

## THE SCALE INSECTS (Hemiptera: Coccoidea) ON CITRUS PLANTS IN CROATIA

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### ABSTRACT

This paper deals with the scale insects on citrus plants (Rutaceae) in the open field, and on house and greenhouse pot plants in Croatia.. They have been monitored during a six year investigation (2005-2010). Inspections have resulted in scale species, namely Coccidae: *Ceroplastes japonicus* Green, *C. rusci* (Linnaeus), *Coccus hesperidum* Linnaeus, 1758, *C. pseudomagnoliarum* (Kuwana, 1914), *Parthenolecanium persicae* (Fabricius), *Saissetia coffeae* (Walker), and *S. oleae* (Olivier); Diaspididae: *Aonidiella aurantii* (Maskell), , *C. dictyospermi* (Morgan), *Lepidosaphes beckii* (Newman), *L. gloverii* (Packard), *Parlatoria oleae* (Colvée), *P. ziziphi* (Lucas), *Pinnaspis aspidistrae* (Signoret), Margarodidae: *Icerya purchasi* Maskell, and Pseudococcidae: *Planococcus citri* (Risso), *P. longispinus* (Targioni Tozzetti), *P. viburni* (Signoret). Distribution and host plants of these species in Croatia will be reported.

**Key words:** Croatia, monitoring, scale insects, Rutaceae

## 1 INTRODUCTION

The insect fauna of citrus plants (family Rutaceae) is very rich. According to the ScaleNet (2010), 981 species of the scale insects (Hemiptera: Coccoidea) are registered worldwide on these host plants, including 174 of the Palaearctic region. They can be permanent or occasional pests. Some of them have long been considered major and severe pests of citrus, especially armored scale insects (family Diaspididae) (Rose, 1990). The scale insects from other families of Coccoidea such as Coccidae, Pseudococcidae and Margarodidae can devastate citrus fruits and citrus trees severely as well.

They thrive on nearly all parts of host plants, sometimes settle under bark, and cause a variety of plant deformities. Some of them excrete large amount of honeydew and by the subsequent development of sooty mould fungi, they severely reduce photosynthesis and transpiration.

They disperse passively with the aid of wind, water, soil, humans and domestic and wild animals. Global trade has been a major factor in their spread worldwide.

## 2 MATERIALS AND METHODS

Faunistic research on scale insects of citrus plants in Croatia were carried out over a 6 year period (2005–2010) by visual inspections of potentially infested plants in the open field, and on house and greenhouse pot plants with the help of a 10x magnification lens. Host plant material infested with scale insects from leaves, stems, barks and fruits were collected in plastic bags. Each sample was labelled with details about the host plant, damage symptoms, collector, sample number, date and the locality.

The collected specimens were slide mounted under the dissecting stereo microscope, according to methods of Wilkey (1990) and Hodgson & Henderson (2000). The microscopic

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morphological characters of adult female were studied using the keys of McGillivray (1921), Balachowsky (1948, 1950, 1951, 1953, 1954), Dekle (1965), Hamon & Williams (1984), Gill (1988, 1993, 1997), Kosztarab & Kozár (1988), Williams & Watson (1988a, 1988b); Hodgson & Henderson (2000), Williams (2004) and Miller & Davidson (2005).

### 3 RESULTS AND DISCUSSION

Faunistic investigation of the scale insects of citrus plants in Croatia have resulted in 18 identified scale species, namely from family Coccidae: *Ceroplastes japonicus* Green, *C. rusci* (Linnaeus), *Coccus hesperidum* Linnaeus, 1758, *C. pseudomagnoliarum* (Kuwana, 1914), *Parthenolecanium persicae* (Fabricius), *Saissetia coffeae* (Walker), and *S. oleae* (Olivier) (table 1); Diaspididae: *Aonidiella aurantii* (Maskell), *C. dictyospermi* (Morgan), *Lepidosaphes beckii* (Newman), *L. gloverii* (Packard), *Parlatoria oleae* (Colvée), *P. ziziphi* (Lucas), *Pinnaspis aspidistrae* (Signoret) (table 2); Margarodidae: *Icerya purchasi* Maskell (table 3) and Pseudococcidae: *Planococcus citri* (Risso), *Pseudococcus longispinus* (Targioni Tozzetti) and *P. viburni* (Signoret) (table 4).

Quantitative distribution of scale insect appearing frequency on citrus plants in Croatia is shown in figure 1. *C. hesperidum* at the first place, then *A. aurantii* and *I. purchasi* had the highest appearing frequency.

Table 1: Determined scale insects on citrus plants from family Coccidae in Croatia in period 2005 - 2010

FAMILY OF SCALE INSECTS	SPECIES OF SCALE INSECT	HOST PLANT	LOCALITY	YEAR
Coccidae				
	<i>Ceroplastes japonicus</i>	<i>Citrus deliciosa</i>	Novigrad	2005
		<i>Citrus deliciosa</i>	Bašanija	2006
		<i>Citrus deliciosa</i>	Umag	2006
		<i>Citrus reticulata</i>	Opatija	2008
	<i>Ceroplastes rusci</i>	<i>Citrus limon</i>	Zaklopatica-Lastovo	2005
		<i>Citrus reticulata</i>	Orašac	2005
		<i>Citrus limon</i>	Dubrovnik	2008
		<i>Citrus limon</i>	Trsteno	2008
	<i>Coccus hesperidum</i>	<i>Citrus limon</i>	Veliki Brijun	2005
		<i>Citrus limon</i>	Koprivnica*	2005
		<i>Citrus limon</i>	Vis Vis	2006
		<i>Citrus limon</i>	Sesvete*	2006
		<i>Citrus limon</i>	Požega*	2006
		<i>Citrus limon</i>	Požega*	2006
		<i>Citrus limon</i>	Zagreb Knežija*	2006
		<i>Citrus limon</i>	Parkovi i nasadi Duilovo Split*	2009
		<i>Citrus deliciosa</i>	Vela Luka Korčula	2005
		<i>Citrus deliciosa</i>	Vela Luka Korčula	2005
		<i>Citrus deliciosa</i>	Dubrovnik	2005
		<i>Citrus deliciosa</i>	Orašac	2005
		<i>Citrus deliciosa</i>	Sesvete*	2006
		<i>Citrus deliciosa</i>	Brodski Stupnik*	2006
		<i>Citrus deliciosa</i>	Visovac	2006
		<i>Citrus deliciosa</i>	Dubrovnik	2006
	<i>Citrus deliciosa</i>	Vanga Brijuni	2007	
	<i>Citrus deliciosa</i>	Solaris Šibenik	2010	
	<i>Citrus sinensis</i>	Zadar	2006	

		<i>Citrus sinensis</i>	Škudelin	2009
<i>Coccus pseudomagnoliarum</i>		<i>Citrus limon</i>	Galija Brijuni	2006
		<i>Citrus deliciosa</i>	Čibača	2005
		<i>Citrus deliciosa</i>	Galija Brijuni	2005
		<i>Citrus deliciosa</i>	Vanga Brijuni	2006
		<i>Citrus deliciosa</i>	Dubrovnik	2007
	<i>Parthenolecanium persicae</i>		<i>Citrus deliciosa</i>	Bužinija
		<i>Citrus deliciosa</i>	Bužinija	2007
		<i>Citrus sinensis</i>	Bužinija	2005
		<i>Citrus sinensis</i>	Bužinija	2007
<i>Saissetia coffae</i>		<i>Citrus limon</i>	Jadro Brnik Split*	2009
		<i>Citrus deliciosa</i>	Jadro Brnik Split*	2009
<i>Saissetia oleae</i>		<i>Citrus deliciosa</i>	Čibača	2005
		<i>Citrus deliciosa</i>	Dubrovnik	2005
<b>TOTAL</b>	<b>7 SCALE SPECIES</b>	<b>5 HOST PLANTS</b>	<b>26 LOCALITIES</b>	<b>2005-2010</b>

Table 2: Determined scale insects on citrus plants from family Diaspididae in Croatia in period 2005 - 2010

FAMILY OF SCALE INSECTS	SPECIES OF SCALE INSECT	HOST PLANT	LOCALITY	YEAR
Diaspididae	<i>Aonidiella aurantii</i>	<i>Citrus deliciosa</i>	Orebić	2007
		<i>Citrus deliciosa</i>	Trsteno	2008
		<i>Citrus deliciosa</i>	Parkovi i nasadi Duilovo Split*	2009
		<i>Citrus deliciosa</i>	Solaris Šibenik	2010
		<i>Citrus limon</i>	Orebić	2007
		<i>Citrus limon</i>	Trsteno	2008
		<i>Citrus limon</i>	Dubrovnik	2008
		<i>Citrus medica</i>	Trsteno	2008
		<i>Citrus reticulata</i>	Parkovi i nasadi Duilovo Split*	2009
		<i>Citrus reticulata</i>	Orašac	2005
	<i>Chrysomphalus dictyospermi</i>	<i>Citrus limon</i>	Lokrum	2008
		<i>Poncirus trifoliata</i>	Opatija	2007
	<i>Lepidosaphes beckii</i>	<i>Citrus sinensis</i>	Korčula Korčula	2005
	<i>Lepidosaphes gloverii</i>	<i>Citrus limon</i>	Trsteno	2008
	<i>Parlatoria oleae</i>	<i>Citrus deliciosa</i>	Opuzen	2008
	<i>Parlatoria ziziphi</i>	<i>Citrus limon</i>	Cavtat	2006
<i>Pinnaspis aspidistrae</i>	<i>Citrus deliciosa</i>	MBM Knežine*	2008	
<b>TOTAL</b>	<b>7 SCALE SPECIES</b>	<b>6 HOST PLANTS</b>	<b>12 LOCALITIES</b>	<b>2005-2010</b>

Table 3: Determined scale insects on citrus plants from family Margarodidae in Croatia in period 2005 - 2010

FAMILY OF SCALE INSECTS	SPECIES OF SCALE INSECT	HOST PLANT	LOCALITY	YEAR
Margarodidae	<i>Icerya purchasi</i>	<i>Citrus aurantium</i>	Rogoznica	2006
		<i>Citrus deliciosa</i>	Dubrovnik	2010
		<i>Citrus deliciosa</i>	Dubrava Šibenik	2008
		<i>Citrus limon</i>	Veliki Brijun	2005
		<i>Citrus limon</i>	Lokrum	2008
		<i>Citrus paradisi</i>	Rogoznica	2006
		<i>Citrus reticulata</i>	Galija Brijuni	2005
		<i>Citrus reticulata</i>	Vanga Brijuni	2005
		<i>Citrus reticulata</i>	Solaris Šibenik	2010

<b>TOTAL</b>	<b>1 SCALE SPECIES</b>	<b>5 HOST PLANTS</b>	<b>8 LOCALITIES</b>	<b>2005-2010</b>
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Table 4: Determined scale insects on citrus plants from family Pseudococcidae in Croatia in period 2005 - 2010

<b>FAMILY OF SCALE INSECTS</b>	<b>SPECIES OF SCALE INSECT</b>	<b>HOST PLANT</b>	<b>LOCALITY</b>	<b>YEAR</b>
Pseudococcidae	<i>Planococcus citri</i>	<i>Citrus deliciosa</i>	Trsteno	2008
		<i>Citrus deliciosa</i>	MBM Duilovo Split*	2009
		<i>Citrus deliciosa</i>	Jadro Brnik Split*	2009
		<i>Citrus limon</i>	MBM Duilovo Split*	2009
		<i>Citrus limon</i>	Jadro Brnik Split*	2009
	<i>Pseudococcus longispinus</i>	<i>Citrus aurantium</i>	MBM Lučko*	2006
		<i>Citrus deliciosa</i>	Trsteno	2008
		<i>Citrus deliciosa</i>	Solaris Šibenik	2010
		<i>Citrus limon</i>	MBM Dubrovnik*	2005
		<i>Citrus limon</i>	MBM Duilovo Split*	2005
		<i>Citrus reticulata</i>	Dubrovnik	2005
		<i>Citrus reticulata</i>	Vanga Brijuni	2005
	<i>Pseudococcus viburni</i>	<i>Citrus limon</i>	Zagreb*	2009
	<b>TOTAL</b>	<b>3 SCALE SPECIES</b>	<b>4 HOST PLANTS</b>	<b>8 LOCALITIES</b>

\* host plants located indoors

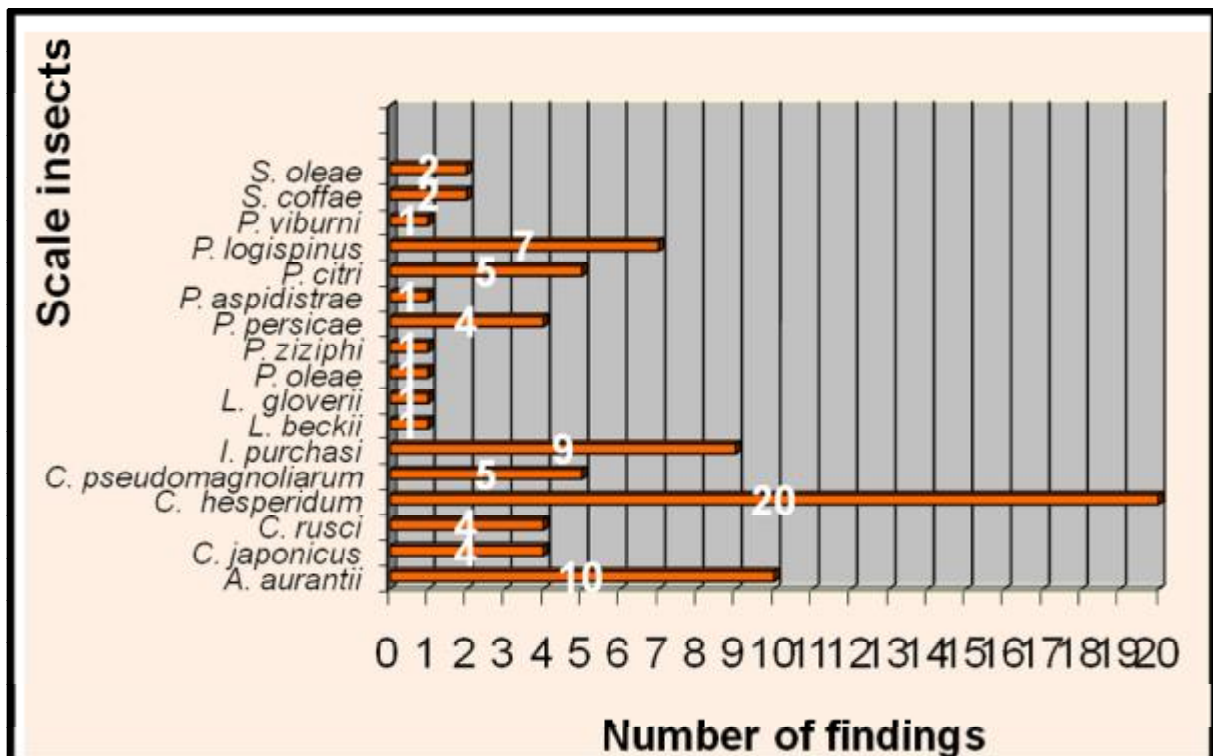


Figure 1: Quantitative distribution of scale insect appearing frequency on citrus plants

## 4 CONCLUSIONS

Six year inspection (2005 - 2010) on scale insects on citrus plants (Rutaceae) in the open field, and on house and greenhouse pot plants in Croatia showed that citrus plants are very good hosts for the scale insects. Global trade is one of the major factor in spread of scale insects worldwide. Inspections have resulted in 18 different species of scale insects, namely Coccidae: *Ceroplastes japonicus* Green, *C. rusci* (Linnaeus), *Coccus hesperidum* Linnaeus, 1758, *C. pseudomagnoliarum* (Kuwana, 1914), *Parthenolecanium persicae* (Fabricius), *Saissetia coffeae* (Walker), and *S. oleae* (Olivier); Diaspididae: *Aonidiella aurantii* (Maskell), *C. dictyospermi* (Morgan), *Lepidosaphes beckii* (Newman), *L. gloverii* (Packard), *Parlatoria oleae* (Colvée), *P. ziziphi* (Lucas), *Pinnaaspis aspidistrae* (Signoret), Margarodidae: *Icerya purchasi* Maskell, and Pseudococcidae: *Planococcus citri* (Risso), *P. longispinus* (Targioni Tozzetti), *P. viburni* (Signoret). *C. hesperidum* at the first place, then *A. aurantii* and *I. purchasi* had the highest appearing frequency.

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