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APHIDS HOSTING ON MADEIRAN INDIGENOUS ORCHIDS (HEMIPTERA: APHIDIDAE) *

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ABSTRACT. In a survey of the Madeira Archipelago aphid fauna, 13 samples of aphids were collected on the inflorescences of four species of indigenous orchids, *Dactylorhiza foliosa* (Verm.) Soó, *Gennaria diphylla* (Link) Parl., *Neotinea maculata* (Desf.) Stearn and *Orchis scopulorum* Summerth, between March and May 1997, March and August 1998, and February and March 2000. Those samples were studied and, as a result, six aphid species belonging to the Aphididae family were identified: *Aphis fabae* Scopoli, *Aulacorthum solani* (Kaltenbach), *Myzus ascalonicus* Doncaster, *Myzus ornatus* Laing, *Neomyzus circumflexus* (Buckton) and *Rhopalosiphoninus staphyleae* (Koch). Three of them are new records: *A. solani* to Porto Santo, and *M. ascalonicus* and *R. staphyleae* to Madeira Archipelago.

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Biological and faunistic considerations are presented for each aphid species, and the geographical distributions of aphids and orchids are analysed. With the present contribution, the number of known aphid species from the Archipelago rises to 160, with 155 from Madeira and 37 from Porto Santo.

KEY WORDS: Aphididae, aphids, Orchidaceae, indigenous orchids, Madeira, Porto Santo.

RESUMO. Foram colhidas 13 amostras de afídeos nas inflorescências de quatro espécies de orquídeas indígenas, *Dactylorhiza foliosa* (Verm.) Soó, *Gennaria diphylla* (Link) Parl., *Neotinea maculata* (Desf.) Stearn e *Orchis scopulorum* Summerth, entre Março e Maio de 1997, Março e Agosto de 1998, e Fevereiro e Março de 2000. Como resultado do estudo dessas amostras foram identificadas seis espécies de afídeos pertencentes à família Aphididae: *Aphis fabae* Scopoli, *Aulacorthum solani* (Kaltenbach), *Myzus ascalonicus* Doncaster, *Myzus ornatus* Laing, *Neomyzus circumflexus* (Buckton) e *Rhopalosiphoninus staphyleae* (Koch). Destas, três constituem novidades faunísticas: *A. solani* para o Porto Santo, e *M. ascalonicus* e *R. staphyleae* para o arquipélago da Madeira. São apresentadas considerações faunísticas e biológicas para cada espécie de afídeo e é analisada a distribuição geográfica de afídeos e orquídeas. Com a presente contribuição, o número de espécies de afídeos conhecidas no Arquipélago eleva-se para 160, sendo 155 para a Madeira e 37 para o Porto Santo.

PALAVRAS-CHAVE: Aphididae, afídeos, Orchidaceae, orquídeas indígenas, Madeira, Porto Santo.

INTRODUCTION

The aphid fauna of the Madeira Archipelago (Madeira, Porto Santo and Desertas) is relatively well studied. In a previous paper, PITA & ILHARCO (2004) reviewed all the available bibliography, which added new citations of species to the list of aphids from the Archipelago. They found out that about 30 publications had been issued since the early 20th century until present, and practically half of them in the last three decades (PITA & ILHARCO, *op. cit.*). In all, several works including new records were published: 25 for Madeira, 9 for Porto Santo and 3 for Desertas (PITA & ILHARCO, 2003, 2004).

The Orchidaceae family is represented in the Archipelago by five species: *Dactylorhiza foliosa* (Verm.) Soó, *Gennaria diphylla* (Link) Parl., *Goodyera macrophylla* Lowe, *Neotinea maculata* (Desf.) Stearn and *Orchis scopulorum* Summerth, of which *D. foliosa*, *G. macrophylla* and *O. scopulorum* are endemics (FERNANDES & CARVALHO,

2000). Worldwide, it is one of the largest families of flowering plants, comprising about 20,000 species, with 19,000 to be found mainly in the tropics. Approximately 50% of the European species occur in southern Europe, in the Mediterranean Basin and in Portugal (STEWART, 1992). Among the more representative genera are *Dactylorhiza* and *Orchis*, which are also found in Macaronesia (MABBERLEY, 1997), where the highest rates of endemism of native orchids are recorded in Madeira. Aphid collections were made during a study on the reproductive biology of native Madeiran orchids by the second author.

The purpose of this work was to draw up an inventory of the aphid species collected, for the first time, from native orchids of Madeira and Porto Santo, and to record new aphid-host associations in Madeira Archipelago.

MATERIAL AND METHODS

Thirteen aphid samples were collected by one of us (F. M. F.) from four species of native orchids – *D. foliosa*, *G. diphylla*, *N. maculata* and *O. scopulorum* – between March and May 1997, March and August 1998, and February and March 2000, in the islands of Madeira and Porto Santo.

The samples were preserved in ethanol and later in slide mounts, following the usual procedures for aphids. The samples belong to the Aphid Collection of the first author, and their code references start with a letter (*e. g*. A318).

The species are alphabetically sorted, and faunistic and biological considerations are added for each one. Moreover, their distribution in the world, in Macaronesia and in mainland Portugal is given. Hosts are also alphabetically listed, and the associated aphid fauna, all representing new aphid-host associations, are also given. New records are marked with symbols: * - recorded for the first time from a given island; ** - first record in the Archipelago.

RESULTS AND DISCUSSION

Following the analysis of the collected samples, six species of aphids were identified, belonging to the Aphididae family: *Aphis fabae* Scopoli, *Aulacorthum solani* (Kaltenbach), *Myzus ascalonicus* Doncaster, *Myzus ornatus* Laing, *Neomyzus circumflexus* (Buckton) and *Rhopalosiphoninus staphyleae* (Koch). Three of them are new records: *A. solani* for Porto Santo, and *M. ascalonicus* and *R. staphyleae* for the archipelago of Madeira. With the present contribution, the number of aphid species known in the Archipelago increases to 160, of which 155 are in Madeira and 37 in Porto Santo (PITA & ILHARCO, 2004).

Although the hosts are native orchids, two of which being endemic, no new aphid species were found. All identified aphid species are polyphagous, some of them in a high degree. Ants attend only one of them, *A. fabae*. Concerning the distribution, three of them are cosmopolitan. To our knowledge, there are no bibliographic data reporting any direct

role of aphids in orchid pollination, therefore our photographic record of an aphid carrying a *pollinarium* on its back may have been only casual. Nevertheless, their presence on the inflorescences suggests an indirect role. According to ILHARCO (1992) and PITA & ILHARCO (1998), the honeydew produced by the aphids attracts beneficial insects and serves as food for pollinators such as bees and hoverflies.

LIST OF APHID SPECIES

***Aphis fabae* Scopoli, 1763**

The black bean aphid, *A. fabae*, is dull black-coloured. It is a heteroecious holocyclic species and a vector of more than 30 viruses. In Europe its host is primarily *Euonymus*, and it is polyphagous on secondary hosts, including many cultures. It is distributed over the temperate regions of the northern hemisphere, in South America and Africa; in the warmer tropical zones and in the Middle East it tends to be replaced by *A. solanella* (BLACKMAN & EASTOP, 2000). It is known in mainland Portugal since the early 20th century (ILHARCO, 1960, 1971). In Macaronesia, it was recorded from Madeira (VIEIRA, 1951; ILHARCO, 1974), Porto Santo (GRANATE, 1971; MARQUES, 1972), Azores (GRANATE, 1971; MARQUES, 1972; BORGES *et al.*, 2000) and Canary Islands (GOMEZ-MENOR, 1960; TAMBS-LYCHE, 1971; NIETO NAFRÍA *et al.*, 1977).

Material studied

MADEIRA – Ribeiro Frio, Posto Florestal, 800 m (20 March 1997, A82a, 3 apterae, on *Dactylorhiza foliosa*); Encumeada, 950 m (10 June 1998, A319, 3 apterae, 1 alate, on *Dactylorhiza foliosa*).

PORTO SANTO – Pico Castelo, 350 m (30 March 1998, A109b, 1 apterous, on *Gennaria diphylla*).

* ***Aulacorthum solani* (Kaltenbach, 1843)**

The individuals of this species, currently called glasshouse-potato aphid or foxglove aphid, present a bright-green colour, with very long antennae and thin and long siphunculi, with no reticulation. In the apterous forms, two dark-green spots may be observed at the base of the siphunculi and, in the winged forms, several pigmented cross stripes in the abdomen. Length varies between 1.5 mm and 3 mm. It is a vector for about 40 viruses and also a very polyphagous species which, as a rule, lives anholocycly. According to BLACKMAN & EASTOP (2000), it is a cosmopolitan species, probably of European origin. It has been recorded from mainland Portugal since 1947 (ILHARCO, 1960). In Macaronesia, it is known in Madeira (TAVARES, 1914; ILHARCO, 1974), Azores (MÜLLER, 1965; ILHARCO, 1976), Canary Islands (TAMBS-LYCHE, 1971; IZQUIERDO *et al.*, 2001) and Cape Verde Islands (van HARTEN, 1982).

Material studied

MADEIRA – Ribeiro Frio, Posto Florestal, 800 m (20 March 1997, A82b, 1 apterous, on *Dactylorhiza foliosa*); Funchal, Jardim Botânico, 250 m (16 March 1998, A107, 1 apterous, 1 alate, on *Gennaria diphylla*); Fajã da Nogueira, Montado do Sabugal, 1000 m (18 March 1998, A108a, 1 apterous, on *Gennaria diphylla*); Paúl da Serra, 1500 m (09 May 1998, A318, 2 apterae, on *Neotinea maculata*); Fajã da Nogueira, Montado do Sabugal, 1000 m (20 March 2000, A1847, 14 apterae, 1 alate, on *Neotinea maculata*); Santo da Serra, Quinta, 670 m (07 February 2000, A1848a, 8 apterae, 1 alate, on *Gennaria diphylla*).

PORTO SANTO – Pico Castelo, 350 m (30 March 1998, A109a, 3 apterae, on *Gennaria diphylla*).

** ***Myzus ascalonicus*** **Doncaster, 1946**

M. ascalonicus, the shallot aphid, is a yellow-greyish aphid, with the inner faces of the antennal tubercles almost parallel, differing from the usual convergent pattern within the genus *Myzus*. The winged forms present a compact and dark abdominal plate. No sexual forms are known yet. It is an exclusively anholocyclic species which presents a high degree of polyphagy, colonising more than 20 families of plants. It is considered a vector of more than 20 viruses. BLACKMAN & EASTOP (2000) include Europe, India, Japan, Australia, New Zealand, Auckland Isles and North and South America in its distribution area. According to the same authors, the origin of this species is unknown. It has been found in mainland Portugal (ILHARCO, 1979) and, in Macaronesia, in the Azores (CRUZ de BOELPAEPE & TEIXEIRA, 1990) and the Canary Islands (CARNERO & NIETO NAFRÍA, 1993).

Material studied

MADEIRA – Areeiro, Montado do Cidrão, 1450 m (06 August 1998, A320b, 3 apterae, on *Orchis scopulorum*).

Myzus ornatus **Laing, 1932**

M. ornatus, the violet aphid, is a light-yellow coloured aphid, of small or very small size, and with low production of alates. The apterous forms present small pigmented sclerites on the dorsum, with a characteristic pattern, whereas alates have a central, dorsal black spot in the abdomen. This aphid lives isolated, on host leaves. It is a vector for about 20 viruses. It is an anholocyclic species, highly polyphagous, including ornamental plants. The oviparous females are not known, but the males were described in India, in 1975 (BLACKMAN & EASTOP, 2000). It is distributed all over the world. It occurs in mainland Portugal (VASCONCELOS, 1964; ILHARCO, 1967) and in most Macaronesia – Madeira (C. I. E., 1969), Porto Santo (ILHARCO, 1973), Azores (C. I. E., 1969), and Canary Islands (NIETO NAFRÍA *et al*., 1977).

Material studied

MADEIRA – Fajã da Nogueira, Montado do Sabugal, 1000 m (18 March 1998, A108b, 2 apterae, on *Gennaria diphylla*); Areeiro, Montado do Cidrão, 1450 m (08 May 1998, A317b, 1 apterous, on *Orchis scopulorum*); Areeiro, Montado do Cidrão, 1450 m (06 August 1998, A320a, 1 apterous, on *Orchis scopulorum*).

***Neomyzus circumflexus* (Buckton, 1876)**

In this species, the apterous forms vary from pale-yellow to bright green and are easily recognisable by a dorsal, U-shaped black sclerite. The alate forms are not frequent. *N. circumflexus*, the mottled arum aphid, is a polyphagous species, feeding both on monocots and dicots, and even on ferns and conifers. However, it lives preferentially on indoor ornamental plants. BLACKMAN & EASTOP (2000) suggest that despite its ability to transmit more than 30 plant viruses, its importance as a vector decreases under cold climates because it rarely appears outdoors. According to the same authors, it is an anholocyclic species, and the sexual forms are unknown. It is found virtually all over the world. VASCONCELOS (1964) and ILHARCO (1967) recorded it from mainland Portugal. In Macaronesia, it occurs in Madeira (ILHARCO, 1974), the Azores (MÜLLER, 1965; ILHARCO, 1976) and the Canary Islands (NIETO NAFRÍA *et al*., 1977). Some authors consider *Neomyzus* as a subgenus of *Aulacorthum* (REMAUDIÈRE & REMAUDIÈRE, 1997; BLACKMAN & EASTOP, 2000).

Material studied

MADEIRA – Fajã da Nogueira, Montado do Sabugal, 1000 m (03 May 1997, A20, 1 apterous, on *Neotinea maculata*); Areeiro, Montado do Cidrão, 1450 m (08 May 1998, A317a, 1 apterous, on *Orchis scopulorum*).

** ***Rhopalosiphoninus staphyleae* (Koch, 1854)**

Of greenish or brownish colour, the apterous form exhibits darkened stripes in the abdomen and the swollen part of the siphunculi is paler than the base or the apex. In alate forms, the spotted dorsal pattern is much more extended. In Europe this tulip aphid is a heteroecious holocyclic species, alternating between species of the genus *Staphylea* (primary host) and the underground parts of plants from several families, mainly Liliaceae and Iridaceae (secondary hosts). In the rest of the world it is very likely exclusively anholocyclic on secondary hosts, as it probably happens in the Azores (ILHARCO, 1980) and in Madeira, where the primary host does not occur. The distribution of *R. staphyleae* includes Europe, Africa (Kenya, Burundi, South Africa), Japan (?), Australia, New Zealand, North America and Peru (MILLAR, 1994; BLACKMAN & EASTOP, 2000). It is unknown in mainland Portugal. In Macaronesia, it was only recorded from the Azores (ILHARCO, 1980). For REMAUDIÈRE & REMAUDIÈRE (1997) and BLACKMAN & EASTOP (2000) the specimen collected is considered a subspecies, *Rhopalosiphoninus staphyleae staphyleae*.

Material studied

MADEIRA – Santo da Serra, Quinta, 670 m (07 February 2000, A1848b, 1 apterous on *Gennaria diphylla*).

LIST OF HOSTS

***Dactylorhiza foliosa* (Verm.) Soó**
Aphis fabae
Aulacorthum solani

Endemic species of Madeira. There are 30 native species of this genus in temperate Eurasia (13 in Europe), Alaska, Mediterranean and Macaronesia (MABBERLEY, 1997). Some tubers of the genus are eaten in Iran (MABBERLEY, 1997).

***Gennaria diphylla* (Link) Parl.**
Aphis fabae
Aulacorthum solani
Myzus ornatus
Rhopalosiphoninus staphyleae

Native species. The only species of the genus occurs in Corsica, Sardinia, Algeria, Morocco, southern Spain, mainland Portugal, Madeira and Canary Islands (DELFORGE, 1995; MABBERLEY, 1997).

***Neotinea maculata* (Desf.) Stearn**
Aulacorthum solani
Neomyzus circumflexus

Native species. There are four species of this genus, distributed from Eurasia to Macaronesia and North Africa (DELFORGE, 1995).

***Orchis scopulorum* Summerth**
Myzus ascalonicus
Myzus ornatus
Neomyzus circumflexus

Endemic species of Madeira. There are 33 species of this genus, from the temperate northern hemisphere (23 in Europe) to the southwest of China and India (MABBERLEY, 1997).

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