

New findings of phytophagous insects (Hemiptera: Coccoidea and Aphidoidea) from Ilhéu Chão (Desertas Islands, Madeira Archipelago)

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With 6 figures

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ABSTRACT: Here we report new taxonomic findings of aphids (Aphidoidea) and scales (Coccoidea) for Ilhéu Chão (Desertas Islands, Madeira Archipelago). *Protaphis pseudocardui* (Theobald, 1915) is for the first time reported to Madeira archipelago while the aphids *Aphis craccivora*, *A. gossypii*, *A. umbrella* and *Uroleucon sonchi*, and the scales *Coccus* cf. *hesperidum*, *Icerya purchasi*, *Pulvinaria urbicola*, *Saissetia coffeae* and *S. oleae* are new findings to the Desertas Islands. We also provide information on the host plant associations of these phytophagous insects. Our results highlight the need for further research on the insect fauna of Desertas Islands.

Keywords: faunistic records, host plant associations, aphids, scales, *Protaphis pseudocardui*, Ilhéu Chão, Desertas Islands, Madeira Archipelago.

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RESUMO: Neste artigo reportamos novas descobertas taxonómicas de afídeos (Aphidoidea) e cochonilhas (Coccoidea) para o Ilhéu Chão (Ilhas Desertas, Arquipélago da Madeira). A presença de *Protaphis pseudocardui* (Theobald, 1915) é pela primeira vez relatada no arquipélago da Madeira, enquanto que os afídeos *Aphis craccivora*, *A. gossypii, A. umbrella* e *Uroleucon sonchi*, e as cochonilhas *Coccus* cf. *hesperidum, Icerya purchasi, Pulvinaria urbicola*, *Saissetia coffeae* e *S. oleae*, são novas descobertas para as Ilhas Desertas. Também fornecemos informações sobre as associações destes insetos fitófagos com as plantas hospedeiras. Os nossos resultados salientam a necessidade de mais estudos sobre a fauna de insetos das Ilhas Desertas.

Palavras-chave: registos faunísticos, associações de plantas hospedeiras, afídeos, cochonilhas, *Protaphis pseudocardui*, Ilhéu Chão, Ilhas Desertas, arquipélago da Madeira.

INTRODUCTION

Phytophagous insects are one of the most speciose groups of living organisms worldwide being also well represented on oceanic islands. In many archipelagos, they are an important fraction of the overall biodiversity and include a high number of endemics and remarkable examples of species diversification and ecological associations (Borges et al., 2008a; Percy, 2010; Machado et al., 2017). Besides their ecological importance in most natural terrestrial habitats (OLFF & RITCHIE, 1998; BELOVSKY & SLADE, 2000), phytophagous insects also have a prominent role in human-changed habitats, particularly in forestry and agricultural fields, due to their direct and indirect impacts on the production of goods for human consumption. The dramatic increase in the transportation of goods and commodities during the last decades contributed to the introduction of many phytophagous insect species in island ecosystems, where some have been responsible for huge economic losses, negative social impacts and severe consequences for the conservation of native biodiversity (Ромво et al., 2010).

The species checklist of Madeira and Selvagens archipelagos was a major landmark for the knowledge of the biodiversity of these islands by providing updated information on species taxonomy and distribution for most groups of living organisms, including all phytophagous insects groups (Borges et al., 2008b). Two recent works updated the information on the scales (Coccoidea) and aphid species (Aphidoidea) from Madeira archipelago, which now comprehend respectively 109 and 183 species (Franco et al., 2011; Aguiar et al., 2013). However, the knowledge on the phytophagous insects of Madeira is far from being complete since new taxonomic findings are still occurring (Aguiar & Ilharco, 2005) and basic information on abundance, distribution and host plant associations is lacking for most species. The aim of this study is to present new findings of scales and aphids from Ilhéu Chão (Desertas Islands) jointly with information on species distribution and their association with host plants.

MATERIAL AND METHODS

The studied specimens were collected at Ilhéu Chão, in Desertas Islands, between 19 and 22 of June 2017. Ilhéu Chão is the smallest of the three Desertas Islands with 1km² and presents a relatively well-preserved plant cover with several vegetation patches dominated by native species (e.g. Artemisia argentea, Asphodelus fistulosus, Jasminum odoratissimum, Suaeda vera) (MENEZES et al., 2005). The insects were collected from several plant species (see RESULTS AND DISCUSSION section) and were frequently found in association with the invasive Argentine ant (Linepithema humile) (RAMOS, 2017). All specimens were captured with the aid of forceps and stored in vials in 70% ethanol. Later, they were identified using a stereomicroscope (Nikon Optiphot-2) and specific literature (BLACKMAN & EASTOP, 1989; 1994; 2006; NIETO NAFRÍA et al., 2004; BLACKMAN, 2013), at the Laboratório de Qualidade Agrícola (LQA) and have been deposited in the entomological collection (ICLAM) of this institution preserved in 70% ethanol or slide-mounted. Below we present our findings jointly with information on sampling dates, site location, species associations and photographs of some species. The family and speciesnames are listed alphabetically following Borges et al. (2008b) and ecological and distributional information is presented for each species. The collection code is also indicated for the specimens stored in ICLAM.

RESULTS AND DISCUSSION

Overall, many specimens from 12 phytophagous insect species were collected in this study (see below). Six species are scales (Coccoidea) and the other six aphids

(Aphidoidea). All scale (except *Hemiberlesia lataniae*) and aphid species are new findings to Desertas Islands and the aphid *Protaphis pseudocardui* (Theobald, 1915) is recorded for the first time in the archipelago. Comprehensive data on the sampled species is presented below.

Superfamily Coccoidea

Family Coccidae

Coccus cf. hesperidum Linnaeus, 1758

Material examined: Ilhéu Chão, 21/06/2017, 1 immature \bigcirc (ICLAM: C1251).

Remarks: *Coccus hesperidum* was previously known from Madeira and Porto Santo while its congener *C. viridis* Green, 1889 is restricted to Madeira Island (Aguiar, 2008). We found a single specimen matching the description of *C. hesperidum* associated with the endemic plant *Artemisia argentea* (Asteraceae).

Pulvinaria urbicola Cockerell, 1893

Material examined: Ilhéu Chão, 21/06/2017, 28 ♀♀ (ICLAM: C1259, C1267, C1269, C1272).

Remarks: This native species was previously known from Madeira Island (as *Pulvinaria grabhami* a junior synonym of *P. urbicola*) (AguIAR, 2008). In Ilhéu Chão, the species was found in association with the native plants *Plantago coronopus* (Plantaginaceae), *Silene uniflora* (Cariophyllaceae) and the endemic *Artemisia argentea* (Fig. 1).



Fig. 1 – *Pulvinaria urbicola* adult females in association with *Artemisia argentea*. Photo credit: Cândida Ramos.

Saissetia coffeae (Walker, 1852) Material examined: Ilhéu Chão, 19/06/2017, many immature and adult ♀♀ (ICLAM: C1255). Remarks: This introduced species was previously known from Madeira and Porto Santo Islands (Aguiar, 2008). Now, it was found in Ilhéu Chão in association with *Silene* sp. (Cariophyllaceae).

Saissetia oleae (Olivier, 1791)

Material examined: Ilhéu Chão, 21/06/2017, many immature and adult QQ (ICLAM: C1252, C1268, C1270).

Remarks: This introduced species was reported from Madeira and Porto Santo Islands (Aguiar, 2008). At Ilhéu Chão, we found it in association with the endemic plants *Artemisia argentea* and *Phagnalon lowei* (Asteraceae).

Family Diaspididae

Hemiberlesia lataniae (Signoret, 1869)

Material examined: Ilhéu Chão, 21/06/2017, many adult $\[Pi]$ (ICLAM: C1250, C1254, C1256, C1268a).

Remarks: This native species was known from Madeira, Porto Santo and Desertas Islands (Aguiar, 2008). In this study it was found in association with the endemic plants *Artemisia argentea* and *Phagnalon lowei*.

Family Monophlebidae

Icerya purchasi Maskell, 1879

Material examined: Ilhéu Chão, 21-22/06/2017, many immature and adult QQ (ICLAM: C1249, C1253, C1257, C1260, C1271).

Remarks: This introduced species was only known to occur in Madeira (Aguiar, 2008). It was now found in Ilhéu Chão, in association with *Artemisia argentea* (Fig. 2) and *Sonchus oleraceus* (Asteraceae).



Fig. 2 – *Icerya purchasi* adult females in association with *Artemisia argentea*. Photo credit: Cândida Ramos.

Superfamily Aphidoidea

Family Aphididae

Aphis craccivora Koch, 1854

Material examined: Ilhéu Chão, 22/06/2017, 5 apterous QQ (ICLAM: A1157).

Remarks: This native species was known from Madeira and Selvagens (Aguiar & ILHARCO, 2008) and was now found in Ilhéu Chão associated with *Silene* sp.

Aphis gossypii Glover, 1877

Material examined: Ilhéu Chão, 21/06/2017, 12 apterous QQ (ICLAM: A1162).

Remarks: This native species had been reported from Madeira and Porto Santo Islands (Aguiar & Ilharco, 2008). It was now found in Ilhéu Chão associated with the endemic plant *Crepis divaricata* (Asteraceae) (Fig. 3).



Fig. 3 – *Aphis gossypii* adult females on *Crepis divaricata*. Photo credit: Cândida Ramos.

Protaphis pseudocardui (Theobald, 1915) Material examined: Ilhéu Chão, 21/06/2017, 4 alate and 8 apterous $\bigcirc \bigcirc \bigcirc$ (ICLAM: A1161).

Remarks: This is the first record of this species in Madeira Archipelago. *Protaphis pseudocardui* was found in association with an unidentified Asteraceae.

Aphis umbrella (Börner, 1950)

Material examined: Ilhéu Chão, 21/06/2017, 5 alate and 4 apterous 22 (ICLAM: A1158).

Remarks: This native species was known from Madeira Island (Aguiar & ILHARCO, 2008). We found it in Ilhéu Chão associated with the native plant *Lavatera cretica* (Malvaceae) (Fig. 4).



Fig. 4 – *Aphis umbrella* adult females on the underside of a *Lavatera cretica* leaf, being tended by a worker of the invasive Argentine ant *Linepithema humile*. Photo credit: Cândida Ramos.



Fig. 5 – *Macrosiphoniella* sp. adult females on *Artemisia argentea* leaves. Photo credit: Cândida Ramos.

Macrosiphoniella sp.

Material examined: Ilhéu Chão, 22/06/2017, 1 nymph and 1 apterous \mathcal{Q} (ICLAM: A1159).

Remarks: This genus is known from Madeira and Porto Santo Islands. Besides the Madeiran endemic *Macrosiphoniella madeirensis* (AguIaR & ILHARCO, 2005), four other introduced species are also known to occur in the archipelago – *M. artemisiae* (Fonscolombe, 1841), *M. millefolii* (De Geer, 1773), *M. sanborni* (Gillette, 1908) and *M. tapuskae* (Hottes & Frison, 1931) (AguIaR & ILHARCO, 2008). We found two specimens of this genus in Ilhéu Chão in association with *Artemisia argentea* (Fig. 5). It was not possible to identify the species with confidence since both specimens were in bad condition. However, they are most probably *M. artemisiae* since this species is known to associate with *Artemisia argentea* in Madeira.

Uroleucon sonchi (Linnaeus, 1767)

Material examined: Ilhéu Chão, 21/06/2017, many nymphs and apterous $\bigcirc \bigcirc$ (ICLAM: A1160).

Remarks: This native species was known from Madeira and Porto Santo Islands, but also from Selvagens Archipelago (Aguiar & Ilharco, 2008). We found it in Ilhéu Chão associated with *Sonchus oleraceus* (Fig. 6).



Fig. 6 – Uroleucon sonchi adult females on Sonchus oleraceus. Photo credit: Cândida Ramos.

Our findings considerably increase the knowledge on the scales and aphids from Desertas. The species checklist of these islands is updated and now includes 8 scale (Coccoidea) and 12 aphid species (Aphidoidea). The discovery of the aphid Protaphis pseudocardui (Theobald, 1915), a hitherto unknown species in the archipelago, was unexpected and highlights the need for further studies to survey the insect biodiversity of Desertas. These surveys should be carried in all three Desertas Islands since they have been poorly sampled and their differences in geomorphology and historical legacy may translate in distinct taxonomic assemblages. The ecological information on scales and aphids showed that many species feed on the endemic Artemisia argentea, which seems to be a key host plant at Ilhéu Chão by supporting large populations of different phytophagous species. On the other hand, some phytophagous insects, particularly aphids, were found associated to a single host plant, which may render them more vulnerable to ecological disturbances in the simplified ecosystem of Ilhéu Chão.

The scales and aphids are engaged in mutualistic interactions with the invasive Argentine ant, benefiting of protection from predators and parasitoids and providing a rich food resource (the honeydew) to these aggressive ants. The consequences of these associations (frequently involving a pair of exotic species) on the natural communities of Ilhéu Chão remain unstudied but may negatively affect native species survival and the structure of natural assemblages.

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