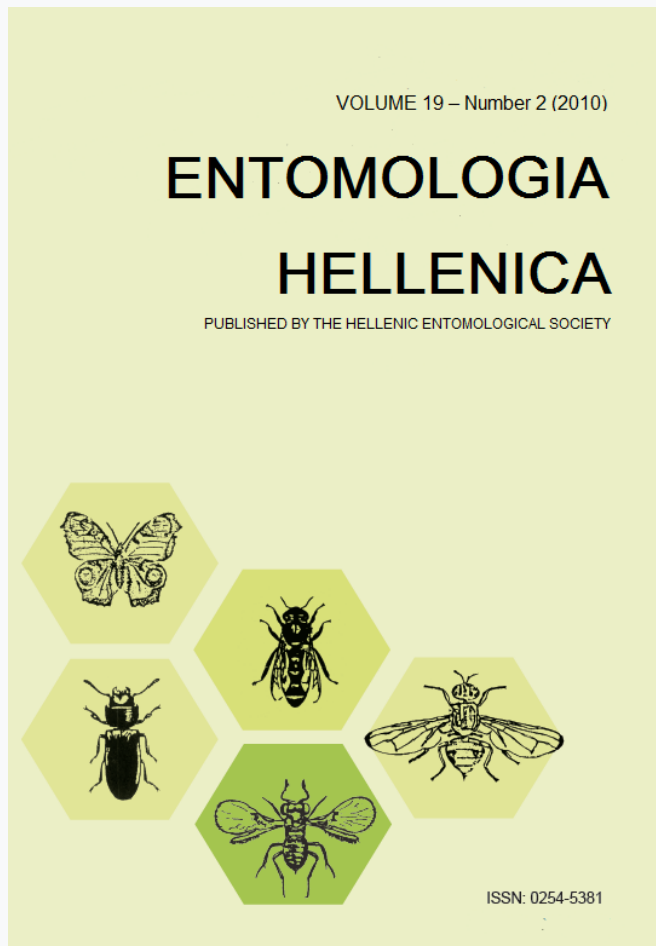


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Non-indigenous scale insects on ornamental plants in Bulgaria and China: A survey

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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 composi-

tion 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 group 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.

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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).

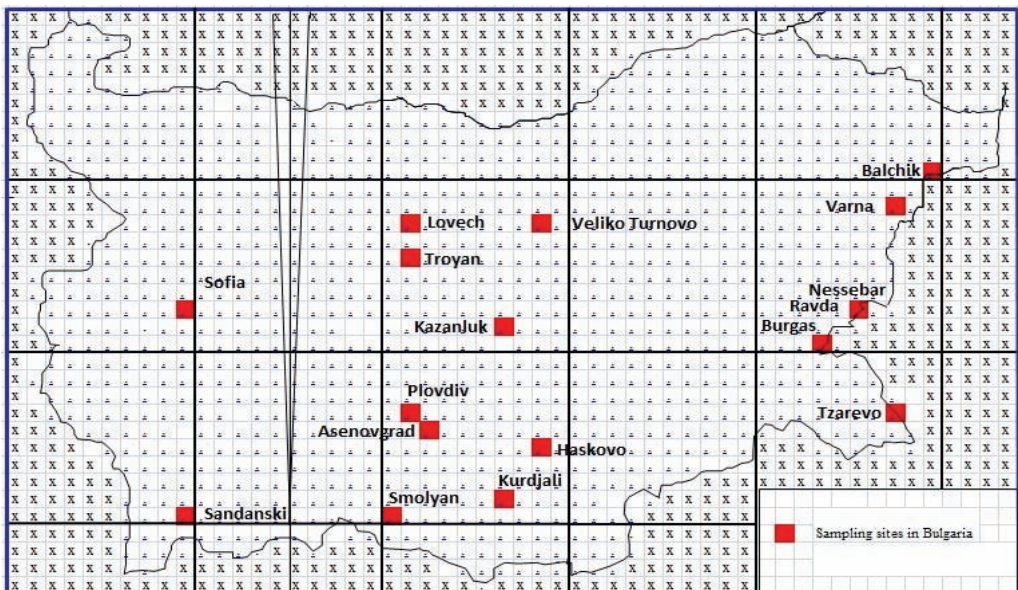


FIG.1. Sampling sites in Bulgaria (UTM map).



FIG. 2. Sampling sites in China.

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 1. 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.

| Family | Species | Host plant | Area of origin | Sampling sites | First record | Country |
|--------------------|---|---|--------------------------|---|-----------------------|----------|
| Coccidae | <i>Ceroplastes japonicus</i> Green | <i>Laurus nobilis</i> L. | Tropical Asia | Varna | Pencheva 2007 | Bulgaria |
| | <i>Coccus hesperidum</i> Linnaeus | <i>Nerium oleander</i> L., <i>Citrus</i> sp., <i>Prunus</i> <i>lauocerasus</i> L. | Tropical, subtropical | Sofia, Varna, Burgas, Troyan, Smolyan, Asenovgrad | Tzalev 1968 | Bulgaria |
| | <i>Saissetia coffeae</i> (Walker) | <i>Coffea arabica</i> L. | Afrotropical | Ravda, Sofia | Tschorbadjiew 1938 | Bulgaria |
| | <i>Saissetia oleae</i> (Olivier) | <i>Olea europaea</i> L. | Afrotropical | Sofia, Plovdiv | Krusteva 1977 | Bulgaria |
| | <i>Aspidiotus nerii</i> Bouché | <i>Strelitzia</i> sp., <i>Aulacibus</i> sp. | Afrotropical | Plovdiv, Veliko Turnovo, Smolyan | Tschorbadjiew 1938 | Bulgaria |
| Diaspididae | <i>Aulacaspis rosae</i> (Bouche) | <i>Rosa</i> sp. | Asia | Sofia, Smolyan, Lovech, Kurdjali | Tschorbadjiew 1938 | Bulgaria |
| | <i>Aulacaspis yasumatsui</i> Takagi | <i>Cycas revoluta</i> Thunb. | Asia | Tzarevo | Trencheva et al. 2009 | Bulgaria |
| | <i>Chrysomphalus aonidum</i> (Linnaeus) | <i>Dracaena</i> sp. | Southern America | Nessebar | Tschorbadjiew 1938 | Bulgaria |
| | <i>Diaspidiotus perniciosus</i> (Comstock) | <i>Cotoneaster</i> sp., <i>Crataegus</i> sp. | Asia | Petrich | Stanev 1963 | Bulgaria |
| | <i>Parlatoria oleae</i> (Colvée) | <i>Pyrus</i> sp., <i>Malus</i> sp. | Asia | Petrich | Lazarov 1940 | Bulgaria |

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.

| Family | Species | Host plant | Area of origin | Sampling sites | First record | Country |
|-----------------------|--|--|--------------------|--|-----------------------|----------|
| | <i>Pseudaulacaspis pentagona</i> (Targioni – Tozzetti) | <i>Morus alba</i> L., <i>Morus nigra</i> L., <i>Catalpa</i> sp., <i>Actinidia</i> sp. | Asia | Petrich, Sandanski, Kazanluk | Staneva 1989 | Bulgaria |
| | <i>Unaspis euonymi</i> (Comstock) | <i>Euonymus</i> sp. | Asia | Sofia, Sandanski, Petrich, Burgas, Varna, Haskovo, Kurdjali, Lovech, Troyan, Nessebar, Ravda, Veliko Turnovo, Plovdiv, Asenovgrad, Smolyan | Tschorbadjiew 1938 | Bulgaria |
| Diapriidae | | | | | | |
| | <i>Planococcus citri</i> (Risso) | <i>Nerium oleander</i> L. | Asia | Balchik | Tschorbadjiew 1938 | Bulgaria |
| | <i>Pseudococcus longispinus</i> (Targioni – Tozzetti) | <i>Coffea arabica</i> L. | Australia | Ravda | Tzalev 1968 | Bulgaria |
| Pseudococcidae | <i>Phenacoccus solani</i> Ferris | <i>Euphorbia nerifolia</i> var. <i>cristata</i> , <i>Hylocereus undatus</i> , <i>Hoya carnosa</i> , <i>Schefflera</i> <i>macrorostachya</i> | Nearctic Region | Beijing, Xinjiang | Chen et al. 2002 | China |

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.

| Family | Species | Host plant | Area of origin | Sampling sites | First record | Country |
|-----------------------|--|----------------------------------|-----------------|----------------|---------------------|----------|
| Pseudococcidae | <i>Phenacoccus solenopsis</i> Tinsley | <i>Hibiscus rosa-sinensis</i> L. | Nearctic Region | Guangdong | Hodgson et al. 2008 | China |
| | <i>Pseudococcus philippinicus</i> Williams | <i>Dracaena</i> spp. | Oriental Region | Beijing | Wang and Wu 2010 | China |
| | Margarodidae | <i>Icerya purchasi</i> Maskell | Australasia | Plovdiv | Tzalev 1968 | Bulgaria |

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 aonidum*, 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 philippinicus* 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

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References

- Ben-Dov, Y. and C.J. Hodgson. 1997. Soft Scale Insects - Their Biology, Natural Enemies and Control. Elsevier, Amsterdam – New York. 452 pp.
- Ben-Dov, Y., D.R. Miller and G.A.P. Gibson. 2010. ScaleNet. A Database of the Scale Insects of the World. Available from: <http://www.sel.barc.usda.gov/scalenet/scalenet.htm> (last accessed July 2010).
- Chen, S.P., C.N. Chen and C.Y. Wong. 2002. New record of a pest - *Phenacoccus solani* Ferris (Homoptera: Pseudococcidae) in Taiwan. Journal of Agricultural Research of China 51: 79-82. (in Chinese)
- Gill, R.J. 1988. The Scale Insects of California, Part 1, The Soft Scales (Homoptera: Coccoidea: Coccinae). State of California, Department of Food and Agriculture Division of Plant Industry. 132 pp.
- Hodgson, C., G. Abbas, M.J. Arif, S. Saeed and H. Karar. 2008. *Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Coccoidea: Pseudococcidae), an invasive mea-

- lybug damaging cotton in Pakistan and India, with a discussion on seasonal morphological variation. *Zootaxa* 1913:1-35.
- Kosztarab, M. and F. Kozár. 1988. Scale insects of Central Europe. *Akademiai Kiado, Budapest, Hungary*. 456 pp.
- Krusteva, L. 1977. Schtitonosnite vuski. *Rastitelna Zashchita* 25: 40-44. (in Bulgarian)
- Lasarov, A. 1940. Prouchvaniya vurhu ploskite schitonosni vuski (Diaspinae, Coccidae) po ovoschnite durveta u nas. *Sofiya*. 46 pp. (in Bulgarian; summary in German)
- Maskell, W.M. 1897. On a collection of Coccidae, principally from China and Japan. *Entomologist's Monthly Magazine* 33: 239-244.
- Miller, D.R., G.L. Miller and G.W. Watson. 2002. Invasive species of mealybugs (Hemiptera: Pseudococcidae) and their threat to U.S. agriculture. *P. Entomol. Soc. Wash.* 104: 825-836
- Miller, D. 2005. Selected scale insect groups (Hemiptera: Coccoidea) in the Southern region of the United States. *Fla. Entomol.* 88: 482-501.
- Miller, D. and J. Davidson. 2005. Armored scale insects pests of trees and shrubs. *Cornell University Press, New York*. 442 pp.
- Nentwig, W. and M. Josefsson. 2009. Introduction. Chapter 1. In: Roques et al. (Eds) *Alien terrestrial arthropods of Europe*. *BioRisk* 4: 5-9.
- 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)
- Pellizzari, G. and J.F. Germain. 2010. Scales (Hemiptera, Superfamily Coccoidea). Chapter 9.3. In: Roques A et al. (Eds). *Alien terrestrial arthropods of Europe*. *BioRisk* 4: 475-510.
- Rainato, A. and G. Pellizzari. 2008. Redescription of the adult male and description of second-instar male, prepupa and pupa of *Ceroplastes japonicus* Green (Hemiptera: Coccoidea: Coccidae). *Zootaxa* 1895: 25-38.
- Stanev, M. 1963. Studies on the biology and on the control of *Quadraspidiotus perniciosus* Comstock in Bulgaria. *Bulletin of the Institute of Plant Protection* 5: 5-27. (in Bulgarian; summary in English)
- Staneva, E. 1989. Chernichevata schitonosna vuska i borbata sreschtu nea. *Vnedreni Novosti* 3, NTS. *Sujz po Selsko Stopanstvo*: 24-28. (in Bulgarian)
- Tang, F.T. 1977. The scale insects of horticulture and forest of China. Vol. I. The Institute of Gardening, Liaoning, China. 259 pp. (in Chinese)
- Tang, F.T. 1992. The Pseudococcidae of China. *Shanxi Agricultural University, Taigu, Shanxi, China*. 768 pp. (in Chinese)
- Tang, F.T. and J. Hao. 1995. The Margarodidae and others of China. *Chinese Agricultural Science Technology Press, Beijing, P. R. China*. 738 pp. (in Chinese)
- Tomov, R., K. Trencheva, G. Trenchev, E. Cota, A. Ramadhi, B. Ivanov, S. Naceski, I. Papazova-Anakieva and M. Kenis. 2009. Non-indigenous insects and their threat to biodiversity and economy in Albania, Bulgaria and Republic of Macedonia. *Pensoft Publishers, Sofia-Moskow*. 112 pp.
- Trencheva, K., G. Trenchev, R. Tomov and S.-A. Wu. 2010. First report of *Aulacaspis yasumatsui* Takagi, 1977 (Hemiptera: Diaspididae) in Bulgaria. *Plant science* 47: 206-209.
- Tschorbadjiew, P. 1938. Short note on scale insects (Coccidae, Rhynchota) in Bulgaria. *Izvestiya na Bulgarskoto Entomologichno Druzhestvo*. *Sofiya* 10: 88-90. (in Bulgarian)

- Tzalev, M. 1968. Prinos kum prouchvane faunata na schitonosnite vuski (Homoptera, Coccoidea) po parkovite i ukrasnite rasteniya v Bulgaria. Izvestiya na Zoologicheskiya Institut s Muzey 28: 205-218. (in Bulgarian; summary in German)
- Wang, S.S. and S.A.Wu. 2009. New record of a pest-*Phenacoccus solani* Ferris (Hemiptera: Pseudococcidae) in Chinese Mainland. Plant Quarantine. 23:35-37. (in Chinese)
- Wang, S. and S.A.Wu. 2010. A new record species of the Genus *Pseudococcus* Westwood (Hemiptera: Pseudococcidae) from China. Acta Zootaxonomica Sinica. 35: 240-246.
- Wu, S.A. and R.Z. Zhang. 2009. A new invasive pest, *Phenacoccus solenopsis*, threatening seriously to cotton production. Chinese Bulletin of Entomology. 46: 159-162. (in Chinese)

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

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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 δειγματοληψίες στην Κίνα. Τα τρία είδη ανήκουν στην οικογένεια Pseudococcidae.