

SHORT COMMUNICATION

Invasive insect pests and their associated parasitoids on ornamental urban plants on Corfu island - *Phytoliriomyza jacarandae* Steyskal and Spencer 1978 (Diptera, Agromyzidae) a new record in Greece

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Summary In this study the results of recent surveys on alien insect pests of ornamental urban plants on the island of Corfu are reported. Overall seven alien species associated with allochthonous ornamental plants were recorded: *Acizzia jamatonica* (Kuwayama 1908), *Glycaspis brimblecombei* Moore 1964 (Hemiptera, Psyllidae), *Corythucha ciliata* (Say 1832) (Hemiptera, Tingidae), *Obolodiplosis robiniae* (Haldeman 1847) (Diptera, Cecidomyiidae), *Phytoliriomyza jacarandae* Steyskal and Spencer 1978 (Diptera, Agromyzidae), *Cacyreus marshalli* Butler 1898 (Lepidoptera, Lyceinidae) and *Leptocybe invasa* Fisher and La Salle 2004 (Hymenoptera, Eulophidae). Particularly, *Phytoliriomyza jacarandae*, a leafminer of the Blue jacaranda tree *Jacaranda mimosifolia* D. Don. (Bignoniaceae) is reported for the first time from Greece. Two associated parasitoids, *Platygaster robiniae* Buhl and Duso 2008 (Hymenoptera, Platygasteridae) and *Psyllaephagus bliteus* Riek 1962 (Hymenoptera, Encyrtidae) obtained from *Obolodiplosis robiniae* and *Glycaspis brimblecombei*, respectively, are also reported. Details on current distribution, host plants and biological remarks are given for each species.

Additional keywords: alien insects, first record, urban environment

Introduction

The introduction of alien insects is a growing phenomenon especially in countries with intensive international movement of goods and people. This is particularly evident in the Mediterranean Basin where climatic conditions are more favourable for the numerous tropical and subtropical species to establish themselves. The continuously increasing use of numerous species of plants native to different regions of the planet in European parks and gardens has been enriching the European fauna with mainly alien species that develop on the same host plants (Bella, 2013). In the last decade,

several invasive insect pests have been introduced, have spread rapidly in the Mediterranean area and are causing serious damage to agricultural, forest and ornamental plants. Biological invasions by alien insect species are a great ecological and economic threat for their direct and indirect impact on indigenous biodiversity.

The aim of this work was to identify alien insect species on urban ornamental plants on Corfu. Field observations were made by the author in the late summer 2013 in public gardens in various towns.

Materials and methods

Samplings were carried out in August 2013 throughout Corfu. Ornamental exotic plants were investigated to ascertain the presence of possible pests, by beating or by careful vis-

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ual search of specimens or by examination of symptoms. Species identification was based on the morphology of adults and preimaginal stages; important was the observation of the type of galls and leafmines and the association with the host plants. Part of the samples was conserved in 75% ethanol and labelled. The collected material was studied in the laboratory, dissected under a binocular microscope and prepared when necessary. Examined material is preserved in the private collection of the author and partly in the entomological collection of the Department of Agri-food and Environmental Systems Management, University of Catania.

Results

Detected species

Hemiptera, Psyllidae

Acizzia jamatonica (Kuwayama 1908)

Native range: species of oriental origin (China, Korea and Japan).

Distribution: in Europe, it was first detected in Italy and later recorded in numerous European countries, including the United Kingdom, Portugal, Spain, France, Corsica, Switzerland, Germany, Slovenia, Croatia, Montenegro, Serbia, Slovakia, Greece, Bulgaria and Hungary. Since 2006, it has been found in the United States of America (Bella, 2013).

Host plant: different species of *Albizia* (Fabaceae, Mimosoideae); in Europe on the Persian silk tree, *A. julibrissin* (Willdenow) Durazzini.

Material examined: Corfu city, 39°37'N, 19°55'E, 10 m a.s.l., 17.VIII.2013, adults on *A. julibrissin*.

Biological remarks: the life cycle of *A. jamatonica* includes numerous overlapping generations; the psyllid overwinters in the adult stage. Leaves and shoots can be completely colonised by juvenile and adult stages with serious damage, leading to total or partial desiccation. Large amounts of honeydew

are produced and can cause some inconvenience in urban environments (Sánchez García and Burckhardt, 2009).

Glycaspis brimblecombei Moore 1964

Native range: species described from Australia.

Distribution: this species has shown invasive behaviour in the last 15 years and has spread across several continents outside its native range. It was first detected in the United States of America (California, Florida and the Hawaiian Islands) and subsequently recorded from Mexico, Central and South America (Brazil, Uruguay, Ecuador, Venezuela, Colombia, Peru, Chile and Argentina) and Africa (Morocco, Algeria, Tunisia and South Africa). It is also found in the Canary Islands, New Zealand and Mauritius (Bella, 2013). In Europe, *G. brimblecombei* is reported from Portugal, Spain, France, Corsica, Italy, Sicily, Sardinia, Greece, Corfu and Montenegro (Bella and Rapisarda, 2013; Reguia and Peris-Felipo, 2013; Ben Attia and Rapisarda, 2014; Milonas and Partsinevelos, 2014; Tsagkarakis *et al.*, 2014).

Host plant: associated with different species of Eucalyptus (Myrtaceae) (Brennan *et al.*, 2001); in the Mediterranean area mainly on the River red gum, *E. camaldulensis* Dehnh.

Material examined: 16-20 August 2013; Benitses, 39° 32'N, 19° 54'E, 6 m a.s.l.; Lefkimi 39° 24'N, 20° 04'E, 6 m a.s.l.; Kassiopi, 39° 47'N, 19° 45'E, 8 m a.s.l.; Corfu city, 39° 37'N, 19° 55'E, 10 m a.s.l.; Roda, 39° 47'N, 19° 48'E, 27 m a.s.l.; Agios Mattheos, 39° 29'N, 19° 52'E, 140 m a.s.l.; Sinarades, 39° 34'N, 19° 50'E, 151 m a.s.l.; Kato Garouna, 39° 32'N, 19° 51'E, 225 m a.s.l.; Pelekas, 39° 35'N, 19° 49'E, 247 m a.s.l.; nymphal stage and adults have been observed on *E. camaldulensis*.

Biological remarks: nymph instars construct white conical lerps using wax and honeydew secretions, while the adults are highly mobile and live freely on the foliage. It produces copious amounts of wax and honeydew on the infested leaves, causing desiccation and premature leaf drop (Laudonia and Garonna, 2010).

Hemiptera, Tingidae

Corythucha ciliata (Say 1832)

Native range: species of Nearctic origin.

Distribution: now widespread across Europe in the United Kingdom, Portugal, Spain, France (including Corsica), Italy (including Sardinia and Sicily), Belgium, Netherlands, Germany, Austria, Switzerland, Croatia, Slovenia, Serbia, Montenegro, Greece, Turkey, Czech Republic, Slovakia, Romania, Hungary and Bulgaria. It has been found in Chile, southern Russia, Korea, China, Japan and Australia (Bella, 2013).

Host plant: feeds primarily on Sycamore trees, *Platanus* (Platanaceae), especially *P. occidentalis* L.; other host plants are *Broussonetia papyrifera* (L.) Vent., *Carya ovata* (Mill.) Koch, *Tilia* sp., *Chamaedaphne* sp., *Fraxinus* sp., and *Quercus laurifolia* Michx.

Material examined: Corfu city, 39°37'N, 19°55'E, 10 m a.s.l., 17.VIII.2013, adults on *Platanus* sp.

Biological remarks: *C. ciliata* feeds on the underside of leaves desiccating the tissue, which may drop prematurely. A single female can lay up to 350 eggs along the leaf veins. There are five immature instars, and in Europe one life cycle is completed in just 20 to 50 days and several generations can occur each year (Malumphy *et al.*, 2006).

Diptera, Cecidomyiidae

Obolodiplosis robiniae (Haldeman 1847)

Native range: species of Nearctic origin.

Distribution: in Europe, it was first noticed during 2003 in Italy, and subsequently it has rapidly spread throughout a large part of Europe. It has also been observed in South Korea, China, Japan, New Zealand, Ukraine and Russia (Bella, 2013). For the Corfu the species is reported by Skuhrová and Skuhrový (2006).

Host plant: different species of *Robinia* (Fabaceae: Papilionoideae).

Material examined: Benitses, 39°32'N, 19°54'E, 6 m a.s.l., 16.VIII.2013; Corfu city, 39°37'N, 19°55'E, m 10 a.s.l., 17.VIII.2013. Galls and larvae have been observed on the Black

locust tree, *R. pseudoacacia* L.

Biological remarks: the larvae form characteristic leaf-margin roll galls. Usually 1-2 larvae can be found in a gall and 1-3 galls per leaflet. The larvae of the summer generations pupate inside the galls on the trees, while those of the autumn generation pupate in the soil after leaf fall. Several generations (2, 3 or even 4) of the gall midge may develop in a year depending on climatic conditions (Bella, 2007).

Diptera, Agromyzidae

Phytoliriomyza jacarandae Steyskal and Spencer 1978

Native range: species of South American origin.

Distribution: it is widespread in Argentina (Córdoba), the United States of America (California), Australia, New Zealand and South Africa (Spencer, 1990). In the Palaearctic region, the only records are in Italy (Liguria and Sicily regions) and Portugal (Bella *et al.*, 2007; Bella, 2013).

Host plant: monophagous leafminer of the Blue jacaranda tree, *Jacaranda mimosifolia* D. Don. (Bignoniaceae).

Material examined: Kato Garouna, 39°32'N, 19°51'E, 216 m a.s.l., 16.VIII.2013.

Biological remarks: the young larva produces a short linear brown mine in a single leaflet developing into an irregular blotch. The affected leaves drop and the larva pupate in the soil. The canopy quickly yellows and defoliates (Bella *et al.*, 2007).

Lepidoptera, Lycaenidae

Cacyreus marshalli Butler 1898

Native range: species of South African origin (Swaziland, Lesotho, Botswana, Mozambique, Zimbabwe and South Africa).

Distribution: it is widespread in the Balearic Islands, Portugal, Spain, Netherlands, Norway, Finland, Sweden, France, Corsica, Belgium, Germany, Switzerland, Great Britain, Italy, Sardinia, Sicily, Malta, Slovenia, Croatia, Czech Republic, Greece, Romania, Slovakia, Bulgaria, Turkey, Israel, Estonia, Ukraine,

Uzbekistan, the Canary Islands and Morocco (CABI, 2014).

The first record for mainland Greece is that of Martinou *et al.* (2011), while from the island of Corfu the species is recorded by Parker (2010).

Host plant: *C. marshalli* is a pest of cultivated *Geranium* spp. and *Pelargonium* spp. (Geraniaceae), but the butterfly also has the capacity to infest native *Geranium* spp., and could cause problems for the wild species.

Material examined: Benitses, 39°32'N, 19°54'E, 6 m a.s.l., 16.VIII.2013, adults on flowers of *Geranium* sp.

Biological remarks: eggs are laid near the flower buds or less frequently on the leaves; the hatched larvae penetrate inside the stems of the host plant, where they bore galleries and emerge at the fourth and final larval stage to form light-green to dark-brown pupae. In favourable conditions they can produce up to six generations per year. The flight period occurs from the first half of April to the first half of November (Longo, 2004).

Hymenoptera, Eulophidae

***Leptocybe invasa* Fisher and La Salle 2004**

Native range: species described from Australia.

Distribution: it is widespread in Europe (Balearic Islands, Portugal, Spain, France, Corsica, Italy, Sardinia, Sicily, Greece and Canary Islands); also found in Africa (Morocco, Algeria, Uganda, Ethiopia, Kenya, Tanzania, Mozambique, Zimbabwe and South Africa); in Asia (Turkey, Israel, Jordan, Syria, Kurdistan, Iran, Iraq, India, Thailand, Vietnam, Cambodia and China); in Oceania (Australia and New Zealand); in South America (Brazil and Argentina) and in the USA (Florida) (Maatouf and Lumaret, 2012).

Host plant: the pest attacks different species of *Eucalyptus* (Myrtaceae).

Material examined: Benitses, 39°32'N, 19°54'E, 6 m a.s.l., 16.VIII.2013, galls and adults on *Eucalyptus camaldulensis*.

Biological remarks: *L. invasa* is particular-

ly damaging to new growth, due to its preference for young leaves (including petioles) and stems of new shoots for oviposition: plants may become deformed, and growth may be stunted due to heavy galling. The wasp produces two or three overlapping generations per year. A female lays about 80-100 eggs shallowly beneath the epidermis; the larvae complete their development within the gall (Kim, 2008).

Associated parasitoids

Hymenoptera, Platygasteridae

***Platygaster robiniae* Buhl and Duso 2008**

Native range: species of Nearctic origin.

Distribution: the parasitoid wasp is present in France, Italy, Sicily, Switzerland, Denmark, Croatia, Montenegro, Serbia, Slovakia, Czech Republic, Bulgaria, Ukraine, South Korea and China (Jørgensen, 2009; Sviridov and Bazhenova, 2009; Lu *et al.*, 2010; DAISIE, 2014).

Host: specific parasitoid of the locust gall midge, *Obolodiplosis robiniae* (Diptera, Cecidomyiidae).

Material examined: Benitses, 39°32'N, 19°54'E, 6 m a.s.l., 16.VIII.2013; Corfu city, 39°37'N, 19°55'E, 10 m a.s.l., 17.VIII.2013, found to parasitize larvae of *O. robiniae* infesting *Robinia pseudoacacia* L. (Fabaceae).

Biological remarks: *P. robiniae* is a gregarious, koinobiont endoparasitoid of *O. robiniae*; it is an egg-larval parasitoid, parasitising eggs of *O. robiniae* and emerging from the host larvae. After hatching, the parasitoid undergoes only two larval instars, and development from egg to adult takes about 28 days to complete. The life cycle of a parasitoid generation is synchronised with that of its host; the adult wasps' emergence coincides with that of the host, so that they can parasitise the host eggs (Kim *et al.*, 2011).

Observed parasitisation: based on personal observations conducted in the town of Corfu, 55 galls were observed (1-3 for single leaflets) on a totally of 30 attacked preleved leaves, with 32 emerged specimens of *P. robiniae*.

Hymenoptera, Encyrtidae

Psyllaephagus bliteus Riek 1962

Native range: species native to Australia.

Distribution: it spread to New Zealand, Brazil, Spain, Italy (including Sicily and Sardinia), Greece (Corfu), Morocco and Algeria and is due to an accidental introduction, probably together with its host (Bella and Rapisarda, 2013; Reguia and Peris-Felipo, 2013). For psyllid biological control programmes, *P. bliteus* has been deliberately introduced to the USA (California), Mexico and Chile (Bella, 2013).

Host: *P. bliteus* is a specific parasitoid of the invasive Red gum lerp psyllid, *Glycaspis brimblecombei*, a pest on different species of *Eucalyptus* (Myrtaceae).

Material examined: Benitses, 39°32'N, 19°54'E, 6 m a.s.l., 16.VIII.2013, found to parasitize nymphal instars of *G. brimblecombei* infesting *Eucalyptus camaldulensis*.

Biological remarks: *P. bliteus* is an endoparasitoid that delays development until the psyllid host reaches the late fourth or fifth instars. It pupates within the remains of the host. Adults have a metallic green body, the female with darker antennae and more pubescent than the male. Their lifespan depends on the temperature. The biological cycle completes between 16 and 41 days, depending greatly on weather conditions (Bella and Rapisarda, 2013).

Observed parasitisation: personal observations made during summer 2013 in the town of Benitses: from a total of 713 lerps (500 examined leaves of *E. camaldulensis*), 168 nymphs (23.6%) of *G. brimblecombei* result were parasitised.

Discussion

In the present contribution, seven alien insect species (1 Hemiptera, Psyllidae; 1 Hemiptera, Tingidae; 1 Diptera, Cecidomyiidae; 1 Diptera, Agromyzidae; 1 Lepidoptera, Lycaenidae; 1 Hymenoptera, Eulophidae) associated with non-indigenous ornamental plants on Corfu (Greece) are recorded. One

of these pests, the agromyzid *Phytoliriomyza jacarandae*, is new to the Greek fauna. Moreover, the presence of two parasitoid wasps, *Platygaster robiniae* (Hymenoptera, Platygastridae) and *Psyllaephagus bliteus* (Hymenoptera, Encyrtidae) obtained from *Obolodiplosis robiniae* and *Glycaspis brimblecombei*, respectively, are also reported. The introduction of all new recorded alien insects must be considered accidental; also the two associated antagonists were most probably introduced together with their hosts, as has already happened in other European countries.

In the Palaearctic region, the only records of *Phytoliriomyza jacarandae* are in Italy (mainland and Sicily) and Portugal; it was probably imported to these countries and to Greece with infested ornamental Blue jacaranda trees (Bella *et al.*, 2007; Bella, 2013).

The detected species show a high level of host-plant specificity, and their dispersion is related to the presence of their exotic host plants, thus they should remain restricted to artificial habitats, such as nurseries, parks, gardens and urban areas. However, two species, *Corythucha ciliata* and *Cacyreus marshalli*, can spread to natural environments and attack spontaneous plants.

The rapid colonisation in Mediterranean countries by the psyllid *Glycaspis brimblecombei* can represent a more serious threat, with both economic and ecological impacts, because of the large diffusion of *Eucalyptus* trees used for extensive reforestation (Bella and Rapisarda, 2013). The spontaneous dispersal of the psyllid's exotic parasitoids also in Greece leads to a remarkable interest in the biological control of the pest, as already shown in the countries where it has been found. The rapid colonisation of European countries by alien pests requires continuous investigation of their possible impacts and population dynamics.

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ΣΥΝΤΟΜΗ ΑΝΑΚΟΙΝΩΣΗ

Χωροκατακτητικοί εντομολογικοί εχθροί και τα παρασιτοειδή τους σε καλλωπιστικά φυτά του αστικού περιβάλλοντος της Κέρκυρας - *Phytoliriomyza jacarandae* Steyskal and Spencer 1978 (Diptera, Agromyzidae) νέα καταγραφή στην Ελλάδα

S. Bella

Περίληψη Η παρούσα εργασία παρουσιάζει τα αποτελέσματα πρόσφατων επισκοπήσεων για ξενικά είδη εντόμων σε καλλωπιστικά φυτά στο αστικό περιβάλλον της Κέρκυρας. Συνολικά καταγράφηκαν επτά ξένα είδη τα οποία σχετίζονται με αλλόχθονα καλλωπιστικά φυτά: *Acizzia jamatonica* (Kuwayama 1908), *Glycaspis brimblecombei* Moore 1964 (Hemiptera, Psyllidae), *Corythucha ciliata* (Say 1832) (Hemiptera, Tingidae), *Obolodiplosis robiniae* (Haldeman 1847) (Diptera, Cecidomyiidae), *Phytoliriomyza jacarandae* Steyskal and Spencer 1978 (Diptera, Agromyzidae), *Cacyreus marshalli* Butler 1898 (Lepidoptera, Lycaenidae) και *Leptocybe invasa* Fisher and La Salle 2004 (Hymenoptera, Eulophidae). Αυτή είναι η πρώτη αναφορά του *Phytoliriomyza jacarandae*, υπονομευτής του *Jacaranda mimosifolia* D. Don. (Bignoniaceae), στην Ελλάδα. Επίσης καταγράφηκαν δύο υμενόπτερα παρασιτοειδή, *Platygastraster robiniae* Buhl and Duso 2008 (Hymenoptera, Platygastridae) και *Psyllaephagus bliteus* Riek 1962 (Hymenoptera, Encyrtidae), των *Obolodiplosis robiniae* και *Glycaspis brimblecombei*, αντίστοιχα. Παρουσιάζονται λεπτομέρειες για την τρέχουσα γεωγραφική κατανομή, ξενιστές και βιολογικά χαρακτηριστικά κάθε είδους.

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