

## ALIEN WHITEFLIES (Hemiptera: Aleyrodidae) OF EUROPE RECORDED IN CROATIA

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### ABSTRACT

Whiteflies belong to the order Hemiptera and comprise a single superfamily, Aleyrodoidea, within the suborder Sternorrhyncha. They are all placed in a single family, Aleyrodidae with 1556 described species accommodated in 161 genera. The whitefly fauna of Europe and the Mediterranean Basin comprises 56 species that are considered to be native or naturalized, accommodated within 25 genera. Alien species are defined as species living outside of their natural range and outside of their natural dispersal potential. At present, the alien species represent 39 % of the total whitefly fauna occurring in Europe. Whiteflies are distributed throughout the major zoogeographical regions of the World, with their greatest diversity in tropical and south temperate regions. The trade of exotic trees and ornamentals is responsible for many accidental introductions of insects to countries far away from their native area. Most alien species of whiteflies were accidentally introduced with their host plant. The starting point for compiling the list of alien whitefly species in Croatia was a book “Alien Terrestrial Arthropods of Europe” and database DAISIE. A list of alien whiteflies in Croatia was made by searching of agricultural, forestry and taxonomic entomological peer-reviewed literature and the latest check list of whiteflies in Croatia. The check list of whiteflies in Croatia published in 2008, contains 31 species belonging to 18 genera. According to DAISIE list, seven of them are alien to Europe. These are the following species: *Aleurolobus olivinus* Silvestri 1911, *Aleurothrixus floccosus* Maskell 1896, *Bemisia afer* Priesner & Hosny 1934, *Bemisia tabaci* Gennadius 1889, *Dialeurodes citri* Ashmead 1885, *Massilieuroides chittendeni* Laing 1928 and *Trialeurodes vaporariorum* Westwood 1856. Two alien whitefly species recorded for the first time in Croatia after 2008 and not presented in DAISIE (2009) are *Aleurocanthus spiniferus* Quaintance 1903 detected in 2012 and *Aleuroclava aucubae* (Kuwana 1911) found in 2013.

**Key words:** alien whiteflies, Aleyrodidae, Croatia

### 1 INTRODUCTION

Whiteflies comprise a relatively small group of insects in a unique family Aleyrodidae with only 1556 described species (Martin & Mound, 2007). A total of 26 whitefly species alien to Europe have been recorded (Daisie, 2009). Twenty one alien species belong to the most widespread and largest subfamily Aleyrodinae and five species belong to the subfamily Aleurodicinae, which is mainly confined to South America, with very few species in South-Eastern Asia and other geographical regions. The alien species mainly originated from tropical regions. Worldwide trade of plants has increased enormously during the last decade.

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Because of increased import to Europe of different ornamentals, possibility of interception of new whitefly species has also increased. Some species, such as *Trialeurodes vaporariorum* and *Bemisia tabaci*, have become cosmopolitan due to anthropogenic activities. Climate changes also increase the chances of survival of alien species introduced from warmer parts of the world and influence distribution of whiteflies within Europe. The literature on alien species of Aleyrodidae in Europe is relatively scattered, with most of the studies dealing with alien pests of economic importance such as *B. tabaci* and *T. vaporariorum*. This paper presents an overview of alien species of whiteflies recorded in Croatia.

## 2 MATERIALS AND METHODS

Data on introduction of alien whiteflies in Croatia covers the period from the mid-20<sup>th</sup> century until year 2014. Based on the analysis of literature data of faunistic investigations of whiteflies in Croatia and DAISIE data base (Daisie, 2009), a list of alien whitefly species in Croatia was made. To establish the status of alien whiteflies in Europe following criteria were used:

**A – Alien species from outside of Europe** are species introduced from outside of their natural range (past or present) and outside of their natural dispersal potential. Their presence in the given region is due to intentional or unintentional introduction or care by humans, or they have arrived there without the help of people from an area in which they are alien;

**E – European species** which became alien outside of their native range (Daisie, 2009).

Current status of European alien whitefly species recorded in Croatia was determined according to following criteria:

**IS – Intercepted species** are alien species detected during inspection or testing of an imported consignment which is not, or is not known to be settled or established anywhere in Croatia;

**ES – Established species** are settled and naturalized but not (yet) intrusive species;

**IN – Intrusive species** cause major disruptions to ecosystems or even greater environmental or economic damage (Seljak, 2013).

Affiliation of whitefly native range to certain zoogeographic region was listed according to Evans (2006).

## 3 RESULTS AND DISCUSSION

Exotic whitefly species are regularly dispersed among countries as a consequence of plant trade, small size of whiteflies, their cryptic nature and immature stages being attached to the host-plant. Due to these characteristics they are one of the most commonly transported arthropod groups. They are also among the most successful groups in terms of invading new geographical areas. According to Daisie (2009), a total of 26 whitefly species alien in Europe and to Europe have been recorded. The latest check-list of whiteflies of Croatia contains 31 species (Šimala & Masten, 2008). Seven of them are alien to Europe (Table 1).

The species *Aleurolobus olivinus* and *Dialeurodes citri* are well established in the nature in coastal part of Croatia. *A. olivinus* is a typical Mediterranean oligophagous species, mainly found on oleaceous hosts in the southern coastal part of Croatia. *D. citri* is a very important pest on all *Citrus* species throughout the citrus growing area in Croatia (Žani *et al.*, 2000). Species *Aleurothrixus floccosus* is currently present on *Citrus* spp., only in limited area of the Croatian Middle Adriatic region, while a broadly polyphagous species *Bemisia afer* is widespread throughout the country on numerous mostly dicotyledonous woody host plant species. *Massilieurodes chittendeni* was intercepted several times in Croatia by trade of rhododendron plants from The Netherlands and Italy. After the first record in Croatia in 2000, species *Bemisia tabaci* became a serious pest of vegetables and ornamentals in field and protected conditions in coastal part of Croatia (Žani *et al.*, 2001, 2003). An extremely

polyphagous species *Trialeurodes vaporariorum* is the most important whitefly pest of protected crops in Croatia. It is the most common and widespread whitefly species.

Two another alien whitefly species recorded for the first time in Croatia after 2008 and not presented in Daisie (2009) are *Aleurocanthus spiniferus* detected in 2012 (Šimala & Masten, 2013) and *Aleuroclava aucubae* found in 2013 (Šimala *et al.*, 2014). *A. spiniferus* originated in south-east Asia and has spread widely in tropical and subtropical Asia, and into Africa and the Pacific. This species is listed as a quarantine threat to Europe and is included in the EU Annex II/A1 and in the EPPO A2 list. It presents a potential permanent risk to citrus in Croatia, especially to production of mandarin in Neretva river valley. For now, *A. spiniferus* has a status of eradicated species in Croatia. *A. aucubae* is a polyphagous insect. According to Mound & Halsey (1978), the pest has been recorded from 15 plant families, including *Citrus* species. It is present in nature on fig and on some ornamental plant species in northern coastal part of Croatia. From the present knowledge, this alien whitefly species apparently does not cause economic damage to cultivated plants. Thus, it presents a potential risk as a minor pest to citrus production in Croatia.

**Table 1** List and main characteristics of whitefly species alien to Europe recorded in Croatia

Species	Native range	1 <sup>st</sup> record in Europe	European status (DAISIE, 2009)	1 <sup>st</sup> record in Croatia	Current status in Croatia	Invaded European countries	Host plants	References
<i>Aleurocanthus spiniferus</i> <b>Quaintance 1903*</b>	Oriental Region (Asia)	2008, IT	-	2012	IS	FR, IT, ME	Polyphagous; occasionally a pest on <i>Annona</i> and <i>Citrus</i>	Porcelli (2008); Šimala & Masten Milek (2013)
<i>Aleuroclava aucubae</i> <b>(Kuwana 1911)*</b>	Oriental Region (Asia)	2007, IT	-	2013	ES	IT, SI	Polyphagous;	Pelizzari & Šimala (2007); Šimala <i>et al.</i> (2014)
<i>Aleurolobus olivinus</i> <b>(Silvestri 1911)</b>	Western Palearctic Region (Mediterranean)	-	E	1937	ES	CY, ES, FR, FR-COR, GR, GR-CRE, IT, IT-SAR, IT-SIC, MT, PT	Oligophagous; a preference for Oleaceae	Novak (1940)
<i>Aleurothrixus floccosus</i> <b>(Maskell 1896)</b>	Neotropical Region (South America)	1968, ES-CAN; 1969, FR	A	2007	ES	AL, ES-CAN, FR, FR-COR, GB, GR, IL, IT, IT-SAR, IT-SIC, MT, PT	Polyphagous; a preference for <i>Citrus</i>	Mifsud <i>et al.</i> (2010); Žani (2007)
<i>Bemisia afer</i> <b>(Priesner &amp; Hosny 1934) complex</b>	Western Palearctic Region (Africa)	-	A	2005	ES	ES, FR, FR-COR, GB, GR, IT, IT-SIC, MT	Polyphagous;	Martin <i>et al.</i> (2000); Šimala & Masten Milek (2008)

<b><i>Bemisia tabaci</i> (Gennadius 1889) complex</b>	Oriental Region (Asia)	-	A	2000	IN	AL, AT, BA, BE, BG, CH, CY, CZ, DE, ES, ES-BAL, ES-CAN, FR, FR- COR, GR, GR-CRE, HU, IL, IT, IT-SAR, IT-SIC, ME, MT, NL, NO, PL, PT, RO, RU, SI	Polyphagous;	Mifsud <i>et al.</i> (2010); Žani <i>et al.</i> (2001)
<b><i>Dialeurodes citri</i> (Ashmead 1885)</b>	Oriental Region (Asia)	1945	A	1977	IN	AL, FR, FR-COR, IL, IT, IT- SAR, IT- SIC, MT, SI	Polyphagous; a preference for <i>Citrus</i>	Mifsud <i>et al.</i> (2010); Bakari , 1983
<b><i>Massilieuodes chittendeni</i> (Laing 1928)</b>	Oriental Region (Asia)	1928, GB	A	2007	IS	BE, CH, CZ, DE, DK, FI, FR, GB, IT, NL, PL, SE, SI	<i>Rhododendron</i> spp.	Mifsud <i>et al.</i> (2010); Šimala & Masten Milek (2008)
<b><i>Trialeurodes vaporariorum</i> (Westwood 1856)</b>	Nearctic Region (North America)	1856, GB	A	< 1961	IN	AL, AT, BG, CH, CZ, DE, DK, EE, FR, HU, IT, IT- SAR, IT- SIC, LT, MT, PT, RO, RS, SI	Polyphagous;	Mifsud <i>et al.</i> (2010); Kova evi (1961)

\* Alien species not listed in Daisie (2009)

#### 4 CONCLUSIONS

Seven alien whitefly species of Europe listed in Daisie (2009) are recorded in Croatia. All of them, except for the species *M. chittendeni* are domesticated in nature. Two alien whitefly species recorded for the first time in Croatia after the latest check-list in 2008 and not presented in DAISIE (2009) are *A. spiniferus* intercepted in 2012 and *A. aucubae* recorded in 2013. By origin, the majority of alien species have arrived from Asia – 5 species (55,6 %). From 9 in Croatia recorded alien species of whiteflies, 6 species or 66,7 % have been discovered since 2000.

Changes in climate and global warming could influence new introductions and distribution of exotic whitefly species and increase the chances of their survival in European environment. It can be predicted that the number of introduced alien whitefly species will grow as Croatia shows constant increase of traded commodities with other European and non-European countries.

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