SCALE INSECTS (Hemiptera: Coccomorpha) ON MEDITERRANEAN MEDICINAL PLANTS

Tatjana MASTEN MILEK[1], Mladen ŠIMALA[2], Maja PINTAR[3], Vjekoslav MARKOTIĆ[4]

CCAFRA – Institute for Plant Protection Zagreb, Republic of Croatia

ABSTRACT

Faunistic research on scale insects on Mediterranean medicinal plants that has been in progress in Croatia since 2005, led to the discovery of 16 scale insect species from 5 different families, on various medicinal plant species. Following species have so far been recorded: *Ceroplastes japonicus Green, 1921*,, *Coccus hesperidum* Linnaeus, 1758, *Lichtensia viburni* Signoret, 1873, *Parthenolecanium corni* (Bouché, 1844) and *Saissetia oleae* (Olivier, 1791), from the family Coccidae, *Aonidia lauri* (Bouché, 1833*), Aonidiella aurantii* (Maskell, 1879), *Aspidiotus nerii* Bouché, 1833, *Hemiberlesia rapax* (Comstock, 1881), *Lindingaspis rossi* (Maskell, 1891) and *Parlatoria oleae* (Colvée, 1880), from the family Diaspididae, *Lecanodiaspis sardoa* Targioni Tozzetti, 1869 from the family Lecanodidaspididae, *Icerya purchasi* Maskell, 1879, from the family Monophlebidae, and *Planococcus citri* (Risso, 1813), *Pseudococcus calceolariae* (Maskell, 1879), *Pseudococcus viburni* (Signoret, 1875) from the family Pseudococcidae.

Key words: Croatia, scale insects, faunistic research, Mediterranean medicinal plants

1 INTRODUCTION

According to the definition by World Health Organization (WHO), medicinal plants are plants whose parts contain biologically active ingredient with therapeutic activity that can be used for chemical and pharmacological synthesis. Medicinal plants include annual, biannual or perennial, herbaceous and woody plant species that can be both wild and cultivated. Croatian landscapes, particularly those of the Mediterranean region, have always been known for their abundance of wild medicinal plants such as lavender, sage, chamomile, rosemary, laurel, Cistus and other. Mediterranean medicinal plants are very good hosts for the scale insects. Scale insects thrive on nearly all parts of host plants, sometimes settle under the 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

[1] dr. sc., Gorice 68b, HR-10000 Zagreb, Croatia, e-mail: tatjana.masten@hcphs.hr
[2] dr. sc., ibid.
[3] dipl. ing., ibid.
[4] dipl. ing., ibid.

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 on Mediterranean medicinal plants in Croatia were carried out over a 11 year period (2005–2016) by visual inspections of potentially infested plants in the open field and greenhouse pot plants with the help of a 10x magnification lens. Host plant material infested with scale insects (leaves, stems and barks) 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 morphological characters of adult female were studied using the keys of Balachowsky (1948, 1950, 1951, 1953, 1954), Gill (1988, 1993, 1997), McKenzie (1967), Williams & Watson (1988a, 1988b); Hodgson & Henderson (2000), Williams (2004) and Miller & Davidson (2005).

3 RESULTS AND DISCUSSION

A review of scale insect species on Mediterranean medicinal plants in Croatia, from 2005 until today, is presented in Table 1. According to nomenclature of ScaleNet (Garcia Morales *et al.*, 2017), it comprises 16 scale insects species from 5 different families. The majority of registered species belong to the following families: Diaspididae (6 species), Coccidae (5 species) and Pseudococcidae (3 species). Families of scale insects Lecanodiaspididae and Monohlebidae comprise only 1 recorded scale insect species each (Fig. 1). Quantitative distribution of scale insect appearing frequency on Mediterranean medicinal plants in Croatia is shown in Fig 2. *A. lauri* had the highest appearing frequency, followed by *C. japonicus* and *A. nerii*.

Table 1: Determined scale insects on Mediterranean medicinal plants in Croatia in period 2005-2016.

FAMILY OF SCALE INSECTS	SPECIES OF SCALE INSECT	HOST PLANT	LOCALITY	YEAR
Coccidae	***Coccus hesperidum***	*Laurus nobilis*	Solin	2006
		Laurus nobilis	Buje	2006
		Lavandula angustifolia	Jadrija	2012
	Ceroplastes japonicus	*Laurus nobilis*	Škudelin	2005
		Laurus nobilis	Bašanija	2005
		Laurus nobilis	Opatija	2006

		Laurus nobilis	Novigrad	2007
		Laurus nobilis	Buje	2008
		Laurus nobilis	Novigrad	2009
		Laurus nobilis	Turanj	2010
		Laurus nobilis	Split	2011
	Lichtensia viburni	*Rosmarinus officinalis*	Šibenik	2012
	Parthenolecanium corni	*Rosmarinus officinalis*	Jadrija	2013
	Saissetia oleae	*Laurus nobilis*	Trsteno	2014
		Cistus spp.	Mljet	2015
		Rosmarinus officinalis	Split	2016
Diaspididae	***Aonidia lauri***	*Laurus nobilis*	Dubrovnik	2005
		Laurus nobilis	Čibača	2005
		Laurus nobilis	Solin	2005
		Laurus nobilis	Poreč	2005
		Laurus nobilis	Vela Luka	2005
		Laurus nobilis	Vinkovci	2005
		Laurus nobilis	Malinska	2006
		Laurus nobilis	Konavalsko polje	2006
		Laurus nobilis	Rovinj	2006
		Laurus nobilis	Stari Zadar Cres	2007
		Laurus nobilis	Supetar	2010
		Laurus nobilis	Opatija	2011
		Laurus nobilis	Buje	2012
		Laurus nobilis	Mali Lošinj	2013
		Laurus nobilis	Opatija	2014
		Laurus nobilis	Split	2015

		Laurus nobilis	Lastovo	2015
		Laurus nobilis	Šibenik	2016
		Laurus nobilis	Hvar	2016
		Laurus nobilis	Vis	2016
		Laurus nobilis	Komiža	2016
	Aonidiella aurantii	*Laurus nobilis*	MBM Turanj	2012
		Salvia officinalis	MBM Turanj	2012
	Aspidiotus nerii	*Rosmarinus officinalis*	Lovran	2008
		Salvia officinalis	MBM Duilovo	2009
		Laurus nobilis	Opatija	2014
		Cistus spp.	Babino polje Mljet	2015
	Hemiberlesia rapax	*Laurus nobilis*	Split	2010
	Lindingaspis rossi	*Laurus nobilis*	Sutivan	2015
	Parlatoria oleae	*Rosmarinus officinalis*	Jadrija	2013
		Laurus nobilis	Sutivan	2016
Lecanodiaspididae	***Lecanodiaspis sardoa***	*Cistus spp.*	Babino polje Mljet	2015
		Cistus spp.	Orebić	2016
Monohlebidae	***Icerya purchasi***	*Rosmarinus officinalis*	Jadrija	2010
		Salvia officinalis	MBM Zagreb	2011
Pseudococcidae	***Planococcus citri***	*Laurus nobilis*	Jadro Brnik	2010
		Rosmarinus officinalis	Jadro Brnik	2010
	Pseudococcus calceolariae	*Lavandula angustifolia*	Opatija	2011
	Pseudococcus viburni	*Laurus nobilis*	MBM Zagreb	2007
		Lavandula angustifolia	Jadrija	2011
		Marticaria chamomilla	Mljet	2016
TOTAL: 5 families, 16 species, 7 host plants, 57 localities				

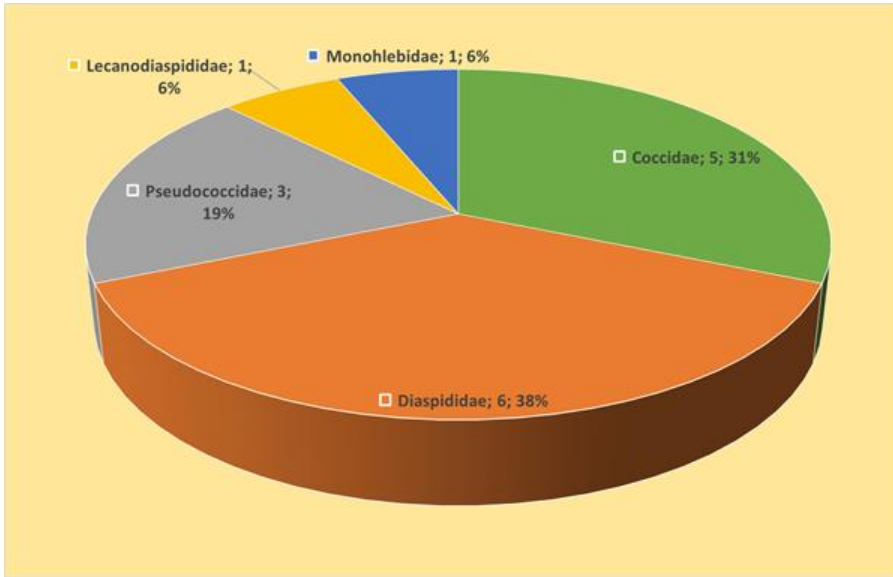

Figure 1: The structure of scale insect on Mediterranean medicinal plants by family.

4 CONCLUSIONS

11 year inspection (2005 - 2016) on scale insects on Mediterranean medicinal plants in the open field, and greenhouse pot plants in Croatia showed that Mediterranean medicinal plants are very good hosts for the scale insects. Global trade is one of the major factor in spread of scale insects worldwide. This faunistic investigation of the scale insects on Mediterranean medicinal plants in Croatia have resulted in 16 identified scale species, namely from family Coccidae: *Ceroplastes japonicus* Green, 1921, *Coccus hesperidum* Linnaeus, 1758, *Lichtensia viburni* Signoret, 1873, *Parthenolecanium corni* (Bouché, 1844) and *Saissetia oleae* (Olivier, 1791) from the family Diaspididae: *Aonidia lauri* (Bouché, 1833), *Aonidiella aurantii* (Maskell, 1879), *Aspidiotus nerii* Bouché, 1833, *Hemiberlesia rapax* (Comstock, 1881), *Lindingaspis rossi* (Maskell, 1891) and *Parlatoria oleae* (Colvée, 1880), from the family Lecanodidaspididae: *Lecanodiaspis sardoa* Targioni Tozzetti, 1869, from the family Monophlebidae: *Icerya purchasi* Maskell, 1879 and from the family Pseudococcidae: *Planococcus citri* (Risso, 1813), *Pseudococcus calceolariae* (Maskell, 1879) and *Pseudococcus viburni* (Signoret, 1875).

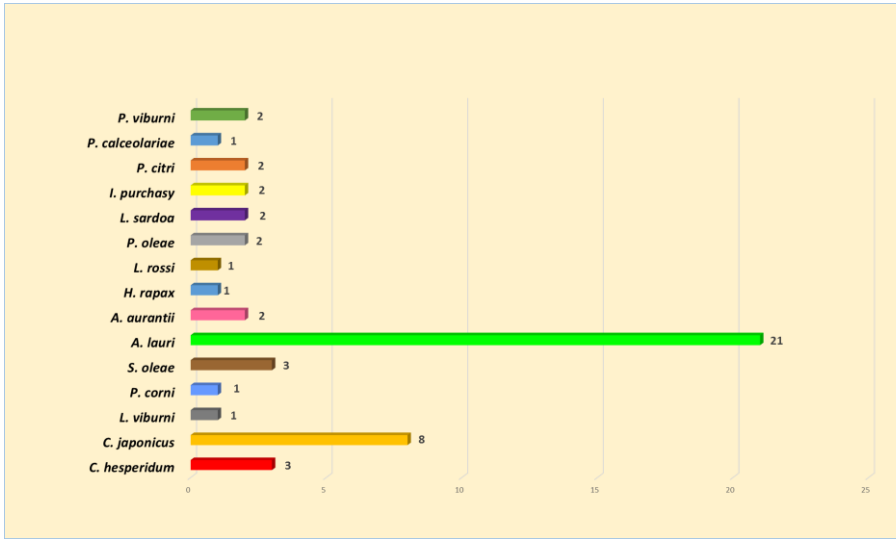

Figure 2: Quantitative distribution of scale insect appearing frequency on Mediterranean medicinal plants.

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