

THE FIRST OUTDOOR-NESTING POPULATION OF *WASMANNIA AUROPUNCTATA* IN CONTINENTAL EUROPE (HYMENOPTERA, FORMICIDAE)

[La primera población de *Wasmannia auropunctata* nidificando en exterior en Europa continental (Hymenoptera, Formicidae)]

Xavier Espadaler¹, Carlos Pradera² & Juan Antonio Santana³

Abstract

An established and spreading, outdoor population of the little fire ant, *Wasmannia auropunctata* (Roger, 1863), is documented for the southern Spanish Mediterranean coast. This is the first continental European outdoor nesting population. Polygyny and sexual production were ascertained. The infested area, in a suburb of Marbella (Málaga) is 5.8 ha in extension and 1.2 km perimeter.

Resumen

Se documenta la primera población europea de *Wasmannia auropunctata* (Roger, 1863), nidificando en el exterior, establecida y en expansión. Se ha registrado poliginia y reproducción sexual. El área infestada, en una urbanización de Marbella (Málaga), es de 5.8 ha de extensión y 1.2 km de perímetro.

Key words

Invasive, little fire ant, Spain, Western Mediterranean

Palabras clave

Invasora, pequeña hormiga de fuego, España, Mediterráneo occidental

Introduction

A private complaint to a pest control company of «very small, stinging ants» from inhabitants of a private property in a neighbourhood from Marbella (Málaga, Spain) led to the capture of the ants. Using Longino & Fernandez (2007) and Cuezco et al. (2015), the preliminary identification as the little

fire ant (*Wasmannia auropunctata* (Roger, 1863)), was verified and prompted immediately a field survey resulting in a rather wide extension within that urbanized area of Marbella. Here we document this presence, the first locality within the European continent where this invasive species is established and spreading.

1. Contact author. CREAf, Autonomous University of Barcelona, 08193 Cerdanyola del Vallès, Spain E-mail: xavierespadaler@gmail.com

2. Sistemas de Gestión Ambiental S.L., c/ Francesc Boix i Campó, 6-8, 08038, Barcelona, Spain

3. Contraplagas Ambiental S.L., Pol. Ind. Molino de Viento, c/ Parauta. N° 5, 29651, Mijas-Costa, Spain

Material and methods

The field survey was undertaken (12.V.2018) by the authors, by a systematic visual search on both street sides outside of premises, at the corners of floor contact with walls and any kind of vertical surface of buildings, electrical equipments, or flowerpots. Although very small, ants were readily detected using a search image from the point where they were first seen and sampled. It was a vertical crack on a whitewashed wall, from which the ants were oozing out (Fig. S1 in Appendix S1, as digital supplementary material to this article). A street map from Google Earth was used to signal the occurrence of ants at each detection point. When available, inhabitants were asked for the first year they were aware of the presence of the ant. Other ant species were also captured and noted in the map. *Wasmannia* vouchers have been deposited in the Museo de Ciencias Naturales (Madrid) and the Museu de Ciències Naturals (Barcelona).

Results and discussion

The invaded site (36.51°N, 4.86°W) is close to the A-7 motorway, being the northernmost, and spreading, population of *W. auropunctata* established outdoors (Wetterer,

2013). The infested area has a perimeter of 1.2 km and 5.8 ha of surface. Elevation 39-66 m. Some fifty private properties are infested by the little fire ant (Fig. S2). Workers were detected in many structural angles in buildings, exiting from, and entering to wall cracks (Fig. S3). They followed evident trails. Workers also used outflow holes from wall gardens and orchards drainage system (Fig. 1). Nests, with multiple queens (Fig. 2; Fig. S4), were also found under stones (Fig. S5, Fig. S6) in the shaded areas of well irrigated orchards (Fig. 3). Eggs, worker and sexual larvae, and male pupae were present too (Fig. S7, Fig. S8). Compared to the norm for soil surface foraging Mediterranean ants, *Wasmannia* workers showed a very slow pace. Rubbed over the back of the hand, the ants did not immediately sting.

People complained about painful stinging and one case declared them occupying electrical conductions. The ants were detected by local residents a mean $\pm$ s.e. of 2.8 ± 0.7 years ago ($n=5$). Of course, this does not imply an arrival date. Expansion rates in tropical localities for *W. auropunctata* vary from 73 m/year in Gabon (Walsh et al. 2004) and up to 500 m/year at Galápagos Archipelago



Figure 1. *Wasmannia auropunctata* worker trail, entering and leaving outflow holes from wall gardens and orchards drainage system. Image: Carlos Pradera.

Figura 1. Fila de obreras de *Wasmannia auropunctata*, entrando y saliendo de agujeros de drenaje en muros de jardines y huertos. Imagen: Carlos Pradera.



Figure 2. *Wasmannia auropunctata*. Two queens, a few workers, eggs and young larvae under a stone. Image: Carlos Pradera.

Figura 2. *Wasmannia auropunctata*. Dos reinas, algunas obreras, huevos y larvas jóvenes bajo una piedra. Imagen: Carlos Pradera.



Figure 3. Tree shaded, irrigated orchard corners with stones constitute a perfect nesting habitat for *Wasmannia auropunctata*. Image: Xavier Espadaler.

Figura 3. Huertos con esquinas sombreadas por la vegetación y con piedras son un hábitat perfecto para *Wasmannia auropunctata*. Imagen: Xavier Espadaler.

(Lubin, 1984). The expansion of the Spanish population has probably been much slower because local climatic conditions are decidedly not tropical. Mean monthly minimum, mean and maximum temperatures at Marbella are 13.5 °C, 17.8 °C and 22.2 °C. Mean total yearly precipitation is 703 mm (n=44 years). Thus, arrival of the pest in Spain likely occurred >5 years ago. No other ant species were detected within the limits of the infested area.

At the limits of the infested area other ant species were noted: *Aphaenogaster iberica* Emery, 1908; *Camponotus barbaricus* Emery, 1905 (Fig S9); *Crematogaster scutellaris* (Olivier, 1792); *Linepithema humile* (Mayr, 1868); *Messor barbarus* (Linnaeus, 1767); *Nylanderia jaegerskioeldi* (Mayr, 1904); *Pheidole pallidula* (Nylander, 1849); *Plagiolepis pygmaea* (Latreille, 1798); *Tapinoma simrothi* Krausse, 1911; *Tetramorium immigrans* Santschi, 1927.

In Europe, the species has been cited from: i) United Kingdom: Kew Gardens

(Donisthorpe 1908) in Wetterer (2013); ii) the Netherlands: Wageningen, intercepted during import inspection at the Plant Protection Service (Boer & Vierbergen, 2008); iii) Italy: Lisca Bianca, an intriguing single worker from an uninhabited islet at the Aeolian archipelago (Jucker et al., 2008).

Of Neotropical origin, the species is widely distributed in tropical climate areas and a few localities with Mediterranean climate (Wetterer, 2013). Outside of its native area in South America and Central America (Mikheyev & Mueller, 2007), it has been inadvertently dispersed by human traffic, especially in plant material, vehicles, construction materials. It constitutes a pest at cocoa and coffee plantations and irrigated gardens. As a tramp species (Passera, 1994) it has reached a generalized pest status in South America (Fowler et al., 1990; Bueno & Fowler, 1994), Florida (Thompson, 1990; Klotz et al., 1995), Caribbean islands (Wetterer, 2013) and Galápagos Islands (Herrera & Causton, 2008). In Africa it is known from Cameroon,

Central African Republic, Sierra Leone and Gabon, and in Oceania from Sumatra, Papua New Guinea, Northeast Australia, New Zealand (only inside buildings) and several Oceania Islands. Out of those regions, it has been reported from Israel (Vonshak *et al.*, 2010). From time to time it is occasionally detected in climatized locales, especially in Canada (Wetterer & Porter, 2003). It will be interesting to check if this Spanish *W. auropunctata* population shows the molecular profile of clade B (Chifflet *et al.* 2016), the same as populations from Israel, more adapted to a temperate climate. For an updated map of its world distribution see <http://antmaps.org/?mode=species&species=Wasmannia.auropunctata>

The establishment and spread of the little fire ant in the Spanish southern coast demonstrates that general climatic conditions and local environment is appropriate to its ecological requirements. Additional records in the southern Spanish Mediterranean coast may turn up in the future. Although admittedly a very difficult species to eradicate or control (Vanderwoude *et al.*, 2016), public, municipal authorities have been warned of the presence of the little fire ant and will receive a copy of this paper.

Acknowledgements

To James Trager for his English text revision.

References

- BOER, P.; VIERBERGEN, B. 2008. Exotic ants in The Netherlands (Hymenoptera: Formicidae). *Entomologische Berichten* (Amsterdam), 68: 121-129.
- BUENO, O.C.; FOWLER, H.G. 1994. Exotic ants and native ant fauna of Brazilian hospitals. Pp. 191-198. In: D.F. Williams (ed.): *Exotic ants. Biology, impact, and control of introduced species*. Westview Press, Boulder. 332 pp.
- CHIFFLET, L.; RODRIGUERO, M.S.; CALCATERRA, L.A.; REY, O.; DINGHI, P.A.; BACCARO, F.B.; SOUZA, J.L.P.; FOLLETT, P.; CONFALONIERI, V.A. 2016. Evolutionary history of the little fire ant *Wasmannia auropunctata* before global invasion: inferring dispersal patterns, niche requirements and past and present distribution within its native range. *Journal of Evolutionary Biology*, 29: 790-809.
- CUEZZO, F.; CALCATERRA, L.A.; CHIFFLET, L.; FOLLETT, P. 2015. *Wasmannia* Forel (Hymenoptera: Formicidae: Myrmicinae) in Argentina: systematics and distribution. *Sociobiology*, 62: 246-265.
- FOWLER, H.G.; BERNARDI, J.V.E.; DELABIE, J.C.; FORTI, L.C.; PEREIRA DA SILVA, V. 1990. Major ant problems of South America. Pp. 3-14. In: Vander Meer, R.K., Jaffe, K.; Cedenio, A. (eds.): *Applied myrmecology: a world perspective*. Westview Press, Boulder. 741 pp.
- HERRERA, H.W.; CAUSTON, C.E. 2008. Distribution of fire ants *Solenopsis geminata* and *Wasmannia auropunctata* (Hymenoptera: Formicidae) in the Galapagos Islands. *Galapagos Research*, 65: 11-14.
- JUCKER, C., RIGATO, F., & REGALIN, R. 2008. Exotic ant records from Italy (Hymenoptera, Formicidae). *Bollettino di Zoologia Agraria e di Bachicoltura Ser. II*, 40: 99-107.
- KLOTZ, J.H.; MANGOLD, J.R.; VAIL, K.M.; DAVIS, L.R.; JR., PATTERSON, R.S. 1995. A survey of the urban pest ants (Hymenoptera: Formicidae) of peninsular Florida. *Florida Entomologist*, 78: 109-1118.
- LONGINO, J.T.; FERNÁNDEZ, F. 2007. Taxonomic review of the genus *Wasmannia*. In: Snelling, R.R., Fisher, B.L. & Ward, P.S. (eds.): *Advances in ant systematics (Hymenoptera: Formicidae): homage to E. O. Wilson - 50 years of contributions*. *Memoirs of the American Entomological Institute*, 80: 271-289.
- LUBIN, Y.D. 1984. Changes in the native fauna of the Galápagos Islands following invasion by the little red fire ant, *Wasmannia auropunctata*. *Biological Journal of the Linnean Society*, 21: 229-242.

- MIKHEYEV, A.S.; MUELLER, U.G. 2007. Genetic relationships between native and introduced populations of the little fire ant *Wasmannia auropunctata*. *Diversity and Distributions*, 13: 573-579.
- PASSERA, L. 1994. Characteristics of tramp species. Pp. 23-43. In: D.F. Williams, D.F. (Ed.): *Exotic ants. Biology, impact, and control of introduced species*. Westview Press, Boulder. 332 pp.
- THOMPSON, C.R. 1990. Ants that have pest status in the United States. Pp. 51-67. In: Vander Meer, R.K., Jaffe, K.; Cedeno, A. (eds.): *Applied myrmecology: a world perspective*. Westview Press, Boulder. 741 pp.
- VANDERWOUDE, C.; MONTGOMERY, M.; FORESTER, H.; HENSLEY, E.; ADACHI, M.K. 2016. The history of little fire ant *Wasmannia auropunctata* Roger in the Hawaiian Islands: spread, control, and local eradication. *Proceedings of the Hawaiian Entomological Society*, 48:39-50.
- VONSHAK, M.; DAYAN, T.; IONESCU-HIRSH, A.; FREIDBERG, A.; HEFETZ, A. 2010. The little fire ant *Wasmannia auropunctata*: a new invasive species in the Middle East and its impact on the local arthropod fauna. *Biological invasions*, 12: 1825-1837.
- WALSH, P.D.; HENSCHER, P.; ABERNETHY, K.A.; TUTIN, C.E.G.; TELFER, P.; S.A. LAHM, S.A. 2004. Logging speeds little red fire ant invasion of Africa. *Biotropica*, 36: 637-641.
- WETTERER, J.K.; PORTER, S.D. 2003. The little fire ant *Wasmannia auropunctata*: distribution, impact and control. *Sociobiology*, 42: 1-41.
- WETTERER, J.K. 2013. Worldwide spread of the little fire ant, *Wasmannia auropunctata* (Hymenoptera: Formicidae). *Terrestrial Arthropods Reviews*, 6: 173-184.

Appendix S1 Supplementary material



Figure. S1 (left). Wall with cracks, at the first point (red line) where *Wasmannia auropunctata* was detected. Spain: Marbella. 12.V.2018.

Figura S1 (izq.). Muro con rendijas, primer punto (línea roja) en el que se detectó *Wasmannia auropunctata*. España: Marbella. 12.V.2018. Imagen: Juan Antonio Santana.

Figure. S2 (above). A street in which *Wasmannia auropunctata* worker trails were detected all over the structural line of sidewalks and property walls. Spain: Marbella. 12.V.2018. Image: Xavier Espadaler.

Figura S2 (arriba). Calle en la cual se detectaron hileras de *Wasmannia auropunctata* a lo largo de las líneas estructurales entre aceras y muros. España: Marbella. 12.V.2018. Imagen: Xavier Espadaler.



Figure S3. *Wasmannia auropunctata*. Spain: Marbella. 12.V.2018. Two workers passing on a trail. Image: Carlos Pradera.

Figura S3. *Wasmannia auropunctata*. España: Marbella. 12.V.2018. Dos obreras se cruzan en una hilera. Imagen: Carlos Pradera.



Figure S4. *Wasmannia auropunctata*. Spain: Marbella. 12.V.2018. Queen and workers. Small squares are 1 mm². Image: Carlos Pradera.

Figura S4. *Wasmannia auropunctata*. España: Marbella. 12.V. 2018. Reina y obreras. Cuadrados pequeños 1 mm². Imagen: Carlos Pradera.



Figure S5. Citrus tree with some stones at the base that were occupied by *Wasmannia auropunctata*. Spain: Marbella. 12.V.2018. Image: Xavier Espadaler.

Figura S5. Naranja con algunas piedras en la base, ocupadas por *Wasmannia auropunctata*. España: Marbella. 12.V. 2018. Imagen: Xavier Espadaler.



Figure S6. Orchard corner with stones where *Wasmannia auropunctata* were nesting. Spain: Marbella. 12.V.2018. Image: Xavier Espadaler.

Figura S6. Esquina de un huerto con piedras donde nidificaban *Wasmannia auropunctata*. España: Marbella. 12.V.2018. Imagen: Xavier Espadaler.



Figure S7. *Wasmannia auropunctata*. Spain: Marbella. 12.V.2018. Two workers tending a sexual larva. Image: Carlos Pradera.

Figura S7. *Wasmannia auropunctata*. España: Marbella. 12.V.2018. Dos obreras atendiendo una larva de sexuado. Imagen: Carlos Pradera.



Figure S8. *Wasmannia auropunctata*. Spain: Marbella. 12.V.2018. Queen and male pupa. Small squares are 1 mm². Image: Carlos Pradera.

Figura S8. *Wasmannia auropunctata*. España: Marbella. 12.V.2018. Reina y pupa de macho. Cuadrados pequeños 1 mm². Imagen: Carlos Pradera.



Figure S9. *Wasmannia auropunctata*. Spain: Marbella. 12.V.2018. Two workers clinging on tarsi of a worker of the local, native *Camponotus barbaricus*, a proof, and consequence, of their interaction. Image: Carlos Pradera.

Figura S9. *Wasmannia auropunctata*. España: Marbella. 12.V.2018. Dos obreras agarradas a los tarsos de una obrera de la especie nativa *Camponotus barbaricus*, son prueba, y consecuencia, de su interacción. Imagen: Carlos Pradera.



Figure S10. *Wasmannia auropunctata*. Spain: Marbella. 12.V.2018. Workers feeding at a peanut butter bait. Image: Carlos Pradera.

Figura S10. *Wasmannia auropunctata*. España: Marbella. 12.V.2018. Obreras alimentándose en un cebo de mantequilla de cacahuete. Imagen: Carlos Pradera.