

Research articleSubmitted: May 31st, 2020 - Accepted: September 10th, 2020 - Published: November 15th, 2020**Non-native insect pests from the Madeira Archipelago (Portugal):
new records and further data
(Insecta: Orthoptera; Thysanoptera; Hemiptera; Coleoptera; Diptera;
Lepidoptera; Hymenoptera)**Salvatore BELLA^{1,*}, Antonio Franquinho AGUIAR²¹ (CREA) Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Centro di Ricerca Olivicoltura, Frutticoltura e Agrumicoltura - Corso Savoia 190, 95024 Acireale (CT), Italy - salvatore.bella@crea.gov.it² Laboratório de Qualidade Agrícola - Caminho Municipal dos Caboucos 61, 9135-372 Camacha, Madeira, Portugal
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Abstract

In this study, the results of recent surveys on non-native insect pests from the Madeira Archipelago are reported. Overall, 13 non-native species were recorded: *Tessellana tessellata* (Charpentier) (Orthoptera, Tettigoniidae), *Gynaikothrips ficorum* (Marchal) (Thysanoptera, Phlaeothripidae), *Leptoglossus occidentalis* Heidemann (Hemiptera, Coreidae), *Macrohomonotoma gladiata* Kuwayama (Hemiptera, Homotomidae), *Platycorypha nigrivirga* Burckhardt and *Cacopsylla fulguralis* (Kuwayama) (Hemiptera, Psyllidae), *Greenidea ficicola* Takahashi (Hemiptera, Aphididae), *Aloephagus myersi* Essig (Hemiptera, Pemphigidae), *Protopulvinaria pyriformis* (Cockerell) (Hemiptera, Coccidae), *Rhynchophorus ferrugineus* Olivier (Coleoptera, Dryophthoridae), *Phytoliriomyza jacarandae* Steyskal & Spencer (Diptera, Agromyzidae), *Lantanophaga pusillidactylus* (Walker) (Lepidoptera, Pterophoridae), and *Josephiella microcarpae* Beardsley & Rasplus (Hymenoptera, Agaonidae). Particularly, *T. tessellata*, *L. occidentalis*, *M. gladiata*, *P. jacarandae*, and *J. microcarpae* are reported for the first time from the island of Madeira. *L. occidentalis* is also reported for the first time from the island of Porto Santo. For *P. jacarandae*, this is the first record from Macaronesia, while for *M. gladiata* this is the first record also for Portugal. Most of these species are associated with allochthonous plants. Details on current distributions, host plants, biological remarks, and natural enemies are given for each species.

Key words: allochthonous insects, Madeira Archipelago, new records.**Introduction**

The Madeira Archipelago is part of the Macaronesian biogeographical region and is 1000 km from the Iberian Peninsula and just 600 km from the coast of Morocco. The terrestrial arthropod fauna of the Madeira Archipelago presents a high number of native taxa, but the number of introduced species is already considerable and is expected to keep rising due to the increasing international movement of goods and people from the various continents of the world (Pombo et al. 2010). A considerable number of alien invasive insects are accidentally introduced each year to Madeira, some of which succeed in establishing and may pose a threat to natural ecosystems and the local economy (Silva et al. 2008; Porto et al. 2017; Ciaccia et al. 2019). This 'invasion' phenomenon is particularly evident in European areas where climatic conditions are more favourable for the acclimatisation of tropical and subtropical species and where invasion is increased by the use of numerous exotic ornamental plants in parks and gardens (Bella & D'Urso 2012; Bella 2013).

The aim of this work was to identify and record new non-native insect species in the Madeira Archipelago (Portugal). Field observations were made by the authors in recent years in various areas of the islands of Madeira and of Porto Santo.

Materials and methods

Samplings were carried out in recent years throughout the islands of Madeira and Porto Santo in urban and rural environments to ascertain the presence of possible non-native insects. Particular attention was paid to allochthonous plants through visual searches of the specimens or examination of symptoms. Species identification was based on the morphologies of adults and preimaginal stages, the types of galls and leafmines, and the associations with host plants. The specimens were preserved in 70% ethanol and labelled. The collected material was studied under a binocular microscope, dissected, and mounted when necessary for the identification. The examined material has

been deposited in the private collections of the authors and in the entomological collection of the Laboratório de Qualidade Agrícola, Madeira, identified by the acronym ICLAM.

Results

Detected species

Orthoptera, Tettigoniidae

Tessellana tessellata (Charpentier 1825)

Material examined. Portugal: Madeira, ICLAM–03530: 1 ♂, Ribeirinha, Camacha, Santa Cruz, 650 m, 32.672814, -16.847457, 17.X.2003, A.M.F. Aguiar leg.; ICLAM–08649: 2 ♂♂, on Poaceae, Parque Ecológico do Funchal, 1500 m, 32.718424, -16.906187, 14.X.2017, M.M. Andrade leg.; cFA–1852: 1 ♂, 1 ♀, on Poaceae, Parque Ecológico do Funchal, 1500 m, 32.718424, -16.906187, 14.X.2017, M.M. Andrade leg.

Distribution. In Macaronesia, it is already recorded from all Canarian islands except Fuerteventura (Gobierno de Canarias. BDBC 2019). It is absent from the Azores and the Cape Verde islands. Worldwide, its distribution includes Europe, from the Iberian Peninsula to Germany in the north, to the east to Ukraine, Moldavia, and southern European Russia, and to North Africa in the south (Algeria and Lybia) (De Jong et al. 2014; Cigliano et al. 2019). It is known from Portugal, at least by Lock (1999).

Host plants. Especially on Poaceae.

Biological remarks. This species lives in dry grassland amongst grasses, and females lay eggs in hollow dry grass stems.

Remark. The Brown-spotted Bush-cricket represents a new record for Madeira and the archipelago.

Thysanoptera, Phlaeothripidae

Gynaikothrips ficorum (Marchal 1908)

Material examined. Portugal: Madeira, Funchal, 27.VI.2015, 0–5 m, colonies on *Ficus microcarpa* L.f. (Moraceae), S. Bella leg.; Calheta, 28.VI.2015, 0–10 m, on *F. microcarpa*, S. Bella leg.

Distribution. The Cuban laurel thrips, *G. ficorum*, is native to southeastern Asia. It was intercepted for the first time in the Palaearctic region from Algeria and has since become established in several countries in the Euro-Mediterranean Region. It was recorded in Europe for the first time in 1983 from Corsica (Mifsud et al. 2012). This exotic introduced species has been known from Madeira since

1909 (Zur Strassen 1977), although it was described under another name. In the rest of Macaronesia, it is present in the Canary Islands and is apparently absent from the Azores and the Cape Verde Islands (Berzosa et al. 2005; Gobierno de Canarias. BDBC 2019; Governo dos Açores. BDBA 2019).

Host plants. This thrip prefers to feed on *Ficus microcarpa*, but in cases of abundant infestation it feeds also on *F. aurea* Nutt., *F. benjamina* L., and *F. elastica* Roxb. ex Hornem. (Moraceae), as well as *Codiaeum variegatum* (L.) Rumph. ex A. Juss. (Euphorbiaceae), *Melicocca bijugatus* Jacq. (Sapindaceae), *Nicotiana tabacum* L. (Solanaceae), *Viburnum suspensum* Lindl. (Caprifoliaceae), *Citrus* sp. (Rutaceae), *Eucalyptus* sp. (Myrtaceae), *Gliricidia* sp. (Fabaceae), *Calocarpum* sp. (Sapotaceae), and orchids (Orchidaceae) (Ziouani et al. 2019).

Biological remarks. Adults and larval stages feeding on tender leaves curl the leaves and form leaf-galls (personal observations). The following predators and parasites are reported to be associated with *G. ficorum*: *Androthrips ramachandrai* Karny (Thysanoptera, Phlaeothripidae), *Anthocoris flavipes* (Reuter), *A. nemoralis* (F.), *Cardiastethus rugicollis* (Champion), *Macrotracheliella laevis* Champion, *Montandoniella confusa* Streito & Matocq (= *moraguesi* Puton), and *Orius albidipennis* (Reuter) (Hemiptera, Anthocoridae), *Teratophyllum insigne* Reuter (Hemiptera, Teratophyllidae), *Nephus peyerimhoffi* (Sicard) (Coleoptera, Coccinellidae), *Chrysoperla carnea* (Stephens) (Neuroptera, Chrysopidae), *Thripastichus gentilei* (Del Guercio), *T. thripophonus* Waterston, *Pleurotropis* sp. (Hymenoptera, Eulophidae), and *Adactylidium* sp. (Acari, Acarophenacidae) (Ziouani et al. 2019). Other thrips which serve as prey are *Arrhenothrips ramakrishnae* Hood, *Gynaikothrips flaviantennatus* Moulton, *Liothrips africanus* Vuil., *L. oleae* (Costa), *L. urichi* Karny (Phlaeothripidae), *Frankliniella occidentalis* Pergande, and *Thrips tabaci* Lindeman (Thripidae) (Mifsud et al. 2012).

Hemiptera, Coreidae

Leptoglossus occidentalis Heidemann 1910

Material examined. Portugal: Madeira, ICLAM–04163: 1 ♀, on *Pinus pinaster* Aiton, Ribeirinha, Camacha, Santa Cruz, 32.672994, -16.847458, 650 m, 07.X.2013, D. Cravo leg.; ICLAM–04170: 1 ♂, same data, 22.X.2013, F. Rocha leg.; ICLAM–04773: 1 ♂, 1 ♀, same data, 08.X.2014, J. Jesus leg.; ICLAM–04774: 1 ♀, same data, 13.X.2014, J. Jesus leg.; ICLAM–04828: 1 ♂, same data, 23.X.2014, J. Jesus leg.; ICLAM–05524: 1 ♀, same data, 08.X.2015, J. Jesus leg.; ICLAM–05525: 1 ♀, same data, 13.X.2015, J. Jesus leg.; ICLAM–06187: 1 ♀, same data, 13.X.2016, J. Jesus leg. Porto Santo, ICLAM–06332: 1 ♀, on *Pinus halepensis* Mill., Pico do Facho, 33.083474, -16.323925, 446 m, 20.II.2017, N. Nunes leg.

Distribution. The Western conifer-seed bug, *L. occidentalis* is native to western North America. After its first observation in Italy in 1999, it has been reported as an invasive species from most European countries in the last 20 years and in northern Africa and in Asia (Van Der Heyden 2019). The colonisation of the entire European continent occurred within the last ca. 10-15 years, probably promoted by independent introductions in different parts of Europe (Lesieur et al. 2019). It has already been reported for Portugal (Grosso-Silva 2010). This species is not present in the remaining Macaronesian archipelagos, although curiously another American representative of the genus, *L. gonagra* (F.) is recorded from some islands of the Canary Archipelago (Gobierno de Canarias. BDBC 2019).

Host plants. On Pinaceae: Pines (*Pinus* spp.), Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco), and Eastern hemlock (*Tsuga canadensis* (L.) Carrière).

Biological remarks. This species is known to hibernate in a variety of sites, such as loose bark, holes in dead trunks, and human dwellings. *Trichopoda pennipes* (F.) (Diptera, Tachinidae), *Gryon pennsylvanicum* (Ashmead) (Hymenoptera, Scelionidae), *Anastatus pearsalli* Ashmead and *A. bifasciatus* (Geoffroy) (Hymenoptera, Eupelmidae), and *Ooencyrtus* spp. (Hymenoptera, Encyrtidae) are reported as parasitoids.

Remark. This species represents a new record for the islands of Madeira and Porto Santo and for the archipelago.

Hemiptera, Homotomidae

Macrohomotoma gladiata Kuwayama, 1908

Material examined. Portugal: Madeira, Funchal, Sample ICLAM08764/C1312: 1♂, 3♀♀, 35 nymphs, on *Ficus microcarpa*, Caminho do Amparo, 32.649218, -16.940749, 227 m, 22.05.2020, J. Jesus leg.; Funchal, Sample ICLAM08776: 2♂♂, on *F. microcarpa*, Caminho do Amparo, 32.649203, -16.904842, 227 m, 01.06.2020, J. Jesus leg.

Distribution. *M. gladiata* is of Asian origin and in this continent it has been reported from China, Hong Kong, Taiwan, India, Sumatra, Malaysia, and Japan (Ouvrard 2019). In 2009 the species was introduced in the Mediterranean area with infestations in the Balearic Islands (Olmo García & Nieto López 2009) and mainland Spain (Galindo 2010; Mifsud & Porcelli 2012), after in Italy (Pedata et al. 2012; Bella & Rapisarda 2014). Reported also from the Canary Islands, Algeria and Montenegro (Ouvrard 2019).

Host plants. This species lives on *Ficus microcarpa* and *F. benjamina*. *Ficus benghalensis* L. and *F. microphylla*

Salzm. ex Miq. are also reported as hosts of the psyllid but these quotations are probably erroneous (Ouvrard 2019).

Biological remarks. Colonies of the psyllid develop on new shoots of the host plant, which become covered by white waxy secretions. Eggs are generally laid in clusters of 10-20 units on the new leaves (Pedata et al., 2012). After the attack the shoots become deformed, stop developing and finally die. *Anthocoris nemoralis* (F.) (Hemiptera, Anthocoridae), *Oenopia conglobata* (L.), *Scymnus* sp. (Coleoptera, Coccinellidae) and *Prionomitus mitratus* (Dalman), *Psyllaephagus punensis* Hayat & Khan (Hymenoptera, Encyrtidae) are reported as predators and parasitoids respectively (Ouvrard, 2019). We personally observed the following natural enemies: *Adalia decempunctata* and *Scymnus subvillosus* (Coleoptera, Coccinellidae), *Anthocoris nemoralis*, and several nymphs parasitized by a *Psyllaephagus* sp.

Hemiptera, Psyllidae

Platycorypha nigrivirga Burckhardt 1987

Material examined. Portugal: Madeira, Funchal, 0-5 m, 29.VI.2015, colonies on street-trees of Tipu tree, S. Bella leg.

Distribution. This psyllid is distributed in Brazil, Argentina, Bolivia, Uruguay, the United States of America, and South Africa (Rung et al. 2009; Ouvrard 2019). In Europe, it was first recorded in the Balearic Islands (Mallorca) and continental Spain (Sánchez 2008) and subsequently in Portugal (Sánchez 2011; Bella 2013). This species has recently been added to the list of the psyllids of Madeira by Aguiar et al. (2019).

Host plant. Monophagous on the Tipu tree, *Tipuana tipu* (Benth.) Kuntze (Fabaceae).

Biological remarks. Nymphs and adults produce copious amounts of honeydew on leaves and branches (personal observations).

Cacopsylla fulguralis (Kuwayama 1908)

Material examined. Portugal: Madeira, Funchal, 0-5 m, 29.VI.2015, colonies on young leaves of *Elaeagnus x ebingei* Boom. (Elaeagnaceae), S. Bella leg.

Distribution. *C. fulguralis* is native to Asia, where it occurs in China, Japan, Philippines, South Korea and Taiwan. In Europe, this psyllid was first recorded from France and then from Great Britain, Belgium, the Netherlands, Switzerland, Spain, Italy (including Sicily), and Croatia; it is known also from Russia (Kuril Islands) (Bella & Rapisarda 2014; Ouvrard 2019). It was reported from Madeira by Aguiar et al. (2019).

Host plants. On species of the genus *Elaeagnus* L. (Elaeagnaceae): *E. commutata* Bernh. ex Rydb., *E. cuprea* Rehder, *E. x ebbingei*, *E. glabra* Thunb., *E. macrophylla* Thunb., *E. oldhamii* Maxim., and *E. pungens* Thunb. (Ouvrard 2019).

Biological remarks. Adults and nymphs of *C. fulguralis* feed on plant sap, and produce copious amounts of honeydew, on which moulds develop (personal observations). Strong infestations by *C. fulguralis* lead to chlorosis, leaf drop and die back (Bella 2013). *Anthocoris nemoralis*, *Orius laevigatus* (Fieber), *O. majusculus* (Reuter) (Hemiptera, Anthocoridae) and *Chrysoperla lucasina* (Lacroix) (Neuroptera, Chrysopidae) are reported to prey on this psyllid (Ferre & Denis 2011).

Hemiptera, Aphididae

Greenidea ficicola Takahashi 1921

Material examined. Portugal: Madeira, Funchal, 0-5 m, 29.VI.2015, colonies on young twigs of *Ficus microcarpa* (Moraceae), S. Bella leg.; ICLAM-A1145: 1 alate, on yellow adhesive trap, Pico do Melro, Ponta do Sol, 32.684006, -17.097204, 213 m, 04.VIII.2015, C. Brazão leg.; ICLAM-A1152: 5 apterae, on *Ficus benjamina*, Lugar de Baixo, Ponta do Sol, 32.679927, -17.086855, 18 m, 06.IV.2017, J. Jesus leg.

Distribution. *G. ficicola* is native to southeastern Asia and was accidentally introduced in Africa, the New World, and Australia. The first European records were for Italy (Barbagallo et al. 2005) and subsequently Spain and Malta (Mifsud et al. 2012). It was previously recorded from Madeira by Aguiar et al. (2013).

Host plants. This aphid lives on *Ficus* spp. (Moraceae) but has also been recorded on *Psidium guajava* L. (Myrtaceae) and *Artocarpus integrifolia* L. (Moraceae). *Ficus carica* L. has also been rarely observed as a hostplant of *G. ficicola* (Bella & Mazzeo 2009; Mifsud et al. 2012).

Biological remarks. It is a termophilous anholocyclic species, and its spread to the Western Hemisphere may be favoured by global warming (Bella et al. 2009).

Hemiptera, Pemphigidae

Aloephagus myersi Essig 1950

Material examined. Portugal: Madeira, Funchal, 29.VI.2015, 0-5 m, on *Aloe* sp. (Xanthorrhoeaceae), S. Bella leg.

Distribution. The Aloe aphid is an Afrotropical species of sub-Saharan origin. It has spread to different regions of the planet, including the Palaearctic region (Great Britain, Portugal, Spain, France, Italy (including Sicily), Greece, Tunisia, and Japan), the Nearctic region (Canada, and the United

States of America), and Australia. The first record from Macaronesia (Madeira Island) was by Aguiar et al. (2013).

Host plants. The host plants belong to the genera *Aloe*, *Gasteria* and *Haworthia* (Xanthorrhoeaceae).

Biological remarks. This aphid lives at the bases of succulent leaves, probably alternates to *Pistacia* in Africa, and is anholocyclic elsewhere (Aguiar et al. 2013).

Hemiptera, Coccidae

Protospulvinaria pyriformis (Cockerell 1894)

Material examined. Portugal: Madeira, Funchal, 27.VI.2015, 0-5 m, on *Laurus nobilis* L. (Lauraceae), S. Bella leg.

Distribution. The pyriform scale, *P. pyriformis*, has a neotropical origin and is currently widespread on the American continent. It is widely distributed in many areas of the world. Its presence in Europe has been reported in the Madeira Archipelago since the end of the 19th century (Leonardi 1898), although its discovery on the continent occurred in 1948 in Spain. In the Mediterranean and Macaronesian areas, this coccid has been recorded in the Iberian Peninsula, France, Italy, Malta, Greece, the Azores, the Canary Islands, and Israel (García Morales et al. 2016). In Portugal, it was reported by Green (1923) and subsequently by Carvalho & Aguiar (1997).

Host plants. *P. pyriformis* is a polyphagous species, with more than 100 plant hosts belonging to 36 families (especially Araliaceae, Lauraceae, Myrtaceae, Rubiaceae and Rutaceae).

Biological remarks. A serious pest of fruit trees and ornamentals in several tropical and subtropical countries. Infestations of pyriform scales on plants can result in reduced vigour, leaf drop, and reduction in size and quality of fruit. It can also result in the growth of black sooty mould on leaves, which blocks sunlight and minimises the energy available to the plant. In Madeira, this soft scale is frequently attacked by several encyrtid parasitoids, namely *Microterys nietneri* (Motschulsky) and several still unidentified species of *Anagyrus* Howard and *Metaphycus* Mercet (personal observations, unpublished data).

Coleoptera, Dryophthoridae

Rhynchophorus ferrugineus Olivier 1790

Material examined. Portugal: Madeira, Camacha, 26.VI.2015, 300-400 m, on *Phoenix canariensis* Chabaud, S. Bella leg.

Distribution. Originally from southeastern Asia, this pest of palm trees has spread extensively, mainly as a conse-

quence of worldwide commerce. Today it is present in almost all Mediterranean countries, including those in northern Africa (except Algeria) and the Middle East (EPPO 2019). In Macaronesia, it was first reported from the Canary Islands in 2005 from Gran Canaria Island and in 2008 from Madeira (Stüben 2017; Gobierno de Canarias. BD-BC 2019).

Host plants. The most important host plants of the Red palm weevil are the Date-palm, *P. dactylifera* L., the Canarian palm, *P. canariensis*, and the coconut tree, *Cocos nucifera* L. (Arecaceae). Minor host plants include about two dozen species, most of them palms (EPPO 2019). The most attacked host plant in Macaronesia, *Phoenix canariensis*, is indigenous to the Canary Islands but is cultivated in many other places, including Madeira and Porto Santo in the Madeira Archipelago.

Biological remarks. The female lays approximately two hundred eggs at the bases of young leaves, and the larvae will feed on the internal soft fibres of the crown, tunnelling through the tissues for more than a month and causes the death of the plant (personal data).

Diptera, Agromyzidae

Phytoliriomyza jacarandae Steyskal & Spencer 1978

Material examined. Portugal: Madeira, Ribeira Brava, 0-20 m, 26.VI.2015, leaflets with mines on *Jacaranda mimosifolia* D. Don., S. Bella leg.; ICLAM-0741: 3 ♂♂, 10 ♀♀, on *J. mimosifolia*, Mata da Nazaré, São Martinho, Funchal, 32.6473266, -16.9382098, 205 m, 06.VIII.2001, A.M.F. Aguiar leg.

Distribution. Species of South American origin (Argentina). It is known from the United States of America, Australia, New Zealand, and South Africa. In the Palearctic region, *P. jacarandae* is reported from Italy (Bella et al. 2007), Portugal (Bella 2013) and Greece (Bella 2014).

Host plant. Monophagous on the Blue jacaranda tree, *Jacaranda mimosifolia* (Bignoniaceae).

Biological remarks. The larvae produce a short linear brown mine in a single leaflet, developing into an irregular blotch. The affected leaves drop, and the larvae pupate in the soil. The canopy quickly yellows and defoliates (Bella et al., 2007). In Madeira, we found the following hymenopteran parasitoids attacking the *Jacaranda* leaf-miner: the eulophids *Cirrospilus pictus* (Nees), *C. vittatus* Walker, *Diglyphus isaea* (Walker) and the pteromalid *Pachyneuron aphidis* (Bouché) (personal observations, unpublished data).

Remark. This species represents a new record for the Madeira Archipelago and for Macaronesia.

Lepidoptera, Pterophoridae

Lantanophaga pusillidactylus (Walker 1864)

Material examined. Portugal: Madeira, Funchal, 27.VI.2015, 0-5 m, adults and larvae were observed on bushes of *Lantana camara* L. (Verbenaceae), S. Bella leg.

Distribution. The Lantana plume moth is native to the southern United States of America, Mexico, the Caribbean, and South America. It has been reported in many tropical and subtropical areas of the world. In the Mediterranean-Macaronesian regions, *L. pusillidactylus* was only known until 1996 from Madeira and the Canary Islands, in 1997 it was recorded for the first time from mainland Europe in Spain (King 2000), and a few years later it was recorded from Italy (Sicily) (Bella & Marchese 2007) and from Portugal (Corley et al. 2008). Other records concern the Azores, Gibraltar, Malta, Cape Verde, Morocco and Israel (Bella & Marchese, 2007; Corley et al. 2008).

Host plants. The main host plant is *Lantana camara*, but the larvae have also been reported feeding on *L. montevidensis* (K. Spreng.) Briq., *L. involucrata* L., *L. peduncularis* Anders., *Lippia alba* (Mill.) N.E. Br. ex Britton & P. Wilson, *Phyla lanceolata* (Michx.) Greene, and *P. nodiflora* (L.) Greene (Verbenaceae); *Caperonia palustris* (L.) A. St.-Hil. (Euphorbiaceae); *Mentha spicata* L. (Lamiaceae); and *Utricularia* spp. (Lentibulariaceae) (Bella & Marchese 2007; Herbison-Evans et al. 2019).

Biological remarks. In the urban area larvae complete their life cycle feeding exclusively on floral organs (personal observations).

Hymenoptera, Agaonidae

Josephiella microcarpae Beardsley & Rasplus 2001

Material examined. Portugal: Madeira, Funchal, 27.VI.2015, galls on leaves of *Ficus microcarpa*, S. Bella leg.; ICLAM-08683: 1 ♀ and leaf galls, on *F. microcarpa*, Jardim Almirante Reis, Funchal, 32.647495, -16.902674, 15 m, 04.IX.2015, A.M.F. Aguiar leg.; Sample 21536: leaves with galls on *F. microcarpa*, Machico, Largo do Senhor dos Milagres, 32.719095, -16.764613, 12 m, 20.X.2019, J. Jesus leg.; Sample 21537: leaves with galls on *F. microcarpa*, Machico, Caminho da Dona Clarisse, 32.719254, -16.765726, 11 m, 20.X.2019, J. Jesus leg.

Distribution. *J. microcarpae* is native to south-eastern Asia and has been accidentally introduced and established in the Hawaiian and Canary Islands, California, Florida, Italy, and in Malta (Lo Verde 2002; Rasplus et al. 2010; Mifsud et al. 2012). First recorded in Europe in 1997 in the Canary Islands (Beardsley & Rasplus 2001).

Host plants. It produces characteristic galls (blister deformations) on the leaves of *Ficus microcarpa*.

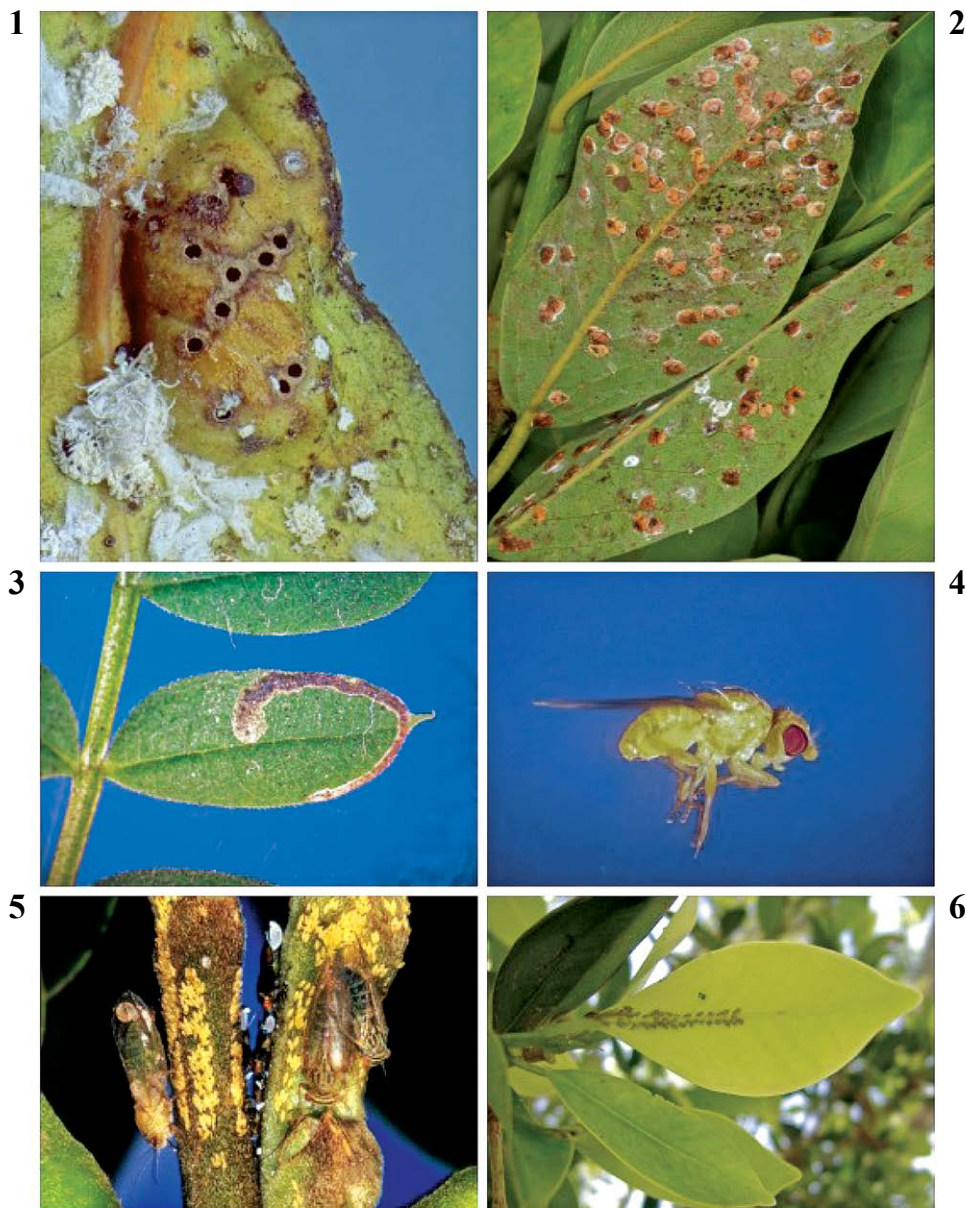
Biological remarks. The adult develops inside the gall and will leave the gall via an exit hole. This wasp in Malta has two generations per year (Mifsud et al. 2012). From our field observations in the city of Funchal, the attacked leaves by *J. microcarpae* show no change in colour and remain vital. The leaves of *Ficus benjamina* plants are not attacked by this species.

Remark. This species represents a new record for the Madeira Island and the Archipelago.

Discussion and conclusion

In this paper, we report 13 non-native insects (1 Orthoptera, Tettigoniidae; 1 Thysanoptera, Phlaeothripidae; 1 Hemiptera, Coreidae; 1 Hemiptera, Homotomidae; 2 Hemiptera, Psyllidae; 1 Hemiptera, Aphididae; 1 Hemiptera, Pemphigidae; 1 Hemiptera, Coccidae; 1 Coleoptera, Dryophthoridae; 1 Diptera, Agromyzidae; 1 Lepidoptera, Pterophoridae; 1 Hymenoptera, Agaonidae) for the fauna of the Madeira Archipelago.

Five of these species are reported for the first time from Madeira: the Bush-cricket *Tessellana tessellata*, the West-



Figs 1-6 – 1, Galls of *Josephiella microcarpae* Beardsley & Rasplus (Agaonidae), on leaves of *Ficus microcarpa*; 2, *Protopulvinaria pyriformis* (Cockerell) (Coccidae) on *Laurus nobilis*; 3-4, *Phytoliriomyza jacarandae* Steyskal & Spencer (Agromyzidae), leaflets with mines on *Jacaranda mimosifolia* and an adult; 5, adults of *Platycorypha nigrivirga* Burckhardt (Psyllidae) on *Tipuana tipu*; 6, *Greenidea ficicola* Takahashi (Aphididae), colonies on young twig of *Ficus microcarpa*.

ern conifer seed bug *Leptoglossus occidentalis*, the Jumping plant-louse *Macrohomotoma gladiata*, the Jacaranda leaf-miner *Phytoliriomyza jacarandae* and the Ficus gall wasp *Josephiella microcarpae*. The coreid bug *Leptoglossus occidentalis*, is reported for the first time also for the island of Porto Santo. For the agromyzid *Phytoliriomyza jacarandae*, this is the first record for Macaronesia. In the Palaearctic region, the only records of this species are in Italy, Greece and Portugal; it was probably imported with infected ornamental Blue jacaranda trees (Bella 2013). For *Macrohomotoma gladiata* this represents the first record also for Portugal.

The introduction of all new recorded alien insects must be considered accidental, and most of these species are associated with allochthonous host plants. The detected species show a high level of host-plant specificity, and their presence remains restricted to artificial habitats, such as nurseries, parks, gardens, and urban areas. The presence of the oligophagous species *Protopulvinaria pyriformis* and *Greenidea ficicola*, must be monitored because they could attack *Citrus* trees and the Common fig, respectively. The rapid colonisation of Madeira in recent decades by numerous alien invasive insects can represent a more serious threat, with both economic and ecological impacts (Boieiro et al. 2015). The spontaneous dispersal of parasitoids and predators of exotic origin in some countries where these pests are already present (Margiotta et al. 2017) has led to considerable interest in the biological control of these species.

Acknowledgements – The authors thank Paola Giambertone (Catania, Italy) for her assistance during field research.

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