Non-indigenous scale insects on ornamental plants in Bulgaria and China: A survey

Trencheva K. University of Forestry, Sofia, Bulgaria
Trenchev G. University of Forestry, Sofia, Bulgaria
Tomov R. University of Forestry, Sofia, Bulgaria
Wu S.-A. Beijing Forestry University

https://doi.org/10.12681/eh.11578

Copyright © 2017 K. Trencheva, G. Trenchev, R. Tomov, S.-A. Wu

To cite this article:

Non-indigenous scale insects on ornamental plants in Bulgaria and China: A survey

K. TRENCEVA1*, G. TRENCEV1, R. TOMOV1 AND S.-A. WU2

1University of Forestry, 10, Kliment Ochridski Blvd, 1756 Sofia, Bulgaria
2Beijing Forestry University, 100083, Beijing, P. R. China

ABSTRACT

A preliminary list of non-indigenous scale insect species on ornamental plants in Bulgaria and China is presented. The sampling was done between April and November, 2009, in the framework of the project “Invasive scale insects on ornamental plants in Bulgaria and China”. The insects were collected in nurseries, parks, gardens, botanical collections and greenhouses. Representatives from four families have been identified in Bulgaria, the most numerous of which are the Diaspididae (eight species), Coccidae (four species), Pseudococcidae (two species) and Margarodidae (one species). Three species of non-indigenous scale insects associated with ornamental plants were collected in China, all belonging to the family Pseudococcidae. A list of alien scale insect species on ornamental plants is given, including the sampling sites, host plants on which they were found, origin and first report in both countries.

KEYWORDS: non-indigenous scale insects, Bulgaria, China, ornamental plants.

Introduction

There has been increased interest in recent years in the utilization of non-native ornamental plants in urban areas because of the beauty and diversity they lend to the landscape. However, the introduction of exotic ornamental plants to the urban landscape often results in the introduction of new pest and disease problems. Scale insects are notorious pests of ornamentals and are commonly transported with plant material and are frequent invasive species because of their small size and habit of feeding in concealed areas (Miller 2005). Due to the lack of natural enemies in their new habitat, and to their high fecundity and their protective covers and wax, effective control may be a major problem (Ben-Dov and Hodgson 1997). Information on the species composition of the scale insects fauna will allow us to predict possible pest problems and to make plans to manage them. In some cases, plants that are relatively immune to scale insect infestations could be selected while those especially susceptible could be avoided. Scale insects are frequent invaders. With 129 established species, they numerically represent one of the major groups of insects alien to Europe (Pellizzari and Germain 2010).

Based on bibliographic sources, 34 species of scale insects are hypothesized by us as non-native on ornamental plants in Bulgaria (Tomov et al. 2009) and 73 in China (Wu unpublished work). The first list of Bulgarian scale insects was published by Tschorbadjiew (1938), who mentioned 23 species on 24 host plants.

*Corresponding author, e-mail: k_trencheva@yahoo.com
Since then there have been a few studies on scale insects on ornamentals, some of them quite old (Lazarov 1940, Stanev 1963, Tzalev 1968, Krusteva 1977, Staneva 1989, Pencheva 2007). The first published list of scales in China is that of Maskell (1897). Since then more than 1000 species were recorded in the country. Although there is some published work on the scale insects on ornamentals in China, the fauna is still poorly known (Tang 1977, 1992, Tang and Hao 1995).

The aim of this paper is to provide further information on the most common non-native scale insects that have been imported into both countries on exotic ornamentals via the plant trade.

**Materials and Methods**

The coccid samples were collected between April and November, 2009, mainly in nurseries, botanical collections and greenhouses, but also in gardens and parks, at the following sampling sites: BULGARIA: Varna, Sofia, Burgas, Troyan, Smolyan, Asenovgrad, Ravda, Plovdiv, Veliko Turnovo, Lovech, Kurdjali, Tzarevo, Nessebar, Sandanski, Kazanluk, Haskovo, Balchik (Fig. 1); CHINA: Beijing, Xinjiang, Guangdong (Fig. 2).

In the laboratory, the specimens were mounted on microscope slides according to the technique of Kosztarab and Kozár (1988) and identified using keys and illustrations of Kosztarab and Kozár (1988), Gill (1988) and Miller and Davidson (2005). Dry material and permanent slides have been deposited at University of Forestry, Plant Protection Department, Laboratory of Entomology, Sofia, Bulgaria and in Beijing Forestry University, Beijing, China. The term non-indigenous (alien) as used in this paper follows the definition of Nentwig and Josefsson (2009). The origin of the species is given according to Pellizzari and Germain (2010) and Miller et al. (2002). The nomenclature used here for the Coccoidea follows the ScaleNet database (Ben-Dov et al. 2010).

![FIG.1. Sampling sites in Bulgaria (UTM map).](http://epublishing.ekt.gr)
Results and Discussion

The list of species collected is shown in Table 1, including the sampling sites, host plants, probable area of origin and the first report in both countries. During this short survey, a total of 15 coccoid species were collected in Bulgaria on 21 species of host plants and 3 species in China on 6 species of host plants. The most representative scale insect families in Bulgaria were Diaspididae, with eight species, and Coccidae, with four species. Three species of non-indigenous scale insects associated with ornamental plants were collected in China, all belonging to the family Pseudococcidae.

The most recent and interesting species collected in Bulgaria were the soft scale Ceroplastes japonicus Green and the diaspidid Aulacaspis yasumatsui Takagi. C. japonicus was recorded in Bulgaria for the first time in 2007 (Pencheva 2007) on an imported Ilex aquifolium L. and on Hedera helix L. According to Rainato and Pellizzari (2008), this species is a pest of ornamentals in urban environments in Italy, France, Slovenia and Croatia. To-date it has only been found indoors in Bulgaria but it is possible that with changes in climate, it might survive outside, at least in some years.

In Bulgaria, two species of Aulacaspis have been recorded: A. rosae, which is widely distributed and linked to Rosaceae, and the recently detected A. yasumatsui, recorded in July by Trencheva et al. (2009), on an imported Cycas revoluta Thunb., in a
<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Host plant</th>
<th>Area of origin</th>
<th>Sampling sites</th>
<th>First record</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocidae</td>
<td>Ceroplastes japonicus Green</td>
<td>Laurus nobilis L.</td>
<td>Tropical Asia</td>
<td>Varna</td>
<td>Pencheva 2007</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td>Coccus hesperidum Linnaeus</td>
<td>Nerium oleander L., Citrus sp., Prunus laurocerasus L.</td>
<td>Tropical, subtropical</td>
<td>Sofia, Varna, Burgas, Troyan, Smolyan, Asenovgrad</td>
<td>Tzalev 1968</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td>Saissetia coffeae (Walker)</td>
<td>Coffea arabica L.</td>
<td>Afrotropical</td>
<td>Ravda, Sofia</td>
<td>Tschorbadjiew 1938</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td>Saissetia oleae (Olivier)</td>
<td>Olea europaea L.</td>
<td>Afrotropical</td>
<td>Sofia, Plovdiv</td>
<td>Krusteva 1977</td>
<td>Bulgaria</td>
</tr>
<tr>
<td>Diaspididae</td>
<td>Aspidiotus nerii Bouche</td>
<td>Strelitzia sp., Aulacabus sp.</td>
<td>Afrotropical</td>
<td>Plovdiv, Veliko Turnovo, Smolyan Lovech, Kurdjali</td>
<td>Tschorbajew 1938</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td>Aulacaspis rosae (Bouche)</td>
<td>Rosa sp.</td>
<td>Asia</td>
<td>Sofia, Smolyan, Lovech, Kurdjali</td>
<td>Tschorbajew 1938</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td>Aulacaspis yasumatsui Takagi</td>
<td>Cycas revoluta Thunb.</td>
<td>Asia</td>
<td>Tzarevo</td>
<td>Trencheva et al. 2009</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td>Chrysomphalus aonidum (Linnaeus)</td>
<td>Dracaena sp.</td>
<td>Southern America</td>
<td>Nessebar</td>
<td>Tschorbajew 1938</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td>Diaspidiotus pernicosus (Comstock)</td>
<td>Cotoneaster sp., Crataegus sp.</td>
<td>Asia</td>
<td>Petrich</td>
<td>Stanev 1963</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td>Parlatoria oleae (Colvée)</td>
<td>Pyrus sp., Malus sp.</td>
<td>Asia</td>
<td>Petrich</td>
<td>Lazarov 1940</td>
<td>Bulgaria</td>
</tr>
</tbody>
</table>
TABLE 1 (continued). List of non-native species collected in Bulgaria and China, including the sampling sites, host plants on which they were found, area of origin and first report in both countries.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Host plant</th>
<th>Area of origin</th>
<th>Sampling sites</th>
<th>First record</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>Unaspis euonymi</em> (Comstock)</td>
<td><em>Euonymus</em> sp.</td>
<td>Asia</td>
<td>Sofia, Sandanski, Petrich, Burgas, Varna, Haskovo, Kordjali, Lovech, Troyan, Nessebar, Ravda, Veliko Turnovo, Plovdiv, Asenovgrad, Smolyan</td>
<td>Tschorbadjiew 1938</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td><em>Planococcus citri</em> (Risso)</td>
<td><em>Nerium oleander</em> L.</td>
<td>Asia</td>
<td>Balchik</td>
<td>Tschorbadjiew 1938</td>
<td>Bulgaria</td>
</tr>
<tr>
<td></td>
<td><em>Pseudococcus longispinus</em> (Targioni – Tozzetti)</td>
<td><em>Coffea arabica</em> L.</td>
<td>Australia</td>
<td>Ravda</td>
<td>Tzalev 1968</td>
<td>Bulgaria</td>
</tr>
<tr>
<td>Pseudococcidae</td>
<td><em>Phenacoccus solani</em> Ferris</td>
<td><em>Euphorbia neriifolia var. cristata</em>, <em>Hylocereus undatus</em>, <em>Hoya carnosa</em>, <em>Schefflera macrorostachya</em></td>
<td>Nearctic Region</td>
<td>Beijing, Xinjiang</td>
<td>Chen et al. 2002</td>
<td>China</td>
</tr>
</tbody>
</table>
TABLE 1 (continued). List of non-native species collected in Bulgaria and China, including the sampling sites, host plants on which they were found, area of origin and first report in both countries.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Host plant</th>
<th>Area of origin</th>
<th>Sampling sites</th>
<th>First record</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudococcidae</td>
<td><em>Phenacoccus solenopsis</em> Tinsley</td>
<td><em>Hibiscus rosa-sinensis</em> L.</td>
<td>Nearctic Region</td>
<td>Guangdong</td>
<td>Hodgson et al. 2008</td>
<td>China</td>
</tr>
<tr>
<td></td>
<td><em>Pseudococcus philippinicus</em> Williams</td>
<td><em>Dracaena</em> spp.</td>
<td>Oriental Region</td>
<td>Beijing</td>
<td>Wang and Wu 2010</td>
<td>China</td>
</tr>
<tr>
<td>Margarodidae</td>
<td><em>Icerya purchasi</em> Maskell</td>
<td><em>Pittosporum tobira</em> Thunb.</td>
<td>Australasia</td>
<td>Plovdiv</td>
<td>Tzalev 1968</td>
<td>Bulgaria</td>
</tr>
</tbody>
</table>
garden center near to the town Tsarevo (Black sea). It is not clear from where the cycads plants were imported. Even if the cycad aulacaspis scale has been intercepted several times into Europe, it has not become established outdoors. In Bulgaria, A. yasumatsui may be a risk to cycads grown under glass and in botanical and private collections.

Other non-indigenous diaspidids that have been established in Bulgaria for a long time are Diaspidiotus perniciosus, Parlatoria oleae, Pseudaulacaspis pentagona and Unaspis euonymi. These species are present in both cultivated and natural habitats and are all polyphagous, except Unaspis euonymi which is monophagous on Euonymus sp.

Further non-native scales such as the coccids Coccus hesperidum, Saissetia coffeae and Saissetia oleae, the diaspidids Aspidiotus nerii and Chrysomphalus aonidium, the pseudococcids Planococcus citri and Pseudococcus longispinus and the monophlebid Icerya purchasi can only survive in Bulgaria in greenhouses, botanical collection or on house plants, which suggests that the climate is not appropriate for them to overwinter in the open.

All the species collected in China were found in greenhouses. Phenacoccus solani Ferris was reported for the first time by Chen et al. (2002) in Taiwan on 13 species of host plant, including Lycoris aurea, Narcissus tazetta and Wedelia chinensis, and by Wang and Wu (2009) in mainland China. It is a polyphagous species in greenhouses in north part of China and in open areas in southern China. Phenacoccus solenopsis Tinsley was reported for the first time by Hodgson et al. (2008) in Taiwan and by Wu and Zhang (2009) in mainland China. This species is now widely distributed in southern China. Pseudococcus philippinus Williams was recorded recently in China on Dracaena spp. (Wang and Wu 2010). It was observed only in greenhouses, but perhaps could be found in open areas in southern China. However, for some species it is unclear how their impact and distribution will increase with climate changes. This list is a starting point for future investigation in both countries.

Acknowledgements

Thanks are due to Professor Giuseppina Pellizzari, Dipartimento di agronomia Ambientale e Produzioni vegetali, Universita di Padova, Italy, who confirmed the identification of A. yasumatsui. Thanks also to Dr. Chris Hodgson for helpful comments on the manuscript.

The study was funded by the NSF, Ministry of Education, Youth and Science, Republic of Bulgaria, project “Invasive scale insects on ornamental plants in Bulgaria and China” and partly by ATARTIB project (NSF).

References


lybug damaging cotton in Pakistan and India, with a discussion on seasonal morphological variation. Zootaxa 1913: 1-35.


Lasarov, A. 1940. Prouchvaniya vurhu ploskite schitonozi vuski (Diaspinae, Coccidae) po ovoschnite durveta u nas. Sofiya. 46 pp. (in Bulgarian; summary in German)


Pencheva, A. 2007. New and little known pests in the greenhouses for ornamental plants of Bulgaria, Acta Entomologica Bulgarica 13: 35-43. (in Bulgarian; summary in English)


Tzalev, M. 1968. Prinos kum prouchvane faunata na schitonochnite vsuki (Homoptera, Coccoidea) po parkovite i ukrasnite rasteniya v Bulgaria. Izvestiya na Zoolo-gicheskiya Institut s Muzey 28: 205-218. (in Bulgarian; summary in German)


Επισκόπηση μη ιθαγενών ειδών κοκκοειδών εντόμων σε καλλωπιστικά φυτά στην Βουλγαρία και την Κίνα

K. TRENCHEVA¹, G. TRENCHEV¹, R. TOMOV¹ KAI S.-A. WU²

¹University of Forestry, 10, Kliment Ochridski blvd, 1756 Sofia, Bulgaria
²Beijing Forestry University, 100083, Beijing, P. R. China

ΠΕΡΙΛΗΨΗ

Παρουσιάζεται μια προκαταρκτική λίστα από μη ιθαγενή κοκκοειδή είδη σε καλλωπιστικά φυτά στην Βουλγαρία και την Κίνα. Η δειγματοληψία πραγματοποιήθηκε μεταξύ Απριλίου και Νοεμβρίου, 2009, στο πλαίσιο του προγράμματος “Επεκτατικά αλλόχθονα κοκκοειδή έντομα σε καλλωπιστικά φυτά στην Βουλγαρία και την Κίνα”. Τα έντομα συλλέχθηκαν από φυτώρια, πάρκα, κήπους, βοτανικές συλλογές και θερμοκήπια. Είδη από 4 οικογένειες βρέθηκαν στην Βουλγαρία. Τα περισσότερα είδη ανήκουν στην οικογένεια Diaspididae (οκτώ είδη), στην οικογένεια Coccidae βρέθηκαν τέσσερα είδη, στην οικογένεια Pseudococcidae δύο είδη και στην οικογένεια Margarodidae ένα είδος. Τρία είδη μη ιθαγενών κοκκοειδών εντόμων σε καλλωπιστικά φυτά βρέθηκαν κατά τις δειγματολήψιες στην Κίνα. Τα τρία είδη ανήκουν στην οικογένεια Pseudococcidae.