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One of the World's Worst Invasive Alien Species *Wasmannia auropunctata* (Hymenoptera: Formicidae) Detected in Cyprus

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Abstract

Native to the Neotropics, *Wasmannia auropunctata* (Roger, 1863) has been unintentionally introduced around the world, heavily impacting native ant biodiversity, societies, and economies as well as human and animal health due to its potentially dangerous stings. Herein we report on the first record of *W. auropunctata* in Cyprus. Specimens were collected from plant nurseries and tourist facilities in Paphos and Limassol district. *Wasmannia auropunctata* is believed to spread via the horticultural pathway to locations with sufficient humidity. Further research is necessary to determine the distribution and assess possible negative impacts of *W. auropunctata* to native biodiversity, society, the economy and human health in Cyprus.

Introduction

Invasive alien species (hereafter IAS) represent one of the main causes of biodiversity loss with impacts on ecosystem function and services (Vilà & Hulme, 2017; Blackburn et al., 2019). Alien species also negatively affect societies, economies as well as both human and animal health and well-being on a global scale (Mazza & Tricarico, 2018; Chinchio et al., 2020; Pyšek et al., 2020). More than 14,000 alien species are currently distributed across Europe, including 65 alien ant species (EASIN, 2022). Among them, four species have been identified as IAS of Union Concern, namely the fire ants *Solenopsis geminata* (Fabricius, 1804), *S. invicta* Buren, 1972 and *S. richteri* Forel, 1909 as well as the little fire ant *Wasmannia auropunctata* (Roger, 1863) (EU Regulation 1203/2022). Furthermore, four alien ant species have been identified among the 100 of the World's Worst Invasive Alien Species (GISD, 2022), namely the Argentine ant *Linepithema humile* (Mayr, 1868), the recently revised African big-headed ant *Pheidole megacephala* (Fabricius, 1793) (Salata & Fisher, 2022), the red imported fire ant *S. invicta*, and *W. auropunctata*. These species have been considered responsible *inter alia* for the displacement of local ant species, economic losses in agriculture and have been reported as human nuisance (GISD, 2022).

Wasmannia auropunctata also called the "electric ant" and "little or small fire ant" is native to the Neotropical zoogeographic realm and currently spread throughout the

world (Wetterer, 2013; Janicki et al., 2016; Guénard et al., 2017). Within its invaded range, it has been found to reduce native arthropod biodiversity (Lubin, 1984; Roque-Albelo et al., 2000; Wetterer & Porter, 2003; Mbenoun-Masse et al., 2017), affect the fecundity and fertility of vertebrates (i.e. tortoises and birds) (Hayashi, 1999; Roque-Albelo & Causton, 1999; Nishida & Evenhuis, 2000) but also to pose a significant health risk to humans due to its stinging that may cause anaphylactic shocks to allergic people or harm domestic animals (i.e. cats and dogs) (Wetterer et al., 1999; Nishida & Evenhuis, 2000; Wetterer & Porter, 2003; Kidon et al., 2022).

In Europe and the Mediterranean Basin, *W. auropunctata* has been reported indoors in the United Kingdom (Donisthorpe, 1908), Germany (Geiter et al., 2002) and the Netherlands (Boer & Vierbergen, 2008). The species was recorded once in 1996 in Italy (Lisa Blanca island) (Jucker et al., 2008), although upon further investigations "*W. auropunctata* is to be considered absent from Lisca Bianca where it was probably recorded erroneously" (Mr Enrico Schifani, personal communication, September 23, 2022; see Schifani, 2022). In Israel (Vonshak et al., 2009, 2010; Vonshak & Ionescu-Hirsch, 2009) and Spain (Espadaler et al., 2018, 2020) *W. auropunctata* has established viable populations and spread into natural habitats. In Cyprus, nine species of alien ants have been identified (Salata et al., 2019). Nevertheless, the presence of *Cardiocondyla mauritanica* Forel, 1890, *Monomorium pharaonis* (Linnaeus, 1758) and *Solenopsis geminata* (Fabricius, 1804) on the island have been supported only by single literature records (Emery, 1909; Collingwood et al., 1997; Wetterer, 2010). In this publication, *W. auropunctata* is reported for the first time in Cyprus.

Materials and methods

Material examined

CYPRUS: ● Paphos, Veronica hotel [34.749580°N, 32.428932°E], alt. 20 m, 24.IV.2022, leg. and ident. L. Borowiec and S. Salata, habitat details: hotel parking area. ● Paphos, Kato Paphos, [34.736479, 32.435402], alt. 6 m. 29.IV.2022, leg. and ident. L. Borowiec and S. Salata, habitat details: collected from sea shore at night. ● Paphos, Kissonerga - Lemba [34.813211, 32.410112], alt. 85 m, 30.IV.2022, leg. J. Demetriou, C. Georgiadis, L. Borowiec and S. Salata, ident. L. Borowiec and S. Salata, habitat details: in plant nursery on plastic sheets placed on the soil. ● Paphos, Kissonerga - Lemba [34.813211, 32.410112], alt. 85 m, 07.IX.2022, leg. J. Demetriou, ident. J. Demetriou, habitat details: in plant nursery on plastic sheets placed on the soil. ● Paphos, Kissonerga [34.8333632, 32.405394], alt. 109 m, 30.IV.2022, leg. J. Demetriou, C. Georgiadis, L. Borowiec and S. Salata, ident. L. Borowiec and S. Salata, habitat details: in plant nursery on the soil. ● Paphos, Chlorakas [34.7979, 32.3960], alt. 20 m, 6+23.VIII.2022, leg. J. Demetriou, ident. J. Demetriou, habitat details: on pedestrian path with ornamental surrounded by luxury villas. ● Limassol, Kato Polemidia [34.6811, 33.0051], alt. 38 m, 26.III.2022, leg. J. Demetriou, ident. L. Borowiec, habitat details: urban park, nest under rock close to *Pistacia atlantica*. ● Limassol, Savvas Savva Park [34.6805, 33.0357], alt. 15 m, 31.V.2022, leg. J. Demetriou, ident. L. Borowiec and S. Salata, habitat details: collected from pavement bordering urban park, shaded, predominantly with large *Ficus microcarpa* L. trees (Fig 1, 2).

Specimens were collected by hand and stored in ≥70° ethanol at the Myrmecological Laboratory, Department of Biodiversity and Evolutionary Taxonomy, University of Wroclaw, Poland and JD's personal collection. Species identification was performed using the identification keys of Bolton (1994) and Longino and Fernández (2007) as well as through comparison with available photographic material on AntWeb (2022). (https://www.antweb.org/images.do?subfamily=myrmicinae&genus=wasmannia&species=auropunctata&rank=species&project=allantwebants). The competent authorities were informed upon the identification of collected specimens.

Fig 1. Habitus of worker of *Wasmannia auropunctata* (Roger, 1863), dorsal and lateral, collected from Cyprus (locality Kissonerga): scale bar 0.5 mm (photographed by L. Borowiec).

Maps

Maps were created using QGIS Version 3.18.2 free and open source Geographic Information System (https://qgis.org/en/site/).

Results and discussion

Specimens of *W. auropunctata* were collected in urban habitats of Limassol and Paphos such as a hotel's parking area, two plant nurseries, and urban parks; representing the

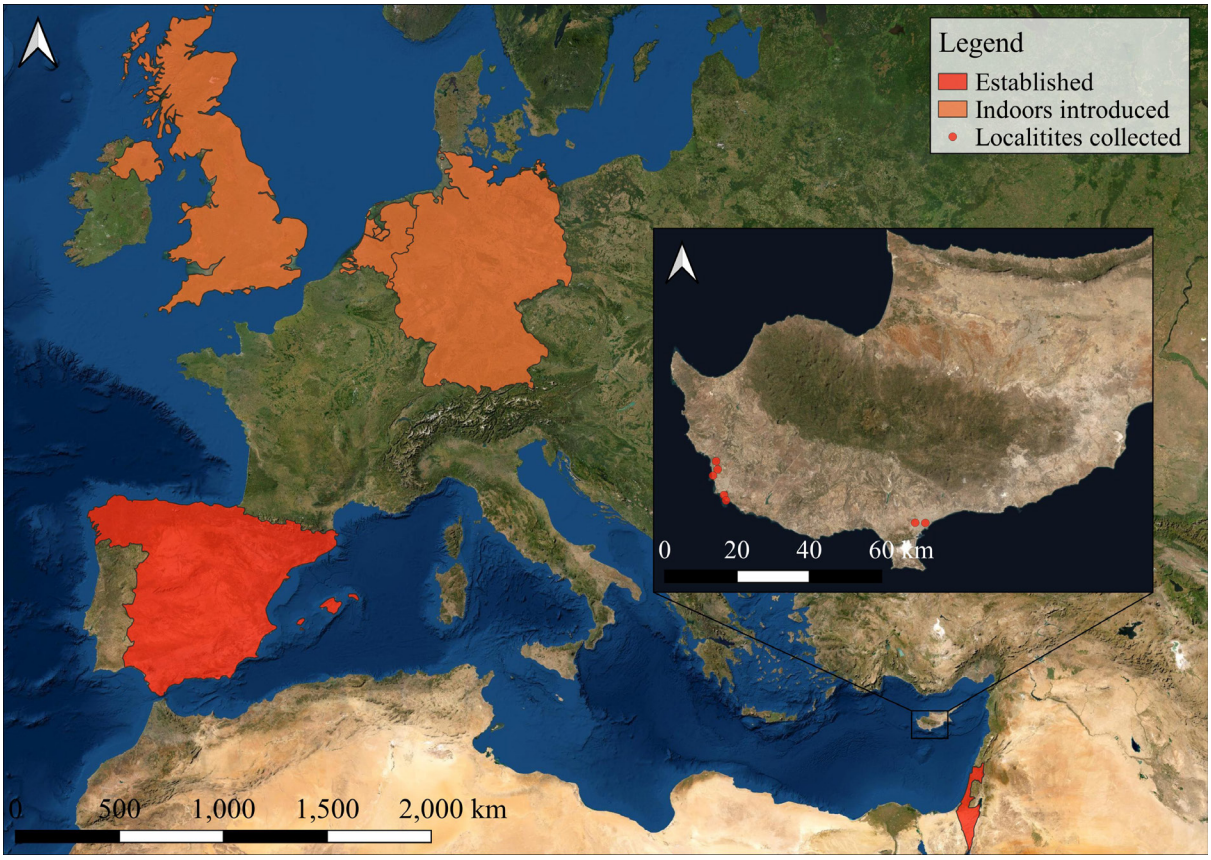

Fig 2. Current known distribution of *Wasmannia auropunctata* (Roger, 1863) in the Mediterranean Basin and Cyprus (inset).

first records for Cyprus and supplementing our knowledge around the distribution of this invasive alien ant in Europe and the Mediterranean (Fig. 2). Opportunistic material surveys in Larnaca, Famagusta and Nicosia yielded no specimens. As biological invasions have been found to pose an important threat to island ecosystems (Reaser et al., 2007; Russel et al., 2017), the presence of *W. auropunctata* in Cyprus raises concerns regarding its possible spread to natural habitats and threat towards native biodiversity. This omnivorous alien species is predicted to expand its range in Cyprus over the next decades because of its ability to colonize and establish in a wide range of disturbed and undisturbed habitats (Longino & Fernández, 2007; Mbenoun Masse et al., 2017; CABI, 2022), construct polygynous nests in a variety of substrates (Longino & Fernández, 2007) and tolerate a wide range of climatic and environmental conditions (i.e. altitude and humidity) (Longino & Fernández, 2007; Vonshak et al., 2010; Cuezzo et al., 2015).

Horizon scanning exercises for IAS not yet present on the island, ranked *W. auropunctata* amongst the top 50 most likely IAS to reach Cyprus and potentially threaten human health and the island's economy (Peyton et al., 2020). Peyton et al. (2020) mention organic packing material, ships, containers and natural dispersal across borders as the most prominent introduction pathways for the species. Based on our study, the *W. auropunctata* is presumed to have spread through the horticultural pathway, hidden in the soil of ornamental and aromatic plants grown in well-irrigated plant nurseries and subsequently planted in parks and tourist facilities with sufficient moisture.

In neighbouring Israel, it was suspected that "*W. auropunctata* was first established in irrigated gardens in the warm climate of the Jordan Valley, and only afterwards spread into less favourable habitats […] through commercial transport of chopped wood, logs, and potted plants" (Vonshak et al., 2010). "As initial eradication efforts failed the ants widely spread mainly by commerce in flowerpots" (Dr Armin Ionescu, personal communication, September 5, 2022). As a result, the species currently occurs predominantly in irrigated habitats or near natural water sources with frequent human activity, enabling its survival in both warmer and drier habitats than those of its native range (Vonshak et al., 2010). In addition, the species has been found entering households during the warm summer months in search of habitats with sufficient moisture (Vonshak et al., 2010), a much needed resource that is considered to facilitate the species spread (Meier, 1994; Vonshak et al., 2010).

Its adverse environmental impacts on the abundance, species richness, and community composition of native arthropod biodiversity in Israel (Vonshak et al., 2010) as well as the related human health risks connected with a reported case of severe anaphylactic allergic reaction (Kidon et al., 2022), confirm the need for further research on its origin, distribution, pathways of spread and impacts on Cyprus.

Furthermore, Cyprus has similar climatological conditions to Israel therefore we expect that the spread of *W. auropunctata* could follow the same patterns observed in Israel causing negative impacts to biodiversity, human health and socio-economic parameters. The use of molecular markers could help identify the origin and number of introductions of *W. auropunctata* in Cyprus. Further research is necessary to assess both the native and alien myrmecofauna of Cyprus, which are relatively understudied. Structured material surveys in plant nurseries and touristic facilities are required to study pathways of introduction and further spread of *W. auropunctata*. Additionally, sampling in natural habitats could enhance early detection efforts in protected areas and establish effective management strategies for its rapid eradication.

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Authors' Contributions

Conceptualization: JD, SS; Methodology: JD, CG, LB, SS; Software: JD; Validation – Verification: LB, SS; Formal analysis: JD; Investigation: JD, CG, AFM, HER, LB, SS; Resources: JD, CG, AFM, HER, LB, SS; Data Curation: JD; Writing-Original Draft: JD, SS; Writing-Review & Editing: JD, CG, AFM, HER, LB, SS; Visualization: JD, LB; Supervision: AFM, HER, LB, SS; Project administration: SS; Funding acquisition: AFM, HER, LB, SS**.**

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