



Rediscovery of the Canary Islands endemic *Aphaenogaster hesperia* Santschi, 1911 (Hymenoptera, Formicidae, Myrmicinae)



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
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
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Abstract

The Canary Islands endemic species *Aphaenogaster hesperia* Santschi, 1911 was described based solely on two workers captured in a north-western coastal area of Tenerife (Canary Islands) in 1902 and 1903. The species has not been recorded in the last 100 years and only information on its type locality is known. This species, belonging to the *crocea* group, has been recently rediscovered in a new site within a pine forest at 950 m a.s.l. The new area is a very different habitat, revealing a lack of ecological knowledge of the species, which may have caused the species to have remained unnoticed for more than 100 years. Novel distributional and morphological data are provided.

Key words: Myrmecology, Stenammini, Canary Islands, Macaronesia

Introduction

The ant genus *Aphaenogaster* Mayr, 1853 is part of the tribe Stenammini Ashmead, 1905 (Ward *et al.* 2015). Currently, the genus comprises 202 valid extant species (Bolton 2023). Their distribution is concentrated in the western Palaearctic and the Nearctic realm, with fewer species in the Australasian and eastern Palaearctic realm, as well as the Indomalayan and Magalasy region (Janicki *et al.* 2016). However, recent evidence supports that *Aphaenogaster* is a polyphyletic genus (Branstetter *et al.* 2022; Ward *et al.* 2015), with Holarctic species belonging to a different evolutive lineage to the subequatorial-equatorial one (the so-called ‘*Deromyrma* clade’). The western Palearctic harbours the highest species richness as well as a remarkable diversity of morphological and ecological terms. An infrageneric division comprising six monophyletic species-groups and two independent clades which require further investigation have been recently proposed (Schifani *et al.* 2022).

The Canary Islands, an oceanic archipelago comprising seven major islands located 96 km off the western coast of Morocco, harbours three different species of the genus *Aphaenogaster* (Gobierno de Canarias 2023). *Aphaenogaster senilis* Mayr, 1853, a native non-endemic species inhabiting the islands of Gran Canaria and Fuerteventura, and *Aphaenogaster iberica* Emery, 1908 an introduced species present at Tenerife and Gran Canaria, belong to the *sardoa* group (Schifani *et al.* 2022). The remaining species is *Aphaenogaster hesperia* Santschi, 1911, an endemic species restricted to Tenerife and belonging to the Siculo-Maghrebian *crocea* group (Schifani *et al.* 2022), which was firstly identified as *A. crocea croceoides* Forel, 1890 (Santschi 1908) but later described as a valid taxonomic species (Santschi 1911). The status and identity of many of the taxa of the *crocea* group in the Maghreb are still quite unclear (Schifani *et al.* 2021), the identification of many of these species is complicated,

especially when only workers are available (Alicata & Schifani 2019). The type material, two workers located in the Felix Santschi collection of the Natural History Museum Basel (NHMB), was collected in the locality of Bajamar, a north-western coastal area of Tenerife, between 1902-1903 (Santschi 1911). Eight years later, the same author (Santschi 1919) mentioned additional material of this species, but without any additional data. In his collection, there is also an additional worker from the locality of Tejina, also a coastal area, located next to Bajamar, collected in 1902. Additionally, eleven workers are stored, being collected in Tejina - La Laja but without any specific date. In the entomological collection of Auguste Forel in the Natural History Museum of the city of Geneva (MHNG) there are six additional workers collected in Tenerife but without any further data on date or precise location. The local entomologist Anatael Cabrera-Díaz was the collector of all this material aforementioned. In his collection, deposited in the National Museum of Natural Sciences (MNCN), there is a worker collected in Bajamar in 1898, which makes it the first collected individual of the species. We have not found a reference to this individual in the bibliography consulted. In this paper the detection of several individuals ca. 15 Km far from the type locality, in a completely different habitat, after more than 100 years is provided.

Material and methods

Fieldwork was conducted between May and July 2023 in the protected landscape of Las Lagunetas (Canary Islands, Tenerife), more concretely in a pine forest patch near a recreational area (Las Raíces; ca. 950 m a.s.l.) (Figure 1), searching for foraging activity and lifting stones and dead wood looking for nests. Individuals were examined under a Zeiss Stemi 2000 stereomicroscope. Microscopic images of the habitus were taken using a Canon EOS-750D camera and stacked with Zerene Stacker (Zerene Systems LLC., version 1.04). In order to provide novel morphological data, linear morphometric measures were obtained with the software Motic Images Plus 3.0. Measurements are expressed in mm and values as mean \pm standard deviation following Alicata and Schifani (2019) and Galkowski *et al.* (2019). Those measurements are: **CL** (cephalic length): the length of the head capsule excluding the mandibles, measured in full-face view in a straight line from the mid-point of the anterior clypeal margin to the mid-point of the posterior margin. **CW** (cephalic width): the maximum width of the head in full face view, measured posteriorly to level of eyes. **CI** (cephalic index): calculated as $CW \times 100 / CL$. **FW** (frons width): the minimum distance between eyes in full face view. **ML** (mesosoma length): the diagonal length of the mesosoma in profile from the point where the pronotum meets the cervical shield to the posterior basal angle of the propodeal lobe. **MW** (mesosoma width): the maximum width of the mesosoma in dorsal view. **PSL** (propodeal spine length): measured from the centre of the propodeal spiracle to the tip of the spine. **SL** (scape length): the maximum straight-line length of the scape, excluding the basal constriction or neck that occurs just distal of the condylar bulb. **SI** (scape index): calculated as $SL \times 100 / CW$.

Results

Between 6th May 2023 and 9th July 2023, more than 100 workers of several nests were collected in the new locality of Las Raíces and stored in absolute ethanol. Material is stored in the private collection of the first author (AJP-D). Diurnal foraging was not observed. Instead, all individuals collected were observed under the rocks inside nest chambers, in some cases together with eggs, larvae and/or pupae.

The collected material was compared with the original description of Santschi (1911) and with photographs of the type material (CASENT0913115, <https://www.antweb.org>, visited 7th May 2023). After verifying that the morphology of the specimens presents all the characteristics indicated in the original description (Santschi 1911) and finding no differences with the available reference material, we conclude that these specimens correspond to the species described by Santschi as *Aphaenogaster hesperia*.

Measurements and indices (eight workers, one locality): CL: 1.11 ± 0.06 ; CW: 0.91 ± 0.06 ; CI: 81.6 ± 1.99 ; FW: 0.79 ± 0.05 ; ML: 1.49 ± 0.09 ; MW: 0.58 ± 0.03 ; SL: 1.09 ± 0.03 ; SI: 119.5 ± 5.33 ; PSL: 0.16 ± 0.01 (Figure 2).

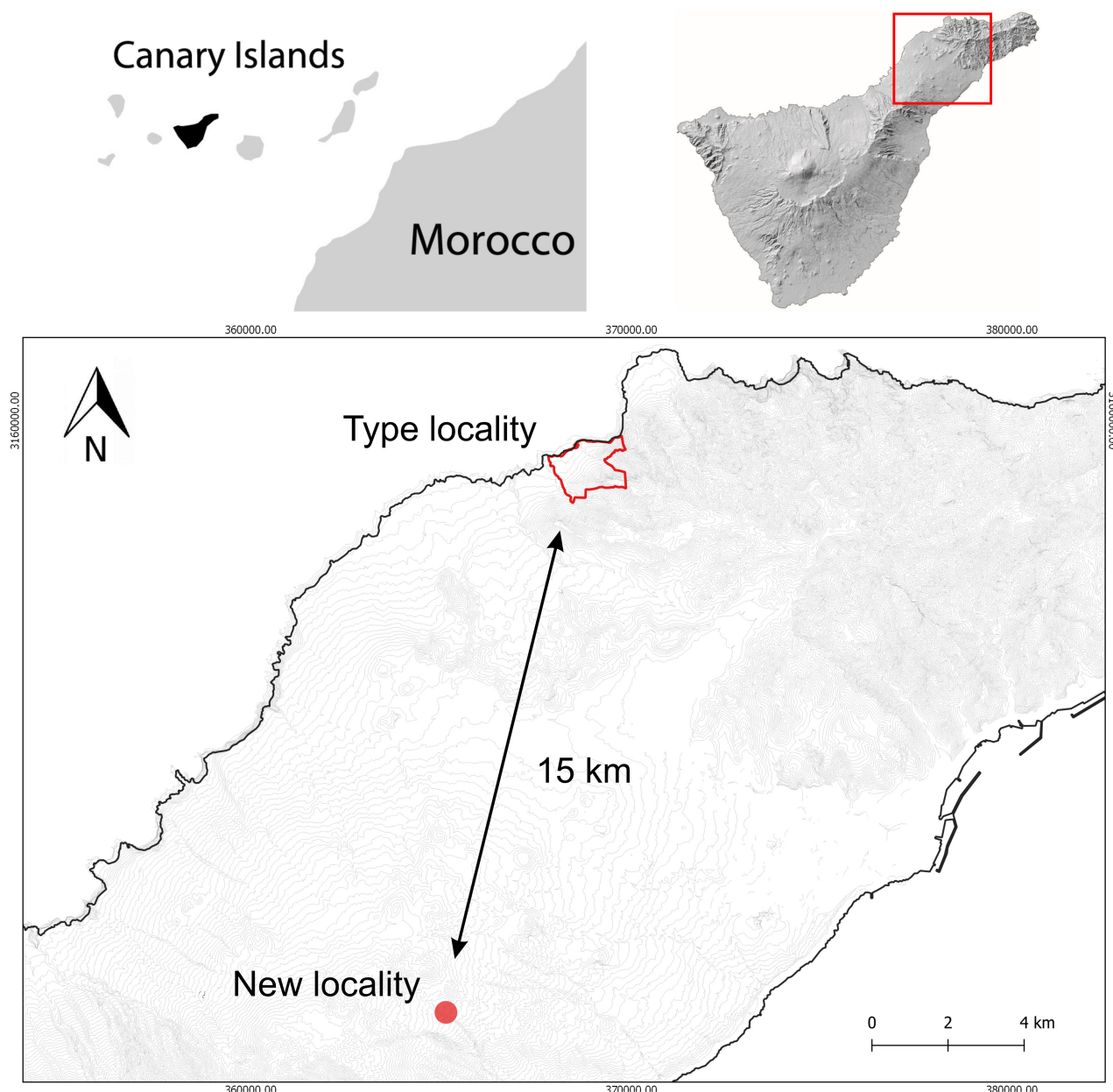


FIGURE 1. Map showing the geographic position of the Canary Islands (A) and the sampling site and type locality within Tenerife (B). Type locality (Bajamar) is marked with a red polygon and new locality (Las Raíces) is marked with a red dot (C).

Habitat: Specimens were found in a contact zone between the pine and cloud forests (laurel forest), with overflowing trade-wind clouds, the so-called ‘humid pine forest’ (association *Sideritido solutae-Pinetum canariensis* subasc. *ericetosum arboreae*) (del Arco-Aguilar & Rodríguez Delgado 2018). *Pinus canariensis* C. Sm. ex DC. in Buch was the dominant species, but other species such as *Cistus monspeliensis* L., *Morella faya* (Aiton) Wilbur and *Erica canariensis* Rivas-Mart., M. Osorio & Wildpret were also present (Figure 3B).

Ecology: All specimens were found under half buried rocks. The number of specimens found under rocks varied from few specimens (one or two) to various tens (Figure 3C). Several eggs and pupae were found attached to the hidden part of the rock and were rapidly retired by workers after the rock was lifted. Specimens occurred aggregated in a very narrow area. Other ant species also recorded for this area were *Crematogaster alluaudi* Emery 1893, *Plagiolepis schmitzii* Forel 1895, *Temnothorax gracilicornis* (Emery 1882) and *Tetramorium depressum* Forel 1892 (see Santschi 1937, Seifert 2020, Schulz 1994, Emery 1882, Cagniant 1997, Espadaler 2007, respectively).

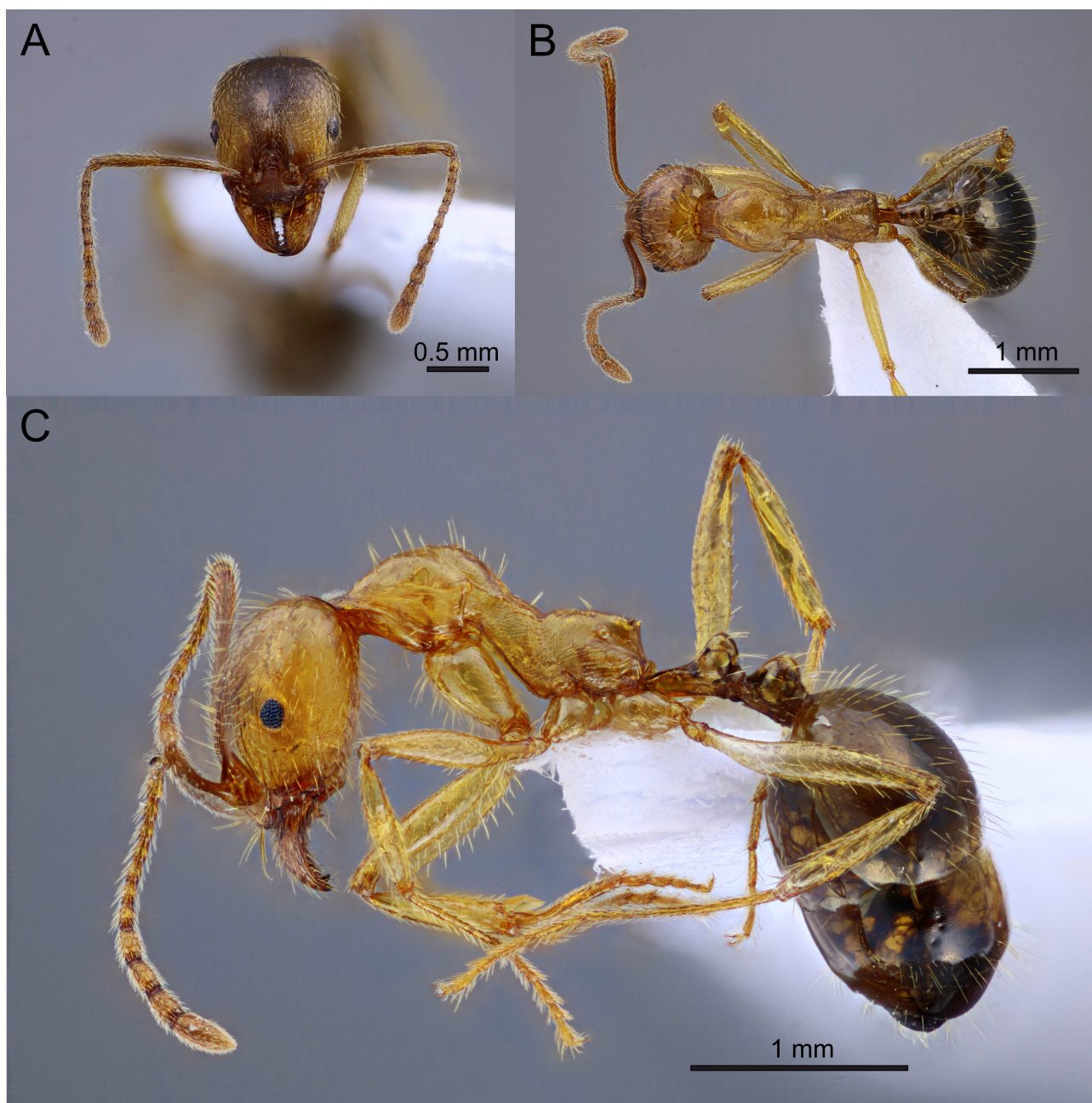


FIGURE 2. *Aphaenogaster hesperia* worker, head (A), dorsal (B) and lateral (C) view.

Discussion

Apart from the type material and another specimen (collected in 1902), Santschi (1919) mentioned that he received material from the Canary Islands and reported *A. hesperia* without any further specific data. This leads us to think that these eleven individuals are the ones that Santschi referred to in 1919. In the entomological collection of Auguste Forel there are six workers without specific date, referring just to the island of Tenerife. Although there is a lack of information on collection date, it should be noted that Forel received ant material from A. Cabrera-Díaz (Forel 1893), potentially previous to the description of *A. hesperia*. To our knowledge, this is the only explicit contribution of Forel to the Canary Island myrmecofauna. Although we acknowledge some uncertainty, we assume that *A. hesperia* material in his collection was sent before 1893 as there is no further mention of neither Canary Islands fauna nor *A. hesperia* in Forel's works. The only material with known dates is the type material and the additional worker of Tejina in Santschi's collection (1902-1903). The material without dates should be tentatively

placed within an estimated time interval between 1893 and 1919 (Forel 1893, Santschi, 1919). Thus, if 1919 is the last date when *A. hesperia* has been seen, 104 years have passed until the current rediscovery.



FIGURE 3. Sampling sites. (A) Nitrophilous community in Bajamar (type locality). (B) Pine forest of Las Raíces (new locality). (C) Detail of the brood chamber, *Aphaenogaster hesperia* workers can be seen carrying larvae.

Bajamar (type locality) (Figure 3A) is a coastal area, dominated by a nitrophilous community with small patches of a shrubland composed by *Euphorbia lamarckii*. As the precise location where *A. hesperia* was discovered is unknown, there is no further information on the habitat type apart from where the species was discovered. With the idea that the type habitat of the *A. hesperia* was either nitrophilous community or *Euphorbia* shrubland (0-500 m a.s.l.), an intensive survey carried out in Bajamar by the first author during the last five years did not yield any individual of *A. hesperia*. Additionally, 1,000 sampling points across the Canary Islands ($n = 304$ in Tenerife) were exhaustively sampled across different habitats (Hernández-Teixidor *et al.* 2020) but without any record of the species. However, specimens of *A. hesperia* were rediscovered in a small patch within a pine forest

placed at 950 m a.s.l. and 15 Km far from Bajamar. This new locality is both geographically and ecologically distant from the type locality.

During fieldwork, we have made several visits to adjacent areas seeking to expand the distribution range of the species but without success. Specimens were only found in a very narrow area and, a few metres apart from it, the species disappeared. The local density within this area was relatively high, with specimens being found under many rocks. This may be indicative of a biology based on high population densities occurring at very specific areas. Diurnal foraging was not observed, and all specimens were collected under rocks, sometimes with eggs, larvae and/or pupae on brood chambers. This could indicate that the species is either nocturnal and/or develops deep nests. This hidden foraging strategy has been described for other representatives of the genus *Aphaenogaster* (Schifani *et al.* 2023). On the other hand, worker colour across four Formicidae genera has been found to be correlated with foraging time, with pale coloration being linked to nocturnal foraging and dark and pigmented species usually foraging diurnally (Johnson & Rutowski 2022). This finding supports that *A. hesperia*, a pale coloured species, is not heliophile as other dark congeners (e.g., Lubertazzi 2012, Caut *et al.* 2013, Villalta *et al.* 2020) but nocturnal such as the pale species *A. boulderensis* Smith, 1941, *A. floridana* Smith, 1941, *A. megommata* Smith, 1963, or *A. splendida* (Roger, 1859) (Carroll 1975; Schembri & Collingwood 1981; Snelling & George 1979). If confirmed, this foraging strategy of *A. hesperia* may be partly responsible for the fact that the species has not been seen for more than 100 years.

Overall, this suggests that i) the habitat of the species is not only coastal as expected from original description and its range of distribution reaches higher altitudes, ii) the existence of an extensive geographical and ecological gap between the type locality and new locality indicates that this species could be more widespread, iii) it is a rare species with geographically restricted populations, iv) the species shows cryptic habits that make it inconspicuous. More sampling effort is needed in order to uncover the real distribution of *A. hesperia* and to better describe colonies. Being an endemic species known from just a few small localities, it should be a top priority to uncover the phylogenetic relationships with other *Aphaenogaster* species, especially from the Maghreb and Western Mediterranean areas, as well as to assess its current conservation status.

Acknowledgments

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