

**SPECIES OF GENUS *Aulacaspis* Cockerell, 1836 (Hemiptera:
Coccoidea: Diaspididae) IN CROATIA, WITH EMPHASIS ON
Aulacaspis yasumatsui Takagi, 1977**

Tatjana MASTEN MILEK¹, Mladen ŠIMALA¹, Adrijana NOVAK¹

¹Institute for Plant Protection in Agriculture and Forestry of the Republic of Croatia,
Svetošimunska cesta 25, HR – Zagreb, Croatia, tatjana.masten@zzb.hr

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This paper deals with the scale insects *Aulacaspis rosae* (Bouché, 1833) and *Aulacaspis yasumatsui* Takagi, 1977 monitored during a four year faunistic investigation (2005-2008) of the genus *Aulacaspis* Cockerell, 1836 in Croatia. *A. yasumatsui* is a newly recorded species for Croatia and the fourth finding of this species in Europe. Distribution (according to the UTM system) and host plants of these species in Croatia are reported. Some morphological characters useful to differentiate the two species are also described.

***Aulacaspis rosae*, *Aulacaspis yasumatsui*, distribution, morphology, Croatia**

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Rad govori o štitastim ušima *Aulacaspis rosae* (Bouché, 1833) i *Aulacaspis yasumatsui* Takagi, 1977, koje su utvrđene monitoringom roda *Aulacaspis* Cockerell, 1836 tijekom četverogodišnjih faunističkih istraživanja (2005.-2008.) u Hrvatskoj. *A. yasumatsui* novoregistrirana je vrsta za Hrvatsku i četvrti je nalaz ove vrste u Europi. Rasprostranjenost utvrđenih vrsta i njihovih domaćina u Hrvatskoj prikazana je prema UTM sustavu. Opisana su i neka morfološka obilježja potrebna za razlikovanje utvrđenih vrsta.

***Aulacaspis rosae*, *Aulacaspis yasumatsui*, rasprostranjenost, morfolo-gija, Hrvatska**

Introduction

Scale insects are considered very important agricultural pests of perennial plants. They are characterized by a peculiar morphology, sexual dimorphism and great number of described species. Scale insects can cause direct and indirect damage to their host plants. Direct damage arises from the ingestion of plant sap from leaves, twigs and fruits, resulting in loss of plant growth, dieback of twigs, discolorations on leaves and fruits, reduction in quantity and quality of yield. Indirect damage includes the transmission of viruses and the excretion of honeydew, a growth medium for sooty moulds. Species identification is sometimes difficult, due to minimal morphological differences between species. Special preparation and observation of microscopic slides is usually required.

In the Palearctic region the genus *Aulacaspis* (Fam. Diaspididae) comprises 29 species (Ben-Dov *et al.*, 2008). Only three species have been recorded in Europe: *Aulacaspis rosae* (Bouché, 1833), *A. tubercularis* Newstead 1906 and *A. yasumatsui* Takagi, 1977. *A. rosae* is a Euro-Asiatic indigenous species, largely distributed all over Europe. By contrast, *A. tubercularis* and *A. yasumatsui* are clearly introduced alien species. *A. tubercularis* (the White Mango Scale) was recorded on mango plants (*Mangifera indica*) in a nursery in South Italy in 1988 (Porcelli, 1990) and this seems to be the only record of this species in Europe so far. *A. yasumatsui* (the Cycad Aulacaspis Scale) was first recorded in Europe in 1995 and then intercepted several times in different countries. It is considered a serious pest of cycads.

This paper deals with the species and distributional data of the scale genus *Aulacaspis* occurring in Croatia.

Materials and methods

Faunistic investigations on scale insects of Croatia were carried out over a 4 year period (2005 – 2008) in 21 counties of Croatia by visual inspection of potentially infested plants.

The survey was carried out as follows:

- Visual inspection of potentially infested plant material with the help of magnification (10x magnification).
- Collection of host plant material infested with scale insects (leaves and stems) in plastic bags, labelling each sample with collection data (coun-

ty, locality details, host plant, any damage symptoms, collector's name, samples number, date).

- Observation of field characters of collected specimens under the dissecting stereo microscope Olympus SZ 51. Taking photos of scales with an Olympus 510 UZ digital camera.
- Slide mounting according to the methods of Wilkey (1990).
- Microscopic identification on the basis of morphological characters of adult females according to keys by Balachowsky (1954) and Miller, Davidson (2005).
- Microscopic slide labelling with all data.
- Marking the localities of finding according to the UTM system (Horvat *et al.*, 2003).

Results and discussion

With regard to the genus *Aulacaspis* in Croatia, this survey confirmed the presence of *A. rosae* and, moreover, led to the discovery of *A. yasumatsui*, an alien species not yet recorded in Croatia. Information on these species is reported below.

Aulacaspis rosae (Bouché, 1833)

A. rosae is a very common Palaearctic scale insect incidentally introduced into America, Australia and Africa (ScaleNet, 2008). The first record of *A. rosae* in Croatia dates from 1950 (Schmidt, 1956). It was recorded on *Rosa* sp. and *Myrtus communis* L. in the locality of Rijeka. Predictably, this species was found to be widespread all over the country: during our investigation, *A. rosae* was recorded at 12 localities and on 5 different host plants of the genus *Rubus* and *Rosa*, (see table 1!) that are its commonest host plants; *A. rosae* may develop also on some other Rosaceae, and on a few Anacardiaceae, Myricaceae, Saxifragaceae (ScaleNet, 2008). It infests the trunk, twigs and branches. Heavy infestation on roses may cause the death of plants (Kosztarab & Kozàr, 1988).

Aulacaspis yasumatsui Takagi, 1977

A. yasumatsui was originally described from specimens collected on *Cycas* sp. in Bangkok, Thailand, in 1972 (Takagi, 1977). It was not considered a pest until the 1990s, when its potential as a serious pest became apparent (Hodgson & Martin, 2001). *A. yasumatsui* is probably native to South-eastern Asia, but since

the early 1990s it has spread very quickly with the plant trade and is now recorded in China, Hong Kong, Singapore, Taiwan, Vietnam, Ivory Coast, Hawaii, Louisiana, Texas, Florida, Bahamas, Cayman Islands, Guadeloupe, Guam, Martinique, Puerto Rico and US Virgin Islands; it has been intercepted and eradicated in New Zealand (Howard *et al.*, 1999, Malumphy & Matthews, 2006). In Europe, it was intercepted for the first time in the Netherlands in 1995 on cycads imported from Vietnam (Jansen, 1996). Some years later, it was intercepted again and recorded in greenhouses as well (Jansen, 2004). In France, it was intercepted several times in 2001 at the check points of Marseille and in nursery gardens of the French Riviera, on cycads imported from Vietnam, and again in 2006 (Germain, 2001; Germain & Hodges, 2007). In Great Britain *A. yasumatsui* was detected on cycads imported from Vietnam, via the Netherlands, in April 2006 (Malumphy & Matthews, 2006).

A. yasumatsui was detected in Croatia in May 2006, on an imported *Cycas revoluta* Thunb. in a greenhouse near Split in Splitsko dalmatinska County (Masten, 2007, Masten Milek, 2007). To date this is the only record of this species in Croatia (see table 1).

A. yasumatsui feeds on plants belonging to three families: Cycadaceae, Zamiaceae and Stangeriaceae. *Cycas* spp. seem to be the preferred hosts, particularly those of Asian origin, such as the “King sago” *C. revoluta* and “Queen sago” *Cycas rumphii* Miq. As cycads are its preferred host, *A. yasumatsui* got the name Cycad Aulacaspis Scale (CAS). This pest is considered a devastating pest of ornamental cycads in greenhouses, moreover it may also have a significant impact on outdoor plants (Germain & Hodges, 2007). *A. yasumatsui* is difficult to control because of its high fecundity and capacity to infest the roots (Miller & Davidson, 2005). Infestation usually starts on the underside of the leaflets. Damage initially appears as chlorotic spots. As infestation increases, scales infest the upper surfaces of the leaflets, and later petioles and stems. Heavily infested cycads are almost completely coated with a white crust. This species is highly harmful for cycads and heavily infested plants often die. In addition, dead scales may persist on leaves for a long time reducing the ornamental value of plants. As cycads are valuable ornamental plants in the EPPO region, especially in the Mediterranean countries, where they can grow outdoors as well, *A. yasumatsui* was precautionarily included in the EPPO Alert list as a potential harmful pest of cycads. (http://www.eppo.org/QUARANTINE/Alert_List/insects/AULSYA.htm).

Table 1. Records of scales of the genus *Aulacaspis* in the period 2005 – 2008

SCALE SPECIES	HOST FAMILY	HOST PLANT	LOCALITY	UTM	DATE
<i>A. rosae</i>	Rosaceae	<i>Rubus idaeus</i> L.	Hercegovac	33T XL5657	25.3.2005.
		<i>Rosa</i> L. sp.	Dubrovnik	34T BN6126	28.3.2005.
		<i>Rosa</i> L. sp.	Belečko Završje	33 WM8810	18.2.2006.
		<i>Rosa canina</i> L.	Stružec	33T XL2142	2.5.2006.
		<i>Rubus discolor</i> Weihe&Nees	Grabarje	33T YL2427	5.6.2006.
		<i>Rubus discolor</i> Weihe&Nees	Zagreb Stenjevac	33TWL6873	12.10.2006.
		<i>Rubus discolor</i> Weihe&Nees	Zagreb Glavica	33TWL6874	31.3.2007.
		<i>Rosa spinosissima</i> L.	Samobor	33T WL5572	2.4.2007.
		<i>Rubus discolor</i> Weihe&Nees	Jadrija	33T WJ6841	2.6.2007.
		<i>Rubus discolor</i> Weihe&Nees	Vinkovci	34T CR2717	22.2.2008.
		<i>Rubus discolor</i> Weihe&Nees	Zagreb Rim	33T WL7776	27. 2.2008.
		<i>Rosa</i> L. sp.	Novigrad	33T UL8719	4.3.2008.
		<i>A. yasumatsui</i>	Cycadaceae	<i>Cycas revoluta</i> Thunb.	Knežine*
<i>Cycas revoluta</i> Thunb.	Knežine*			33T XJ0722	15.12.2006.

* greenhouse

Notes on morphological characters of *A. yasumatsui* and *A. rosae*

A. yasumatsui and *A. rosae* can be differentiated on the basis of the host plant: *A. rosae* lives mainly on Rosaceae whereas *A. yasumatsui* develops only on plants belonging to Cycadaceae, Zamiaceae and Stangeriaceae. Some macroscopic characters (i.e. shape of the cover, colour of adult female) may also be useful to distinguish the two species: the differences between the two species are summarized in table 2 and shown in figures 1, 2 and 3.

Slide mounted adult females of *A. yasumatsui* and *A. rosae* are very similar. The main difference between them is in the shape of the swollen prosoma. *A. yasumatsui* has a prosoma with rounded lateral margins and does not form a distinct rectangle, while in *A. rosae* the prosoma is distinctly rectangular (figure 4). Details of pigydium are shown in figure 5.

Table 2. Main macroscopic differences between *A. yasumatsui* and *A. rosae*

FIELD CHARACTERS	<i>A. yasumatsui</i>	<i>A. rosae</i>
Host	Cycadaceae (<i>Cycas</i> spp.), Zamiaceae and Stangeriaceae	Rosaceae (<i>Rosa</i> and <i>Rubus</i>), Oleaceae, Geraniaceae
Adult female		
Colour of the cover	white	dirty white
Shape of the cover	circular to mussel-shaped (often distorted due to overcrowding)	circular to oval
Exuvium position	marginal	marginal or submarginal
Exuvium colour	light yellow or white	yellow or brown
Colour of the body	orange	reddish brown
Adult male		
Colour of the cover	white	white
Shape of the cover	elongate, parallel sided, felted, with 3 longitudinal ridges	elongate, parallel sided, felted, with 3 longitudinal ridges
Exuvium position	marginal	marginal
Exuvium colour	light yellow or white	yellow or brown
Eggs		
color	orange	reddish brown

Conclusions

In Croatia the genus *Aulacaspis* currently consists of two species: *Aulacaspis rosae* and *Aulacaspis yasumatsui*. *A. rosae* is an indigenous species widespread throughout the country. *A. yasumatsui* is a new alien species recently introduced in Croatia. *A. yasumatsui* is a threat to cycads grown in greenhouses. It is not known if it could be a threat to cycads grown outdoors in Mediterranean countries like Croatia. For this reason all efforts should be made to avoid further introductions and spread. Moreover, a Pest Risk Analysis (PRA) for this pest is strongly suggested.

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Figure 1. Cover of an adult female ♀ and covers of males ♂ of *A. yasumatsui* (photo T. Masten Milek)



Figure 2. Covers of adult females ♀ and males ♂ of *A. rosae* (photo T. Masten Milek)

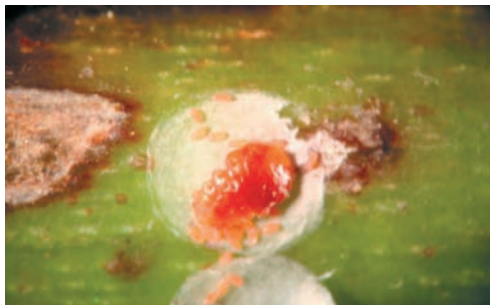


Figure 3. Adult female with eggs of *A. rosae* (the cover has been removed) (T. Masten Milek)

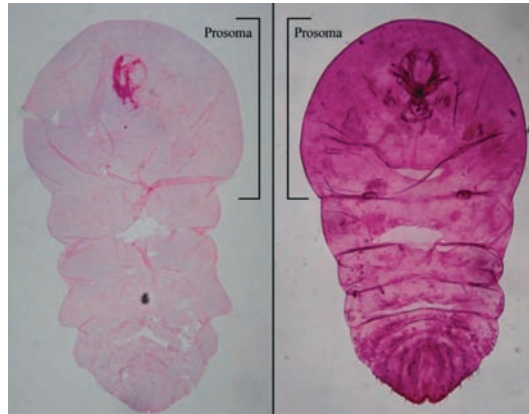


Figure 4. Slide mounted specimens of *A. rosae* (left) and *A. yasumatsui* (right). *A. yasumatsui* female exhibits a swollen prosoma (photo T. Masten Milek)

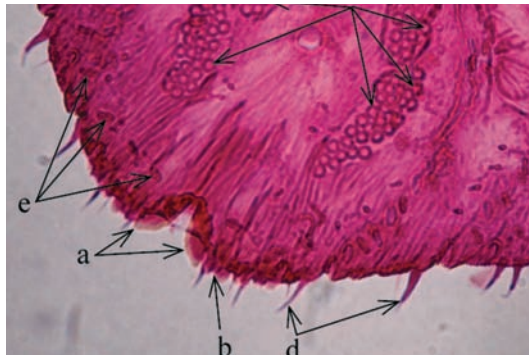


Figure 5. Pygidium of *A. yasumatsui* female: a-median lobes with yoke; b-second lobe bilobed; c- perivulvular pores; d-gland spines; e-macroducts (photo T. Masten Milek)

confirmed the identification of *A. yasumatsui* and gave us a great deal of useful advice regarding this article.

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