

CHANGES IN STATUS AND DISTRIBUTION OF HYDRANGAEA SCALE, *PULVINARIA HYDRANGAEAE* (HEMIPTERA: COCCOMORPHA: COCCIDAE) IN BRITAIN

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ABSTRACT

Hydrangea scale *Pulvinaria hydrangeae* Steinweden, is a sap sucking insect found on a wide range of plants but primarily *Hydrangea* species. It became established in Britain in the late 1980's and has since become widespread in England and has a scattered distribution in Scotland and Wales. The distribution, identification, life cycle, host range and plant damage this insect causes in Britain are discussed.

INTRODUCTION

Pulvinaria hydrangeae Steinweden, commonly known as hydrangea scale or cottony hydrangea scale, was described from specimens collected in North America, although it is suspected to be native to East Asia (Graora, Spasić & Dervišević, 2013). It was first collected in Britain in 1988 (Halstead, 1992) and has since become widespread in England and a frequent enquiry from Royal Horticultural Society members to the Society's Gardening Advice service. It feeds by sucking the sap from the stems and foliage of a wide range of hosts, but most frequently *Hydrangea*. The purpose of this communication is to highlight the increase in frequency and distribution of *P. hydrangeae* in Britain, and to review its biology and control.

IDENTIFICATION

In the field *P. hydrangeae* is most recognisable during early summer when females mature and produce a conspicuous white cottony ovisac to protect their eggs (Plate 9). Mature females are primarily found on the underside of leaves of their host plants but also occur on the apical stems, especially when at high densities. They are ovoid to circular, yellow or brown and 3 to 5 mm long (Gill, 1988). The eggs are laid in a mass of waxy fibres which are convex, elongate, slightly expanding, with broad, shallow grooves (these are lost on old ovisacs), and approximately 10 mm long (Gill, 1988). The adult females often drop off the ovisacs after oviposition and the ovisacs can persist on the plant for weeks after the eggs have hatched (Halstead, 1992). In the field, *P. hydrangeae* can usually be distinguished from other *Pulvinaria* species found in Britain by a combination of factors including morphology, oviposition site, phenology and host.

Including *P. hydrangeae* there are currently five species of soft scale insect (Coccoomorpha: Coccidae) assigned to the related genera *Pulvinaria* and *Pulvinariella* in the tribe Pulvinariini found outdoors in the UK. In the field they are most easily distinguished as adult females with ovisacs. The woolly vine scale *Pulvinaria vitis* (L.) is the only native species and oviposits on bark, usually on smaller branches (Plate 10, Fig. 1). It is widespread and locally common throughout the UK in semi-natural and urban environments; *P. vitis* is polyphagous but most commonly found on species of

Alnus, *Betula*, *Crataegus*, *Populus*, *Ribes*, *Sorbus* and *Vitis*. The horse chestnut scale *Pulvinaria regalis* Canard also oviposits on bark, although it usually oviposits on the trunk and main branches of its hosts. A widespread and locally common species throughout the UK, particularly in urban environments *P. regalis* (Plate 10, Figs 2 & 3) is polyphagous but most frequently found on species of *Acer*, *Aesculus*, *Cornus*, *Laurus*, *Skimmia*, *Tilia* and *Ulmus*; this species is regularly found ovipositing on non-host plants (see Malumphy (1991) for the reasons for this). Woolly camellia (cushion) scale *Pulvinaria floccifera* (Westwood) oviposits on the under surfaces of foliage and the post-reproductive adults fall off the ovisacs (Plate 10, Fig. 4). *Pulvinaria floccifera* is the species most likely to be confused with *P. hydrangeae* but it produces longer ovisacs with more-or-less parallel sides which lack the shallow grooves present on *P. hydrangeae* ovisacs. *Pulvinaria floccifera* is widespread and locally common throughout the UK; it is polyphagous but most commonly found on species of *Camellia*, *Ilex*, *Rhododendron* and *Taxus*. The ice plant scale *Pulvinariella mesembryanthemi* (Vallot) (Plate 10, Fig. 5) is the only species found on *Carpobrotus* (Aizoaceae) and is found where its host plants occur outdoors in Cornwall; it is possible that the scale will be present in parts of Devon where the host plant also occurs outdoors. The unrelated cottony cushion scale *Icerya purchasi* Maskell (Hemiptera: Monophlebidae) (Plate 10, Fig. 6) also produces a distinct, highly convex ovisac with a large number of longitudinal ridges, on bark and/or foliage. It is polyphagous but most commonly found in Britain on *Acacia*, *Citrus* and *Pittosporum* species and is currently restricted outdoors to sheltered areas in S. E. England.

Good morphological descriptions and illustrations of slide-mounted adult female *P. hydrangeae* are provided by Williams & Kosztarab (1972), Hamon & Williams (1984) and Gill (1988). Diagnostic characters include: marginal setae spine-like, some with frimbriate apices; dorsal submarginal tubercles absent; ventral submarginal short-tubular duct band continuous anteriorly around the head; and subdiscal seta present on each anal plate.

LIFE-CYCLE

Pulvinaria hydrangeae has one generation a year (Gill, 1988; Halstead, 1992). Egg masses are produced in spring and early summer positioned predominantly on the undersides of leaves. Eggs hatch in midsummer and the crawler nymphs suck sap mainly on the underside of host plant leaves next to the leaf veins (Gill, 1988; Halstead, 1992). By the autumn the (female) nymphs reach the third instar and move to the stems where they overwinter (Nur, 1963). In spring the crawlers move onto the leaves and mature although some remain on the woody parts of the plants (Gill, 1988). This species is parthenogenic, although non-functional males can be produced (Nur, 1963).

DISTRIBUTION

Pulvinaria hydrangeae was first described from specimens collected in California in 1935, although it was also reported in the same publication to have been collected in Japan in 1895 (Steinweden, 1946). It is most likely to be native to temperate and subtropical regions of Asia where it is known from Japan (Kawai, 1980) and Hong Kong (China) (Martin & Lau, 2011), although Pellizzari & Germain (2010) list the native range as North America. The scale is now found in the US States of California, Florida, Massachusetts, New York and Virginia (Williams, & Kosztarab, 1972; Hamon & Williams, 1984; Gill, 1988). It has been reported from New South Wales, Australia (Qin & Gullan, 1992), New Zealand (Archibold, Cox & Dietz,



PLATE 9. *Pulvinaria hydrangeae*. Fig. 1. Ovisacs covering the lower surface of a hydrangea leaf. Fig. 2. Viburnum foliage and stems heavily infested with scales. Fig. 3. Close up of the ovisac to show the characteristic shallow grooves. Fig. 4. Thousands of orange first instars (crawlers) swarming over a *Morus* twig. Fig. 5. Overwintering third-instar females. Fig. 6. Adult female with ovisac on *Acer japonicum*. © Fera.

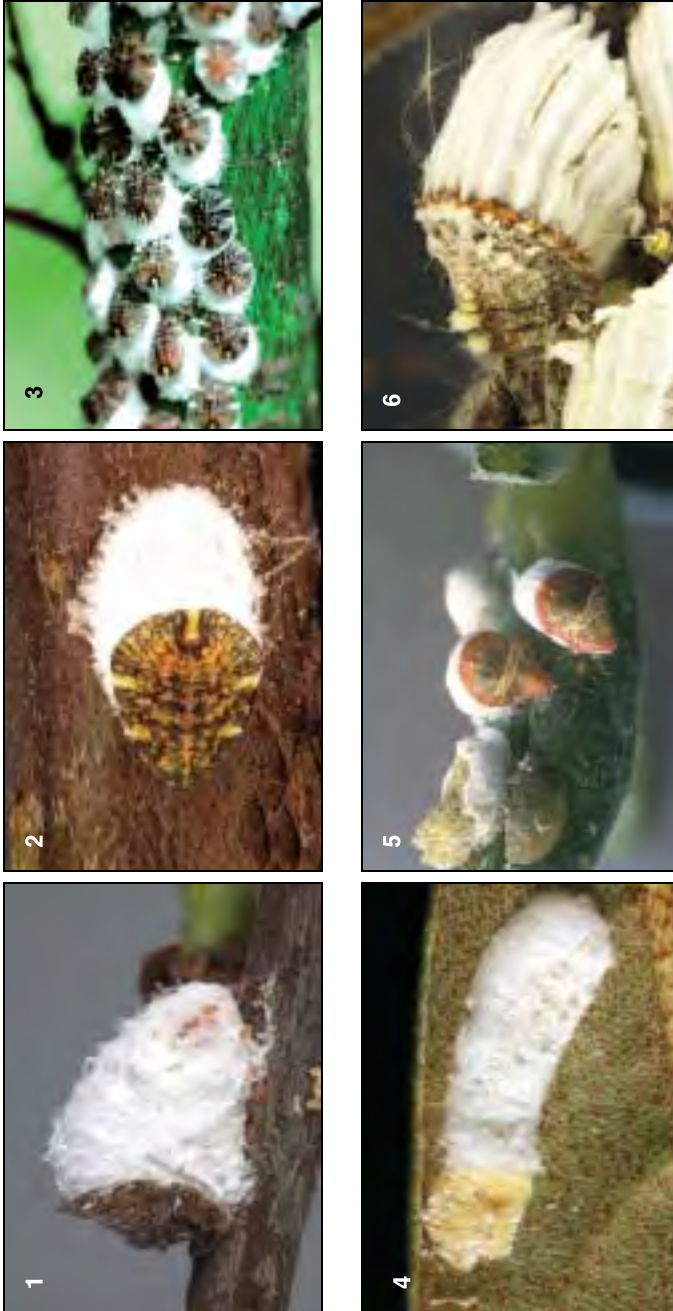


PLATE 10. Fig. 1. *Pulvinaria vitis* adult female and ovisac on *Crataegus monogyna*. Fig. 2. *Pulvinaria regalis* adult female and ovisac on *Tilia* sp. Fig. 3. Infestation of *Pulvinaria regalis* on *Acer japonica*. Fig. 4. *Pulvinaria floccifera* adult female with ovisac on *Rhododendron* sp. Fig. 5. *Pulvinariella mesembryantheri* femoral adult female (green) and two adult females with ovisacs on *Carpobrotus edulis*. Fig. 6. *Icerya purchasi* hermaphrodite adult with ovisac on *Acacia dealbata*. © Fera.

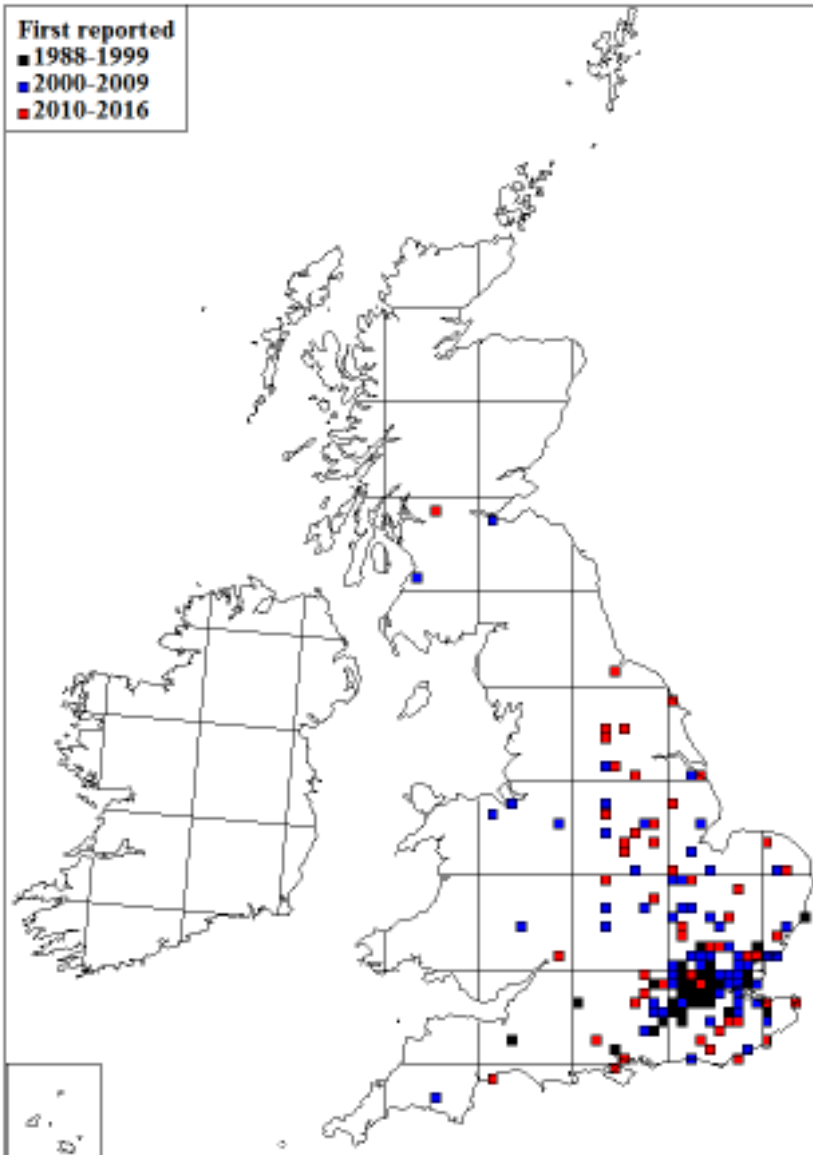


Fig. 1. Distribution of the Hydrangea scale, *Pulvinaria hydrangeae* Steinweden in Britain, January 1988 to December 2016. RHS and Fera data. Produced using Dmap.

Table 1. Host genera of *Hydrangea* scale, *Pulvinaria hydrangeae* Steinweden

Host data are collated from: Archibold, Cox & Dietz (1979); Ben-Dov (2012); Jansen (2000); Milek & Simala (2007), Seljack (2007); and from RHS/FERA data (390 records with host information from 1988 to 2016).

Family	Host genera	RHS/FERA enquiries
Actinidiaceae	<i>Actinidia</i>	3
Adoxaceae	<i>Viburnum</i>	12
Anacardiaceae	<i>Rhus</i>	—
Araliaceae	<i>Aralia</i>	—
	<i>Fatsia</i> (RHS data only)	2
Betulaceae	<i>Carpinus</i>	—
	<i>Corylus</i>	—
Cannabaceae	<i>Celtis</i>	—
Caprifoliaceae	<i>Lonicera</i>	—
	<i>Weigela</i> (RHS data only)	4
Celastraceae	<i>Celastrus</i>	—
	<i>Euonymus</i>	—
Cornaceae	<i>Cornus</i>	10
Ebenaceae	<i>Diospyros</i>	—
Fabaceae	<i>Sophora</i>	—
Fagaceae	<i>Fagus</i>	—
Hydrangeaceae	<i>Deutzia</i>	—
	<i>Hydrangea</i>	283
Juglandaceae	<i>Pterocarya</i>	—
Magnoliaceae	<i>Magnolia</i>	7
Malvaceae	<i>Abutilon</i> (RHS data only)	1
	<i>Tilia</i>	2
Moraceae	<i>Morus</i>	5
	<i>Broussonetia</i>	—
Oleaceae	<i>Fraxinus</i>	—
Platanaceae	<i>Platanus</i>	1
Rosaceae	<i>Amelanchier</i>	—
	<i>Cotoneaster</i>	—
	× <i>Crataemespilus</i>	—
	<i>Crataegus</i>	1
	<i>Maddenia</i>	—
	<i>Malus</i>	1
	<i>Photinia</i>	—
	<i>Pyracantha</i>	—
	<i>Pyrionia</i>	—
	<i>Prunus</i>	16
	<i>Pyrus</i>	—
	<i>Rosa</i>	—
	<i>Rubus</i>	—
Rutaceae	<i>Euodia</i>	—
	<i>Phellodendron</i>	—
	<i>Tetradium</i>	—
Salicaceae	<i>Populus</i>	—
	<i>Salix</i>	—
Sapindaceae	<i>Acer</i>	41
	<i>Aesculus</i>	—
Styracaceae	<i>Halesia</i>	—
	<i>Pterostyrax</i>	—
	<i>Styrax</i> (RHS data only)	1
Taxaceae	<i>Taxus</i>	—
Ulmaceae	<i>Ulmus</i>	—
	<i>Zelkova</i>	—

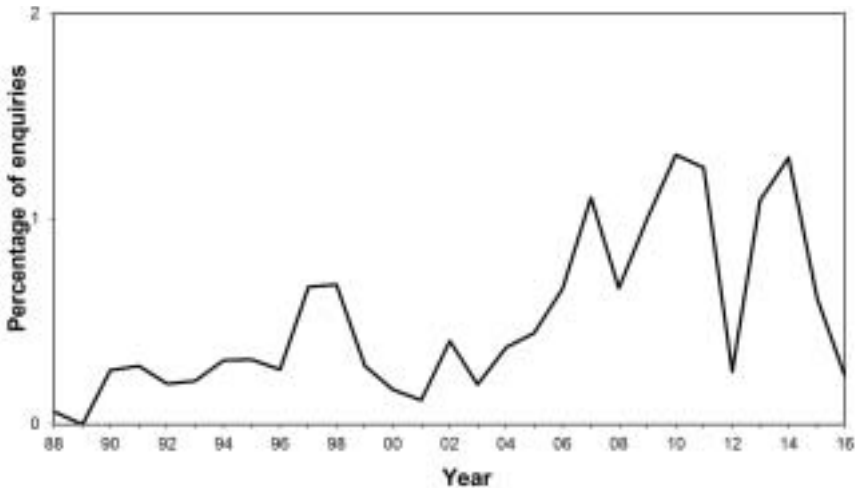


Fig. 2. Hydrangea scale, *Pulvinaria hydrangeae* Steinweden enquiries as a percentage of total entomological enquiries received by the RHS Gardening Advice (1988 to 2016).

1979) and the Canary Islands (Spain) (Ben-Dov, 2012). It was first reported from Europe (France) in the 1960s and has since been found in Austria, Belgium, Bulgaria, Croatia, Germany, Hungary, Italy, the Netherlands, Serbia, Slovenia, Slovakia, Sweden and Switzerland (Pellizzari Scaltriti, 1976; Merlin *et al.*, 1988; Jansen, 2000; Seljak, 2007; Milek, Ivezic & Simala, 2009; Mátrahegyi & Kozár, 2008; Ben-Dov, 2012; Graora, Spasić & Dervišević, 2013; Gertssonhj, 2014; Trencheva & Tomov, 2014).

Pulvinaria hydrangeae was first found in Britain in September 1988 on a species of *Hydrangea* in a garden in Wimbledon, London (TQ27) and was reported in several other areas of London within three years (RHS data; Halstead, 1992). Some of these infestations were reported as being of ‘several years standing’ and it is likely that the scale arrived in Britain before 1987. Halstead (1992) speculates that the scale arrived on infested plants from Belgium or the Netherlands. By the end of 2016, 400 occurrences of the scale had been reported to the RHS and Fera. It has become widespread and common in eastern England with scattered reports from the rest of England, Wales and Scotland (Fig. 1). The increase in distribution has been coupled with a growth in the proportion of reports to RHS Gardening Advice (Fig. 2).

HOST RANGE, DAMAGE AND CONTROL

Pulvinaria hydrangeae is polyphagous and has been reported feeding on plants assigned to 26 families and 52 genera (Table 1). Here we report four host genera for the first time *Fatsia* (Araliaceae, first record for this family), *Abutilon* (Malvaceae), *Styrax* (Styracaceae) and *Weigela* (Caprifoliaceae, first record for this family). A majority of host reports to the RHS and Fera are from species of *Hydrangea* (73%), followed by *Acer* (11%), *Prunus* (4%) and *Viburnum* (3%) (Table 1). These reports

may be indicative of host preferences of this insect, although further investigation is required.

Heavy infestations of this insect can cause host plants to suffer a loss of vigour, leaf loss and the egg masses may be considered unsightly (Halstead, 1992). This scale insect does not usually egest honeydew in quantities that result in 'sticky leaves' and problems with associated sooty mould. In Florida and California it is not considered economically important (Hamon & Williams, 1984; Gill, 1988) whereas in Belgium, the Netherlands, Italy and Slovenia it has become a serious pest of cultivated plants in urban environments (Merlin *et al.*, 1988; Seljak, 2007; Jansen, 2000). There is some at least anecdotal evidence that the insect is having an impact in Britain. For example, a hedge consisting of young viburnum plants around a large retail premise in York was smothered in scale insects and ovisacs in 2008. Not only were the lower surfaces of the foliage covered with the ovisacs but also the stems, and ovisacs were also found on the upper surfaces of some leaves. The second author asked the manager for permission to take a sample and confirmed the insect as *P. hydrangeae*. Shortly afterwards the hedge was completely removed, presumably due to the unsightly infestation. Whilst the proportion of enquiries to RHS Gardening Advice has varied from year to year, overall there has been an increasing trend since the scale was first recorded in Britain (Fig. 2).

Control with insecticides is complicated as some host plants, particularly *Hydrangea* and some *Acers*, are prone to damage from sprays (Halstead, 1992). Treatment in midsummer is most likely to give control as the nymphs are more susceptible to pesticides than the adults.

In the Netherlands, the coccinellid beetles *Exochomus quadripustulatus* (L.) and *Adalia bipunctata* (L.) are predators of *P. hydrangeae* (Jansen, 2000).

DISCUSSION

Hydrangea scale, *Pulvinaria hydrangeae* has become widespread in England since its establishment in the late 1980's and is also established now in parts of Scotland and Wales. It is likely that it will become widely distributed in mainland Britain and there is a risk of spread to Northern Ireland and the Republic of Ireland. The effects of the scale on host plant health and vigour in Britain are not clear, although it has been reported to be damaging in other European countries (Tondeur, Schifffers & Verstraeten, 1990) and is worthy of further investigation. It is clear from the increasing frequency of reports of this insect to RHS Gardening Advice that it is causing concern amongst gardeners.

REFERENCES

- Archibold, R. D., Cox, J. M. & Dietz, L. L. 1979. New records of plant pests in New Zealand III. Six species of Homoptera. *New Zealand Journal of Agricultural Research* **22**: 201–207.
- Ben-Dov, Y. 2012 New data on the scale insects (Hemiptera, Coccoidea) of Tenerife, Canary Islands. *Arquipelago – Life and Marine Sciences* **30**: 71–74.
- Gertsson, C.-A., 2014. Hortensiasköldlus *Pulvinaria hydrangeae* Steinweden, en ny invasive insekt funnen i Skåne (Hem. Coccoidea). *FaZett* **27**: 29–31.
- Graora, D., Spasić, R. & Dervišević, M. 2013. Biology and harmfulness of *Pulvinaria hydrangeae* Steinweden (Hemiptera: Coccidae) in Belgrade area. *Biljni Lekar* **41**: 419–4241.
- Gill, R. J. 1988. The scale insects of California. Part 1: The Soft Scales (Homoptera: Coccoidea: Coccidae). California Department of Food and Agriculture – Technical Series in Agricultural Biosystematics and Plant Pathology. Number 1. Sacramento, California, USA. 142pp.

- Halstead, A. J. 1992. The 1991 presidential address – part 2 some horticultural pests new to Britain in recent years. *British Journal of Entomology and Natural History* **5**: 41–48.
- Hamon, A. B. & Williams, M. L. 1984. *Arthropods of Florida and Neighboring Land Areas. Vol. 11. The soft scales of Florida (Homoptera: Coccoidea: Coccidae)*. Florida Department of Agriculture & Consumer Services. Contribution no. 600. Florida Department of Agriculture, Gainesville. 132 pp.
- Jansen, M. G. 2000. The species of *Pulvinaria* in the Netherlands (Hemiptera: Coccidae). *Entomologische Berichten* **60**: 1–11.
- Kawai, S. 1980. *Scale insects of Japan in color*. National Agricultural Education Association Tokyo 455 pp.
- Malumphy, C. P. 1991. *A morphological and experimental investigation of the Pulvinaria vitis Complex in Europe*. University of London, Ph.D.Thesis. London 270 pp.
- Martin, J. H. & Lau, C. S. K. 2011 The Hemiptera-Sternorrhyncha (Insecta) of Hong Kong, China – an annotated inventory citing voucher specimens and published records. *Zootaxa* **2847**: 1–122.
- Máttrahegyi, E. & Kozár, F. 2008 New scale insect species in Austria's fauna. *Proceedings of the XI International Symposium on Scale Insect Studies, Oeiras, Portugal, 24–27 September 2007*. ISA Press Lisbon, Portugal 322 pp.
- Merlin, J., Gregoire, J. C., Dolmans, M., Speight, M. R., Pasteels, J. M. & Verstraeten, Ch. 1988. Preliminary comparison of two scale insect species on broad-leaved trees in Western Europe. *Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent* **53**: 1153–1158.
- Milek, T. M., Ivezić, M. & Simala, M. 2009. The genus *Pulvinaria* Targioni Tozzetti, 1866 (Hemiptera: Coccoidea: Coccidae) with special regard to *Pulvinaria hydrangeae* Steinweden, 1946 as a newly recorded species in the fauna of Croatia. *Natura Croatica* **18**: 267–278.
- Milek, T. M. & Simala, M. 2007. List of scale insects (Hemiptera: Coccoidea) of Croatia. Posters. *Proceedings of the XI International Symposium on Scale Insect Studies, Lisboa, Portugal, 24–27 September 2007* p. 105–119.
- Nur, U. 1963. Meiotic parthenogenesis and heterochromatization in a soft scale, *Pulvinaria hydrangeae* (Coccoidea: Homoptera). *Chromosoma (Berlin)* **14**: 123–139.
- Pellizzari, G. & Germain, G-F. 2010. Scales (Hemiptera, Superfamily Coccoidea) Chapter 9.3. *BioRisk* **4**: 475–510.
- Pellizzari Scaltriti, G. 1976. Sulla presenza in Italia dell'*Eupulvinaria hydrangeae* (Steinw.) (Homoptera, Coccoidea). *Redia* **59**: 59–67.
- Qin, T. K. & Gullan, P. J. 1992 A revision of the Australian pulvinariine soft scales (Insecta: Hemiptera: Coccidae). *Journal of Natural History* **26**: 103–164.
- Seljak, G. 2007. Scale insects introduced into Slovenia in the last fifty years. *Proceedings of the XI International Symposium on Scale Insect Studies Lisboa, Portugal, 24–27 September 2007* p. 121–127.
- Seljak, G. 2010. A checklist of scale insects of Slovenia. *Entomologica Hellenica* **19**: 99–113
- Steinweden, J. B. 1946 The identity of certain common American species of *Pulvinaria* (Homoptera: Coccoidea: Coccidae). (Contribution no. 49). *Microentomology* **11**: 1–28.
- Tondeur, R Schiffers, B. C. & Verstraeten, Ch. 1990. Comparaison d'efficacité de 22 insecticides de contact pour la lutte contre la cochenille pulvinaire (*Eupulvinaria hydrangeae* Steinweden). *Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent* **55**: 637–646.
- Trencheva, K. & Tomov, R. 2014. Checklist of Scale insects of Bulgaria (Hemiptera, Coccoidea). *Acta Zoologica Bulgarica* **6**: 65–72.
- Williams, M. L. & Kosztarab, M. 1972. Morphology and systematics of the Coccidae of Virginia with notes on their biology (Homoptera: Coccoidea). *Research Division Bulletin, Virginia Polytechnic Institute and State University* **74**: 1–215.