

## THE SCALE INSECTS (HEMIPTERA: COCCOIDEA) OF IMPORTED FRUITS IN CROATIA

Tatjana MASTEN MILEK<sup>1</sup>, Mladen ŠIMALA<sup>2</sup>, Bogdan KORIĆ<sup>3</sup>

<sup>1,2,3</sup>Institute for plant protection in agriculture and forestry of Republic of Croatia

### ABSTRACT

This paper deals with the scale insects of imported fresh fruits in supermarkets in Croatia which have been monitored during a three year investigation (2006-2008). Inspections have resulted in 18 identified scale species. Species *Abgrallaspis cyanophylli*, *A. comperei*, *Diaspis boisduvalii*, *D. brevipes*, *Melanaspis bromiliae*, *Parlatoria cinerea*, *P. pergandii*, *P. trilobitiformis* and *Selenaspis articulatus* are newly recorded species in Croatia. The most inspected consignments were from Brazil, Costa Rica, Greece, Chile and Spain. *A. aurantii* at the first place, then *Lepidosaphes beckii*, *P. oleae*, *P. pergandii* and *P. ziziphi* had the highest appearing frequency. The most frequent host plants belong to the family Rutaceae.

**Key words:** scale insects, imported fresh fruits, supermarkets, Croatia

### 1 INTRODUCTION

Scale insects (Coccoidea) enjoy perennial plants and can devastate nut and fruit trees, greenhouse plants, forest vegetation, woody ornamentals and house plants. They thrive on nearly all parts of host plants, sometimes settle under bark, and cause a variety of plant deformities. 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. The main pathway of scale's worldwide spread is import of plant material and fresh fruits. Last Croatian check list of scale insects includes 132 species (Masten Milek, 2007). Many of them were introduced in Croatia by global trade.

### 2 MATERIAL AND METHODS

Inspection on scale insects of imported fresh fruits in supermarkets in Croatia were carried out over a 3 year period (2006-2008) by visual inspections of potentially infested fruit with the help of a 10x magnification lens. Fruits (as a host plant material) infested with scale insects 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 Watson & Chandler (1999). The microscopic morphological characters of adult female were studied using the keys of MacGillivray (1921); McKenzie (1938, 1945, 1967); Borchsenius (1949); Balachowsky (1953, 1954); Williams & Watson (1988a, 1988b); Gill (1997); Williams (2004); Miller & Davidson (2005).

Fifty samples of fresh fruit were inspected. They were imported from Argentina, Brazil, Chile, China, Greece, Israel, Italy, South Africa, South America, Costa Rica, Mexico and Spain.

<sup>1</sup> Ph. D., Svetošimunska 25, HR-10000 Zagreb, Croatia

<sup>2</sup> Ph. D., ibid.

<sup>3</sup> Ph. D., ibid.

### 3 RESULTS AND DISSCUSION

Inspections have resulted in 18 identified scale species (Tab. 1 and Tab. 2), namely from family Diaspididae: *Abgrallaspis cyanophylli* (Signoret, 1869); *Aonidiella aurantii* (Maskell, 1879); *Aonidiella comperei* McKenzie, 1937; *Chrysomphalus aonidum* (Linnaeus, 1758); *Diaspis boisduvalii* Signoret, 1869; *Hemiberlesia lataniae* (Signoret, 1869); *Lepidosaphes beckii* (Newman, 1869); *Lepidosaphes gloverii* (Packard, 1869); *Melanaspis bromiliae* (Leonardi, 1899); *Parlatoria cinerea* Hadden in Doane & Hadden, 1909, *Parlatoria oleae* (Colveé, 1880); *Parlatoria pergandii* Comstock, 1881; *Parlatoria ziziphi*, (Lucas, 1853); *Pinnaspis aspidistrae* (Signoret, 1869); *Pseudaonidia trilobitiformis* (Green, 1896); *Selenaspis articulatus* (Morgan, 1889) and from family Pseudococcidae: *Dysmicoccus brevipes* (Cockerell, 1893) and *Pseudococcus comstocki* (Kuwana, 1902). Species *A. cyanophylli*, *A. comperei*, *D. boisduvalii*, *D. brevipes*, *M. bromiliae*, *P. cinerea*, *P. pergandii*, *P. trilobitiformis* and *S. articulatus* are newly recorded species in Croatia. It should be pointed out that the most scale insects were alive in samples of imported fruits. The most consignments were from Brazil, Costa Rica, Greece, Chile and Spain. The most frequent host plants belong to the family Rutaceae.

Quantitative distribution of scale insect appearing frequency of imported fresh fruits in supermarkets is shown in fig 1. *A. aurantii* at the first place, then *L. beckii*, *P. oleae*, *P. pergandii* and *P. ziziphi* had the highest appearing frequency.

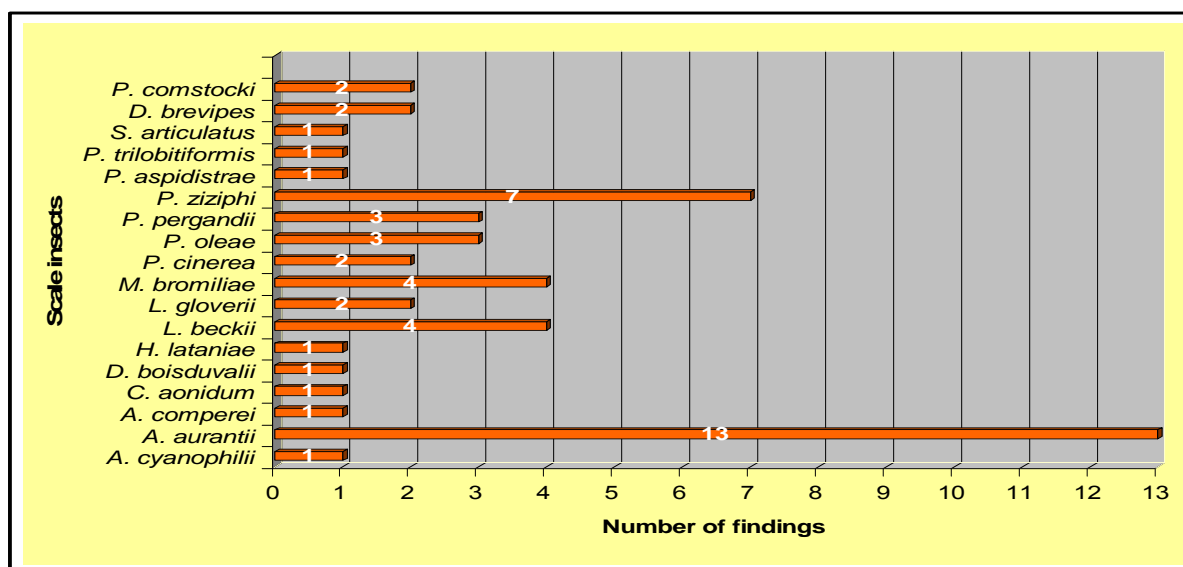


Figure 1: Quantitative distribution of scale insects appearing frequency

Table 1: Determined scale insects of family Pseudococcidae on imported fresh fruits in supermarkets in Croatia in period 2006-2008

SCALE INSECT	FAMILY PLANT	HOST PLANT	DATE	COUNTRY OF ORIGIN
<i>Dysmicoccus brevipes</i> (Cockerell, 1893)	Bromeliaceae	<i>Ananas sativus</i> Mill.	6. 3. 2006.	Costa Rica
		<i>Ananas sativus</i> Mill.	19. 4. 2006.	Costa Rica
<i>Pseudococcus comstocki</i> (Kuwana, 1902)	Rosaceae	<i>Pyrus communis</i> L.	15. 12. 2007.	China
		<i>Pyrus communis</i> L.	20. 2. 2008.	China
2 SPECIES OF SCALE INSECTS	2 FAMILIES OF HOST PLANTS	2 HOST PLANTS	-	2 COUNTRIES OF ORIGIN

Table 2: Determined scale insects of family Diaspididae on imported fresh fruits in supermarkets in Croatia in period 2006-2008

SCALE INSECT	FAMILY OF HOST PLANT	HOST PLANT	DATE	COUNTRY OF ORIGIN
<i>Abgrallaspis cyanophylli</i>	Anacardiaceae	<i>Mangifera indica</i>	12. 3. 2008.	Brazil
<i>Aonidiella aurantii</i>	Rutaceae	<i>Citrus aurantiifolia</i>	2. 12. 2008.	Brazil
		<i>Citrus limon</i>	19. 10. 2007.	Argentina
		<i>Citrus limon</i>	20. 2. 2008.	Spain
		<i>Citrus limon</i>	2. 12. 2008.	South Africa
		<i>Citrus maxima</i>	19. 10. 2007.	Israel
		<i>Citrus paradisi</i>	15. 12. 2007.	South America
		<i>Citrus paradisi</i>	12. 3. 2007.	South America
		<i>Citrus sinensis</i>	19. 10. 2007.	Greece
		<i>Citrus sinensis</i>	15. 12. 2007.	Greece
		<i>Citrus sinensis</i>	5. 3. 2008.	Greece
		<i>Citrus sinensis</i>	14. 5. 2008.	Spain
<i>Citrus sinensis</i>	2. 12. 2008.	Greece		
<i>Citrus sinensis</i>	22. 12. 2008.	Spain		
<i>Aonidiella comperei</i>	Caricaceae	<i>Carica papaya</i>	2. 12. 2008.	Brazil
<i>Chrysomphalus aonidum</i>	Rutaceae	<i>Citrus aurantiifolia</i>	2. 12. 2008.	Brazil
<i>Diaspis boisduvalii</i>	Bromeliaceae	<i>Ananas sativus</i> Mill.	6. 3. 2006.	Costa Rica
<i>Hemiberlesia lataniae</i>	Anacardiaceae	<i>Mangifera indica</i>	12. 3. 2008.	Brazil
<i>Lepidosaphes beckii</i>	Rutaceae	<i>Citrus aurantiifolia</i>	3. 11. 2008.	Brazil
		<i>Citrus limon</i>	2. 12. 2008.	Italy
		<i>Citrus maxima</i>	19.10.2007.	Israel
		<i>Citrus sinensis</i>	12. 5. 2008.	Greece
<i>Lepidosaphes gloverii</i>	Rutaceae	<i>Citrus aurantiifolia</i>	12. 3. 2008.	Mexico
		<i>Citrus aurantiifolia</i>	2. 12. 2008.	Brazil
<i>Melanaspis bromiliae</i>	Bromeliaceae	<i>Ananas sativus</i>	20. 2. 2008.	Costa Rica
		<i>Ananas sativus</i>	5. 3. 2008.	Brazil
		<i>Ananas sativus</i>	12. 3. 2008.	Costa Rica
		<i>Ananas sativus</i> .	12. 11. 2008.	Costa Rica
<i>Parlatoria cinerea</i>	Anacardiaceae	<i>Mangifera indica</i>	12. 3. 2008.	Brazil
	Rutaceae	<i>Citrus aurantiifolia</i>	2. 12. 2008.	Brazil
<i>Parlatoria oleae</i>	Rutaceae	<i>Citrus aurantiifolia</i>	5. 3. 2008.	Chile
		<i>Citrus aurantiifolia</i>	12. 3. 2008.	Mexico
		<i>Citrus limon</i> (L.)	20. 2. 2008.	Spain
<i>Parlatoria pergandii</i>	Rutaceae	<i>Citrus limon</i> (L.)	20. 2. 2008.	Spain
		<i>Citrus aurantiifolia</i>	2. 12. 2008.	Brazil
		<i>Fortunella</i> sp.	5. 12. 2008.	South Africa
<i>Parlatoria ziziphi</i>	Rutaceae	<i>Citrus aurantiifolia</i>	5. 3. 2008.	Chile
		<i>Citrus aurantiifolia</i>	12. 3. 2008.	Mexico
		<i>Citrus aurantiifolia</i>	15. 5. 2008.	Chile
		<i>Citrus aurantiifolia</i>	12. 11. 2008.	Chile
		<i>Citrus limon</i>	19. 10. 2007.	Argentina
		<i>Citrus limon</i>	20. 2. 2008.	Spain
<i>Citrus limon</i>	21. 10. 2008.	South Africa		
<i>Pinnaspis aspidistrae</i>	Rutaceae	<i>Citrus aurantiifolia</i>	2. 12. 2008.	Brazil
<i>Pseudaonidia trilobitiformis</i>	Anacardiaceae	<i>Mangifera indica</i>	14. 10. 2008.	Brazil
<i>Selenaspis articulatus</i>	Rutaceae	<i>Citrus aurantiifolia</i>	5. 3. 2008.	Chile
<b>16 SPECIES OF SCALE INSECTS</b>	<b>4 FAMILIES OF HOST PLANTS</b>	<b>8 HOST PLANTS</b>	-	<b>11 COUNTRIES OF ORIGIN</b>

#### 4 CONCLUSIONS

Three year inspection (2006 - 2008) on scale insects of imported fresh fruits in supermarkets in Croatia showed that global trade is one of the major factor in spread of scale insects worldwide. In fifty samples of fresh fruits it was found 18 different species of scale insects. The most specimens were alive. Nine of them are a new alien species introduced in Croatia. Croatia belongs to the Mediterranean basin with very suitable climatic conditions for scales development. Mediterranean flora is very rich with different species of plants as a potential host plants of many scales. It is not known if this newly recorded species of scale insects could be a threat to some plants grown outdoors in Croatia. Moreover, a Pest Risk Analysis (PRA) for this pests is recommended.

#### 5 ACKNOWLEDGEMENTS

Thanks are due to Prof. dr. sc. Giuseppina Pellizzari from Dipartimento di Agronomia Ambientale e Produzioni vegetali, Università di Padova, Italy and to M. sc. Gabrijel Seljak from Agriculture and Forestry Institute Nova Gorica, Slovenia, who confirmed the our identifications of scale insects.

#### 6 REFERENCES

- Balachowsky, A. S. 1953. Les cochenilles de France, d'Europe, du nord de l'Afrique et du bassin méditerranéen. VII-Monographie des Coccoidea: Diaspidinae-IV, Odonaspadini-Parlatorini, Actualités Sci. Indus. Ent. Appl. 1202: 725-929
- Balachowsky, A. S. 1954. Les cochenilles paléarctique de la tribu des Diaspidini. Mem. Inst. Pasteur Sci.: 450 pp.
- Ben-Dov, Y., Miller, D.R. & Gibson, G.A.P. 2008. ScaleNet: a database of the scale insects of the world. Available from <http://www.sel.barc.usda.gov/scalenet/scalenet.htm>
- Borchsenius, N. S. 1949. Insects Homoptera, Suborders mealybugs and scales (Coccoidea), Family mealybugs (Pseudococcidae), Vol. VII, Fauna SSSR, Zoologicheskii Institut Akademii Nauk SSSR. N.S., 38: 1-382.
- Gill, R. J. 1997. The Scale Insects of California. Part III: The Armoured scales (Homoptera: Coccoidea: Diaspididae). California Department of Food and Agriculture, Sacramento: 307 pp.
- MacGillivray, A. D. 1921. The Coccidae, Tables for the identification of the subfamilies and some of the more important genera and species together with discussions of their anatomy and life history, Urbana, Illinois: 502 pp.
- McKenzie, H. L. 1967. Mealybugs of California with taxonomy, biology, and control of North American species (Homoptera: Coccoidea: Pseudococcidae). Univ. Calif. Press, Berkeley: 526 pp.
- Masten Milek, T. 2007. Fauna štitarstih uši (Insecta: Coccoidea) u Republici Hrvatskoj. Doktorska disertacija, Sveučilište Josipa Jurja Strossmayera u Osijeku. Poljoprivredni fakultet u Osijeku: 242 pp.
- McKenzie, H. L. 1938. The genus *Aonidiella* (Homoptera, Coccoidea, Diaspididae): Microentomol., 3: 1-36
- McKenzie, H. L. 1946. Supplementary on the genera *Aonidiella* and *Parlatoria* (Homoptera: Coccoidea: Diaspididae). Microentomology, 11: 29-36
- Miller, D. R. & Davidson, J. A. 2005. Armored scale insect pests of trees and shrubs. Cornell University Press, New York: 442 pp.
- Watson, G. W., Chandler, L. R. 1999. Identification of Mealybugs important in Caribbean Region., Commonwealth Science Council and CAB International: 5-39
- Wilkey, R. F. 1990. 1.5 Techniques. 1.5.1 Collection, Preservation and microslide mounting. 345-352 In Rosen, D. (Ed.). Armored Scale Insects. Their Biology, Natural Enemies and Control. World Crop Pests, Vol. 4A. Elsevier, Amsterdam: 384 pp.
- Williams, D. J. 2004. The Mealybugs of Southern Asia. The Natural History Museum, Kuala Lumpur, Southdene: 896 pp.
- Williams, D. J., Watson, G. W. 1988a. The Armoured Scales (Diaspididae) Part 1. The Scale Insects of the Tropical South Pacific Region, CAB International Institute of Entomology: 289 pp.
- Williams, D. J., Watson, G. W. 1988b. The Mealybugs (Pseudococcidae) Part 2. The Scale Insects of the Tropical South Pacific Region, CAB International Institute of Entomology: 260 pp.