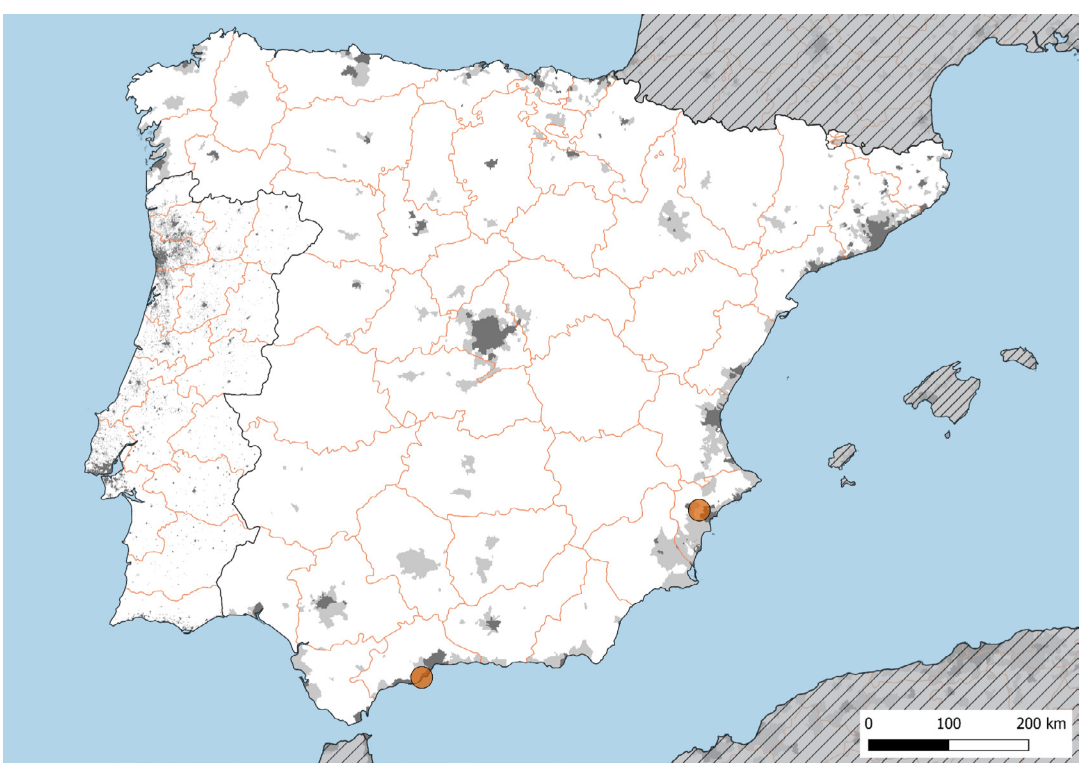


**Fig 30.** Iberian distribution of *Trichomyrmex mayri*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

appears to be scarcer (Wetterer, 2009; Hita Garcia & Fisher, 2011). Originally, its native range was believed to be the Afrotropical region, but later evidence suggests its origin is South East Asia (Wetterer, 2009; Hita Garcia & Fisher, 2011). The first known introductions are in Madeira (1858 or earlier) and Australia (1858) (Wetterer, 2009b).

Its biology is poorly studied. Colonies are polygynous and may be very populous, with up to 12500 workers and 50 queens (Astruc et al., 2001), but they are usually small or medium-sized (Smith, 1965). Nests are found in soil, under stones, dead wood, stumps, branches, hollow stems, and under bark (Smith, 1965; Deyrup et al., 2000). New colonies are formed by budding (Astruc et al., 2001). We have not found information about its reproductive strategy. The species is not territorial towards its conspecifics and shows no intraspecific aggressiveness (Astruc et al., 2001). It is a generalist omnivorous and feeds on honeydew, dead insects and other food sources in homes (Smith, 1965). It also predates other invertebrates and has been used for biocontrol of pests in cultivated fields (Wetterer, 2009). It inhabits anthropogenic habitats and disturbed places, such as agricultural fields, greenhouses, heated buildings, botanical gardens, and zoos (Wetterer, 2009b). Occasionally, it can be found inside houses and other buildings (Smith, 1965; Deyrup et al., 2000). Although it has negative impacts on natural environments and has been reported as a pest in cultivated fields, it has not been treated as an invasive species, and authors say it has not reached the status of a major pest (Smith, 1965; Wetterer, 2009b).

In Iberia, it has been located in parks and in gardens of residential complexes (Reyes-López & Espadaler, 2005; Reyes-López & Obregón, 2018; Fig 31). Its presence seems to be growing in south east Iberia, and new records in nearby cities are expected in the near future.

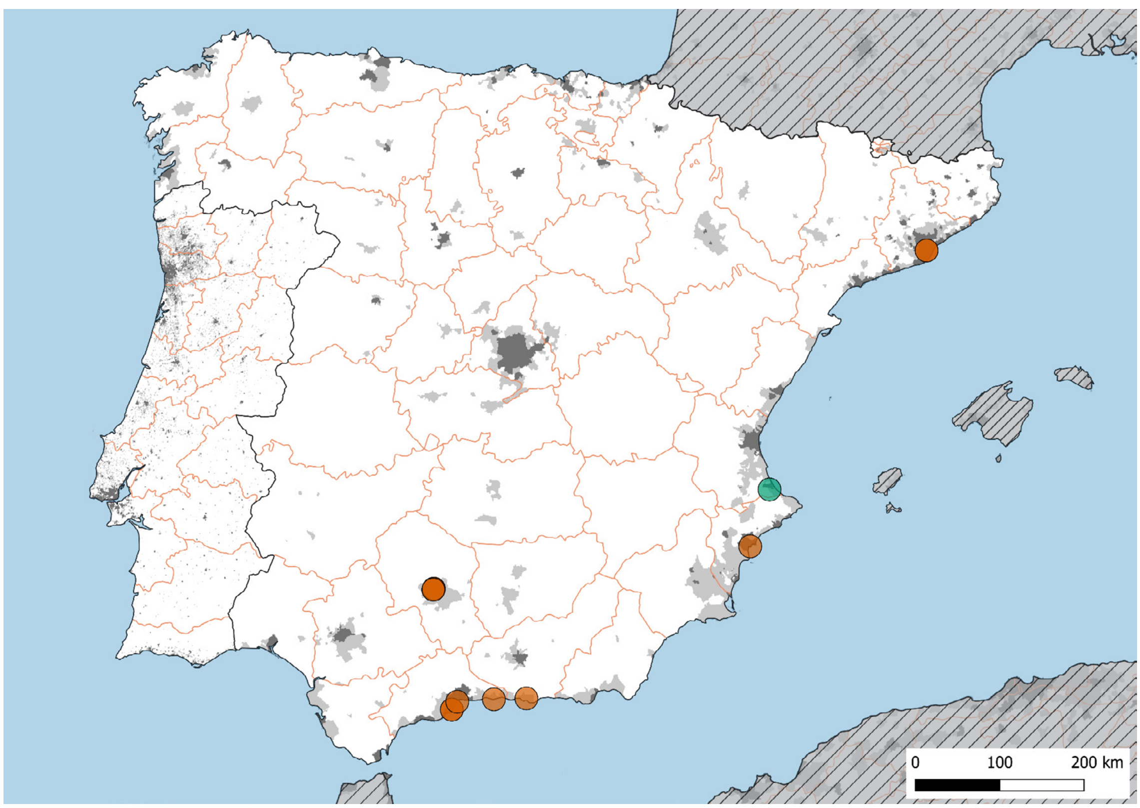


**Fig 31.** Iberian distribution of *Tetramorium bicarinatum*. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

***Tetramorium caldarium*** **(Roger, 1857)**

A small, monomorphic and bicolored species with a yellowish body and a darker gaster. It is characterized by well-developed frontal carinae and short propodeal spines. Before 1979, *Tetramorium caldarium* (Roger, 1857) was considered a junior synonym of *Tetramorium simillimum* (Smith, 1851), another cosmopolitan species not recorded in Iberia. However, Bolton (1979) revived *T. caldarium* from synonymy, recognizing it as a distinct species. Both are morphologically very similar and are likely native to the same region: sub-Saharan Africa (Wetterer & Garcia, 2015). *T. caldarium* can be distinguished from *T. simillimum* by its more strongly developed frontal carinae and antennal scrobes, as well as by differences in head shape, with the head broadening behind the eyes (Bolton, 1979; Wetterer & Garcia, 2015).

Though native to the Afrotropical region, it is now a globally distributed species, recorded in Europe, the Arabian Peninsula, parts of Asia, Australia, Oceania, Central and South America, the southern United States and the Caribbean Islands (Bolton, 1980; Wetterer & Hita Garcia, 2015; Janicki et al., 2016; Guénard et al., 2017). In temperate regions, it persists only indoors, typically in heated buildings (Bolton, 1980).

Relatively little is known about the biology of *T. caldarium*. However, Wetterer and Hita Garcia (2015) suggest that accumulated records indicate the species is arid-adapted, preferring non-shaded environments and occurring in both disturbed and undisturbed habitats. There is currently no evidence that *T. caldarium* causes significant negative impacts on invaded ecosystems (Wetterer & Hita Garcia, 2015).

The first records of *T. caldarium* on the Iberian Peninsula date back to 2004, when it was found in landscaped areas along embankments in Cádiz (Reyes-López & Espadaler, 2005). It was later confirmed in urban parks in Huelva, Málaga and again in Cádiz (Fig 32). There is also a new provincial record of *T. caldarium* from Parque de los Pueblos de América, located in Motril, Granada province, recorded on 6.VII.2025 by M. Logachev (see Supplementary Material). Currently, *T. caldarium* spread in Iberia seems to be in an incipient stage.

### *Tetramorium immigrans* Santschi, 1927

*Tetramorium immigrans* Santschi, 1927, commonly known as the pavement ant, is a widespread and synanthropic species that has successfully colonized urban environments across Europe and North America. Recent studies point that it was likely introduced to eastern North America in the late 19th century and to western Europe around the 1960s (Moss et al., 2022). Workers are medium-sized (2.7–3.5 mm) and of dark brown coloration. The species belongs to the *Tetramorium caespitum* (Linnaeus, 1758) species complex, which includes five species in Iberia: *Tetramorium alpestre* Steiner et al., 2010, *T. caespitum*, *T. immigrans*, *Tetramorium impurum* (Foerster, 1850), and *Tetramorium indocile* Santschi, 1927. These taxa are indistinguishable through standard morphological evaluation and require a complex morphometric analysis, DNA sequencing, or examination of male genitalia for reliable identification (Wagner et al., 2017).

A review on this species is given by Moss et al. (2022), but a short summary is provided hereafter. Native to the region around the Caucasus Mountains, *T. immigrans* is well adapted to disturbed, open habitats, particularly those with dry, well-drained soils and moderate moisture. It frequently nests under pavement and stones, often in sandy loam, and its success is linked to thermal preferences, with activity peaking between 20–25°C. Colonies are monogynous and can reach high worker densities. Workers exhibit both group and mass recruitment to food sources and engage in ritualized, largely non-lethal battles between neighboring colonies, particularly in spring. Although it dominates urban habitats, its success appears to be driven by its high reproductive investment, behavioral flexibility, and tolerance of high-density living in anthropogenic landscapes.

In Europe, *T. immigrans* has spread extensively in urban areas, but its ecological impact remains poorly studied. Although we lack direct evidence, we believe that the species should be well-established in many, if not all, Mediterranean cities of Iberia and likely in other major cities and anthropized

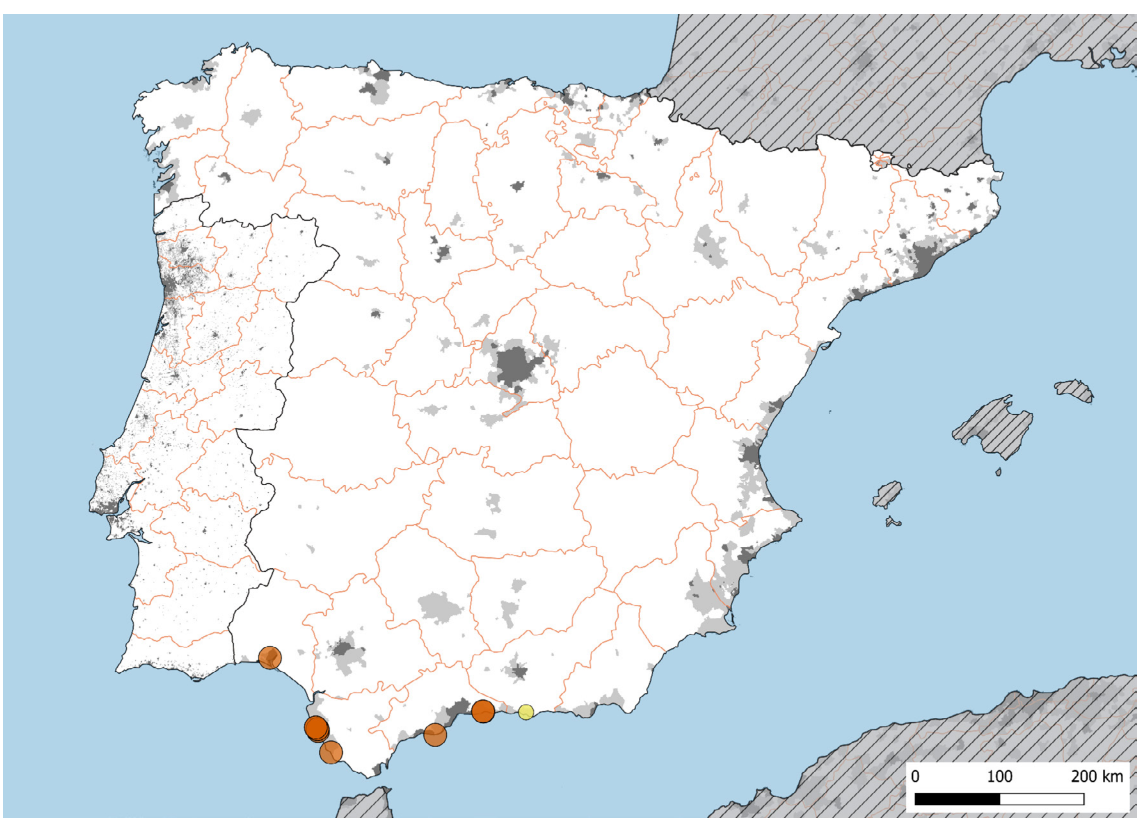


**Fig 32.** Iberian distribution of *Tetramorium caldarium*. Source of records: bibliographic (orange circles) and personal material (yellow circles). Grey patches correspond to the main urban areas.

environments throughout the region, due to its high adaptability to urban areas and the fact that its introduction in the region probably dates back at least several decades ago. For instance, in the metropolitan area of Barcelona, where the myrmecofauna is well-studied, *T. immigrans* is likely the most common ant species found in parks and streets, and the sole member of the complex present, dominating the urban ecosystem entirely. In the cities and rural areas of northern Iberia, however, it could likely coexist with other members of the complex. The labor-intensive identification process largely explains the scarcity of data on these species in Iberia (Fig 33), as few researchers in the region have access to the specialized equipment or expertise needed to sort individuals of the complex. Older Iberian material should be examined in order to determine an approximate date for its introduction in the region.

### *Tetramorium lanuginosum* Mayr, 1870

This is a small (2.5–3 mm), monomorphic and brownish species, easily recognized by its dense coat of long body hairs, some of which are bifurcated at the tips. It also has prominent frontal carinae that extend posteriorly, nearly reaching the rear margin of the head, as well as big propodeal spines, not characteristic for the local fauna.

*Tetramorium lanuginosum* was originally described from Indonesia and is probably native to tropical and subtropical East Asia and perhaps to northern Australia and western Oceania (Wetterer, 2010b). From its native range, it has spread across tropical and subtropical regions worldwide and is now considered a cosmopolitan species. Most records come from the Caribbean, Central America, southern parts of the United States, numerous Pacific islands, tropical Africa, Madagascar, the Mediterranean Basin, and the Arabian Peninsula (Wetterer, 2010b; Janicki et al., 2016; Guénard et al., 2017). Outside its natural range, it typically inhabits anthropized and urban environments, such as parks and irrigated gardens, nesting in moist soil at the base of palm trees, under stones, in rotting wood or among leaf litter (Sharaf et al., 2017; Sharaf et al., 2018b; Arcos et al., 2020).

This species is timid and non-aggressive, making it unlikely to become invasive except perhaps on small islands where dominant ant species are absent (Wetterer, 2010b). Beyond this, little is known about the biology of *T. lanuginosum*, including aspects such as its colony structure, feeding preferences, and reproductive strategies.

The first record of *T. lanuginosum* on the Iberian Peninsula was in Jardines de Picasso, Málaga, in 2004 (Reyes-López & Espadaler, 2005). Since then, its presence has been confirmed in several other locations across the peninsula, including various cities in Alacant, Almería, Cádiz, and also in Barcelona (Reyes-López et al., 2008; Arcos et al., 2020; Casiraghi et al., 2020; Reyes-López et al., 2024; Fig 34).

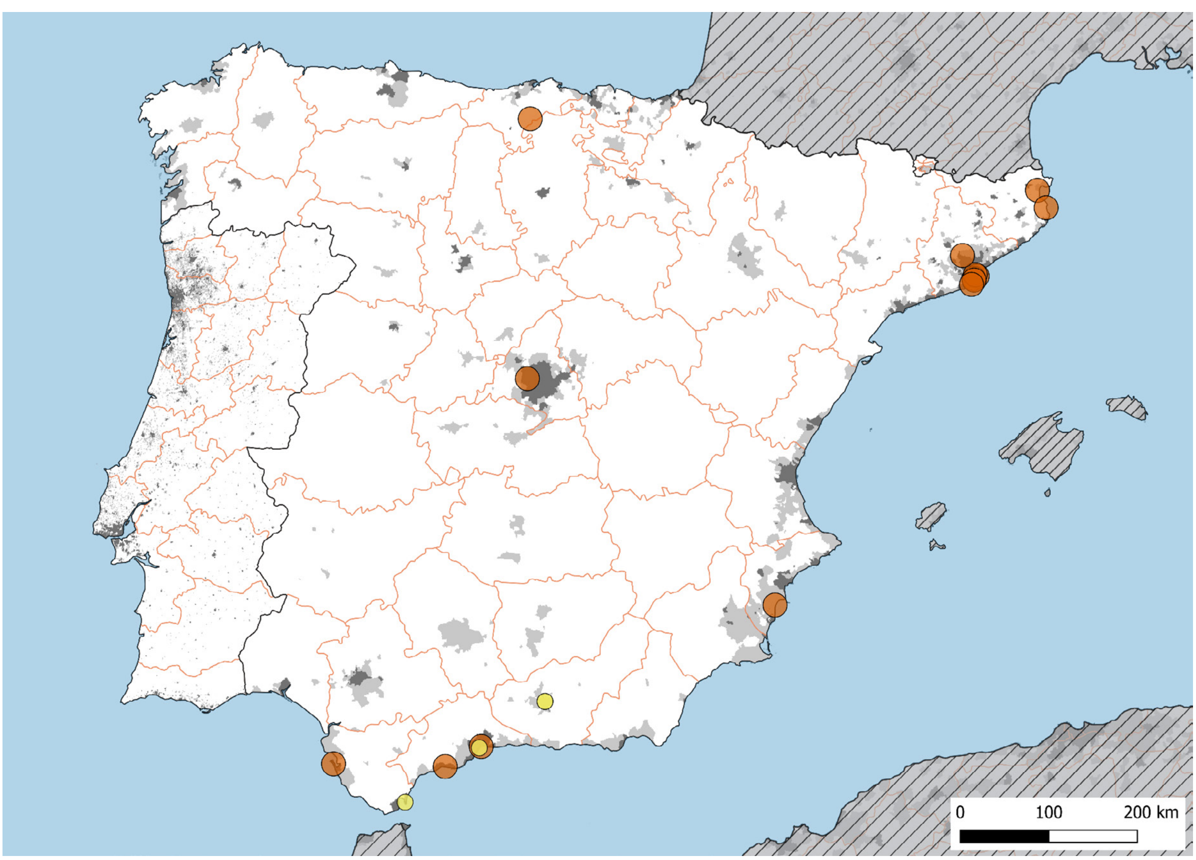


**Fig 33.** Iberian distribution of *Tetramorium immigrans*. Source of records: bibliographic (orange circles) and personal material (yellow circles). Grey patches correspond to the main urban areas.

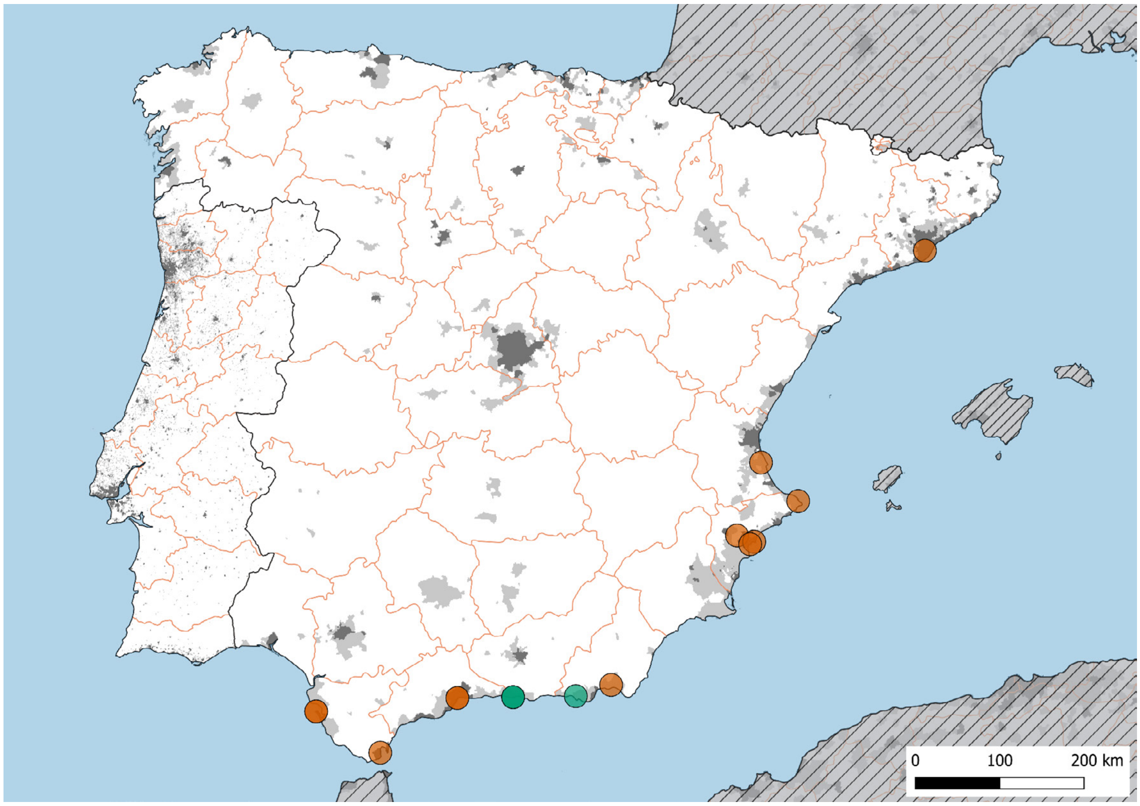


**Fig 34.** Iberian distribution of *Tetramorium lanuginosum*. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

***Wasmannia auropunctata* (Roger, 1863)**

Commonly known as the little fire ant, *W. auropunctata* is a very small (1.5 mm), monomorphic and yellowish species (Wetterer, 2013). It is easily recognized by its two-segmented antennal club, prominent frontal carinae, long propodeal spines, and rectangular petiolar node (Longino & Fernández, 2007). Native to Central and South America (Wetterer & Porter, 2003), it has been introduced to many tropical and subtropical regions worldwide, including the Caribbean, southern parts of North America, West Africa, Melanesia, Polynesia, Micronesia, and numerous Pacific, Atlantic islands and southern China (Guangdong Province) (Wetterer & Porter, 2003; Janicki et al., 2016; Guénard et al., 2017; Chen et al., 2022), as well as in Spain (Espadaler et al., 2018; Loiseau et al. 2025; Pérez-Delgado et al., 2025), Cyprus (Demetriou et al., 2022) and France (Blight et al., 2024). In temperate regions such as Canada and Central Europe, the species only persists indoors (Wetterer, 2013).

Today, *W. auropunctata* is considered a cosmopolitan invasive species and is listed among the world's 100 worst invasive organisms (Lowe et al., 2000). Furthermore, it has attracted public attention due to its painful sting, which can affect humans and has even been linked to eye injuries in domestic animals (Rosselli & Wetterer, 2017). A comprehensive overview of its biology and distribution can be found in Longino and Fernández (2007) and Wetterer (2013), but a summarized account follows hereafter. Colonies are polygynous and, in their introduced range, often become unicolonial. The species is highly adaptable and occupies a wide range of habitats, from disturbed and anthropized environments to humid forests and agricultural fields. It nests in a diversity of materials including wood, leaf litter, under stones or sidewalks, inside hollow plants, and even within electrical devices. While primarily scavengers, workers also act as predators, feed on nectar and plant materials, and tend homopterans for honeydew. Although slow-moving, individuals are rapidly recruited to food sources. Reproduction occurs both sexually and by parthenogenesis, and it is unknown whether mating flights occur or if reproduction happens exclusively within the nest. The ecological impact of *W. auropunctata* is well documented, with numerous studies showing that it significantly reduces native ant diversity and negatively affects other invertebrate species. In infested areas, the species can reach extremely high population densities.

The recent discovery of *W. auropunctata* in Marbella (Málaga) in 2018 marked the first confirmed established population occurring outdoors in Europe (Espadaler et al., 2018; Fig 35). Reports of stings from local residents indicated that the ants had already been present since at least 2015. Following this initial detection, the species was found in the nearby towns Calahonda and Estepona in 2020, with its arrival estimated as early as 2016 (Espadaler et al., 2020a). By 2023, its distribution had expanded further to include Benalmádena (Pradera & Espadaler, 2024). In just five years, Marbella's infestation grew from 5.7 ha in 2018 to 16 ha, nearly tripling its extent (≈ 180 % increase) (Pradera & Espadaler, 2024). Most recently, in 2024, *W. auropunctata* was documented in La Marina (Alacant province; Fig 35), representing the first confirmed population outside Málaga and the fifth known location on the Iberian Peninsula (Arcos et al., 2025).

*Wasmannia auropunctata* is currently listed as an invasive species of concern under EU Regulation 1143/2014 (European Parliament and Council of the European Union, 2014). The ant's ability to establish dense populations, displace native species, and colonize both urban and coastal ecosystems demonstrates its invasive potential in Mediterranean climates, and it is to be expected that the species will expand to other coastal cities in the following years.

## 2.2 Clearly non-native species recorded only indoors

***Hypoponera ergatandria*** **(Forel, 1893)**

Small and brownish ant species with a cosmopolitan distribution, including records from Indonesia, Hawaii, Japan, Tanzania, and several European countries, where its presence is typically restricted to heated infrastructure (Seifert, 2013). Colonies are often redistributed unintentionally via potted plant material, and occur in botanical gardens, butterfly parks or garden centers (Seifert, 2013). *Hypoponera ergatandria* (Forel, 1893) is presumed to depend on moist soil or organic matter to persist, a factor which, together with its minute and inconspicuous appearance, has likely facilitated its widespread yet often unnoticed distribution. Although not considered to have a significant ecological impact, there have been reports of workers stinging botanical garden staff (Seifert, 2013), and from alates during nuptial flights originating from a basement in Italy (Schifani et al., 2024a), suggesting at least a minor nuisance potential in human-managed environments.

The species exhibits pronounced polymorphism in both the male and queen castes. Males occur in two forms, minor and major, and reproductive females range from alate gynes with large eyes and ocelli to ergatoid queens, which resemble workers but have larger eyes, a spermatheca, and are overall slightly larger (Seifert, 2013). This variability has historically led to taxonomic confusion within the *punctatissima* group (Bolton & Fisher, 2011). However, Seifert (2013; 2018) provided discriminant functions that reliably separate *H. punctatissima* from *H. ergatandria*. A similar species, *Hypoponera eduardi* (Forel, 1894), native to the Iberian Peninsula, differs in that it possesses a sculptured mesopleuron (glabrous in *H. punctatissima* and *H. ergatandria* workers) and a scape length to head width ratio greater than 0.88 (Bolton & Fisher, 2011).

Given the historical taxonomic confusion, it is important to note that pre-2013 records attributed to *H. punctatissima* may in fact partly refer to *H. ergatandria*, and should be reexamined using current diagnostic criteria. To date, there are only two Iberian records of *H. ergatandria* (Fig 36): from a greenhouse in Almería, although no additional ecological or behavioral information is available from this locality (Seifert, 2013), and from Rota (Cádiz) in an indoors setting (Espadaler et al., 2024).

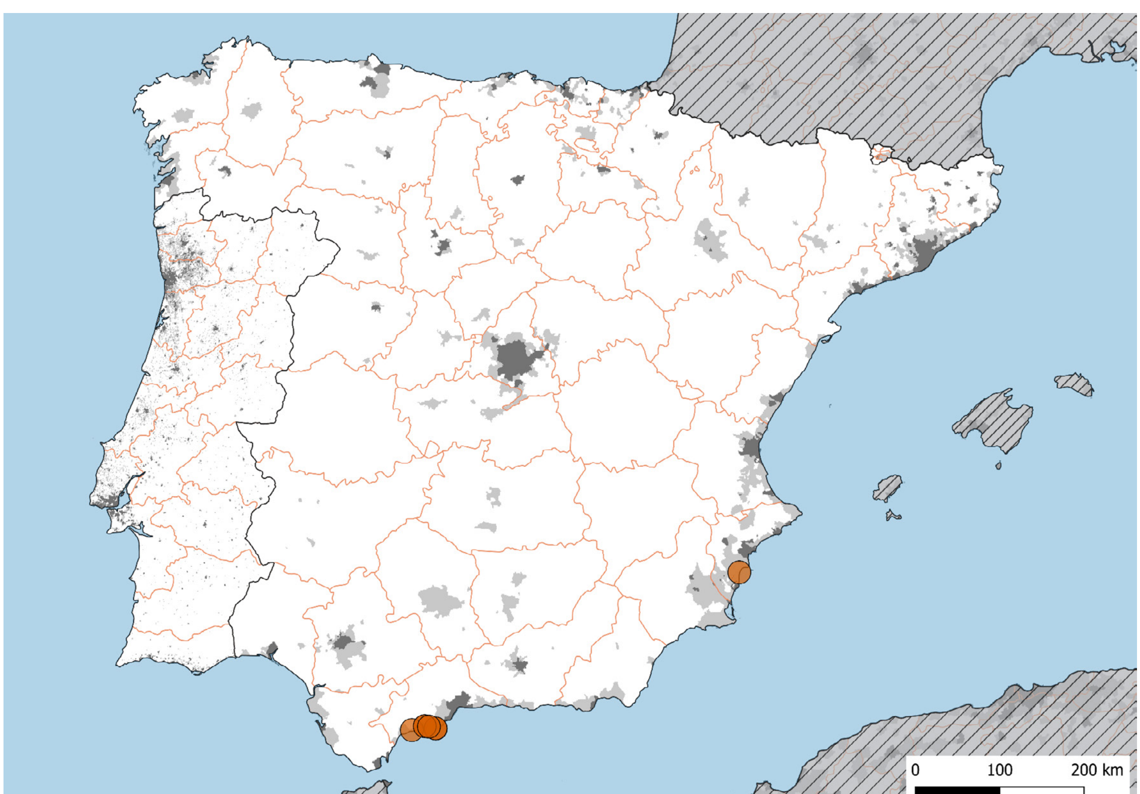


**Fig 35.** Iberian distribution of *Wasmannia auropunctata*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

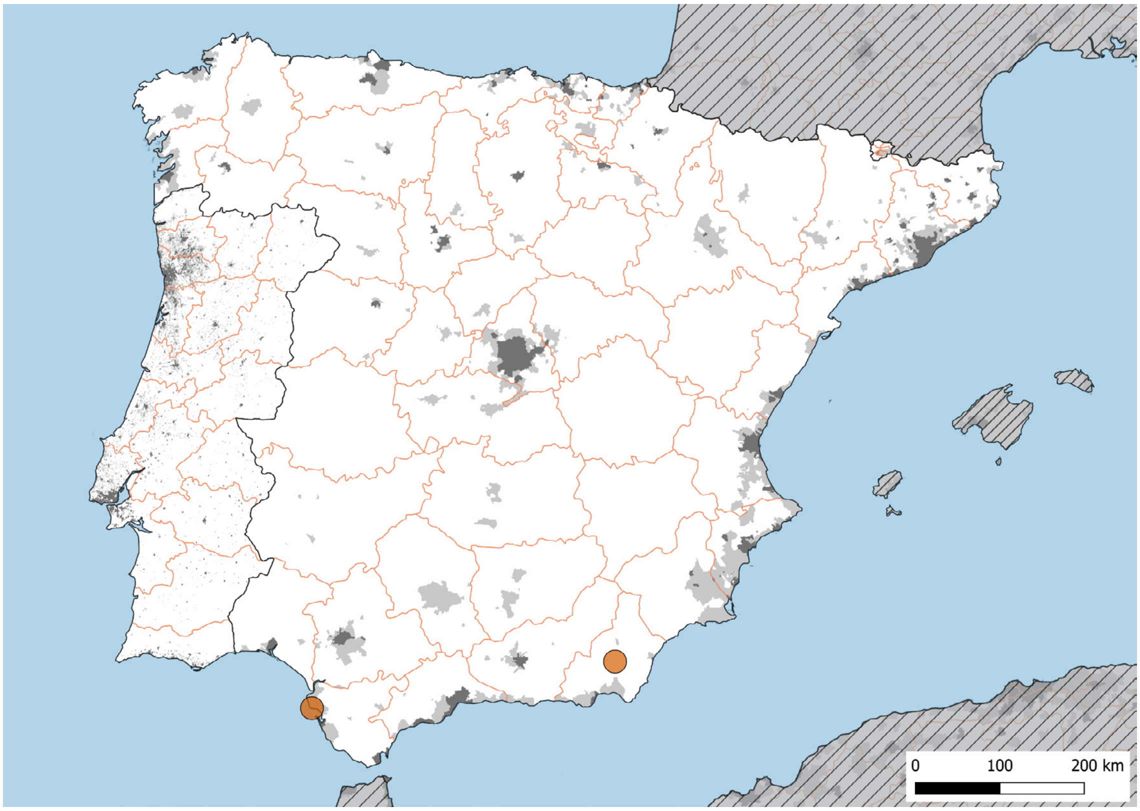


**Fig 36.** Iberian distribution of *Hypoponera ergatandria*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

***Monomorium floricola* (Jerdon, 1851)**

Native to tropical Asia, *Monomorium floricola* (Jerdon, 1851) is among the most widely distributed ant species globally. It has spread across tropical and subtropical regions, including the Americas, Africa, Australia, and numerous islands in the Indian and Pacific Oceans (Janicki et al., 2016; Guénard et al., 2017). In Europe, however, its presence has been reported only sporadically, typically confined to indoor environments or greenhouses (Wetterer, 2010a). Recently, it was detected in a zoological park in Málaga (Fig 37) during a routine pest inspection (Reyes-López et al., 2022), and subsequently eradicated (J. Reyes-López, University of Córdoba, pers. comm., July 2023). According to the Reyes-López et al. (2022), the ants had been present since at least 2021. To date, no outdoor nesting populations have been documented in Europe.

This species is predominantly arboreal, forming polygynous and polydomous colonies in small pre-formed cavities, often within man-made structures, traits that facilitate its dispersal. New colonies are founded through budding by wingless queens (Wetterer, 2010a). Workers are small (1.4–2.0 mm), slender, and monomorphic, with a distinctive bicolored pattern: a dark brown head and gaster, and a yellowish mesosoma. This coloration makes them unmistakable in the Iberian region, especially when compared to other non-native *Monomorium* Mayr, 1855 species, which are not bicolored.

Commonly referred to as the flower ant or bicolored trailing ant, *M. floricola* is considered invasive due to its negative impacts on agriculture and native biodiversity (Wetterer, 2010a). It has been reported to prey on butterfly eggs, contributing to population declines (Nafus, 1993; Lach et al., 2016). Indoors, it is also recognized as a minor pest (Wetterer, 2010a) and has been shown to act as a vector for pathogenic microorganisms in hospitals, posing a risk to human health (Fowler et al., 1993). While it can become dominant in disturbed ecosystems and may outcompete native species, concrete evidence of its impact on native ant communities remains limited.

Currently, there are no known established populations of *M. floricola* in Iberia. Although temporary introductions may occur in the future, the species is unlikely to become permanently established. Unlike other non-native species such as *M. carbonarium*, *M. floricola* appears to depend on heated buildings and greenhouses for survival in Europe. Among thousands of iNaturalist records reviewed by the authors over the years, no specimen matching the appearance of *M. floricola* has been observed on the Iberian Peninsula, which reinforces the idea that even if the species is occasionally present, it is neither widespread nor established in urban environments, where it would likely have been spotted.

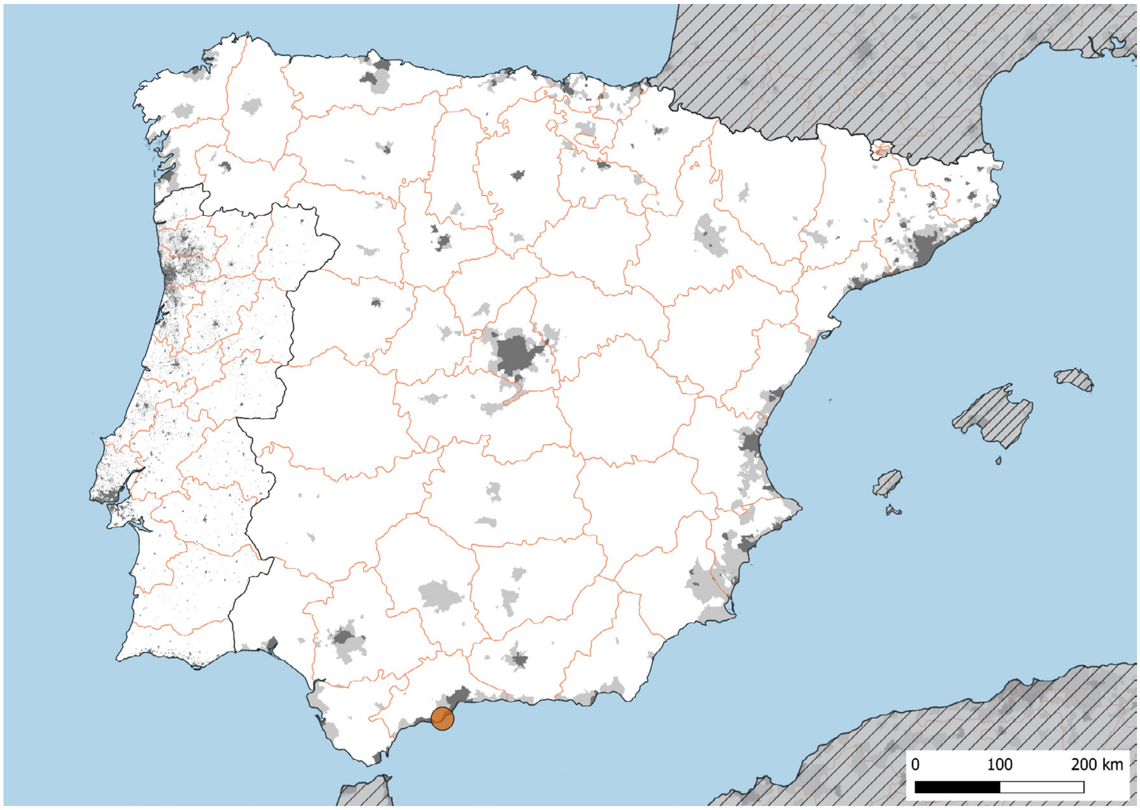


**Fig 37.** Iberian distribution of *Monomorium floricola.* Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

***Monomorium pharaonis* (Linnaeus, 1758)**

Morphologically, *M. pharaonis* is a small ant, with workers measuring 2.2–2.4 mm in length (Bolton, 1987). The body is yellowish to light yellowish brown, usually with a dark transverse band on the first gastral tergite. The integument has a matte appearance due to fine microreticulation. It can be confused with other yellowish *Monomorium* species found in Iberia, such as *M. exiguum* and *M. andrei*, but it differs in having a larger body size and 10th and 11th antennal segments that are distinctly longer than wide.

*Monomorium pharaonis* is one of the most successful worldwide colonizers, established on all continents except Antarctica due to its strong association with human environments (Wetterer, 2010a). Although traditionally believed to be native to Africa, the geographic distribution of related *Monomorium* species suggests a likely origin in tropical Asia (Wetterer, 2010a). It is now widely established in tropical zones, including the Neotropics, Indomalaya, Australasia, Madagascar, and Pacific islands, and occurs indoors across much of the Holarctic (Wetterer, 2010a). In temperate climates, its survival is highly dependent on heated buildings, which provide the warmth and humidity necessary for colony development (Bolton, 1987; Wetterer, 2010a).

Colonies are populous, polygynous and polydomous (Wetterer, 2010a). Reproduction occurs via intranidal mating, and new colonies arise through budding rather than nuptial flights (Wetterer, 2010a). Workers perform mass recruitment to food sources by laying pheromone trails, with trail-marking intensity increasing in response to food quality (Jackson & Châline, 2007). Pheromone longevity depends on the substrate, with trails decaying more quickly on absorbent materials and lasting longer on smooth surfaces like plastic (Jeanson et al., 2003).

The species can be problematic in hospitals and other healthcare settings, where it has been documented acting as a mechanical vector of pathogens such as *Staphylococcus aureus* Rosenbach, 1884 and *Salmonella* spp. Lignières, 1900, and invading sterile medical environments (Wetterer, 2010a). Infestations also occur in homes, commercial buildings, warehouses, and ships, with nests often located in hidden microhabitats such as wall voids, electrical sockets, insulation, or plumbing systems.

On the Iberian Peninsula, *M. pharaonis* has sporadically been recorded indoors, particularly in heated buildings. Although globally widespread, *M. pharaonis* is rarely recorded in Iberia, with documented localities including Madrid, Barcelona, València or Cádiz (Fig 38). The earliest record dates to specimens collected by José María Dusmet in the early 20th century (Santschi, 1925). Jameson (1932) describes an early experiment aimed at exterminating ants from infested barracks of soldiers in Gibraltar, citing *M. pharaonis* (with a question mark) as the species used in 1931 for this purpose. He described the ant as a small, common species in Gibraltar,

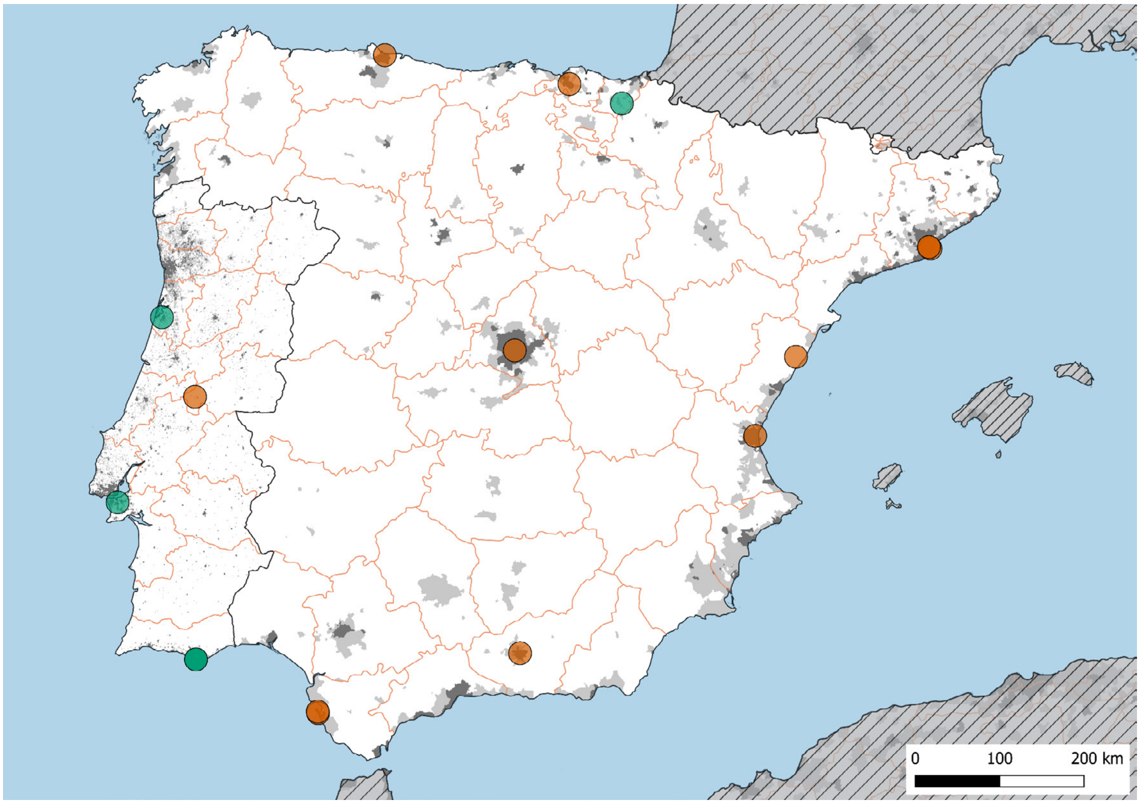


**Fig 38.** Iberian distribution of *Monomorium pharaonis*. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

which casts further doubt on the accuracy of the identification, as *M. pharaonis* is not known to have been widespread in Gibraltar at that time. It is more likely that the species involved was a different, locally common ant, potentially misidentified due to the limited taxonomic resources available at the time. We have therefore omitted this record, the only one known from Gibraltar, from our current database.

The limited number of records and the temporal span between them likely reflects limited detection rather than actual rarity, as most ant surveys avoid private indoor environments, limiting most of the records to those facilitated by pest control agencies. No established outdoor populations have been reported in Iberia, and infestations tend to be temporary, disappearing after control interventions. Under current climatic conditions, the species shows little potential to spread beyond urban and domestic environments in Iberia, but further indoor records are expected in the future.

### *Nylanderia steinheili* (Forel, 1893)

*Nylanderia steinheili* is a small ant, measuring 2–3 mm, with a dark brown to black body. Unlike other *Nylanderia* species recorded on the Iberian Peninsula, it is distinguished by its whitish coxae (Espadaler & Lozano, 2023).

This species is likely native to either Central or South America (LaPolla & Kallal, 2019). However, it has been introduced to extensive areas of the West Indies, the Galápagos Islands and the Seychelles. The ant has also been reported in different parts of Europe but exclusively in indoor environments (Janicki et al., 2016; Guénard et al., 2017). In 2023, *N. steinheili* was detected in CosmoCaixa museum, Barcelona (Fig 39), within an installation simulating a tropical forest ecosystem of Brazil. Despite this occurrence, the species is not expected to establish outdoor populations on the Iberian Peninsula (Espadaler & Lozano, 2023).

### *Tapinoma melanocephalum* (Fabricius, 1793)

*Tapinoma melanocephalum* (Fabricius, 1793) is a minute ant species, measuring approximately 1.3–1.5 mm in length, with a dark brown head and mesosoma, and a yellow gaster and appendages. The common name "ghost ant" refers to its distinctive appearance, with its pale, translucent gaster and legs creating the illusion of a smaller, "levitating" body. Historically, this name referred exclusively to *T. melanocephalum*, but recently Seifert (2025) described a morphologically similar species, *T. jandai* Seifert, 2025, which has often been misidentified as *T. melanocephalum*. Additionally, a rare colour morph of *Tapinoma pygmaeum* may display similar pigmentation, characterised by a whitish gaster (Seifert, 2025).

*Tapinoma melanocephalum* is recognized as a globally invasive species and a common pest in tropical and subtropical regions, with a growing presence in temperate zones (Wetterer, 2009b). It thrives in human-modified environments and spreads primarily via global commerce and transportation (Wetterer, 2009b). Although its precise

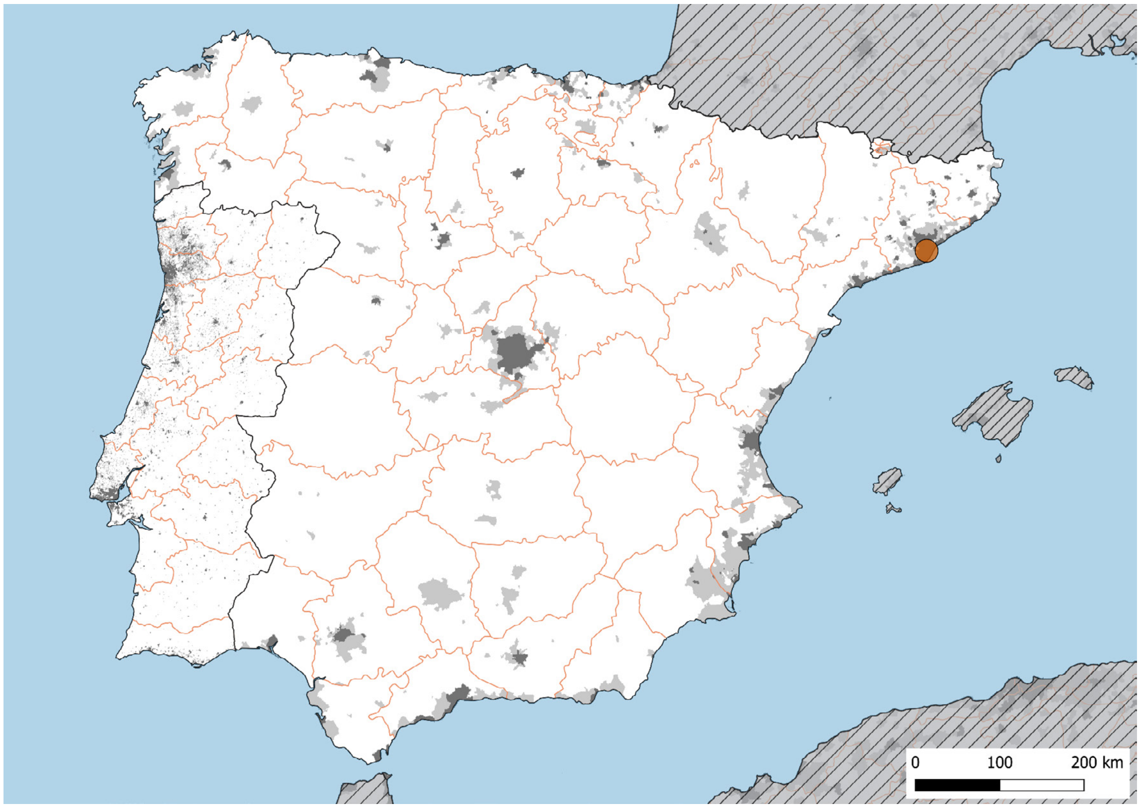


**Fig 39.** Iberian distribution of *Nylanderia steinheili*. Source of records: bibliographic (orange circles). Grey patches correspond to the main urban areas.

native range is uncertain, genetic diversity, early records, and the proximity of closely related species (*T. minutum* Mayr, 1862; *T. indicum* Forel, 1895) suggest an origin in the Indo-Pacific region. Since its initial documentation, possibly as early as 1793 in French Guiana, it has spread to all continents except Antarctica, with notable established populations in the Americas, Africa, Europe, and Oceania (Dlussky, 1994; Wetterer, 2009b).

Ecologically, *T. melanocephalum* can displace native ant species and indirectly contribute to agricultural damage by tending hemipteran pests such as mealybugs and aphids (Fowler et al., 1994; Wetterer, 2009b). Under controlled conditions, it has shown potential as a biological control agent for certain greenhouse pests like spider mites (Osborne et al., 1995). In invaded regions, it is frequently encountered indoors, particularly in residential dwellings, greenhouses (Wetterer, 2009b), and hospitals, where it poses public health concerns by acting as a potential vector of antibiotic-resistant bacteria (Moreira et al., 2005).

The introduction of *T. melanocephalum* to Europe seems more recent compared to other world regions, with the first confirmed observation in England dating back to 1886 (Billups, 1887). To date, it has been recorded in 19 European countries, always in indoor settings such as houses or greenhouses (Klimeš & Okrouhlík, 2015; Pinto, 2023). Although as Klimeš and Okrouhlík (2015) point out, the records reported in the scientific literature do not really reflect how common this species must be because of the lack of a monitoring and reporting system for pests in buildings.

On the Iberian Peninsula, it was first detected in Barcelona in 2002, but this introduction probably dates back to 1999 (Espadaler & Espejo, 2002). Over the past two decades, its presence has been reported in several other urban areas (Fig 40), including Alacant (Albert & Arcos, 2015), Gijón (Martínez et al., 2024), and Beja (Pinto, 2023), with all detections occurring indoors. Although most of these introductions were never tracked after its first detection, they were probably temporary or later eradicated.

We consider it unlikely that *T. melanocephalum* could establish stable outdoor populations in Mediterranean climates due to its strict requirements for high humidity and moderate temperatures throughout the year. Nevertheless, it may pose a threat to local biodiversity in urban environments where such conditions are artificially maintained and favored by the “urban heat island” effect, as shown for the highly invasive ant *L. humile* (López-Collar et al., 2024).

## 2.3 Likely non-native species

### *Anochetus ghilianii* (Spinola, 1851)

*Anochetus ghilianii* is native to northern Morocco and the only outdoors-nesting representative of its genus in Iberia and Europe. The species is characterized within the Iberian fauna by its long, powerful mandibles with three apical teeth, which individuals use for capturing prey and for defense. Workers are medium-sized (6–7 mm) and yellowish brown.

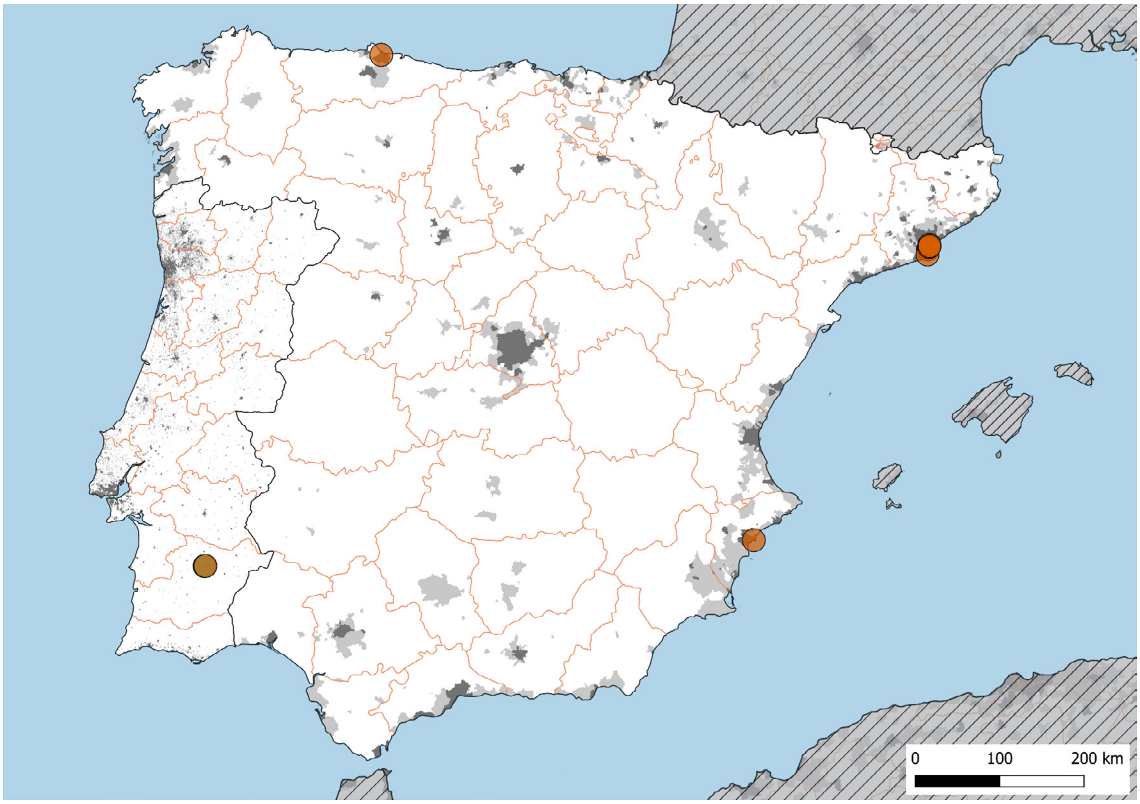


**Fig 40.** Iberian distribution of *Tapinoma melanocephalum*. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). A bibliographic record is superimposed with an observation from iNaturalist in Portugal. Grey patches correspond to the main urban areas.

In Iberia, its distribution is limited to the southernmost coast of Cádiz and Gibraltar, between the Barbate and Guadiaro rivers (Tinaut et al., 2011; Fig 41 and Fig 42).

Historically, *A. ghilianii* was considered native to Iberia and was even listed as vulnerable in the Spanish Red List of Invertebrates (Verdú et al., 2011). However, recent evidence suggests that it is in fact an non-native species. Mitochondrial DNA analysis indicates that Iberian populations originated from northern Morocco, likely introduced through maritime trade (Jowers et al., 2015), as all Iberian specimens share a haplotype also found in Tangier. This is further supported by the fact that queens lack wings (Tinaut et al., 2011), which limits their natural dispersal from Africa to Iberia. Recently, it has been recorded from Algeria (Hamecha et al., 2025), with doubts about its possible status as introduced due to the large gap compared to previously known Moroccan populations.

This species has endogean habits, forming small monogynous colonies (usually fewer than 100 workers) that nest beneath large stones (Tinaut et al., 2011). It prefers open or shrubby environments such as garrigue and maquis, avoiding dense forests and being mostly restricted to coastal areas. In Iberia, it has only been recorded below 400 m altitude, whereas in Morocco it can be found up to 1300 m (Jowers et al., 2015). Its possible ecological impact remains unknown.

The first known specimens of *A. ghilianii* in Iberia were collected by Vittore Ghiliani in 1842 (Tinaut, 2016), suggesting that its introduction occurred at least almost 200 years ago, making it one of the earliest known non-native ants in the region. Despite this long presence, its expansion appears to have been limited, as it remains confined to a small area in southern Iberia.

### *Aphaenogaster gemella* (Roger, 1862)

The species belongs to the *Aphaenogaster sardoa* Mayr, 1853 species group (Schifani et al., 2022), and it is one of three representatives of this group reported on the Iberian Peninsula, alongside *Aphaenogaster iberica* Emery, 1908 and *Aphaenogaster senilis* Mayr, 1853. All three are matte grey in color, exhibit well-developed pilosity, and reach lengths of up to 1 cm. *A. gemella*, however, is clearly distinguished from the other two by its significantly reduced propodeal spines.

The species was originally described by Roger (1862) based on specimens collected in Algeria and Mallorca. However, during the 20th century, its population on the Balearic Islands declined, likely due to competition with the invasive ant *L. humile* (Gómez & Espadaler, 2006). Comín del Río (1988) noted that *A. gemella* was once abundant on the islands, according to historical records, but then had become nearly absent by the time of his survey. In 1983, the species was observed for the last time in Inca, Mallorca, and now it is considered as probably extinct in the region. Today, its natural distribution is confined to the Maghreb region of North Africa (Boer, 2013; Arcos & Alarcón, 2024). In 2024, a small population of *A. gemella* was found in Tarifa (Fig 6), confirming its establishment on the territory (Arcos & Alarcón, 2024). The species nests on ground and is most probably omnivorous.

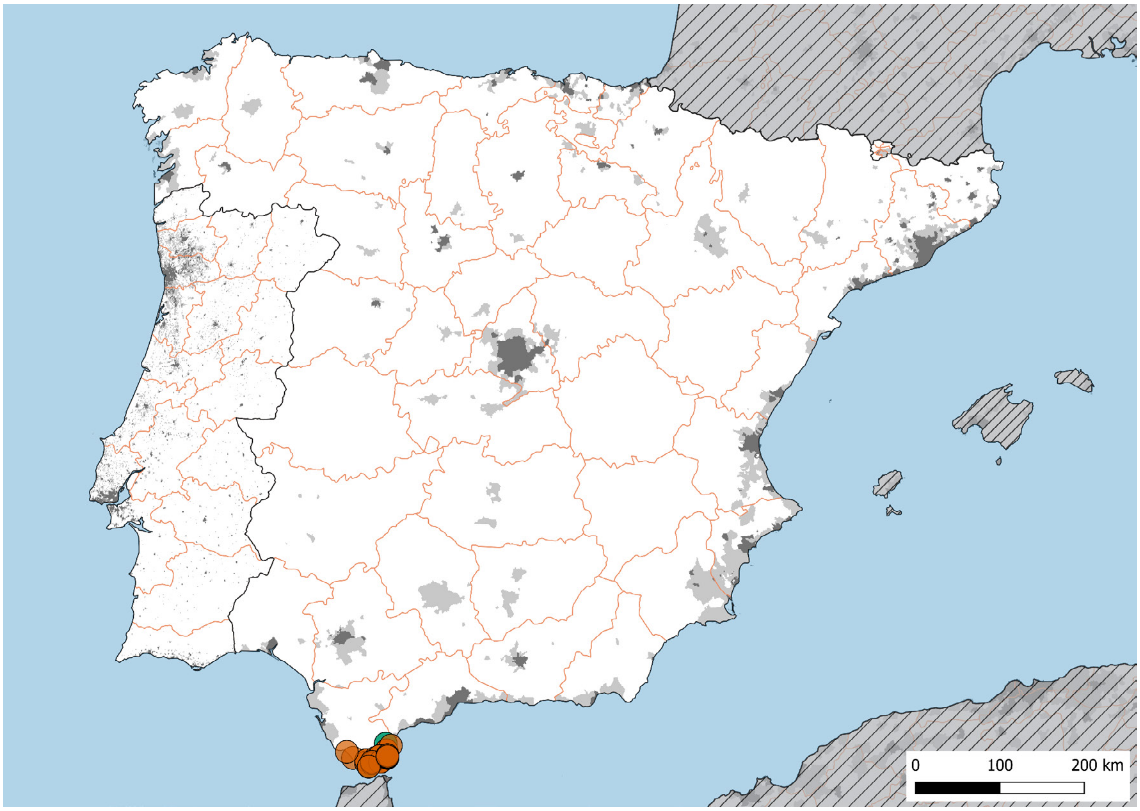


**Fig 41.** Iberian distribution of *Anochetus ghilianii*. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

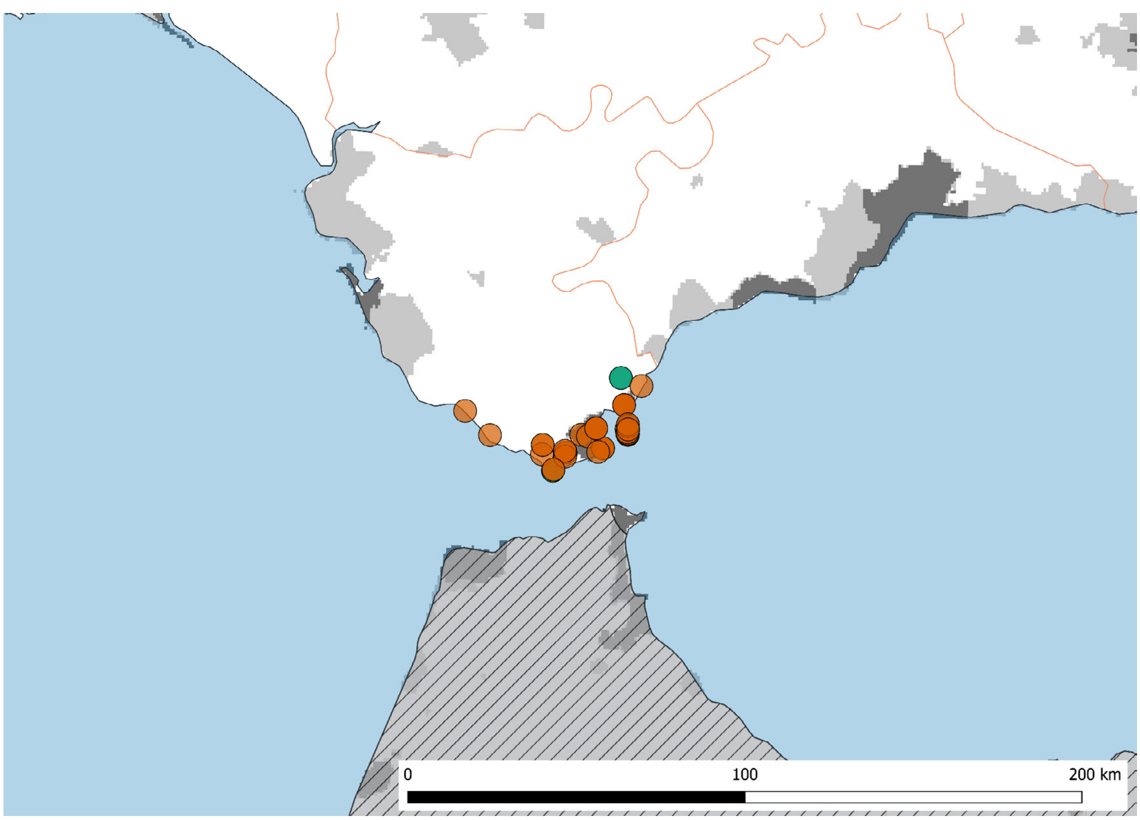


**Fig 42.** Close-up view of the Iberian distribution of *Anochetus ghilianii* in south Iberia. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

On both the Iberian Peninsula and the Balearic Islands, this ant has been found exclusively in urbanized areas and has never been observed in the wild, suggesting it is likely an non-native opportunist. Despite its rarity, *A. gemella* has shown the ability to maintain introduced populations, as seen by its persistence in the Balearics for over a century (Boer, 2013). This supports its status as a potentially non-native species living in Mediterranean urban environments. Its invasive potential seems to be low when taking into account the case of the Balearics, where it was never seen as a plague nor negative impacts were reported.

***Aphaenogaster splendida*** **(Roger, 1859)**

*Aphaenogaster splendida* is a slender, yellowish ant species measuring 3.5–4.5 mm in length. It has an elongated head and body, with short propodeal spines. Its overall body proportions resemble those of autochthonous *Aphaenogaster* Mayr, 1853 species from the *sardoa* species group, but it can be distinguished from them by its distinct yellow coloration.

The species likely originated in the Middle East (Salata et al., 2021), from which it was introduced to the Balkans and other parts of Europe. In Italy, Malta, and Greece, it has so far been recorded only in rural areas and tourist resorts, but not in natural habitats (Salata et al., 2021). On the Iberian Peninsula, the species has been observed on multiple occasions over the years (Fig 7). The earliest known record dates back to before 1891 in Málaga (Medina, 1891), followed 87 years later by an occurrence in pine forest plantations in Córdoba in 1978 (Rodríguez, 1982), in a coastal garden in Almuñécar, Granada in 1981 (Tinaut & Pascual, 1986), and inside a house in the same area in 2023 (Reyes-López et al., 2024). In 2023, the species was also confirmed near an isolated house near Almuñécar (Reyes-López et al., 2024). Additionally, there is a record of *A. splendida* from Denia, Alacant, observed by Víctor Escribano Talavera in July 2022 and published in iNaturalist. It remains unclear whether a stable population is currently established in the region or if the records reflect only occasional introductions of isolated queens or colonies.

Given that most historical records from the Mediterranean region are from anthropogenic habitats, the species is most likely non-native on the Iberian Peninsula. However, its impact on native fauna remains unknown and its sporadic occurrence suggests a relatively low invasive potential, especially taking into account that the colonies are monogynous (Salata et al., 2021). Schembri & Collingwood (1981) noted that the species occurs in a variety of habitats in Malta, particularly in shaded areas, nesting in soil under stones, flower pots and crevices. These observations are consistent with those of Salata et al. (2021), who reported the species in Italy, Malta and Greece typically nesting in shaded locations such as walls and stones in urban areas and near beaches.

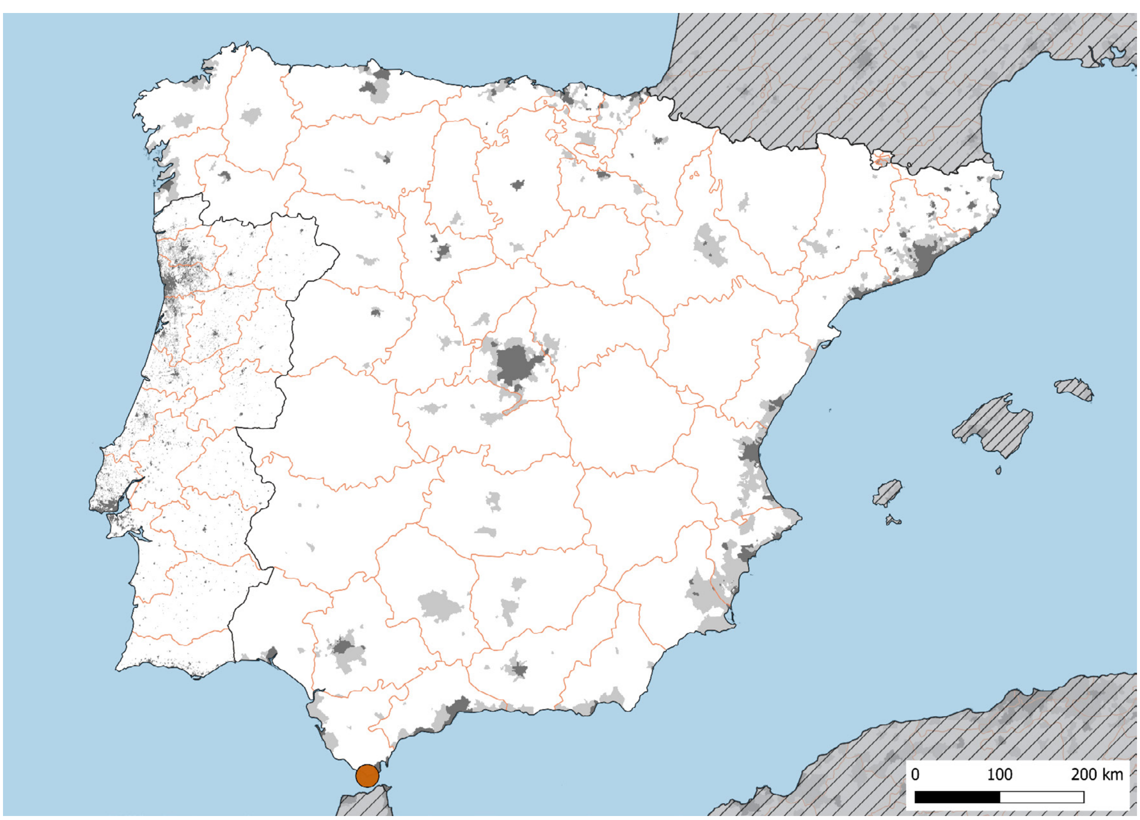


**Fig 43.** Iberian distribution of *Aphaenogaster gemella*. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). A bibliographic record and an iNaturalist observation are superimposed. Grey patches correspond to the main urban areas.

### 3. Excluded from the checklist

***Lepisiota nigra* (Dalla Torre, 1893)**

A record of *Lepisiota nigra* from Málaga appears on Antmaps.org (Janicki et al., 2016; Guénard et al., 2017), citing as its source an online forum post ("Cagniant, H. 'La myrmécofaune de Playa Bella.' www.akolab.com (2006)"). Based on this reference, it was subsequently mentioned by other authors (Espadaler et al., 2020b; Arcos & García, 2023). However, this publication appears to be unavailable or inaccessible at this time. In addition, the author himself was unaware of the record (H. Cagniant, France, personal communication, July 26, 2024), and the fact that it has not been found again, suggests that it is indeed erroneous. In addition, the Mediterranean *Lepisiota* fauna is in urgent need of taxonomic revision (Schifani et al., 2018). Therefore, we exclude *L. nigra* from the Iberian species checklist.

### 4. Data quality of the dataset and recommendations for future publications

While compiling and reviewing both historical and recent literature on non-native ants in Iberia, we observed that many records were incomplete or lacked key metadata necessary for their full scientific utility. Approximately 42% of the records did not include geographic coordinates; instead, they often provided only general locality descriptions, such as town names or park references, which offered limited spatial precision and ultimately introduced uncertainty into the databases. Additionally, 71% of the records contained approximate coordinates, and in 15% of cases, the estimated spatial error exceeded 1 km. Altitude data were primarily absent in 50% of records, and habitat information was missing in 26% of cases. Furthermore, 7% of the records listed collection dates as unknown, 69% did not specify the collector, 92% omitted the identifier, and in 74% of cases, the material examined was not stated.

Through this analysis, we highlight the importance of including complete and standardized metadata to improve traceability and the long-term value of non-native species records. To support this, we propose a recommended citation format for future records of non-native ants, based on previous consensus (Bénichou et al., 2018) and our personal experience, aimed at ensuring consistency, data quality, usability, and indexability within biodiversity databases:

Taxon; COUNTRY – examined specimens; geographic data [from largest to smallest]; coordinates; coordinates uncertainty; altitude; date; collector [followed by "leg."]; identifier [followed by "det."]; other collecting data [habitat, collection method, etc.]; additional comments on the record; specimen identifier; material depository.

Example:

*Aphaenogaster gemella*; SPAIN – 1w; Cádiz, Tarifa; 36.01439, 5.60191; 1 m; 14.8 m.a.s.l.; 11.VII.2024; M.A. Logachev leg.; M.A. Logachev det.; urban habitat; collection code ES2024MLA-380; additional ID: NNIP-PE7QYC; M.A. Logachev personal collection.

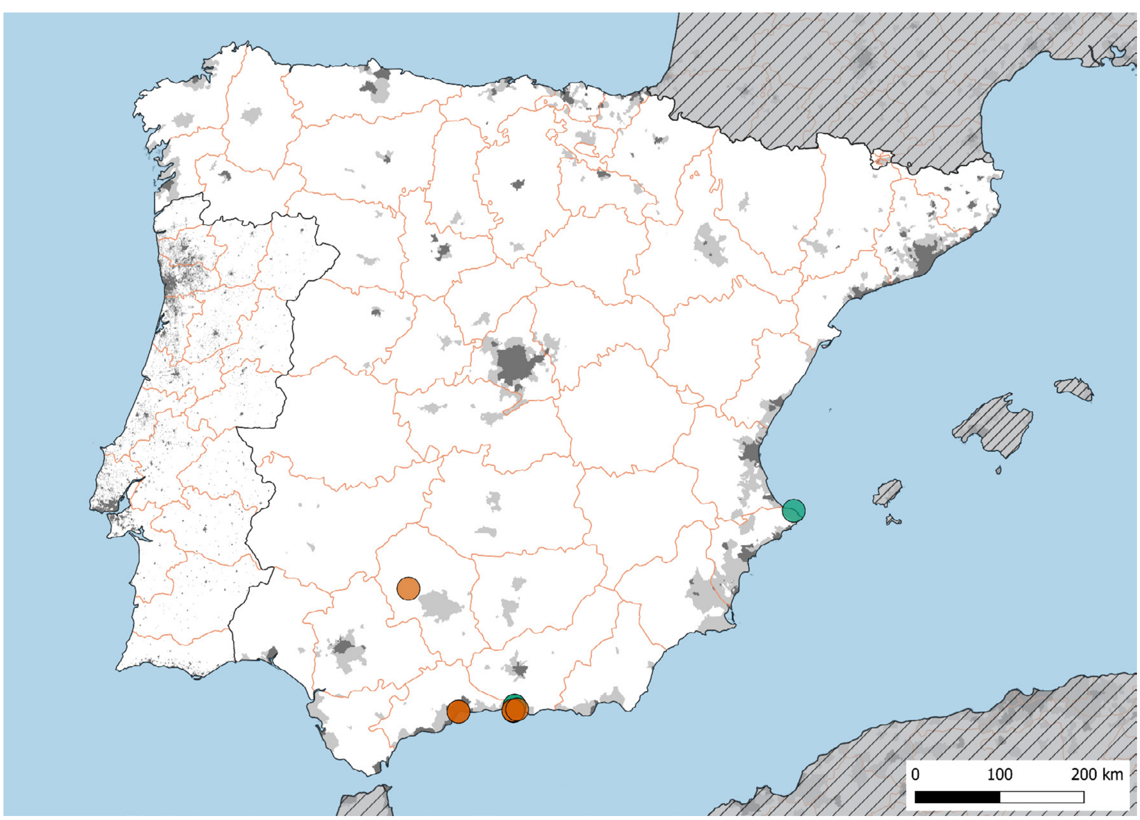


**Fig 44.** Iberian distribution of *Aphaenogaster splendida*. Source of records: bibliographic (orange circles) and citizen science platform iNaturalist (green circles). Grey patches correspond to the main urban areas.

**Discussion**

The Iberian Peninsula currently harbors 40 confirmed non-native ant species, nearly four times the 11 taxa listed in the last comprehensive review over two decades ago (Espadaler & Collingwood, 2001). Such marked growth reflects broader European trends, with previous assessments also identifying around 40 non-native species across the Mediterranean-influence area (Schifani, 2019). These species now represent approximately 13% of the known Iberian ant fauna (Arcos & García, 2023), indicating that non-native ants are no longer marginal but have become a significant component of the regional assemblage. Of these, 13 ants (32.5%) are recognised as invasive, while the invasive potential of another 16 species (40%) remains uncertain.

Most introductions are recent: 14 non-native species were first detected during the 2000s, followed by six in the 2010s and six more in the 2020s, confirming the global acceleration of ant introductions suggested by other authors (Blatrix et al., 2018; Salata et al., 2019; Schifani, 2019; Demetriou et al., 2023), likely driven by increasing global trade, urbanization, and improved detection efforts. These established taxa originate from all major biogeographic realms, though the Afrotropical region stands out as the main donor, a pattern consistent with observations across the Mediterranean Basin (Schifani, 2019). Most introductions are assumed to result from the commercial movement of ornamental plants, soil, and other horticultural products, which are repeatedly implicated as vectors in European interception records (Destout et al., 2025). However, for the Iberian Peninsula specifically, no formal studies have yet assessed the pathways of introduction for non-native ants. Furthermore, climate warming may facilitate the establishment of heat-limited species in currently inhospitable areas of Iberia, including the northern provinces and elevated interior regions, further complicating future invasion dynamics (López-Collar et al., 2024).

Spain accounts for the vast majority of non-native ant records (85%), followed by Portugal (13.2%) and Gibraltar (1.7%), with Andorra contributing marginally. Spatial distribution patterns in Iberia reveal a strong coastal bias, with nearly two-thirds of all records concentrated along a narrow arc stretching from Catalonia through València to Andalusia and southern Portugal. Five Spanish provinces, Barcelona (14.7%), Sevilla (13.0%), Cádiz (8.6%), Almería (7.6%), and Málaga (7.0%), together account for approximately 50.8% of all records. In Portugal, Lisboa (4.7%) and Faro (4.5%) make up over two-thirds of the country's total. Most of these hotspots share key features: mild Mediterranean climates, year-round tourism, irrigated urban green spaces, and access to air and sea terminals, factors that simultaneously raise introduction probabilities and boost establishment success. In contrast, much of northern Iberia and the interior provinces remain comparatively free of non-native ants, likely reflecting both climatic constraints and lower sampling intensity.

Citizen science has emerged as a useful tool with strong potential for tracking the spread of non-native ants on the Iberian Peninsula, particularly in regions with limited formal sampling. In this study, 817 expert-validated records were sourced from the iNaturalist platform, representing 49.6% of the total dataset, covering 20 non-native ant taxa and constituting the dominant source of records since 2020. Between 2020 and 2025 alone, 771 records were contributed via iNaturalist, accounting for 79.6% of all non-native ant records collected during that five-year period. These contributions were especially impactful in western Iberia; in Portugal, citizen-science observations outnumber bibliographic records by a factor of 3:1, whereas in Spain, both sources contribute almost equally. In contrast, no iNaturalist records are currently available for Andorra, where only single bibliographic records exist. In coastal Portugal and Galicia, the ratio of iNaturalist records to published occurrences reached 7:1. For example, in the districts of Lisboa and Faro, citizen scientists contributed 119 observations, compared to just 18 published records. This aligns with previous findings highlighting a significant undersampling of ant species in Portugal relative to Spain (Arcos et al., 2022). These figures highlight the growing role of public participation in early detection, monitoring of expansion fronts, and documenting urban colonization events. However, the use of citizen-generated data requires caution, as these datasets are prone to biases such as spatial clustering, seasonal oversampling, and variable taxonomic accuracy.

Regarding non-native ant diversity, *L. humile* is by far the most dominant species, accounting for almost half of the database records, followed by *C. mauritanica*, *Nylanderia* sp. (including records of *N. jaegerskioeldi*), *P. longicornis*, and *M. carbonarium* (Table 2). Species like *L. humile* are particularly overrepresented on iNaturalist, suggesting that public participation enhances the detection of conspicuous, non-cryptic species. *L. humile* is found in over 50 provinces, with Málaga, Cádiz, and Barcelona hosting the largest number of non-native species. Most non-native ants occur outdoors (70%), with 17.5% found in both environments and only 12.5% restricted to indoor habitats such as greenhouses or buildings. This suggests that most introductions are not limited to artificial environments, increasing the likelihood of naturalized populations.

Based on the total number of records, the ecological impact of non-native ants in Iberia is likely driven largely by a few introduced, outdoor-established species. *L. humile*, the Argentine ant, remains widespread in Mediterranean lowlands, with over 750 records compiled in this study. However, long-term monitoring reveals unstable dynamics, including local collapses that complicate long-term management (Gómez et al., 2003; Roura-Pascual et al., 2004). *N. jaegerskioeldi*, native to the Afrotropical region and the Middle East, has established across much of southern Iberia, particularly in irrigated urban and periurban habitats where it nests in moist soils and thrives under high temperatures and humidity. *P. longicornis*, globally distributed and associated with disturbed environments, has steadily expanded its presence in southern Iberia since its first detection in the year 2000; it is also firmly established in Barcelona, where the population has grown markedly since 2020. *B. patagonicus*, originally from South America, is rapidly spreading through southern Spain and is consistently found in synanthropic contexts, including residential gardens and building perimeters. A newer threat is *W. auropunctata*, whose occupied area in Andalusia continues to expand, and which has recently been detected for the first time in the province of Alacant (Pradera & Espadaler, 2024; Arcos et al., 2025).

However, despite the increasing number of non-native species in the region, detailed impact assessments remain largely absent for most taxa, limiting our capacity to distinguish harmless non-native species from those with subtle but significant ecological effects. Some recent efforts toward risk screening of non-native ants in Europe (i.e. Báthori et al., 2024; Schifani et al., 2024c) provide useful frameworks, but comprehensive impact studies remain scarce. These contrasting invasion trajectories highlight the need for more studies on ecological impacts, as well as for flexible management strategies that combine rapid responses to incipient foci with long-term surveillance to study non-native population dynamics. Given the ongoing and accelerating introduction of new foreign species in the region, the arrival of additional non-native ants in Iberia in the near future is highly likely. In this sense, improved bio-surveillance strategies focused on ants are strongly needed (Menchetti et al., 2024).

A striking issue in Iberian records is the quality of bibliographic data. Approximately 42% of the records lack geographic coordinates, 50% omit elevation data, and 7% provide no collection date. To address this, we stress the importance of reporting complete metadata when publishing new records and have proposed a standardised reporting template (see Results).

Finally, one limitation of our study is the lack of confirmation regarding the current status of many older records. In numerous cases, it is unknown whether the cited populations still persist or have disappeared, which may result in maps that overrepresent the current distribution by aggregating historical occurrences without population follow-up.

In sum, the Iberian Peninsula has become one of Europe's most active frontiers for the establishment of non-native ants, with rapidly growing diversity and uncertain ecological impacts. Addressing this emerging biodiversity shift will require coordinated research, improved metadata practices, and targeted management strategies. Without early detection and long-term surveillance, incipient invasions may go unnoticed until ecological disruption is widespread, and the true distribution of species may become increasingly distorted if records are not periodically updated to confirm long-term survival.

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### Authors' Contribution

J. A.: Conceptualization; methodology; investigation; resources; data curation; writing-original draft; writing-review & editing; visualization; software; formal analysis; supervision; project administration.
D.L-C.: Conceptualization; methodology; investigation; resources; data curation; writing-review & editing; visualization; supervision.
M.M.: Conceptualization; methodology; investigation; resources; data curation; writing-review & editing; visualization.
M.T.H.: Conceptualization; methodology; investigation; resources; data curation; writing-review & editing; visualization.
M.L.: Conceptualization; methodology; investigation; resources; data curation; writing-review & editing; visualization.
T.P.: Conceptualization; methodology; investigation; resources; data curation; writing-review & editing; visualization.
Á.R.: Conceptualization; methodology; investigation; resources; data curation; writing-review & editing; visualization.

### References

Abril, S. & Gómez, C. (2009). Ascertaining key factors behind the coexistence of the native ant species *Plagiolepis pygmaea* with the invasive Argentine ant *Linepithema humile* (Hymenoptera: Formicidae). Sociobiology, 53: 559-568.

Acosta, F.J. & Martínez, M.D. (1983). *Pheidole teneriffana* Forel, 1983, nueva cita para la Península Ibérica. Boletín de la Asociación Española de Entomología, 7: 320.

Agosti, D. & Collingwood, C.A. (1987). A provisional list of the Balkan ants (Hymenoptera: Formicidae) with a key to the worker caste. II. Key to the worker caste, including the European species without the Iberian. Mitteilungen der Schweizerischen Entomologischen Gesellschaft, 60: 261-293.

Aguirre, A. (1992). Los Aphidoidea de Almería (Insecta, Homoptera). Tesis doctoral, Universidad de Granada, Departamento de Biología Animal y Ecología.

Angulo, E., Caut, S. & Cerdá, X. (2011). Scavenging in Mediterranean ecosystems: effect of the invasive Argentine ant. Biological Invasions, 13: 11831194.
https://doi.org/10.1007/s10530-011-9953-6

Angulo, E., Hoffmann, B.D., Ballesteros-Mejia, L., Taheri, A., Balzani, P., Bang, A., Renault, D., Cordonnier, M., Bellard, C., Diagne, C., Ahmed, D.A., Watari, Y. & Courchamp, F. (2022). Economic costs of invasive alien ants worldwide. Biological Invasions, 24: 2041-2060.
https://doi.org/10.1007/s10530-022-02791-w

Angulo, E., Guénard, B., Balzani, P., Bang, A., Frizzi, F., Masoni, A., Abril, S., Suarez, A.V., Hoffmann, B., Benelli, G., Aonuma, H., Lach, L., Mothapo, P.N., Wossler, T. & Santini, G. (2024). The Argentine ant, *Linepithema humile*: Natural history, ecology and impact of a successful invader. Entomologia Generalis, 44: 41-61.
https://doi.org/10.1127/entomologia/2023/2187

Albert, G. & Arcos, J. (2015). Ants of Serra Gelada Natural Park and interesting records for the ants of Alicante (Hymenoptera, Formicidae). Iberomyrmex, 7: 3-6.

Arcos, J. (2021). New records of the exotic black little ant *Monomorium carbonarium* in the Iberian Peninsula and discovery of the ergatoid queen (Hymenoptera: Formicidae). Fragmenta Entomologica, 53: 69-74.
https://doi.org/10.13133/2284-4880/432

Arcos, J. & Alarcón, P. (2024). Confirmed presence of the enigmatic ant *Aphaenogaster gemella* (Hymenoptera: Formicidae) in Iberia. The Journal of Basic and Applied Zoology, 85: 21. https://doi.org/10.1186/s41936-024-00375-9

Arcos, J. & García, F. (2023). Hormigas de la península Ibérica e islas Baleares. Barcelona. 491 pp.

Arcos, J., García, F. & Ortiz de Zugasti, N. (2020). New Iberian records for the wooly ant *Tetramorium lanuginosum* Mayr, 1870 (Hymenoptera, Formicidae). Iberomyrmex, 12: 12-15.

Arcos, J., Chaves, D., Alarcón, P. & Rosado, Á. (2022). First record of *Temnothorax convexus* (Forel, 1894) in Portugal (Hymenoptera: Formicidae) with an updated checklist of the ants from the country. Sociobiology, 69: e7623.
https://doi.org/10.13102/sociobiology.v69i2.7623

Arcos, J., Amorós, E., Rosado, Á. & Alarcón, P. (2025). Beyond urban boundaries: The invasive ant *Wasmannia auropunctata* (Roger, 1863) (Hymenoptera, Formicidae) now reaching Iberian coastal habitats. Contributions to Entomology, 75: 183-189.
https://doi.org/10.3897/contrib.entomol.75.e142567

Astruc, C., Malosse, C. & Errard, C. (2001). Lack of intraspecific aggression in the ant *Tetramorium bicarinatum*: A chemical hypothesis. Journal of Chemical Ecology, 27: 1229-1248.

Aulus-Giacosa, L., Ollier, S. & Bertelsmeier, C. (2024). Non-native ants are breaking down biogeographic boundaries and homogenizing community assemblages. Nature Communications, 15: 2266.
https://www.nature.com/articles/s41467-024-46359-9

Báthori, F., Herczeg, G., Vilizzi, L., Jégh, T., Kakas, C., Petrovics, M. & Csősz, S. (2024). A survey and risk screening of non-native ant species colonising greenhouses in Hungary. Biological Invasions, 26: 1033-1044.

Bénichou, L., Gérard, I., Laureys, É. & Price, M. (2018). Consortium of European Taxonomic Facilities (CETAF) best practices in electronic publishing in taxonomy. European Journal of Taxonomy, 475: 1-37.
https://doi.org/10.5852/ejt.2018.475

Bertelsmeier, C., Avril, A., Blight, O., Confais, A., Diez, L., Jourdan, H., Orivel, J., Saint Germès, N. & Courchamp, F. (2015). Different behavioural strategies among seven highly invasive ant species. Biological Invasions, 17: 2491-2503.
https://doi.org/10.1007/s10530-015-0892-5

Billups, T.R. (1887). *Tapinoma melanocephalum*, FOR. The Entomologist, 20: 184-185.

Blatrix, R., Colin, T., Wegnez, P., Galkowski, C. & Geniez, P. (2018). Introduced ants (Hymenoptera: Formicidae) of mainland France and Belgium, with a focus on greenhouses. Annales de la Société Entomologique de France (N.S.), 54: 1-16. https://doi.org/10.1080/00379271.2018.1490927

Blight, O., Renucci, M., Tirard, A., Orgeas, J., & Provost, E. (2010). A new colony structure of the invasive Argentine ant (*Linepithema humile*) in Southern Europe. Biological Invasions, 12: 1491-1497.
https://doi.org/10.1007/s10530-009-9561-x

Blight, O., Thomas, T., Jourdan, H., Bichaton, J.Y., Colindre, L. & Galkowski, C. (2024). Detection and early impacts of France's first established population of the little fire ant, *Wasmannia auropunctata*. Biological Invasions, 26: 627-631.
https://dx.doi.org/10.1007/s10530-023-03218-w

Boer, P. (2013). Revision of the European ants of the *Aphaenogaster testaceopilosa*-group (Hym.: Formicidae). Tijdschrift voor Entomologie, 156: 57-93.

Boer, P., Noordijk, J., Heijerman, T., Verhoogt, K. & Van Vugt, R. (2018). De tweekleurige hartknoopmier, *Cardiocondyla obscurior*, in de Hortus botanicus Leiden (Hymenoptera: Formicidae). Entomologische Berichten, 78: 10-15.

Boieiro M., Espadaler, X., Azedo, A.R., Collingwood, C. & Serrano, A.R.M. (2009). One genus and three ant species new to Portugal (Hymenoptera, Formicidae). Boletín Sociedad Entomológica Aragonesa, 45: 515-517.

Bolton, B. (1979). The ant tribe Tetramoriini. The genus *Tetramorium* Mayr in the Malagasy region and the New World. Bulletin of the British Museum (Entomology) 38: 129-181.

Bolton, B. (1980). The ant tribe Tetramoriini (Hymenoptera: Formicidae). The genus *Tetramorium* Mayr in the Ethiopian zoogeographical region. Bulletin of the British Museum (Natural History), Entomology Series, 40: 193-384.

Bolton, B. (1983). The Afrotropical dacetine ants (Formicidae). Bulletin of the British Museum (Natural History). Entomology, 46: 267-416.

Bolton, B. (1987). A review of the *Solenopsis* genus-group and revision of Afrotropical Monomorium Mayr (Hymenoptera: Formicidae). Bulletin of the British Museum (Natural History). Entomology, 54: 263-452.

Bolton, B. (2000). The ant tribe Dacetini. Memoirs of the American Entomological Institute, 65: 1-1028.

Bolton, B. (2007). Taxonomy of the dolichoderine ant genus *Technomyrmex* Mayr (Hymenoptera: Formicidae) based on the worker caste. Contributions of the American Entomological Institute, 35: 1-150.

Bolton, B. & Fisher, B.L. (2011). Taxonomy of afrotropical and west palaearctic ants of the ponerine genus *Hypoponera* Santschi (Hymenoptera: Formicidae). Zootaxa, 118: 1-118.
https://doi.org/10.11646/zootaxa.2843.1.1

Booher, D.B., Gibson, J.C., Liu, C., Longino, J.T., Fisher, B.L., Janda, M., Narula, N., Toulkeridou, E., Mikheyev, A.S., Suarez, A.V. & Economo, E.P. (2021). Functional innovation promotes diversification of form in the evolution of an ultrafast trap-jaw mechanism in ants. PLoS Biology, 19: 1-22.
https://doi.org/10.1371/journal.pbio.3001031

Borowiec, L. & Salata, S. (2019). Next step in the invasion: *Trichomyrmex mayri* (Forel, 1902) new to the Philippines (Hymenoptera: Formicidae). Annals of the Upper Silesian Museum, Entomology, 28: 1-3.
https://doi.org/10.5281/zenodo.2644912

Borowiec, L. & Salata, S. (2020). Review of ants (Hymenoptera: Formicidae) from Jordan. Annals of the Upper Silesian Museum in Bytom. Entomology, 29: 1-26.
https://doi.org/10.5281/zenodo.3733156

Borowiec, L. & Salata, S. (2022). A monographic review of ants of Greece (Hymenoptera: Formicidae). Vol. 1. Introduction and review of all subfamilies except the subfamily Myrmicinae. Part 1: text. Natural History Monographs of the Upper Silesian Museum, 1: 1-775.

Brown, W.L. & Wilson, E.O. (1959). The evolution of the dacetine ants. The Quarterly Review of Biology, 34: 278-294.

Callum, S.K. & Majer, J.D. (2009). Impacts of an incursion of African big-headed ants, *Pheidole megacephala* (Fabricius), in urban bushland in Perth, Western Australia. Pacific Conservation Biology, 15: 102-115.

Casiraghi, A., Espadaler, X., Pérez-Hidalgo, N. & Gómez, K. (2020). Two additions to the Iberian myrmecofauna: *Crematogaster inermis* Mayr, 1862, a newly established, tree-nesting species, and *Trichomyrmex mayri* (Forel, 1902), an emerging exotic species temporarily nesting in Spain (Hymenoptera, Formicidae). Journal of Hymenoptera Research, 78: 57-68. https://doi.org/10.3897/jhr.78.51858

Center for International Earth Science Information Network (CIESIN) (2018). Gridded Population of the World (GPW), Version 4. Available from: https://sedac.ciesin.columbia.edu/data/collection/gpw-v4

Chang, V. & Ota, A.K. (1990). Ant control in Hawaiian drip irrigation systems. In: Vander Meer, R.K., Jaffe, K. & Cedeno, A. (Eds.), Applied myrmecology: A world perspective (pp. 708-715). Westview Press, Boulder, Colorado.

Chen S., Zhao Y., Lu Y., Rao H. & Xu Y. (2022). First record of the little fire ant, *Wasmannia auropunctata* (Hymenoptera: Formicidae), in Chinese mainland. Journal of Integrative Agriculture, 21: 1825-1829.
https://doi.org/10.1016/S2095-3119(22)63903-0

Cipollone-Pérez, A., Alarcón, P. & Vidal-Cordero, J.M. (2023). Primera cita de la especie alóctona *Brachymyrmex patagonicus* Mayr, 1868 (Hymenoptera: Formicidae) para la provincia de Sevilla (España). Boletín de la Sociedad Andaluza de Entomología, 33: 190-195.

Collingwood, C.A. (1985). Hymenoptera: Fam. Formicidae of Saudi Arabia. Fauna of Saudi Arabia, Vol. 7, pp. 230-302.

Collingwood, C. & Prince, A. (1998). A guide to ants of continental Portugal (Hymenoptera: Formicidae). Boletim da Sociedade Portuguesa de Entomologia, Suplemento 5: 1-49.

Collingwood, C.A., Tigar, B.J. & Agosti, D. (1997). Introduced ants in the United Arab Emirates. Journal of Arid Environments, 37: 505-512.

Collingwood, C.A., Pohl, H., Guesten, R., Wranik, W. & Van Harten, A. (2004). The ants (Insecta: Hymenoptera: Formicidae) of the Socotra Archipelago. Fauna of Arabia, 20: 473-495.

Comín Del Río, P. (1988). Estudio de los formícidos de Baleares: Contribución al estudio taxonómico, geográfico y biológico. Tesis Doctoral, Universidad de las Islas Baleares, Palma de Mallorca, 457 pp.

Cordonnier, M., Blight, O., Angulo, E. & Courchamp, F. (2020). The native ant *Lasius niger* can limit the access to resources of the invasive Argentine ant. Animals, 10: 2451.
https://doi.org/10.3390/ani10122451

Creighton, W.S. & Snelling, R.R. (1974). Notes on the behavior of three species of *Cardiocondyla* in the United States (Hymenoptera: Formicidae). Journal of the New York Entomological Society, 82: 82–92.

Cremer, S., Ugelvig, L.V., Lommen, S.T.E., Petersen, K.S. & Pedersen, J.S. (2006). Attack of the invasive garden ant: aggression behaviour of *Lasius neglectus* (Hymenoptera: Formicidae) against native *Lasius* species in Spain. Myrmecologische Nachrichten, 9: 13-19.

Delabie, J.H. & Blard, F. (2002). The tramp ant *Hypoponera punctatissima* (Roger) (Hymenoptera: Formicidae: Ponerinae): New records from the southern hemisphere. Neotropical Entomology, 31: 149-151.

Demetriou, J., Georgiadis, C., Roy, H., Martinou, A., Borowiec, L., & Salata, S. (2022). One of the world's worst invasive alien species *Wasmannia auropunctata* (Hymenoptera: Formicidae) detected in Cyprus. Sociobiology, 69: e8536-e8536.
https://doi.org/10.13102/sociobiology.v69i4.8536

Demetriou, J., Georgiadis, C., Koutsoukos, E., Borowiec, L. & Salata, S. (2023). Alien ants (Hymenoptera: Formicidae) on a quest to conquer Greece: A review including an updated species checklist and guidance for future research. NeoBiota, 86: 81-122. https://doi.org/10.3897/neobiota.86.98157

Destour, G., Kaufmann, B., Centanni, J., Abdelli, Z., Doums, C., Dumet, A., Gippet, J., Gomel, L., Lucas, A., Tauru, H., Vergnes, A., Blatrix, R. & Javal, M. (2025). Genetic tracing reveals the role of ornamental plant trade in the simultaneous spread of three invasive ant species in Western Europe. Peer Community Journal, 5: e67.
https://doi.org/10.24072/pcjournal.577

Deyrup, M.A. (2017). Ants of Florida: Identification and Natural History. CRC Press, 423 pp.

Deyrup, M. & Deyrup, S. (1999). Notes on the introduced ant *Quadristruma emmae* (Hymenoptera: Formicidae) in Florida. Entomological News, 110: 13-21.
https://doi.org/10.5962/bhl.part.19470

Deyrup, M., Davis, L. & Cover, S. (2000). Exotic ants in Florida. Transactions of the American Entomological Society, 126: 293-325.

Dlussky, G.M. (1994). Zoogeography of southwestern Oceania. In: Puzatchenko, Y.G., Golovatch, S.I., Dlussky, G.M., Diakonov, K.N., Zakharov, A.A. & Korganova, G.A. (Eds.), Animal populations of the islands of southwestern Oceania (ecogeographic studies). Moskva: Nauka, pp. 48-93.

Emery, C. (1893). Voyage de M. Ch. Alluaud aux îles Canaries. Formicides. Annales de la Société Entomologique de France, 62: 81-88.

Espadaler, X. (1979). Citas nuevas o interesantes de hormigas (Hymenoptera: Formicidae) para España. Boletín de la Asociación Española de Entomología, 3: 95-101.

Espadaler, X. (1999). *Lasius neglectus* Van Loon, Boomsma & Andrasfalvy, 1990 (Hymenoptera, Formicidae), a potential pest ant in Spain: nota entomológica. Orsis: Organismes i Sistemes, 14: 43-46.

Espadaler, X. (2005). *Monomorium destructor*, la hormiga de Singapur, detectada y detenida en el puerto de Barcelona (Hymenoptera, Formicidae). Orsis: Organismes i Sistemes, 20: 27-32.

Espadaler, X. & Bernal, V. (2003). Exotic ants in the Canary Islands (Hymenoptera: Formicidae). Vieraea, 31: 1-7.

Espadaler, X. & Bernal, V. (2020). *Lasius neglectus* – A polygynous, sometimes invasive, ant. CREAF. http://lasius.creaf.cat/ (accessed date: 22 July 2025).

Espadaler, X. & Castillo, A. (2014). *Monomorium carbonarium* (F. Smith) surviving indoors in NE Spain (Hymenoptera: Formicidae). Orsis: Organismes i Sistemes, 28: 149-151. https://doi.org/10.5565/rev/orsis.10

Espadaler, X. & Collingwood, C.A. (2001). Transferred ants in the Iberian Peninsula. Nouvelle Revue d'Entomologie, 17: 257-263.

Espadaler, X. & Espejo, F. (2002). *Tapinoma melanocephalum* (Fabricius, 1793), a new exotic ant in Spain (Hymenoptera: Formicidae). Orsis: Organismes i Sistemes, 17: 101-104.

Espadaler, X. & Fernández, G. (2014). *Lepisiota capensis* (Mayr, 1862), a new exotic ant (Hymenoptera, Formicidae) in La Gomera (Canary Islands). Iberomyrmex, 6: 5-8.

Espadaler, X. & Lozano, L. (2023). *Nylanderia steinheili* (Forel, 1893) otra especie exótica, no invasora, en España (Hymenoptera: Formicidae). Boletín de la Sociedad Entomológica Aragonesa, 73: 159-162.

Espadaler, X. & Ortiz de Zugasti, N. (2019). *Cardiocondyla obscurior* Wheeler, 1929 (Hymenoptera: Formicidae) in Catalonia (NE Spain), with comments on exotic ant species. Butlletí de la Institució Catalana d'Història Natural, 83: 153-156. https://doi.org/10.2436/20.1502.01.21

Espadaler, X. & Pradera, C. (2016). *Brachymyrmex patagonicus* and *Pheidole megacephala*, two new exotic ants in Spain (Hymenoptera, Formicidae). Iberomyrmex, 8: 4-10.

Espadaler, X. & Ramos, J. (2022). *Trichomyrmex mayri* (Forel, 1902) nidificando en España (Hymenoptera: Formicidae). Boletín de la Sociedad Andaluza de Entomología, 32: 117-122.

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

Espadaler, X. & Vila, R. (2025). *Pheidole rosae* Forel, 1901 crosses the Atlantic: A third exotic *Pheidole* in Barcelona, Spain (Hymenoptera: Formicidae). Butlletí de la Institució Catalana d'Història Natural, 89: 3-7. https://doi.org/10.2436/20.1502.01.196

Espadaler, X., Rey, S. & Bernal, V. (2004). Queen number in a supercolony of the invasive garden ant, *Lasius neglectus*. Insectes Sociaux, 51: 232-238.

Espadaler, X., Pradera, C. & Santana, J.A. (2018). The first outdoor-nesting population of *Wasmannia auropunctata* in continental Europe (Hymenoptera, Formicidae). Iberomyrmex, 10: 5-7.

Espadaler, X., Pradera, C., Santana, J.A. & Ríos Reyes, A. (2020). Dos nuevas poblaciones europeas de la pequeña hormiga de fuego, *Wasmannia auropunctata* (Roger, 1863) (Hymenoptera: Formicidae) en Andalucía (España). Boletín de la Sociedad Andaluza de Entomología, 30: 189-192.

Espadaler, X., Pradera, C. & Vila, R. (2020). *Lepisiota melas* (Emery), una hormiga exótica más para la península ibérica y dos adiciones a las hormigas de Cataluña (Hymenoptera, Formicidae). Iberomyrmex, 12: 16-25.

Espadaler, X., Pradera, C. & Estrada, V. (2024). Segunda cita de la especie exótica *Pheidole megacephala* (Fabricius, 1793) (Hymenoptera, Formicidae) en la España peninsular. Boletín de la Asociación Española de Entomología, 48: 309-312. https://doi.org/10.70186/baeeVLAJ7145

Espadaler, X., Pradera, C. & Martín-Arroyo Camacho, J.J. (2025). Una segunda población para *Lepisiota capensis* (Mayr, 1862) (Hymenoptera: Formicidae) en Cádiz (España). Boletín de la Sociedad Andaluza de Entomología, 35: 000-000.

European Parliament and Council of the European Union. (2014). Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. Official Journal of the European Union, L 317: 35-55.

Eyer, P.A., Espinoza, E.M., Blumenfeld, A.J. & Vargo, E.L. (2020). The underdog invader: Breeding system and colony genetic structure of the dark rover ant (*Brachymyrmex patagonicus* Mayr). Ecology and Evolution, 10: 493-505. https://doi.org/10.1002/ece3.5917

Eyer, P.A., Shults, P.T., Chura, M.R., Moran, M.N., Thompson, M.N., Helms, A.M., Saran, R.K. & Vargo, E.L. (2021). Divide and conquer: Multicolonial structure, nestmate recognition, and antagonistic behaviors in dense populations of the invasive ant *Brachymyrmex patagonicus*. Ecology and Evolution, 11: 4874-4886. https://doi.org/10.1002/ece3.7396

FAO (2018). Invasive ants as a biosecurity threat. http://www.fao.org/publications/card/es/c/I8939EN/

Fisher, B.L. & Bolton, B. (2016). Ants of Africa and Madagascar. A guide to the genera. Berkeley, CA: University of California Press.

Fischer, G. & Fisher, B.L. (2013). A revision of *Pheidole* Westwood (Hymenoptera: Formicidae) in the islands of the Southwest Indian Ocean and designation of a neotype for the invasive *Pheidole megacephala*. Zootaxa, 3683: 301-356. https://doi.org/10.11646/zootaxa.3683.4.1

Fournier, D., De Biseau, J.C. & Aron, S. (2009). Genetics, behaviour and chemical recognition of the invading ant *Pheidole megacephala*. Molecular Ecology, 18: 186-199. https://doi.org/10.1111/j.1365-294X.2008.04018.x

Fowler, H.G., Bueno, O.C., Sadatsune, T. & Montelli, A.C. (1993). Ants as potential vectors of pathogens in Brazilian hospitals in the State of São Paulo. Insect Science and its Application, 14: 367-370.

Frumhoff, P.C. & Ward, P.S. (1992). Individual-level selection, colony-level selection, and the association between polygyny and worker monomorphism in ants. The American Naturalist, 139: 559-590.

Galkowski, C. (2008). Quelques fourmis nouvelles ou intéressantes pour la faune de France (Hymenoptera, Formicidae). Bulletin de la Société linnéenne de Bordeaux, 143: 423-433.

Giraud, T., Pedersen, J. S. & Keller, L. (2002). Evolution of supercolonies: the Argentine ants of southern Europe. Proceedings of the National Academy of Sciences, 99: 6075-6079.

Global Invasive Species Database (2025). Species profile: *Linepithema humile*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=127 on 21 July 2025.

Gómez, K. (2017). Two species of exotic ants (Hymenoptera: Formicidae) new to Malta. Boletín de la Sociedad Entomológica Aragonesa, 61: 233-235.

Gómez, K. & Espadaler, X. (2006). Exotic ants (Hymenoptera: Formicidae) in the Balearic Islands. Myrmecologische Nachrichten, 8: 225-233.

Gómez, C., Pons, P. & Bas, J.M. (2003). Effects of the Argentine ant *Linepithema humile* on seed dispersal and seedling emergence of Rhamnus alaternus. Ecography, 26: 532-538. https://doi.org/10.1034/j.1600-0587.2003.03484.x

Gómez, K., Espadaler, X., Martínez-Ferrer, M.T. & Campos-Rivela, J.M. (2024). *Monomorium monomorium* Bolton, 1987 in Spain (Hymenoptera: Formicidae). Butlletí de la Institució Catalana d'Història Natural, 88: 101-103. https://doi.org/10.2436/20.1502.01.181

Gray, K.J., Porter, C., Hawkey, P.M., Compton, S.G. & Edwards, J.P. (1995). Roger's ants: a new pest in hospitals. BMJ: British Medical Journal, 311: 129.

Gruber, M.A., Santoro, D., Cooling, M., Lester, P.J., Hoffmann, B.D., Boser, C. & Lach, L. (2022). A global review of socioeconomic and environmental impacts of ants reveals new insights for risk assessment. Ecological Applications, 32: e2577. https://doi.org/10.1002/eap.2577

Guénard, B., Weiser, M., Gomez, K., Narula, N. & Economo, E.P. (2017). The Global Ant Biodiversity Informatics (GABI) database: a synthesis of ant species geographic distributions. Myrmecological News, 24: 83-89. https://doi.org/10.25849/myrmecol.news_024:083

Guénard, B. (2018). First record of the emerging global pest *Brachymyrmex patagonicus* Mayr 1868 (Hymenoptera: Formicidae) from continental Asia. Asian Myrmecology, 10: 1-6. https://doi.org/10.20362/am.010012

Guillem, R. & Bensusan, K. (2008). *Technomyrmex vexatus* (Santschi, 1919) from Gibraltar (Hymenoptera: Formicidae): a new ant species for Europe and genus for Iberia. Myrmecological News, 11: 21-23. https://doi.org/10.25849/myrmecol.news_011:021

Guillem, R. & Bensusan, K. (2019). First record of *Technomyrmex vexatus* for Spain (Formicidae: Dolichoderinae). Iberomyrmex, 11: 16-17.

Guillem, R. & Bensusan, K. (2022). Three new exotic species of ants (Hymenoptera: Formicidae) for Madeira, with comments on its myrmecofauna. Journal of Hymenoptera Research, 91: 321-333. https://doi.org/10.3897/jhr.91.81624

Guillem, R., Bensusan, K., Torres, J.L. & Perez, C.H. (2009). The genus *Pyramica* Roger, 1862 (Hymenoptera: Formicidae) in Cádiz province (southern Spain), with a description of methods for their capture. Boletín de la Asociación española de Entomología, 33: 461-468.

Hamecha, L., Mairif, M., Taheri, A., Messaoud, Y. & Djetti, T. (2025). A new genus and species from Algeria: the trap-jaw ant *Anochetus ghilianii* (Hymenoptera, Formicidae). Arxius de Miscel·lània Zoològica, 23: 63-67. https://doi.org/10.32800/amz.2025.23.0063

Heinze, J., Kühnholz, S., Schilder, K. & Hölldobler, B. (1993). Behavior of ergatoid males in the ant, *Cardiocondyla nuda*. Insectes Sociaux, 40: 273-282. https://doi.org/10.1007/BF01242363

Heinze, J., Cremer, S., Eckl, N. & Schrempf, E. (2006). Stealthy invaders: the biology of *Cardiocondyla* tramp ants. Insectes Sociaux, 53: 1-7. https://doi.org/10.1007/s00040-005-0847-4

Hernández-Teixidor, D., Pérez-Delgado, A.J., Suárez, D. & Reyes-López, J. (2020). Six new non-native ants (Formicidae) in the Canary Islands and their possible impacts. Journal of Applied Entomology, 6: 1-8. https://doi.org/10.1111/jen.12751

Heterick, B.E., Casella, J. & Majer, J.D. (2000). Influence of Argentine and coastal brown ant (Hymenoptera: Formicidae) invasions on ant communities in Perth gardens, Western Australia. Urban Ecosystems, 4: 277-292. https://doi.org/10.1023/A:1015703815207

Hita Garcia, F. & Fisher, B.L. (2011). The ant genus *Tetramorium* Mayr (Hymenoptera: Formicidae) in the Malagasy region-introduction, definition of species groups, and revision of the *T. bicarinatum*, *T. obesum*, *T. sericeiventre* and *T. tosii* species groups. Zootaxa, 3039: 1-72. https://doi.org/10.11646/zootaxa.3039.1.1

Hoffmann, B.D. (1998). The big-headed ant *Pheidole megacephala*: a new threat to monsoonal northwestern Australia. Pacific Conservation Biology, 4: 250-255. https://doi.org/10.1071/PC980250

Hoffmann, B.D., Andersen, A.N. & Hill, G.J. (1999). Impact of an introduced ant on native rainforest invertebrates: *Pheidole megacephala* in monsoonal Australia. Oecologia, 120: 595-604. https://doi.org/10.1007/PL00008824

Hölldobler, B. & Wilson, E.O. (1990). The ants. Harvard University Press, Cambridge, MA.

Holway, D.A., Lach, L., Suarez, A.V., Tsutsui, N.D. & Case, T.J. (2002). The causes and consequences of ant invasions. Annual Review of Ecology and Systematics, 33: 181-233. https://doi.org/10.1146/annurev.ecolsys.33.010802.150444

Jackson, D.E. & Châline, N. (2007). Modulation of pheromone trail strength with food quality in Pharaoh's ant, *Monomorium pharaonis*. Animal Behaviour, 74: 463-470. https://doi.org/10.1016/j.anbehav.2006.11.027

Jameson, G.D. (1932). An experiment to exterminate bugs from infested buildings. Journal of the Royal Army Medical Corps, 60: 138-139.

Janicki, J., Narula, N., Ziegler, M., Guénard, B. & Economo, E.P. (2016). Visualizing and interacting with large-volume biodiversity data using client-server web-mapping applications: the design and implementation of antmaps.org. Ecological Informatics, 32: 185-193. https://doi.org/10.1016/j.ecoinf.2016.02.006

Jeanson, R., Ratnieks, F.L. & Deneubourg, J.L. (2003). Pheromone trail decay rates on different substrates in the Pharaoh's ant, *Monomorium pharaonis*. Physiological Entomology, 28: 192-198. https://doi.org/10.1046/j.1365-3032.2003.00332.x

Jowers, M.J., Taheri, A. & Reyes-López, J. (2015). The ant *Anochetus ghilianii* (Hymenoptera: Formicidae), not a Tertiary relict, but an Iberian introduction from North Africa: Evidence from mtDNA analyses. Systematics and Biodiversity, 13: 545-554. https://doi.org/10.1080/14772000.2015.1047889

Kallal, B. & LaPolla, J.S. (2012). Monograph of *Nylanderia* (Hymenoptera: Formicidae) of the world. Part II: Nylanderia in the Nearctic. Zootaxa, 3508: 1-64. https://doi.org/10.11646/zootaxa.3508.1.1

Keefer, T.C. (2016). Biology, diet preferences, and control of the dark rover ant *Brachymyrmex patagonicus* (Hymenoptera: Formicidae) in Texas. Doctoral dissertation, Texas A&M University.

Klimeš, P. & Okrouhlík, J. (2015). Invasive ant *Tapinoma melanocephalum* (Hymenoptera: Formicidae): a rare guest or increasingly common indoor pest in Europe. European Journal of Entomology, 112: 705-712. https://doi.org/10.14411/eje.2015.089

Lach, L., Volp, T.M., Greenwood, T.A. & Rose, A. (2016). High invasive ant activity drives predation of a native butterfly larva. Biotropica, 48: 146-149. https://doi.org/10.1111/btp.12284

LaPolla, J.S., Hawkes, P. G. & Fisher, B. L. (2011). Monograph of *Nylanderia* (Hymenoptera: Formicidae) of the world, part I: *Nylanderia* in the Afrotropics. Zootaxa, 3110: 10-36. https://doi.org/10.11646/zootaxa.3110.1.2

LaPolla, J.S. & Fisher, B.L. (2014). Then there were five: a reexamination of the ant genus *Paratrechina* (Hymenoptera: Formicidae). ZooKeys, 422: 35. https://doi.org/10.3897/zookeys.422.7779

LaPolla, J.S. & Kallal, R.J. (2019). *Nylanderia* of the world. Part III: *Nylanderia* in the West Indies. Zootaxa, 4658: 401-451. https://doi.org/10.11646/zootaxa.4658.3.1

Loiseau, A., Kergoat, G. J., Blight, O., Demetriou, J., Espadaler, X., Benoit, L., Calcaterra, L. A, Chifflet, L., Jourdan, H., Menchetti, M., Facon, B. & Foucaud, J. (2025). Newcomers and Old Friends: Long-Distance and Bridgehead Introductions Both Contribute to the Recent Invasion of the Little Fire Ant in Southern Europe. Diversity and Distributions, 31: e70051. https://doi.org/10.1111/ddi.70051

Longino, J.T. & Fernández, F. (2007). Taxonomic review of the genus *Wasmannia* (pp. 271-289). In Snelling, R.R., Fisher, B.L. & Ward, P.S. (Eds.), Advances in ant systematics: Homage to E.O. Wilson – 50 years of contributions. Memoirs of the American Entomological Institute, 80: 690 pp.

López-Collar, D., Cabrero-Sañudo, F.J. (2021). Update on the invasion status of the Argentine ant, *Linepithema humile* (Mayr, 1868), in Madrid, a large city in the interior of the Iberian Peninsula. Journal of Hymenoptera Research, 85: 161-77. https://doi.org/10.3897/jhr.85.65725

López-Collar, D., Cabrero-Sañudo, F.J. & Gil-Tapetado, D. (2024). The urban island: climatic suitability of *Linepithema humile* (Hymenoptera: Formicidae) and the role of cities in the invasion of the Western Palearctic. Integrative Zoology. https://doi.org/10.1111/1749-4877.12903

Lowe, S., Browne, M., Boudjelas, S. & De Poorter, M. (2000). 100 of the world's worst invasive species. Aliens, 12: 1-12.

Luna-Santamaría, J., Miralles-Nuñez, A., Sánchez, I. & Vidal-Cordero, J.M. (2022). Nuevos registros de la hormiga exótica invasora *Paratrechina longicornis* (Latreille, 1802) (Hym.: Formicidae) en España. Boletín de la Sociedad Andaluza de Entomología, 32: 126-132.

MacGown, J., Hill, J. & Deyrup, M. (2007). *Brachymyrmex patagonicus* (Hymenoptera: Formicidae), an emerging pest species in the Southeastern United States. Florida Entomologist, 90: 457-464. https://doi.org/10.1653/0015-4040(2007)90[457:BPHFAE]2.0.CO;2

MacGown, J.A., Wetterer, J.K. & Hill, J.G. (2012). Geographic spread of *Strumigenys silvestrii* (Hymenoptera: Formicidae: Dacetini). Terrestrial Arthropod Reviews, 5: 213-222. https://doi.org/10.1163/18749836-05031051

Mackay, W.P. (2000). A review of the New World ants of the subgenus Myrafant (genus *Leptothorax*) (Hymenoptera: Formicidae). Sociobiology, 36: 265-444.

Majer, J.D. & Heterick, B.E. (2015). Invasive ants on the Australian mainland: the other 24 species. Anais XXII Simpósio de Mirmecologia: An International Meeting, Ilhéus, Brazil.

Martínez, M.J. (1992). A new ant introduction for North America: *Pheidole tenerifana* (Forel) (Hymenoptera: Formicidae). Pan-Pacific Entomologist, 68: 153-154.

Martínez, J.A.F. & Luque, F.R. (2017). Nueva cita de *Lepisiota frauenfeldi* Mayr, 1855 (Hymenoptera: Formicidae) en la provincia de Almería, España. Boletín de la Sociedad Andaluza de Entomología, 27: 98-102.

Martínez, E.M.V., Martín, A.S., & Míguez, M.P. (2024). *Tapinoma melanocephalum* (Fabricius, 1793) (Hymenoptera: Formicidae). Primera cita para la provincia de Asturias (España). Iberomyrmex, 13: 7-9.

Martínez Ibáñez, M.D. & Martínez de Murguía, L. (2011). Cita nueva de la hormiga exótica *Hypoponera punctatissima* (Roger, 1859) (Hymenoptera: Formicidae: Ponerinae) en la Península Ibérica y su importancia médica. Heteropterus Revista de Entomología, 11: 157-160.

Martínez Ibáñez, M.D., Tinaut Ranera, J. A., & Ruano Díaz, F. (2007). El género *Paratrechina* Motschoulsky, 1863, en España (Hymenoptera, Formicidae). Boletín de la Asociación Española de Entomología, 31: 93-100.

Medina, M. (1891). Catálogo provisional de las hormigas de Andalucía. Anales de la Sociedad Española de Historia Natural, 20: 95-104.

Menchetti, M., Schifani, E., Gentile, V. & Vila, R. (2022). The worrying arrival of the invasive Asian needle ant *Brachyponera chinensis* in Europe (Hymenoptera: Formicidae). Zootaxa, 5115: 146-150. https://doi.org/10.11646/zootaxa.5115.1.10

Menchetti, M., Schifani, E., Alicata, A., Cardador, L., Sbrega, E., Toro-Delgado, E. & Vila, R. (2023). The invasive ant Solenopsis invicta is established in Europe. Current Biology, *33*: R896-R897. https://doi.org/10.1016/j.cub.2023.07.036

Menchetti, M., Schifani, E., Alicata, A., Cardador, L., Sbrega, E., Toro-Delgado, E. & Vila, R. (2024). Response to Genovesi et al.: Ant biosurveillance should come before invasion. Current Biology, 34: R51-R52. https://doi.org/10.1016/j.cub.2023.11.055

Moreira, D., Morais, V.D., Vieira-da-Motta, O., Campos-Farinha, A.E.C. & Tonhasca, A. (2005). Ants as carriers of antibiotic-resistant bacteria in hospitals. Neotropical Entomology, 34: 999-1006. https://doi.org/10.1590/S1519-566X2005000600017

Moss, A.D., Swallow, J.G. & Greene, M.J. (2022). Always under foot: *Tetramorium immigrans*, a review. Myrmecological News, 32: 75-92. https://doi.org/10.25849/myrmecol.news_032:075

Nafus, D.M. (1993). Movement of introduced biological control agents onto nontarget butterflies, *Hypolimnas* spp. (Lepidoptera: Nymphalidae). Environmental Entomology, 22: 265-272. https://doi.org/10.1093/ee/22.2.265

Natural Earth (2022). Free vector and raster map data. Available from: https://www.naturalearthdata.com

Naves, M.A. (1985). A monograph of the genus *Pheidole* in Florida, USA (Hym.: Formicidae). Insecta Mundi, 1: 53-90.

Obregón-Romero, R. & Reyes López, J.L. (2012). Nuevas aportaciones sobre hormigas exóticas para Portugal continental (Hymenoptera: Formicidae). Boletín de la Asociación Española de Entomología, 36: 279-284.

Ordóñez-Urbano, C., Reyes-López, J., & Carpintero-Ortega, S. (2008). ¿Una especie alóctona puede ser "rara"? El caso de *Pyramica membranifera* (Hymenoptera, Formicidae). Boletín de la Sociedad Entomológica Aragonesa, 42: 321-323.

Ortiz, F.J. & Tinaut, A. (1988). Formícidos del litoral granadino. Orsis: Organismes i Sistemes, 3: 145-163.

Ortiz-Sepulveda, C.M., Van Bocxlaer, B., Meneses, A.D. & Fernandez, F. (2019). Molecular and morphological recognition of species boundaries in the neglected ant genus *Brachymyrmex* (Hymenoptera: Formicidae): toward a taxonomic revision. Organisms Diversity & Evolution, 19: 447-542.

Osborne, L.S., Peña, J.E. & Oi, D.H. (1995). Predation by *Tapinoma melanocephalum* (Hymenoptera: Formicidae) on two spotted spider mites (Acari: Tetranychidae) in Florida greenhouses. Florida Entomologist, 78: 565-570.

Paris, C.I. & Espadaler, X. (2009). Honeydew collection by the invasive garden ant *Lasius neglectus* versus the native ant *L. grandis*. Arthropod-Plant Interactions, 3: 75-85.

Pérez-Delgado, A.J., Santos-Perdomo, I., Jiménez-García, E., Lugo, D., & Suárez, D. (2025). Is the spread of *Wasmannia auropunctata* (Hymenoptera, Formicidae) through the western Palearctic inevitable? First evidence of presence in the Canary Islands. Journal of Hymenoptera Research, 98: 419-433. https://doi.org/10.3897/jhr.98.144997

Pinto, T. (2023). *Tapinoma melanocephalum* (Fabricius, 1793) (Hymenoptera: Formicidae: Dolichoderinae), new to Portugal. Boletín de la Sociedad Entomológica Aragonesa, 73: 141-142.

Pradera, C. (2021). Detectada una infestación de Hormiga de Singapur, *Trichomyrmex* (= *Monomorium*) *destructor* (Hym., Formicidae), en interiores en Marbella. https://desinsectador.com/2021/03/07/detectada-una-infestacion-de-hormiga-de-singapur-trichomyrmex-monomorium-destructor-hynenoptera-formicidae-en-interiores-en-marbella/. (accessed: 22 July 2025).

Pradera, C. & Espadaler, X. (2024). Impacto de la hormiga invasora *Wasmannia auropunctata* en la mirmecofauna local (Hymenoptera, Formicidae), seguimiento del área ocupada y una nueva población en España. Boletín de la Asociación Española de Entomología, 48: 1-9. https://doi.org/10.70186/baeeZTOI5976

Pradera, C. & Espadaler, X. (2025a). Expansión de la hormiga invasora *Wasmannia auropunctata* (Roger, 1863)(Hymenoptera, Formicidae) en la provincia de Málaga (España). Boletín de la Asociación Española de Entomología, 49: 155-157. https://doi.org/10.70186/baeeRSXX4253

Pradera, C. & Espadaler, X. (2025b). Picaduras producidas por H*ypoponera punctatissima* (Roger, 1859) (Hymenoptera:

Formicidae) en España. Boletín de la Sociedad Andaluza de Entomología, 35: 1-9.

Prieto-Lillo, E., Vila, R., Espadaler, X., Delacour, S. & Fernández, G. (2024). Detección de *Paratrechina longicornis* (Latreille, 1802) (Hymenoptera, Formicidae) en Valencia (España). Zoolentia, 4: 49-57. https://doi.org/10.5281/zenodo.14246238

QGIS Development Team (2022). QGIS Geographic Information System. Version 3.22.2. Available from: https://www.qgis.org

Reyes-López, J.L. (2019). Confirmation of the presence of *Trichomyrmex* (= *Monomorium*) *destructor* (Hym., Formicidae) in the Iberian Peninsula. Boletín de la Sociedad Andaluza de Entomología, 29: 227-229.

Reyes-López, J.L. & Carpintero, S. (2014). Comparison of the exotic and native ant communities (Hymenoptera: Formicidae) in urban green areas at inland, coastal and insular sites in Spain. European Journal of Entomology, 111: 421-428. https://doi.org/10.14411/eje.2014.044

Reyes-López, J.L. & Espadaler, X. (2005). Tres nuevas especies foráneas de hormigas para la Península Ibérica (Hymenoptera: Formicidae). Boletín de la Sociedad Entomológica Aragonesa, 36: 263-265.

Reyes-López, J. & Obregón, R. (2018). Redescubrimiento de *Tetramorium bicarinatum* (Nylander, 1846) (Hymenoptera, Formicidae) en la ciudad de Córdoba. ¿Refugios tropicales privados? Boletín de la Sociedad Andaluza de Entomología, 28: 143-144.

Reyes-López, J.L. & Rodríguez-Reyes, M. (2022). An unstoppable process: the first record of *Pheidole* cfr *navigans* Forel, 1901 (Hymenoptera, Formicidae) for continental Spain (Southern Europe). Boletín de la Asociación Española de Entomología, 46: 147-149. https://doi.org/10.70186/baeeYVFH2901

Reyes-López, J.L. & Taheri, A. (2018). First checklist of ants (Hymenoptera, Formicidae) of urban green areas in Cádiz (Andalusia, Spain). Boletín de la Asociación Española de Entomología, 42: 217–223.

Reyes-López, J.L., Ordoñez-Urbano, C. & Carpintero-Ortega, S. (2008). Relación actualizada de las hormigas alóctonas de Andalucía (Sur de España). Boletín de la Asociación Española de Entomología, 32: 81-94.

Reyes-López, J.L., Rodríguez-Reyes, M., Marín Herrera, J. & Reyes Fernández, A. (2021). Nuevos registros de la especie alóctona *Brachymyrmex patagonicus* cfr en Andalucía (España). Boletín de la Sociedad Andaluza de Entomología, 31: 172-174.

Reyes-López, J.L., Rodríguez-Reyes, M., Andreu, M.G. & Sánchez, R.V. (2024). Nueva cita de *Brachymyrmex patagonicus* Mayr, 1868 (Hymenoptera: Formicidae) en la península ibérica: ahora Cádiz (Andalucía, Sur de España). Boletín de la Sociedad Andaluza de Entomología, 34: 111-116.

Reyes-López, J.L., Rodríguez-Reyes, M. & Alarcón, P. (2025). Una nueva especie de hormiga exótica (Hymenoptera: Formicidae) para España y Europa continental: *Lepisiota capensis* (Mayr, 1862). Boletín de la Sociedad Andaluza de Entomología, 35: online first.

Rodríguez, A. (1982). Contribución al conocimiento de las hormigas (Hymenoptera, Formicidae) de Sierra Morena Central. Boletín de la Asociación Española de Entomología, 5: 181-188.

Roger, J. (1862). Beiträge zur Kenntniss der Ameisenfauna der Mittelmeerländer. II. Berliner Entomologische Zeitschrift, 6: 255-262. https://doi.org/10.5281/zenodo.25620

Rosado, Á. (in prep.) Nuevos datos para la mirmecofauna (Hymenoptera: Formicidae) de Aragón (NE España).

Rosselli, D. & Wetterer, J.K. (2017). Stings of the ant *Wasmannia auropunctata* (Hymenoptera: Formicidae) as cause of punctate corneal lesions in humans and other animals. Journal of Medical Entomology, 54: 1783-1785. https://doi.org/10.1093/jme/tjx167

Roura-Pascual, N., Suarez, A.V., Gómez, C., Pons, P., Touyama, Y., Wild, A.L. & Peterson, A.T. (2004). Geographical potential of Argentine ants (*Linepithema humile* Mayr) in the face of global climate change. Proceedings of the Royal Society of London. Series B: Biological Sciences, 271: 2527-2535. https://doi.org/10.1098/rspb.2004.2898

Salata, S., Rutkowski, T. & Borowiec, L. (2018). First record of *Nylanderia jaegerskioeldi* (Mayr, 1904) (Hymenoptera: Formicidae) from Central Europe. Rocznik Muzeum Górnośląskiego w Bytomiu Przyroda, 24: 1-5. https://doi.org/10.5281/zenodo.1564764

Salata, S., Georgiadis, C. & Borowiec, L. (2019). Invasive ant species (Hymenoptera: Formicidae) of Greece and Cyprus. North-Western Journal of Zoology 15: 13–23.

Salata, S., Karaman, C., Kiran, K. & Borowiec, L. (2021). Review of the *Aphaenogaster splendida* species-group (Hymenoptera: Formicidae). Annales Zoologici (Warsaw), 71: 297-343. https://doi.org/10.3161/00034541ANZ2021.71.2.00

Sánchez-García, D. & Espadaler, X. (2015). *Cardiocondyla obscurior* Wheeler, 1929 (Hymenoptera: Formicidae) en España. Iberomyrmex, 7: 7-9.

Santschi, F. (1925). Fourmis d'Espagne et autres espèces paléartiques. EOS (Revista Española de Entomología), 1: 339-360. https://doi.org/10.5281/zenodo.14443

Sarnat, E.M., Fischer, G., Guénard, B. & Economo, E.P. (2015). Introduced Pheidole of the world: taxonomy, biology and distribution. ZooKeys, 109: 1-109. https://doi.org/10.3897/zookeys.543.6050

Saunders, E. (1888). On a collection of Ants from Gibraltar and Tangier. Entomologists' Monthly Magazine, 25: 17.

Schembri, S.P. & Collingwood, C.A. (1981). A revision of the myrmecofauna of the Maltese Islands (Hymenoptera, Formicidae). Annali del Museo Civico di Storia Naturale “Giacomo Doria”, 83: 417-442. https://doi.org/10.5281/zenodo.24597

Schifani, E. (2019). Exotic ants (Hymenoptera, Formicidae) invading Mediterranean Europe: A brief summary over about 200 years of documented introductions. Sociobiology, 66: 198-208. https://doi.org/10.13102/sociobiology.v66i2.4331

Schifani, E. & Alicata, A. (2018). Exploring the myrmecofauna of Sicily: thirty-two new ant species recorded, including six new to Italy and many new aliens (Hymenoptera, Formicidae). Polish Journal of Entomology, 87: 323-348. https://doi.org/10.2478/pjen-2018-0023

Schifani, E., Gentile, V., Scupola, A. & Espadaler, X. (2018). Yet another alien: a second species of *Lepisiota* spreading across the Canary Islands, Spain (Hymenoptera: Formicidae). Fragmenta Entomologica, 50: 61-64. https://doi.org/10.4081/fe.2018.287

Schifani, E., Alicata, A., Menchetti, M., Borowiec, L., Fisher, B.L., Karaman, C., Kiran, K., Oueslati, W., Salata, S. & Blatrix, R. (2022). Revisiting the morphological species groups of West-Palearctic *Aphaenogaster* ants (Hymenoptera: Formicidae) under a phylogenetic perspective: toward an evolutionary classification. Arthropod Systematics and Phylogeny, 80: 627-648. https://doi.org/10.3897/asp.80.e84428

Schifani, E., Pezzin, A., Castracani, C. & Grasso, D.A. (2024a). First record of the exotic ant *Hypoponera ergatandria* in Italy: Indoor alate swarms and stinging queens. Sociobiology, 71: e10091. https://doi.org/10.13102/sociobiology.v71i1.10091

Schifani, E., Grunicke, D., Montechiarini, A., Pradera, C., Vila, R. & Menchetti, M. (2024b). Alien ants spreading through Europe: *Brachyponera chinensis* and *Nylanderia vividula* in Italy. Biodiversity Data Journal, 12: e123502. https://doi.org/10.3897/BDJ.12.e123502

Schifani, E., Giannetto, D. & Vilizzi, L. (2024c). Invasion risk of established and horizon non-native ants in the Mediterranean: A screening for Italy. Insects, 15: 875. https://doi.org/10.3390/insects15110875

Schultz, R. & Seifert, B. (2005). *Lasius neglectus* (Hymenoptera: Formicidae) – a widely distributed tramp species in Central Asia. Myrmecologische Nachrichten, 7: 47-50. https://doi.org/10.25849/myrmecol.news_007:047

Seebens, H., Blackburn, T.M., Dyer, E.E., Genovesi, P., Hulme, P.E., Jeschke, J.M., Pagad, S., Pyšek, P., Winter, M., Arianoutsou, M., Bacher, S., Blasius, B., Brundu, G., Capinha, C., Celesti-Grapow, L., Dawson, W., Dullinger, S., Fuentes, N., Jäger, H., Kartesz, J., Kenis, M., Kreft, H., Kühn, I., Lenzner, B., Liebhold, A., Mosena, A., Moser, D., Nishino, M., Pearman, D., Pergl, J., Rabitsch, W., Rojas-Sandoval, J., Roques, A., Rorke, S., Rossinelli, S., Roy, H.E., Scalera, R., Schindler, S., Štajerová, K., Tokarska-Guzik, B., van Kleunen, M., Walker, K., Weigelt, P., Yamanaka, T. & Essl, F. (2017). No saturation in the accumulation of alien species worldwide. Nature Communications, 8: 14435. https://doi.org/10.1038/ncomms14435

Seifert, B. (2003a). *Hypoponera punctatissima* (Roger) and H. schauinslandi (Emery) – two morphologically and biologically distinct species (Hymenoptera: Formicidae). Abhandlungen und Berichte des Naturkundemuseums Görlitz, 75: 61-81.

Seifert, B. (2003b). The ant genus *Cardiocondyla* (Insecta: Hymenoptera: Formicidae) – a taxonomic revision of the *C. elegans*, *C. bulgarica*, *C. batesii*, *C. nuda*, *C. shuckardi*, *C. stambuloffii*, *C. wroughtonii*, *C. emeryi*, and *C. minutior* species groups. Annalen des Naturhistorischen Museums in Wien. B, Botanik, Zoologie, 104: 203-338.

Seifert, B. (2013). *Hypoponera ergatandria* (Forel, 1893) – a cosmopolitan tramp species different from *H. punctatissima* (Roger, 1859) (Hymenoptera: Formicidae). Soil Organisms, 85: 189-201.

Seifert, B. (2018). The ants of Central and North Europe. Boxberg: Lutra, 407 pp.

Seifert, B. (2020). A taxonomic revision of the Palaearctic members of the subgenus *Lasius* s. str. (Hymenoptera: Formicidae). Soil Organisms, 92: 15-86. https://doi.org/10.25674/so92iss1pp15

Seifert, B. (2024). *Lasius frequens* n. sp. – a sister species of the supercolonial pest ant *Lasius neglectus* showing a differing biology (Hymenoptera: Formicidae). Soil Organisms, 96: 183-194. https://doi.org/10.25674/435

Seifert, B. (2025). Treachery pigmentation pattern leads to misidentification: *Tapinoma melanocephalum* (Fabricius), *Tapinoma pygmaeum* (Dufour) and *Tapinoma jandai* sp. nov. (Hymenoptera, Formicidae). Contributions to Entomology, 75: 245-252. https://doi.org/10.3897/contrib.entomol.75.e154879

Seifert, B. (2025). The *Monomorium carbonarium* species group in the Nearctic and Europe (Hymenoptera: Formicidae). Soil Organisms, 97: 55-84. https://doi.org/10.25674/441

Seifert, B., Okita, I. & Heinze, J. (2017). A taxonomic revision of the *Cardiocondyla nuda* group (Hymenoptera: Formicidae). Zootaxa, 4290: 324-356. https://doi.org/10.11646/zootaxa.4290.2.4

Sharaf, M.R., Abdeldayem, M.S., Aldhafer, H. & Aldawood, A.S. (2013). The ants (Hymenoptera: Formicidae) of Rawdhat Khorim nature preserve, Saudi Arabia, with description of a new species of the genus *Tetramorium* Mayr. Zootaxa, 3709: 565-580. https://doi.org/10.11646/zootaxa.3709.6.6

Sharaf, M.R., Salman, S., Al Dhafer, H.M., Akbar, S.A., Abdel-Dayem, M.S. & Aldawood, A.S. (2016). Taxonomy and distribution of the genus *Trichomyrmex* Mayr, 1865 (Hymenoptera: Formicidae) in the Arabian Peninsula, with the description of two new species. European Journal of Taxonomy, 246: 1-36. https://doi.org/10.5852/ejt.2016.246

Sharaf, M.R., Fisher, B.L., Collingwood, C.A. & Aldawood, A.S. (2017). Ant fauna (Hymenoptera: Formicidae) of the Socotra Archipelago (Yemen): zoogeography, distribution and description of a new species. Journal of Natural History, 51: 317-378. https://doi.org/10.1080/00222933.2016.1271157

Sharaf, M.R., Al Dhafer, H.M., Aldawood, A.S. & Hita Garcia, F. (2018a). Ants of the *Monomorium monomorium* species-group (Hymenoptera: Formicidae) in the Arabian Peninsula with description of a new species from southwestern Saudi Arabia. PeerJ, 6: e4277. https://doi.org/10.7717/peerj.4277

Sharaf, M.R., Fisher, B.L., Al Dhafer, H.M., Polaszek, A. & Aldawood, A.S. (2018b). Additions to the ant fauna (Hym.: Formicidae) of Oman: an updated list, new records and a description of two new species. Asian Myrmecology, 9: e010004; 1-38. https://doi.org/10.20362/am.010004

Shiran, E., Mossadegh, M.S. & Esfandiari, M. (2013). Mutualistic ants (Hymenoptera: Formicidae) associated with aphids in central and southwestern parts of Iran. Journal of Crop Protection, 2: 1-12.

Smith, M.R. (1965). House-infesting ants of the Eastern United States, Their Recognition, Biology, and Economic Importance. Agricultural Research Service, United States Department of Agriculture, Technical Bulletin No. 1326.

Stukalyuk S.V., Radchenko, A.G., Akhmedov, A. & Reshetov, A.A. (2020). Uzbekistan – the alleged native range of the invasive ant *Lasius neglectus* (Hymenoptera, Formicidae): geographical, ecological and biological evidences. Zoodiversity, 54: 111-122. https://doi.org/10.15407/zoo2020.02.111

Stukalyuk, Stanislav & Akhmedov, Askar & Stelia, Valery & Shymanskyi, Artem & Netsvetov, Maksym. (2022). Nuptial flight in ants (Hymenoptera: Formicidae), 27: 152-179.

Taheri, A. & Reyes-López, J.L. (2018). First checklist of ants (Hymenoptera: Formicidae) of urban green areas in Cádiz (Andalusia, Spain). Boletín de la Asociación Española de Entomología, 42: 217-223.

Tartally, A. (2006). Long term expansion of a supercolony of the invasive garden ant, *Lasius neglectus* (Hymenoptera: Formicidae). Myrmecologische Nachrichten, 9: 21-25.

Tartally, A., Antonova, V., Espadaler, X., Csősz, S. & Czechowski, W. (2016). Collapse of the invasive garden ant, *Lasius neglectus*, populations in four European countries. Biological Invasions, 18: 3127-3131. https://doi.org/10.1007/s10530-016-1227-x

Terayama, M., Kubota, S. & Eguchi, K. (2014). Encyclopedia of Japanese ants. Asakura Shoten, Tokyo, 278 pp.

Tinaut, A. (2016). Wilhelm Gottlieb Rosenhauer (1813–1881), Maximilien Spinola (1780–1857) y las primeras citas de hormigas de Andalucía (Hymenoptera, Formicidae). Boletín de la Asociación española de Entomología, 40: 161-174.

Tinaut, A. & Añó, J.L. (2000). *Paratrechina longicornis* (Latreille, 1802) nueva cita para la Península Ibérica (Hymenoptera: Formicidae). Boletín Sociedad Entomológica Aragonesa, 24: 253-254.

Tinaut, A. & Pascual, R. (1981). *Acantholepis frauenfeldi* Myr (Hymenoptera: Formicidae). Nueva cita para la Península Ibérica. Comunicación a las IV Jornadas de la Asociación Española de Entomología, La Laguna.

Tinaut, A. & Pascual, R. (1986). Confirmación de la presencia de *Aphaenogaster splendida* (Roger, 1859) en la Península Ibérica (Hymenoptera, Formicidae). Nouvelle Revue d'Entomologie (n.s.), 3: 189-192.

Tinaut, A., Bensusan, K. & Guillem, R. (2011). Redescription of the queen of *Anochetus ghilianii* (Spinola, 1851) (Hymenoptera, Formicidae). Boletín de la Asociación Española de Entomología, 35: 157-167.

Torres, J.A. & Snelling, R.R. (1997). Biogeography of Puerto Rican ants: A non-equilibrium case? Biodiversity and Conservation, 6: 1103-1121. https://doi.org/10.1023/A:1018332117719

Trigos-Peral, G. & Reyes-López, J. (2016). Ants as bioindicators for monitoring of urban green in the south of the Iberian Peninsula: proposal of functional groups. Iberomyrmex, 8: 37-38.

Trigos-Peral, G., Gómez, K. & Reyes-López, J.L. (2020). Contribution to the knowledge of the invasive species in Andalusia: First records of exotic ant species (Hymenoptera, Formicidae) in Axarquía (Torre del Mar, Málaga, Spain). Boletín de la Asociación Española de Entomología, 44: 239-244.

Trigos-Peral, Gema, Abril, S., Angulo, E. (2021). Behavioral responses to numerical differences when two invasive ants meet: the case of *Lasius neglectus* and *Linepithema humile*. Biological Invasions, 23: 935-953. https://doi.org/10.1007/s10530-020-02412-4

Van Loon, A.J., Boomsma, J.J. & Andrasfalvy, A. (1990). A new polygynous *Lasius* species (Hymenoptera: Formicidae) from central Europe. I. Description and general biology. Insectes Sociaux, 37: 348-362. https://doi.org/10.1007/BF02225997

Verdú, J.R., Numa, C. & Galante, E. (2011). Atlas y libro rojo de los invertebrados amenazados de España (especies vulnerables). Dirección General de Medio Natural y Política Forestal, Ministerio de Medio Ambiente, Medio Rural y Marino, Madrid, 433 p.

Vidal-Cordero, J.M. & Trigos-Peral, G. (2024). Primera cita de *Nylanderia jaegerskioeldi* (Mayr, 1904) (Hymenoptera: Formicidae) para Sevilla (Andalucía, España) y actualización de su distribución en la península ibérica. Boletín de la Sociedad Andaluza de Entomología, 34: 129-135.

Wachkoo, A.A., Bharti, H., Akbar, S.A. (2021). Taxonomic review of the ant genus *Lepisiota* Santschi, 1926 (Hymenoptera: Formicidae: Formicinae) from India. Bonn Zoological Bulletin, 70: 227-245. https://doi.org/10.20363/BZB-2021.70.2.227

Wagner, H.C., Arthofer, W., Seifert, B., Muster, C., Steiner, F.M. & Schlick-Steiner, B.C. (2017). Light at the end of the tunnel: Integrative taxonomy delimits cryptic species in the *Tetramorium caespitum* complex (Hymenoptera: Formicidae). Myrmecological News, 25: 95-129. https://doi.org/10.25849/myrmecol.news_025:095

Wetterer J.K. (2008). Worldwide spread of the longhorn crazy ant, *Paratrechina longicornis* (Hymenoptera: Formicidae). Myrmecological News, 11: 137-149.

Wetterer J.K. (2009a). Worldwide spread of the destroyer ant, *Monomorium destructor* (Hymenoptera: Formicidae). Myrmecological News, 12: 97-108.

Wetterer J.K. (2009b). Worldwide spread of the penny ant, *Tetramorium bicarinatum* (Hymenoptera: Formicidae). Sociobiology, 54: 811.

Wetterer J.K. (2010a). Worldwide spread of the pharaoh ant, *Monomorium pharaonis* (Hymenoptera: Formicidae). Myrmecological News, 13: 115-129.

Wetterer J.K. (2010b). Worldwide spread of the wooly ant, *Tetramorium lanuginosum* (Hymenoptera: Formicidae). Myrmecological News, 13: 81-88.

Wetterer J.K. (2011a). Worldwide spread of *Pheidole tenerifana* (Hymenoptera: Formicidae). Florida Entomologist, 94: 843-847. https://doi.org/10.1653/024.094.0417

Wetterer J.K. (2011b). Worldwide spread of the membraniferous dacetine ant, *Strumigenys membranifera* (Hymenoptera: Formicidae). Myrmecological News, 14: 129-135. https://doi.org/10.25849/myrmecol.news_014:129

Wetterer J.K. (2012). Worldwide spread of Emery's sneaking ant, *Cardiocondyla emeryi* (Hymenoptera: Formicidae). Myrmecological News, 17: 13-20. https://doi.org/10.25849/myrmecol.news_017:013

Wetterer J.K. (2013). Worldwide spread of the little fire ant, *Wasmannia auropunctata* (Hymenoptera: Formicidae). Terrestrial Arthropod Reviews, 6: 173-184. https://doi.org/10.1163/18749836-06001068

Wetterer J.K. (2015). Geographic origin and spread of cosmopolitan ants (Hymenoptera: Formicidae). Halteres, 6: 66-78. https://doi.org/10.5281/zenodo.16020832

Wetterer, J.K. & Hita Garcia, F. (2015). Worldwide spread of *Tetramorium caldarium* (Hymenoptera: Formicidae). Myrmecological News, 21: 93-99. https://doi.org/10.25849/myrmecol.news_021:93

Wetterer, J.K. & Porter, S.D. (2003). The little fire ant, *Wasmannia auropunctata*: distribution, impact, and control. Sociobiology, 42: 1-41.

Wetterer, J.K.; Miller, S.E.; Wheeler, D.E.; Olson, C.A.; Polhemus, D. A.; Pitts, M.; Ashton, I. W.; Himler, A. G.; Yospin, M. M.; Helms, K. R.; Harken, E.L.; Gallaher, J.; Dunning, C.E.; Nelson, M.; Litsinger, J.; Southern, A.; Burgess, T.L. (1999). Ecological dominance by *Paratrechina longicornis* (Hymenoptera: Formicidae) an invasive tramp ant, in Biosphere 2. Florida Entomologist, 82: 381-388. https://doi.org/10.2307/3496865

Wetterer, J.K.; Espadaler, X.; Wetterer, A.L.; Aguin-Pombo, D.; Franquinho-Aguiar, A.M. (2006). Long-term impact of exotic ants on the native ants of Madeira. Ecological Entomology, 31: 358-368. https://doi.org/10.1111/j.1365-2311.2006.00790.x

Wetterer, J.K., Wild, A.L., Suarez, A.V., Roura-Pascual, N. & Espadaler, X. (2009). Worldwide spread of the Argentine ant, *Linepithema humile* (Hym.: Formicidae). Myrmecological News, 12(8): 187-194. https://doi.org/10.25849/myrmecol.news_012:187

Wheeler, W.M. (1922). Ants of the American Museum Congo Expedition. A contribution to the myrmecology of Africa. IX. A synonymic list of the ants of the Malagasy region. Bulletin of the American Museum of Natural History, 45: 1005-1055.

Williams, J.L. & Lucky, A. (2020). Non-native and invasive *Nylanderia* crazy ants (Hymenoptera: Formicidae) of the world: Integrating genomics to enhance taxonomic preparedness. Annals of the Entomological Society of America, 113: 318-336. https://doi.org/10.1093/aesa/saz039

Wilson, E.O. (1967). Ant fauna of Futuna and Wallis Islands stepping stones to Polynesia. Pacific Insects, 9: 563-584.

Wilson, E.O. (2003). *Pheidole* in the New World: A dominant, hyperdiverse ant genus. Cambridge, MA: Harvard University Press.

Wong, M.K., Economo, E.P. & Guénard, B. (2023). The global spread and invasion capacities of alien ants. Current Biology, 33: 566-571. https://doi.org/10.1016/j.cub.2022.12.020