

The Impact of Alien Horticultural Pests on Urban Landscape in the Southern Part of Montenegro

Snježana Hrnčić¹, Sanja Radonjić¹ & Tatjana Perović²

¹ Department for Plant Protection, Biotechnical Faculty, University of Montenegro, Mihaila Lalića 1, 81000 Podgorica, Montenegro; E-mail: shrnccic@yahoo.com

² Department for Subtropical Cultures, Biotechnical Faculty, University of Montenegro, Bjeliši bb, 85000 Bar, Montenegro

Abstract: There are numerous harmful biotic factors that cause serious negative consequences on ornamental plants, which results in disruption of their health status and aesthetic appearance. The very dynamic construction works accompanied by large imports of ornamental plants in the last 15 years have markedly changed traditional appearance of the landscape, particularly in the southern part of Montenegro. During this period the following new alien insect species were recorded: *Metcalfa pruinosa*, *Phylloxera quercus*, *Bemisia tabaci*, *Luperomorpha xanthodera*, *Frankliniella occidentalis*, *Acizzia jamatonica*, *Epichoristodes acerbella*, *Glycaspis brimblecombei*, *Rhynchophorus ferrugineus*, *Leptocybe invasa*, *Ophelimus maskelli*, *Cydalima perspectalis*, *Opogona sacchari*, *Aleurocanthus spiniferus*, and *Cacyreus marshalli*. Among these pests, the most serious damages are caused by the red palm weevil *R. ferrugineus*, which specifically destroy the Canary Island date palm *Phoenix canariensis* along the entire Montenegro seacoast.

Key words: Non-native species, introduction, ornamentals, damages

Introduction

Any species, subspecies, variety, or race occurring in an area or ecosystem to which it is not native may be classified as an alien species. When they cause changes in ecosystems, displacing native organisms by predation or parasitism, by competition for space and nutrients or food, or by alteration of habitat, the alien species are considered to be invasive. When their impact is beyond the acceptable levels, which lead to environmental damages and economic and social losses, alien species become pests (CARMODY 1999).

Ornamental trees, shrubs and flowers as a regular part of the urban greenery, public and private gardens and parks are of huge importance for modern human life, affecting its quality of and functioning. In addition to domestic markets, international trade in ornamental plants is also a major industry, and there is ever-increasing demand for novel and high-quality products to import and export (ALFORD 1995). The market for ornamentals is very wide and dynamic

and this trade usually results in interceptions and introductions of alien pests in importing countries.

The active construction works in the last 15 years, followed by numerous new buildings, along with the fast-growing touristic market in the southern part of Montenegro, were also linked with a huge importation of ornamental plants. This resulted in significantly altered appearance of the seacoast landscape, as well as in the introduction of new alien species, some of them showing drastic impact on the landscape and causing huge economic losses.

In this paper, we present an overview of the new alien insect pests recorded on ornamental plants in southern part of Montenegro in the period 2003-2016.

Materials and Methods

Visual inspections of ornamental plants were made at commercial nurseries and urban parks in the southern part of Montenegro (the collection sites are presented



Fig. 1. Main collection sites in Montenegro. Geographical name of area/ locality as indicated on the map: A – Area of Skadar Lake, B – Boka Kotor Bay, 1 – Podgorica, 2 – Ulcinj, 3 – Bar, 4 – Tivat, 5 – Kotor, 6 – Radanovići, 7 – Đenovići, 8 – Herceg Novi, 9 – Budva, 10 – Danilovgrad, 11 – Cetinje, 12 – Baošići, 13 – Kumbor

in Fig. 1). The samples of adult and immature specimens were collected in 70% ethanol. Samples of infested plants were also taken for further laboratory analyses. In addition to the visual inspections, we checked the specimens captured on blue sticky traps, as well as on pheromone traps. Certain species were detected in the samples sent by the Phytosanitary Inspectorates. All insect samples were processed according to the standard entomological procedures for morphological diagnostics. In most cases, photographs of living specimens and of the signs of damages were taken as well.

Results and Discussion

Fifteen alien phytophagous insect pests were recorded in the period 2003-2016.

The citrus flatid planthopper, *Metcalfa pruinosa* Say, 1830 (Hemiptera, Flatidae) (Fig. 2 a, b)

Metcalfa pruinosa was first recorded for Europe in 1979 in Italy (ZANGHERI & DONADINI 1980) and spread rapidly to all parts of that country and also invaded the adjacent countries. It is a highly polyphagous species and feeds on a wide range of woody and herbaceous plants (CABI 2015b).

The species was first detected in Montenegro in 2003, on *Robinia pseudoacacia* L. in the area of Skadar Lake (Fig. 1). It was also found on many nearby cultivated and wild plants in the same area (HRNČIĆ 2003). In the following years, this species massively spread in the Podgorica locality and along the coastal area. The visual inspections on the infested plants showed its presence on a wide number of ornamental plants, both outside and inside the greenhouses of the nursery plants, as follows: *Robinia* sp., *Bougainvillea* sp., *Washingtonia robusta* H. Wendl, *Rosa* sp., *Camellia japonica* L., *Albizia julibrissin* Durazz., *Prunus laurocerasus* L., *Pittosporum tobira* (Thunb.) W. T. Aiton, *Magnolia* sp., *Lagerstroemia indica* (L.), *Laurus nobilis* L., *Prunus* sp., *Hibiscus* sp., *Jasminum* sp., and *Quercus ilex* L. (HRNČIĆ et al. 2007). The species was also registered on many fruit crops, with grapewine being the most susceptible. The direct damages from the pest are insignificant, while the indirect impact, in the form of the whitish secretion from the immatures and the huge amount of honeydew, is the real aesthetical problem for the urban environment. It was also noticed that the sooty mold fungus commonly developed on the honeydew. Although its presence was currently not as abundant as in the first years after its detection, *M. pruinosa* may be considered established in Montenegro. The occurrence of the wasp *Neodryinus typhlocybae* Ashmead, which is a successful parasitoid on *M. pruinosa*, has been reported on the seacoast in the town of Budva (GLAVENDEKIĆ et al. 2010).

The oak phylloxera, *Phylloxera quercus* Boyer de Fonscolombe, 1834 (Hemiptera, Phylloxeridae) (Fig. 3 a, b)

Phylloxera quercus is found in southern Europe, North Africa and the Middle East. In Europe, it has been confirmed from Italy, France, and Spain, and reported to feed on the undersides of leaves of deciduous and evergreen *Quercus* spp. (REID & CANNON 2010).

The species was first detected in 2003, on several *Quercus ilex* plants in an ornamental nursery at the Podgorica locality (HRNČIĆ & RADONJIĆ 2004) (Fig. 1). During the visual inspections, the numerous necrotic yellow-and-brown spots were registered on the upper side of the infested leaves; these spots than merge with time and lead to tissue deformation downwards and appearance of bronze colour. In cases of severe infestations, the oak nursery plants prematurely lost the leaves, which, consequently, resulted in the drying of some plants. Besides, *Ph. quercus* caused aesthetic damages, particularly noticed on the mature trees that were grown close



Fig. 2 (a, b). *Metcalfa pruinosa*: a) adults; b) drops of excreted honeydew

to the inspected nursery. In the following years, spreading of the species beyond the site of the first detection was not registered, in spite of the repeated infestations within the same nursery and on the same mature trees. *Ph. quercus* can be considered established in Montenegro, in restricted area at the Podgorica locality.

The tobacco whitefly, *Bemisia tabaci* Gennadius, 1889 (Hemiptera, Aleyrodidae) (Fig. 4 a, b)

The genus *Bemisia* is thought to have originated in Asia, possibly in India (CABI 2017). The *B. tabaci* species complex is highly polyphagous and attacks many crops. It has global distribution and wide presence in Europe. The two most widespread members of the *B. tabaci* species complex are the Middle East-Asia Minor 1 (MEAM1, known as B biotype), and the Mediterranean (MED, known as Q biotype). Both MEAM1 and MED have become global invaders and caused strong damages (DE BARRO & AHMED 2011).

All developmental stages of *B. tabaci* were found in 2008 on hibiscus at a residential building in Podgorica (Fig. 1). In the same year, its presence



Fig. 3 (a, b). *Phylloxera quercus*: a) a colony on underside of leaves; b) necrotic spots on upper side of leaves

was detected at a nursery greenhouse at the same locality, on several ornamental plants: *Abutilon* sp., *Lippia citriodora* Kunth, *Thunbergia* sp., and *Lantana camara* L. (HRNČIĆ et al. 2008). The visual observations in the period from 2009 to 2015 showed the spreading of the species to new ornamental hosts: *Verbena* sp., *Euphorbia pulcherrima* Willd. ex Klotzsch, *Gerbera jamesonii* Bolus ex Hooker f., *Mandevilla (Dipladenia) sanderi* Hemsl., *Petunia* sp., *Chrysanthemum* sp., and *Paulownia* sp., as well as to the weed *Sonchus oleraceus* L., at greenhouses at localities Ulcinj, Bar, and Radanovići (HRNČIĆ et al. 2012b) (Fig. 1), with *M. (D.) sanderi* being the most favorable host. The MEAM1 (B biotype) genetic group was represented at the Podgorica locality (found on *Hibiscus* sp. and *S. oleraceus*), while the MED (Q biotype) genetic group was



Fig. 4 (a, b). *Bemisia tabaci*: a) adults on underside of leaves; b) immatures on underside of leaves of *Mandevilla (Dipladenia) sanderi*

represented at localities Ulcinj and Bar (found on *M. (D.) sanderi*) (ŠKALJAC et al. 2010, 2013).

As a result of the feeding of the *B. tabaci* adults and immatures, symptoms of leaf chlorosis and wilting were common in all infested plants. In cases of severe infestations, excretion of huge amount of honeydew, associated with the sooty moulds was noticed. The presence of all developmental stages on the underside of leaves of all hosts indicated that *B. tabaci* may successfully complete its life cycle on them. It was also noticed that the yearly population started building up since the mid of June. Although present in low population density, this pest is considered established in Montenegro.

The western flower thrips, *Frankliniella occidentalis* Pergande, 1895 (Thysanoptera, Thripidae) (Fig. 5)

The species is naturally abundant on many wild flowers throughout western North America to southern California. Its first record in Europe was from the Netherlands in 1983. *F. occidentalis* is



Fig. 5. *Frankliniella occidentalis*: adult

highly polyphagous, with at least 250 plant species from more than 65 families, listed as host plants (CABI 2016). It is considered the most destructive insect pest of greenhouse crops due to the direct damages to the plant parts, as well as because of vectoring the tospoviruses: *Tomato spotted wilt virus* (TSWV) and *Impatiens necrotic spot wilt virus* (INSV) (CLOYD 2009).

The first detection of *F. occidentalis* was at a greenhouse near the Podgorica locality in 2008, on cucumber. Then the species was found on flowers and leaves of *Tagetes* sp., and on blue sticky traps in the same area (HRNČIĆ et al. 2009) (Fig. 1). In 2009, the visual inspections showed spreading into other greenhouses with ornamental plants within the area of the Podgorica locality. This spreading was also confirmed by using blue sticky traps. Some new host plants were detected as well, namely: *Gerbera* sp., *Chrysanthemum* sp., and *Petunia* sp. In 2010, *F. occidentalis* was detected on *Portulacca* sp. (HRNČIĆ & RADONJIĆ 2012). In the same year the TSWV was found on several ornamental plants: *Gerbera* sp., *Petunia* sp., and *Chrysanthemum* sp., in the area of Podgorica (ZINDOVIĆ et al. 2014). Direct damages of the species, caused by feeding on the host plants, were markedly visible on flowers and in some extent on leaves, and were mainly aesthetic. *F. occidentalis* is considered established in Montenegro and regarded as a permanent pest on many ornamental plants in a wider area of Podgorica.

The flea beetle, *Luperomorpha xanthodera* Fairmaire, 1888 (Coleoptera, Chrysomelidae, Alticinae) (Fig. 6 a, b)

The pest originates in Asia. It was first reported for Europe in 2004 from Britain, in 2007 from Italy and in 2009 from the Netherlands (DEL BENE & CONTI



Fig. 6 (a, b). *Luperomorpha xanthodera*: a) an adult on *Jasminum sambac*; b) damages on *Rosa* sp.

2009). The species is considered a pest of minor economic importance (EPPO/ OEPP 2012).

Luperomorpha xanthodera was first reported in 2009 in one nursery at the Podgorica locality (Fig. 1). The findings were on several ornamental plants: *Rosa* sp., *Hibiscus* sp., *Nerium oleander* L., *Lantana* sp., *Citrus mitis* Blanco, and *Leptospermum* sp., as well as on some fruit species. The pest attacked leaves and flowers (RADONJIĆ & HRNČIĆ 2009). In 2010, the species was found at the same locality, on the previous and on some new hosts: *Ligustrum japonicum* Thunb. 'Texanum', *Pittosporum* sp., *Rhyncospermum jasminoides* Lindl., *Jasminum sambac* (L.) Aiton, and *Hydrangea (Hortensia)* sp. In addition, the pest was registered on *Rosa* sp. in



Fig. 7. *Acizzia jamatonica*: immature specimens on underside of leaves

one nursery at the Đenovići locality (Fig. 1). The visual inspection showed that the damages were especially severe on roses and oleander. However, these damages on flowers were mainly aesthetic. *L. xanthodera* has not been detected in the following years and its establishment is not confirmed in Montenegro so far.

The jumping plant lice, *Acizzia jamatonica* (Kuwayama, 1908) (Hemiptera, Psyllidae) (Fig. 7)

The species originates in Asia. It has recently been reported from several European countries. It is particularly damaging for Southern Europe where *Albizia julibrissin* Durazz is widely planted as an ornamental shade tree in private and public gardens. In cases of mass attacks in several consecutive years, the pest can lead even to the death of the host plant (SELJAK 2006).

Acizzia jamatonica was first recorded in 2009 in a commercial plant nursery at the Podgorica locality. The finding was on nursery plants of *A. julibrissin*. The species was found in 2010 in an urban area of the Herceg Novi locality on a mature tree of *A. julibrissin*. The next finding was in 2012 in an urban area of the Kotor locality (MALUMPHY et al. 2013) (Fig. 1). In the following years, the most severe damages were noticed in the urban zone of the Herceg Novi locality, where total or partial desiccation of some infested



Fig. 8 (a, b). *Glycaspis brimblecombei*: a) an adult; b) lerp on upper side of eucalyptus leaves

trees was recorded. All developmental stages of the pest were found on nursery plants and mature trees of *A. julibrissin*. The symptoms of infestation were registered on the leaves and young shoots. In cases of heavy infestations, large amounts of honeydew were produced and associated with *sooty* moulds. The white waxy filaments produced by the juvenile lices were one of the most conspicuous symptoms. Drops of honeydew were also visible under the heavy infested trees. We observed early defoliation of the infested plants as well. All above-mentioned signs of infestation were aesthetic damages, particularly disturbing the urban landscape. No further spreading of the pest was recorded in the period 2013-2016. *A. jamatonica* could be considered established in restricted area of the Boka Kotor Bay and at the Podgorica locality.

The red gum lerp psyllid, *Glycaspis brimblecombei* (Moore, 1964) (Hemiptera, Aphalaridae) (Fig. 8 a, b)

The species originates in Australia. In recent years, it has become an invasive pest, which causes severe defoliation and tree mortality in some *Eucalyptus* spp. (LAUDONIA & GARONNA 2010).

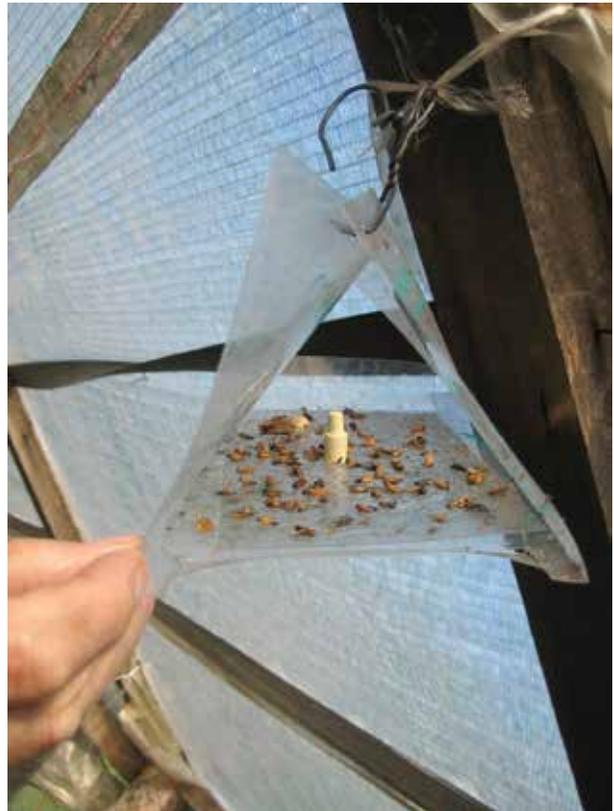


Fig. 9. *Epichoristodes acerbella*: adults on pheromone traps

Glycaspis brimblecombei was first detected in 2012 on *Eucalyptus camaldulensis* Dehnh. The finding was in a residential area of the Bar locality (MALUMPHY et al. 2013) (Fig. 1). Lerp (conical white coverings secreted by the nymphs) were recorded on old and new leaves of the trees. At the same locality, symptoms of severe infestations, followed by conspicuous honeydew and falling of the leaves, were detected in 2013 (PEROVIĆ et al. 2013). No further spreading was observed during visual inspections in the following years. The species may be considered established only in the area of the Bar locality.

The South African carnation tortrix, *Epichoristodes acerbella* (Walker, 1864) (Lepidoptera, Tortricidae) (Fig. 9)

The species is indigenous to South Africa and was first found for Europe in the mid-1960s (in glass-houses in the Scandinavian countries). Later, it appeared in Italy and other Mediterranean countries. *E. acerbella* is a polyphagous pest on a range of crops, but its principal hosts are carnations and chrysanthemums (CABI 2015a).

Epichoristodes acerbella was first detected on pheromone traps in 2012 in nurseries of ornamental plants. The findings were made at localities Ulcinj and Bar, on the seacoast (Fig. 1). Soon after the first



Fig. 10 (a, b, c). *Rhynchophorus ferrugineus*: a) adults; b) damaged palm trees – ‘umbrella-like’ symptom; c) damaged palm trees – symptoms resembling drought stress

detection the species was registered on pheromone traps in a nursery with ornamental plants at localities Đenovići and Podgorica (RADONJIĆ 2012) (Fig. 1). In 2013, the pest was confirmed on pheromone traps from the same localities, and in addition, it was found at locality Radanovići. No further spreading was observed in the following two years. Symptoms

of infestations were rarely detected only on carnation where larvae feed on leaves, with forming a shelter of silk, and bore flower buds. The species is considered established in Montenegro, however, it causes small damages.

The red palm weevil, *Rhynchophorus ferrugineus* (Olivier, 1790) (Coleoptera, Curculionidae) (Fig. 10 a, b, c)

The species originates in Southeastern Asia. It is a notorious pest on palms in all areas where it has established. The first detection of the species in Europe was in Spain in 1994, and since then, it has spread to many European countries (HODDLE 2015, MALUMPHY et al. 2016).

Rhynchophorus ferrugineus was first detected for Montenegro in 2012. The finding was on a Canary Island date palm, *Phoenix canariensis* Chabaud. The ‘umbrella-like’ symptom and symptoms resembling drought stress were found on trees in a hotel complex in the coastal area of the Ulcinj locality (HRNČIĆ et al. 2012a) (Fig. 1). Until October 2014, the pest was restricted only to this area. Then the first signs of its spreading were noticed and the pest was found in the area of the Budva locality (Fig. 1). In 2016, *R. ferrugineus* was registered along the entire seacoast. All infested palms in Montenegro are *Ph. canariensis*, except one *Trachycarpus fortunei* (Hook.) H. Wendl. found in 2016 at the Ulcinj locality. The presence and spreading of the pest along the seacoast resulted in devastation and death of many palms, and in drastic changes in the coastal landscape of our country. The pest is considered established along the whole seacoast of Montenegro.

The blue-gum chalcid, *Leptocybe invasa* Fisher & La Salle, 2004 (Fig. 11 a, b), and the eucalyptus gall wasp *Ophelimus maskelli* (Ashmead, 1900) (Fig. 12 a, b) (Hymenoptera, Eulophidae)

Leptocybe invasa and *Ophelimus maskelli* are native to Australia. They are serious gall-inducing pests of *Eucalyptus*. The two species are now spread and established in Europe, more specifically, in the Mediterranean (MENDEL et al. 2004, DHAHRI et al. 2010).

Both species were found in 2013 on mature trees of *Eucalyptus camaldulensis* Dehnh. in an urban area of the Bar locality (Fig. 1). *L. invasa* was not registered to spread in the following years, but was repeatedly detected at the same locality (unpublished data). In addition to the repeated findings in the years after its first detection, *O. maskelli* was also found in 2015 in imported mature trees of *Eucalyptus* sp. at the locality Radanovići (as an interception). The further inspections showed no spreading of the pest



Fig. 11 (a, b). *Leptocybe invasa*: galls on petioles and midrib to other localities.

With regard to *L. invasa*, the visual inspections of the infested eucalyptus trees showed that the symptoms of infestation were the galls formed on the midribs, petioles and stems of the new shoots. In cases of heavy infestations deformation of leaves and shoots were observed. *O. maskelli* caused numerous single blister-like galls on the surface of the leaves. Both pest are considered established in a very restricted area around the Bar locality.

The box tree moth, *Cydalima perspectalis* (Walker, 1859) (Lepidoptera, Crambidae) (Fig. 13 a, b, c)

The species originates in East Asia. In Europe, it was reported for the first time in 2006 in south-western Germany (KRÜGER 2008). Since then, the pest has been recorded in many European countries (BELLA 2013), including the Balkan countries (e.g. GLAVENDEKIĆ 2014, NAČESKI et al. 2015, OSTOJIĆ et al. 2015, STRACHINIS et al. 2015).

Cydalima perspectalis was first detected in 2014 in an urban area of the locality Herceg Novi, on many box trees. Soon after the first detection, the

Fig. 12 (a, b). *Ophelimus maskelli*: a) single blister-like galls; b) single blister-like galls together with *Glycaspis brimblecombei*

species was found in the urban areas of localities Podgorica, Ulcinj, Bar, Tivat, and Kotor (HRNČIĆ & RADONJIĆ 2014) (Fig. 1). The visual inspections of the infested box trees showed that certain plants were completely dried out, while on those that still were partially green, the leaves were markedly chewed and webbed by silk together with twigs. Huge amounts of dark green frass were found inside and under the infested box trees. All developmental stages of the pest were detected in the infested plants. It was also observed that young larvae skeletonised the leaves, which, although not destroyed completely, dry out over time. Damages were usually noticed late because the young larvae were deeply hidden among the box tree twigs and leaves. The mature larvae can completely defoliate the bushes of *Buxus* within a short period. During the visual inspections, we registered the complete drying of many box trees, which influenced strongly the urban landscape in the infested localities. In 2015, the pest was found at the same localities as in the previous year and, in addition, for the first time at the localities Budva and



Fig. 13 (a, b, c). *Cydalima perspectalis*: a) an adult; b) larvae feeding on leaves of a box tree; c) completely dried box trees



Fig. 14 (a, b). *Opogona sacchari*: a) larvae; b) infested *Dracena draco* tree

Danilovgrad. In 2016, it was also registered at the locality Cetinje. Thus, *C. perspectalis* showed very high rate of spreading and invaded almost the whole southern part of Montenegro within only two years. The species is considered established.

The banana moth, *Opogona sacchari* (Bojer, 1856) (Lepidoptera, Tineidae) (Fig. 14 a, b)

The species was originally described from Mauritius. It is a tineid moth with typically Old World tropical distribution. Populations could establish in the tropical belt and in areas with Mediterranean climate, but also in glasshouses throughout the



Fig. 15 (a, b). *Aleurocanthus spiniferus*: dense colonies of immature specimens on underside of leaves of *Rosa* sp. (a) and *Helix hedera* (b)

world. *O. sacchari* attacks a number of ornamental plants (EPPO/ OEPP 2006, CABI 2015c).

Two samples of infested leaves of imported *Dracena draco* (L.) L. trees were sent by the Phytosanitary Inspectorates in 2014 to the Entomology Laboratory of the Biotechnical Faculty at the University of Montenegro. Larvae and pupae resembling those of *O. sacchari* were found in one of the two samples. Immediately after that, a visual inspection of the two mature *D. draco* trees stored in the customs warehouse was made. The same larvae and pupae were confirmed in one of these trees. Damages were particularly visible at the basis of leaves where infested tissue began to decompose, huge amounts of frass were present and leaves started to dry. Additional samples of leaves were taken and after eclosion of adults at the laboratory, the identity of the pest was confirmed. The infested tree was destroyed. The other tree was under a quarantine survey for one year. This was the only finding of *O. sacchari* in Montenegro and is considered as an interception.

The orange spiny whitefly, *Aleurocanthus spiniferus* (Quaintance, 1903) (Hemiptera, Aleyrodidae) (Fig. 15 a, b)

The species originates in Southeast Asia and as a highly polyphagous infests host plants from more than 30 plant families, including some ornamental plants, such as *Rosa* sp. (EPPO/ CABI 1997).

The first detection of *A. spiniferus* was in 2013 in citrus-producing orchards (RADONJIĆ et al. 2014). In 2015, the species was registered on several ornamental plants in the vicinity of the site of the first finding at the localities Baošići and Kumbor (Fig. 1). The pest was registered on *Rosa* sp., *Helix hedera* L., *Wisteria sinensis* (Sims) DC., and *Laurus nobilis* L. In 2016, it was confirmed from the same localities and the same hosts as in 2015, with a new finding on *H. hedera* at the locality Đenovići. The visual inspections showed that *Rosa* sp. and, to a lesser extent *H. hedera* L., were particularly susceptible to this pest with symptoms of severe infestations. On infested *Rosa* sp., dense colonies of immatures were developed on the underside of the leaves. Because of conspicuous honeydew excretion, the leaves were almost completely covered in black sooty mould fungus. The heavy infested plants showed symptoms of die back. *A. spiniferus* is considered established in localities around the area of Boka Kotor Bay.

The geranium bronze, *Cacyreus marshalli* Butler, 1898 (Lepidoptera, Lycaenidae) (Fig. 16 a, b)

The species is native to South Africa. It was accidentally introduced into the Balearic Archipelago about 1990 by imported ornamental *Pelargonium* sp. (RAYNOR 1990, SARTO & MONTEYS 1992). Since then, it has been spreading around the western Mediterranean and eastwards in Europe, although more slowly, with records from southern Italy and Greece.

During the visual inspections on nurseries with ornamental plants in 2016, symptoms of damaged *Pelargonium* sp. stems were noticed at the localities Bar, Kotor, Radanovići, and Đenovići (HRNČIĆ 2016) (Fig. 1). The most visible symptoms were on stems, which turned black and small holes appeared. Inside these stems, greenish hairy larvae with pink markings were found to form galleries filled with excrements. At the same time, very hairy brownish pupae were found on the damaged stem tissue. These symptoms of infested plants, along with the larval and pupal morphological features resembled an infestation caused by *C. marshalli*. The identity of the species was confirmed after the eclosion of the adults at the laboratory.



Fig. 16 (a, b). *Cacyreus marshalli*: a) an infested pelargonium plant with small holes on the stem; b) a larva

References

- ALFORD V. D. 1995. A colour atlas of pests of ornamental trees, shrubs and flowers. London: Manson Publishing, 448 p.
- BELLA S. 2013. The box tree moth *Cydalima perspectalis* (Walker, 1859) continues to spread in Southern Europe: new records for Italy (Lepidoptera Pyraloidea Crambidae). *Redia* 96: 51-55.
- CABI 2015a. *Epichoristodes acerbella* (South African carnation tortrix) datasheet [online] www.cabi.org/isc/datasheet/21538. Last accessed on March 2017.
- CABI 2015b. *Metcalfa pruinosa* (frosted moth-bug) datasheet. [online] www.cabi.org/isc/datasheet/35054 Last modified 30 September 2015.
- CABI 2015c. *Opogona sacchari* (banana moth) datasheet. [online] www.cabi.org/isc/datasheet/37683. Last modified on 22 June 2017.
- CABI 2016. *Frankliniella occidentalis* (western flower thrips) datasheet. [online] www.cabi.org/isc/datasheet/24426. Last accessed on March 2017.
- CABI 2017. *Bemisia tabaci* (tobacco whitefly) datasheet. [online] www.cabi.org/isc/datasheet/8927. Last accessed on March 2017.
- CARMODY C. 1999. Alien forest pests context for the Canadian Forest Service's Science Program. Ottawa: Science Branch Canadian, Forest Service, Natural Resources Canada, 17 p.
- CLOYD R. A. 2009. Western Flower Thrips (*Frankliniella occidentalis*) management on ornamental crops grown in greenhouses: have we reached an impasse. *Pest Technology* 3 (1): 1-9.
- DE BARRO P. & AHMED M. Z. 2011. Genetic networking of the *Bemisia tabaci* cryptic species complex reveals pattern of biological invasions. *PLoS ONE* 6 (10): e25579.
- DEL BENE G. & CONTI B. 2009. Notes on the biology and ethology of *Luperomorpha xanthodera*, a flea beetle recently introduced into Europe. *Bulletin of Insectology* 62 (1): 61-68.
- DHAHRI S., BEN JAMAA M. L. & LO VERDE G. 2010. First record of *Leptocybe invasa* and *Ophelimus maskelli* eucalyptus gall wasps in Tunisia. *Tunisian Journal of Plant Protection* 5 (2): 229-234.
- EPPO/CABI 1997. Data sheets on quarantine pests: *Aleurocanthus spiniferus*. CABI and EPPO. [online] http://www.eppo.org/QUARANTINE/insects/Aleurocanthus_spiniferus/ALECSN_ds.pdf, Last accessed on March 2017.
- EPPO/ OEPP 2006. *Opogona sacchari*. EPPO/ OEPP Bulletin 36: 171-173.
- EPPO/ OEPP 2012. *Luperomorpha xanthodera*: a new flea beetle recently introduced into the EPPO region, EPPO Reporting Service 1 (12). <https://gd.eppo.int/reporting/article-1839>.
- GLAVENDEKIĆ M., ĆIRKOVIC-OGNJANOVIĆ M. & MIRIĆ M. 2010. Beneficial insects in integrated pest management on public green. In: *Proceedings of 57 Deutsche Pflanzenschutztagung*, pp. 365-366.

Conclusions

Basing on the results of our work, we may conclude that most of the newly recorded alien species successfully established in southern part of Montenegro. Among them, *M. pruinosa*, *B. tabaci*, *A. jamatonica*, *E. acerbella*, *R. ferrugineus*, and *C. perspectalis* are widely distributed. All detected species cause negative alterations in the ornamental plants, which result in disruption of their health and aesthetic appearance. In particular, *C. perspectalis* and *R. ferrugineus* showed also strong impact on the coastal urban landscape. In this sense, the damages caused by *R. ferrugineus* are more important because of its destructions of the Canary Island date palm *Ph. canariensis*, which lead to dramatic changes in the Montenegro seacoast landscape.

Acknowledgements: The authors thank to the Directorate for Food Safety, Veterinary and Phytosanitary Affairs, as well as to the Ministry of Science of Montenegro for their financial support. Many thanks are due to the entomology technician Milorad Raičević. We would like to thank very much also to our colleagues who helped us with taxonomic confirmation of some species: Dr. Ljiljana Andus from the Natural History Museum of Belgrade, Serbia, Dr. Katja Žanić from the Institute for the Adriatic Crops and Karst Reclamation, Split, Croatia, and Dr. Chris Malumphy from the Food and Environment Research Agency – FERA, Sand Hutton, York, UK.

- GLAVENDEKIĆ M. 2014. The box tree moth *Cydalima perspectalis* (Walker) (Lepidoptera: Crambidae) – new pest in Serbia. In: Proceedings of the VII Congress on Plant Protection, Zlatibor, pp. 267-268.
- HODDLE M. S. 2015. Red Palm Weevils – food or foe? *Palms* 59 (1): 21-30.
- HRNČIĆ S. 2003. *Metcalfa pruinosa* Say (Flatidae, Homoptera) a new pest in Serbia and Montenegro. In: Zbornik rezimea, VI savetovanje o zaštiti bilja, Zlatibor, p. 97. (in Serbian)
- HRNČIĆ S. & RADONJIĆ S. 2004. *Phylloxera quercus* Boyer de Fonsc. (Homoptera, Phylloxeridae), the first detection in Montenegro. In: Zbornik radova, VIII naučno-stručni simpozijum, Biotehnologija i agroindustrija, Velika Plana. Proceedings, pp. 351-356. (in Serbian)
- HRNČIĆ S., PEROVIĆ T. & RADONJIĆ S. 2007. *Metcalfa pruinosa* Say (Flatide, Homoptera) – invasive species, distribution and host plants in Montenegro. *Agroznanje – Agroknowledge Journal* 8 (4): 23-29. (in Serbian)
- HRNČIĆ S., RADONJIĆ S., PEROVIĆ T. & ŽANIĆ K. 2008. Tobacco whitefly – *Bemisia tabaci* Gennadius (Homoptera, Aleyrodidae), the first record in Montenegro. In: Zbornik rezimea, V Simpozij o zaštiti bilja u Bosni i Hercegovini, p. 8. (in Serbian)
- HRNČIĆ S., RADONJIĆ S. & ANĐUS L. 2009. The western flower thrips – *Frankliniella occidentalis* first record in Montenegro. In: Zbornik rezimea VI Kongres o zaštiti bilja sa Simpozijumom o biološkom suzbijanju invazivnih organizama, pp. 87-88. (in Serbian)
- HRNČIĆ S. & RADONJIĆ S. 2012. The most important pests of ornamental nursery plants in area of Podgorica. *Biljni lekar* 40 (6): 508-515. (in Serbian)
- HRNČIĆ S., RADONJIĆ S. & PEROVIĆ T. 2012a. The red palm weevil – *Rhynchophorus ferrugineus* Olivier (Coleoptera: Curculionide) a new pest of palms in Montenegro. *Biljni lekar* 40 (6): 516-522. (in Serbian)
- HRNČIĆ S., RADONJIĆ S., PEROVIĆ T., ŽANIĆ K. & ŠKALJAC, M. 2012b. The current status of the Tobacco whitefly – *Bemisia tabaci* Gennadius (Hemiptera: Aleyrodidae) in Montenegro. In: Proceedings of the International Symposium 'Current Trends in Plant Protection', Belgrade, pp. 489-495.
- HRNČIĆ S. & RADONJIĆ S. 2014. *Cydalima perspectalis* Walker (Lepidoptera: Crambidae) – a new invasive pest in Montenegro. In: Zbornik rezimea, 11 Simpozij o zaštiti bilja u Bosni i Hercegovini, Teslić, pp. 24-25. (in Serbian)
- HRNČIĆ S. 2016. Official report to the Directorate for Food Safety, Veterinary and Phytosanitary Affairs of Montenegro. Podgorica: University of Montenegro, Biotechnical Faculty.
- KRÜGER E. O. 2008. *Glyphodes perspectalis* (Walker, 1859) – neu für die Fauna Europas (Lepidoptera: Crambidae). *Entomologische Zeitschrift* 118 (2): 81-83.
- LAUDONIA S. & GARONNA A. P. 2010. The red gum lerp psyllid, *Glycaspis brimblecombei*, a new exotic pest of *Eucalyptus camaldulensis*. *Bulletin of Insectology* 63 (2): 233-236.
- MALUMPHY C., PEROVIĆ T., HRNČIĆ S. & RADONJIĆ S. 2013. First records of Albizia Psyllid *Acizzia jamatonica* Kuwayama and Red Gum Lerp Psyllid *Glycaspis brimblecombei* Moore (Hemiptera, Psyllidae, Aphalaridae) in Montenegro. *Acta Entomologica Serbica* 18 (1-2): 11-16.
- MALUMPHY C., EYRE D. & MORAN H. 2016. Red Palm Weevil, *Rhynchophorus ferrugineus*. Plant Pest Factsheet. Department for Environment Food & Rural Affairs, The Food and Environment Research Agency, York, UK. (online) www.planthealthportal.defra.gov.uk/assets/factsheets/Rhynchophorus-ferrugineus-Defra-PP-Factsheet-Oct-2016-FINAL3.pdf
- MENDEL Z., PROTASOV A., FISHER N. & LA SALLE J. 2004. Taxonomy and biology of *Leptocybe invasa* gen. & sp. n. (Hymenoptera: Eulophidae), an invasive gall inducer on *Eucalyptus*. *Australian Journal of Entomology* 43: 101-113.
- NAČESKI S., SOTIROVSKI K., PAPAŽOVA I. & NIKOLOV N. 2015. Report of the status of plant diseases and pests in the natural and newly established forest plantations in R. Macedonia for 2014. Skopje: UKIM, Šumarski fakultet, pp. 24-25. (in Macedonian)
- OSTOJIC I., ZOVKO M., PETROVIĆ D. & ELEZ D. 2015. New records of box tree moth *Cydalima perspectalis* (Walker, 1859) in Bosnia and Herzegovina. *Works of the Faculty of Agricultural and Food Sciences, University of Sarajevo* 60 (65): 139-143.
- PEROVIĆ T., HRNČIĆ S., LAZOVIĆ B. & ADAKALIĆ M. 2013. *Glycaspis brimblecombei* Moore (Hemiptera, Aphalaridae) – an important pest of eucalyptus in Montenegro. *Biljni lekar* 40 (6): 691-698. (in Serbian)
- RADONJIĆ S. & HRNČIĆ S. 2009. *Luperomorpha xanthodera* Fairmaire (Coleoptera, Chrysomelidae) a new flea beetle in Montenegro. *Zbornik rezimea, VI Simpozijum o zaštiti bilja u Bosni i Hercegovini, Tuzla*. p. 52. (in Serbian)
- RADONJIĆ S. 2012. Official report to the Phytosanitary Directorate. Podgorica: Biotechnical Faculty, University of Montenegro.
- RADONJIĆ S., HRNČIĆ S. & MALUMPHY C. 2014. First record of *Aleurocanthus spiniferus* (Quaintance) (Hemiptera Aleyrodidae) in Montenegro. *Redia* 97: 141-145.
- RAYNOR E. M. 1990. The occurrence of a *Cacyreus* species (Lep.: Lycaenidae) in Majorca. *Entomologist's Record* 102: 250.
- REID S. & CANNON R. 2010. Rapid assessment of the need for a detailed Pest Risk Analysis for *Phylloxera quercus* group. The Food and Environment Research Agency (FERA). <https://secure.fera.defra.gov.uk/phiw/riskRegister/downloadExternalPra.cfm?id=3906>.
- SARTO I. & MONTEYS V. 1992. Spread of Southern African Lycaenid butterfly, *Cacyreus marshalli* Butler, 1898 (Lep: Lycaenidae) in the Balearic Archipelago (Spain) and considerations on its likely introduction to continental Europe. *Journal of Research on the Lepidoptera* 31: 24-34.
- SELJAK G. 2006. An overview of the current knowledge of jumping plant-lice of Slovenia (Hemiptera: Psylloidea). *Acta Entomologica Slovenica* 14 (1): 11-34.
- STRACHINIS I., KAZILAS C., KARAMAOUNA F., PAPANIKOLAOU N. E., PARTSINEVELOU G. K. & MILONAS P. G. 2015. First record of *Cydalima perspectalis* (Walker, 1859) (Lepidoptera: Crambidae) in Greece. *Hellenic Plant Protection Journal* 8: 66-72.
- Škaljac M., Žanić K., GORETA BAN S., KONTSEDALOV S. & GHANIM M. 2010. Co-infection and localization of secondary symbionts in two whitefly species. *BMC Microbiology* 10 (1): 142.
- Škaljac M., Žanić K., Goreta Ban S., Hrnčić S., Radonjić S., Perović T. & Ghanim M. 2013. Diversity and localisation of bacterial symbionts in three whitefly species (Hemiptera: Aleyrodidae) from the east coast of the Adriatic Sea. *Bulletin of Entomological Research* 103 (1): 48-59.
- ZANGHERI S. & DONADINI P. 1980. Comparasa nel Veneto di un Omottero nearctico *Metcalfa pruinosa* Say. (Homoptera, Flatidae). *Redia* 63: 301-305.
- ZINDOVIĆ J., CIUFFO M. & TURINA M. 2014. Molecular characterization of *Tomato Spotted Wilt Virus* in Montenegro. *Journal of Plant Pathology* 96 (1): 201-205.