

An updated checklist of scale insects in Luxembourg (Hemiptera, Sternorrhyncha, Coccoomorpha)

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Abstract. An updated list of the scale insects recorded in Luxembourg is presented. The list includes 47 species belonging to 36 genera in 8 families. Of these, four species are new records for the country. The recorded species show mainly cosmopolitan and Palaearctic distribution. Coccidae, Diaspididae and Pseudococcidae are the most diverse families.

Key words. Hemiptera, scale insects, checklist, Luxembourg.

Introduction

Scale insects (Hemiptera, Sternorrhyncha, Coccoomorpha) are small, sap-sucking true bugs. The common name, scale insects, refers to the protective cover or "scale" (generally waxy) that is secreted by many species. Scale insects are characterized by sexual dimorphism. Females have no wings. Adult males are usually winged and lack functional mouthparts. The suborder Sternorrhyncha contains the superfamilies Aphidoidea (aphids), Psylloidea (jumping plant-lice), Aleyrodoidea (whiteflies) and Coccoidea (scale insects) (Kosztarab & Kozár 1988, Williams & Hodgson 2014). In the international database ScaleNet there are more than 8000 described species up to now (García et al. 2019). Many of these are agricultural pests and invasive species (Ouvrad et al. 2013). Scale insects represent one of the major groups of insects alien to Europe (Pellizzari & Germain 2010).

The first scale insects from Luxembourg were reported by Kraus (1891a, 1891b), Decker (1892), Koltz (1893), Feltgen (1894), Decker (1899), Krombach (1900) and Sunnen (1907). In the monograph on harmful insects for agriculture, Ferrant (1910) described 22 species of scale insects

from which 20 were found in Luxembourg. Scale insects were reported furthermore by Ferrant (1916), Lies (1980), Schneider & Tanson (2003) and Pellizzari & Germain (2010). Gertsson (2016) published a checklist for Luxembourg, where 21 species were reported and Schneider (2017) traced out the biology of four species. The present list shows four new species for the country. New localities are presented, others are detailed and errors are corrected.

Material and methods

The list is the assemblage of many sources and our collections during 2006-2019. The nomenclature used here follows ScaleNet (García et al. 2019).

Adult females were collected and preserved in 70 % ethanol. The specimens were slide mounted using the method described by Danielsson (1985) and Kosztarab & Kozár (1988). The females were dewaxed for three days in a solution of 40 % xylene, 40 % ethylacetate and 20 % ethanol (96 %). The specimens were then heated gently in 96 % ethanol, 10 % KOH and 50 % lactic acid. The cleared insects were placed in Essig's Aphid Fluid with staining solution according to the

method of Kosztarab & Kozár (1988). After clearing in cloveoil they were mounted in Euparal®.

Keys used for identification were those in Gill (1988, 1993, 1997), Kosztarab (1996), Kosztarab & Kozár (1988) and Williams (2004).

All samples are deposited in the Musée national d'histoire naturelle, Luxembourg.

Results

Currently a total of 47 scale insect species are known in the country. They belong to 36 genera and eight families: Asterolecaniidae (one species), Coccidae (14 species), Diaspididae (16 species), Eriococcidae (three species), Kermesidae (one species), Margarodidae (two species), Ortheziidae (three species) and Pseudococcidae (seven species). A total of four species are new to the fauna of Luxembourg and their occurrence has not been previously published. Of the 47 scale insect species 60 % have a cosmopolitan distribution, while the next prevalent species (30 %) have a Palearctic distribution.

Species with an asterisk are new to the fauna of Luxembourg.

Asterolecaniidae Cockerell, 1896 – Pit scales

Asterodiaspis variolosa (Ratzeburg, 1870) – Pit-making oak scale

Reported from Luxembourg by Ferrant (1910) and Gertsson (2016). New locality: Ettelbruck, Lycée Technique Agricole, arbo-retum, 29. 09.2018 on *Quercus x heckelii* (*Q. petraea* × *Q. pontica*). Lives in shallow to deep pits in bark of *Quercus* spp. (Kosztarab & Kozár 1988). A common cosmopolitan species.

Coccidae Fallén, 1814 – Soft scales or coccids

Coccus hesperidum Linnaeus, 1758 – Brown soft scale

Reported from Luxembourg by Ferrant (1910) and Gertsson (2016). New localities: Ettelbruck, Lycée Technique Agri-

cole, 27.09.2018, on *Schefflera actinophylla*; L-Bonnevoie, 02.09.2019, on a pot plant (*Schefflera* sp.?); Reckenthal, « service des Parcs de la Ville de Luxembourg » (greenhouse), 11.09.2019 on *Schefflera arbuticola* and *Ficus benjamina*. A serious polyphagous and cosmopolitan species. It is restricted to glasshouses and indoor plants in cooler regions. In recent years it has become more common outdoors at more northerly latitudes, for example in northern England (Malumphy et al. 2008).

Eulecanium sericeum (Lindinger, 1906) – Fir twig scale

Reported from Luxembourg by Gertsson (2016) and Schneider (2017). A rare montane species, which lives on thin twigs of firs, *Abies* spp. (Kosztarab & Kozár 1988). It was recorded in 11 countries, from Mediterranean region to Norway (Fjelddalen 1996, García et al. 2019).

Eulecanium tiliae (Linnaeus, 1758) – Nut scale

Reported from Luxembourg by Ferrant (1910). The species occurs throughout Europe, and in the Nearctic and the Oriental regions as well. It is broadly polyphagous on woody plants, and is most frequently found on Rosaceae (García et al. 2019, Kosztarab & Kozár 1988).

Palaeolecanium bituberculatum (Signoret, 1873) – Bituberculate scale

Reported from Luxembourg by Ferrant (1910). A common Western Palearctic species especially on Rosaceae (García et al. 2019, Kosztarab & Kozár 1988).

Parasaissetia nigra (Nietner, 1861)* – Nigra scale

Schwebsange (mediterranean garden), 05.08.2018, on *Lavatera maritima*. It is polyphagous, feeding on 95 families of angiosperms, and is a moderate pest of ornamentals in 125 countries. The scale insect is widely distributed in the African, Australian, Asia, Nearctic, Neotropical, Oriental and Palearctic zoogeographical regions of

the world. In the Palaearctic region it was recorded from the Azores, Belgium, Canary Islands, China, England, Greece, France, Israel, Italy, Japan, Madeira Islands, Netherlands, Portugal, Saudi Arabia, Spain and Turkey (García et al. 2019, Tsagkarakis et al. 2016).

Parthenolecanium corni (Bouché, 1844) – Brown scale

Recorded in Luxembourg by Ferrant (1910) and Gertsson (2016). A common cosmopolitan and polyphagous species (García et al. 2019).

Parthenolecanium persicae (Fabricius, 1776) – European peach scale

Reported from Luxembourg by Ferrant (1910) and Gertsson (2016). A common cosmopolitan and polyphagous species (García et al. 2019).

Parthenolecanium pomericum (Kawecki, 1954) – Yew scale

Reported from Luxembourg by Gertsson (2016). A Palaearctic species, which lives on *Taxus* spp. only (García et al. 2019).

Parthenolecanium rufulum (Cockerell, 1903) – Oak soft scale

Reported from Luxembourg by Gertsson (2016). This is a Palaearctic species. It is distributed throughout Europe, but unrecorded in the northern countries, where deciduous oaks are at the northern border of their range. The species are common on *Quercus*, but also recorded on *Carpinus*, *Castanea*, *Corylus*, *Fagus*, *Sorothamnus*, *Robinia*, *Rosa*, *Ulmus*, *Vaccinium* and *Rubus* (Kosztarab & Kozár 1988, Rainato & Pellizzari 2009).

Physokermes hemicryphus (Dalman, 1826) – Small spruce-bud Scale

Reported from Luxembourg by Ferrant (1910) and Gertsson (2016). New locations: Mersch by the railway station, 23.08.2017 on *Picea glauca* var. *conica*; Schwebsange, (mediterranean garden), 29.09.2018, on *P. glauca* var. *conica*. It is a Holarctic species on

Picea spp. and rarely on *Abies* spp. (García et al. 2019). The species is very common in Sweden on *P. glauca* var. *conica* (Gertsson & Isacsson 2012).

Pulvinaria floccifera (Westwood, 1870) – Cottony camellia scale

Reported from Luxembourg by Schneider & Tanson (2003) and Schneider (2017). New locality: Luxembourg, Fieldchen 2006. The distribution pattern and host plants in Luxembourg has been described by Schneider & Tanson (2003). The species is cosmopolitan and polyphagous especially on *Euvonymus*, *Ilex*, *Taxus* and *Vaccinium* (Jansen 2000, García et al. 2019).

Pulvinaria hydrangeae Steinweden, 1946 – Cottony hydrangea scale

Reported from Luxembourg by Schneider & Tanson (2003), Pellizari & Germain (2010) and Schneider (2017). New locality: Luxembourg-Limpertsberg 2007. The distribution pattern and host plants in Luxembourg has been described by Schneider & Tanson (2003). *Pulvinaria hydrangeae* seems to be more distributed in Luxembourg compared to the other *Pulvinaria*-species. The species is a cosmopolitan and polyphagous but not on *Ilex* and seldom on *Taxus* (Jansen 2000, García et al. 2019).

Pulvinaria regalis Canard, 1968 – Horse chestnut scale

Reported from Luxembourg by Schneider & Tanson (2003), Pellizari & Germain (2010), Ries & Pfeiffenschneider (2017) and Schneider (2017). New localities: Schleifmühle 2008 and Kirchberg, arboretum Réimerwee 2011. The distribution pattern and host plants in Luxembourg has been described by Schneider & Tanson (2003). A polyphagous species but seldom on *Ilex* and not on *Taxus*. Recorded in eight countries in Western Europe. Recorded as an urban pest in several European areas (García et al. 2019). *Pulvinaria regalis* has spread very rapidly in the southern provinces in Sweden since 2006 (Gertsson 2011, 2015).

Pulvinaria vitis (Linnaeus, 1758) – Cottony Grape scale

Reported from Luxembourg by Kraus (1891b), Decker (1892), Krombach (1900), Ferrant (1910) and Schneider & Tanson (2003). The distribution pattern and host plants in Luxembourg has been described by Schneider & Tanson (2003). A polyphagous and cosmopolitan species but seldom on *Ilex* and not on *Taxus* (Jansen 2000, García et al. 2019).

Diaspididae Maskell, 1878 – Armored scales

Aonidia lauri (Bouché, 1833) – Laurel scale

Reported from Luxembourg by Ferrant (1910). The laurel scale is widely distributed in the Mediterranean basin, almost exclusively on *Laurus nobilis*. The species is cosmopolitan (García et al. 2019). In the northern countries of the regions only in greenhouses (Kozár 1998).

Aspidiotus nerii Bouché, 1833 – Oleander scale

Reported from Luxembourg by Kraus (1891a), Koltz (1893), Feltgen (1894, 1900), Sunnen (1907) and Ferrant (1910, 1916). New locality: Schwebsange, (mediterranean garden), 29.09.2018, on Orchidaceae. *A. nerii* is highly polyphagous which has been recorded on hundreds of host species in over 100 plant families. It has now a worldwide distribution, especially in tropical and sub-tropical zones. Widespread in Europe, but only under glass in cold areas (García et al. 2019).

Aulacaspis rosae (Bouché, 1833) – Rose scale

Reported from Luxembourg by Ferrant (1910). This is a cosmopolitan species that feeds most commonly on rosaceous hosts, especially on *Rosa* and *Rubus* (García et al. 2019).

Carulaspis juniperi (Bouché, 1851) – Juniper scale

Reported from Luxembourg by Gertsson (2016). New localities: Kirchberg, arboretum Klosegrönnchen, 01.06.2015, on *J. communis*; Ettelbruck, Lycée Technique

Agricole, arboretum, 28.09.2018 on *J. virginiana*. A cosmopolitan species that is restricted to conifers, especially junipers. A common species in urban environments (Kosztarab & Kozár 1988, García et al. 2019).

Chionaspis salicis (Linnaeus, 1758) – Willow scale

Reported from Luxembourg by Ferrant (1910), Gertsson (2016) and García et al. (2019). New locality: Cornelysmillen (Troisvierges), 30.08.2009 on *Salix* sp. It is a common trans-Palaearctic species that also occur in the Middle East and North America. *Chionaspis salicis* is polyphagous and can be a serious pest of forest and ornamental trees and of *Ribes* (García et al. 2019, Kosztarab & Kozár 1988.).

Diaspis echinocacti (Bouché, 1833) – Cactus scale

Reported from Luxembourg by Gertsson (2016) and Pellizari & Germain (2010). This insect is a serious and widespread pest wherever species of Cactaceae grow (García et al. 2019).

Diaspidiotus ostreaeformis (Curtis, 1843) – Curtis scale

Reported from Luxembourg by Ferrant (1910). The Curtis scale or oystershell scale originated in the Palaearctic region but is now distributed in other parts of the world. The preferred hosts are deciduous fruit and nut trees in the family Rosaceae, but it is also common on forest trees (Watson 2002).

Diaspidiotus zonatus (Frauenfeld, 1868) – Zonate armoured scale

Reported from Luxembourg by Ferrant (1910) and Gertsson (2016). This is a Palaearctic species that feeds on woody plants, but most frequently, on *Quercus*. The species is rarely recorded due to it is highly cryptic (García et al. 2019).

Dynaspidiotus abietis (Schränk, 1776) –
Conifer needle scale or Hemlock scale

Reported from Luxembourg by Gertsson (2016). New locality: Ettelbruck, Lycée Technique Agricole, arboretum, 28.09.2018, on *P. pungens*. *Dynaspidiotus abietis* is a common European scale but also recorded from North America. It feeds on *Abies*, *Juniperus*, *Picea*, *Pinus* and *Pseudotsuga* (García et al. 2019, Kosztarab & Kozár 1988).

Epidiaspis leperii (Signoret, 1869) – European pear scale

Reported from Luxembourg by Ferrant (1910). The European pear scale is an economic pest on many rosaceous plants including pears, apples, prunes, and peaches. It causes deformation and pitting in the stems (García et al. 2019, Kosztarab & Kozár 1988).

Hemiberlesia rapax (Comstock, 1881) – Greedy scale

Recorded from Luxembourg according to Kozár (1998). A cosmopolitan and polyphagous pest species in tropical and subtropical regions (García et al. 2019).

Kuwanaspis pseudoleucaspis (Kuwana, 1902) – Bamboo scale

Reported from Luxembourg by Gertsson (2016). *Kuwanaspis pseudoleucaspis* is a cosmopolitan species and the most widespread bamboo scale in Europe. Probably its presence in many countries has been overlooked because infested plants are almost symptomless (García et al. 2019, Ülgentürk et al. 2014).

Lepidosaphes conchiformis (Gmelin, 1790) – Fig oystershell scale

Reported from Luxembourg by Decker (1899). A serious polyphagous and worldwide pest (García et al. 2019). According to Gill (1997) it builds up extremely large populations on fig trees.

Lepidosaphes ulmi (Linnaeus, 1758) – Apple mussel scale

Reported from Luxembourg by Gertsson (2016). This cosmopolitan species has spread widely throughout the temperate regions. A polyphagous species known from especially plants belonging to the Rosaceae. Has caused considerable losses of ornamental trees and fruit trees (García et al. 2019).

Leucaspis pini (Hartig, 1839) – Hartig's pine scale

Reported from Luxembourg by Gertsson (2016). A common Palaearctic mesophilous species living on needles and pines (García et al. 2019, Kosztarab & Kozár 1988).

Pseudaulacaspis pentagona (Targioni Tozzetti, 1886)* – White peach scale

Schwebsange (Mediterranean garden), 29.09.2018 on *Actinidia arguta*. A very destructive pest especially on cherry, mulberry peach and other deciduous fruit trees. This species is a quarantine pest in many parts of the world reported from 112 countries. It was accidentally introduced to Italy in the nineteenth century and within Europe it now occurs in more than 30 countries (García et al. 2019, Malumphy et al. 2009). This species is one of the best examples of the northward expansion of insects in Central Europe during the last decades (Kozár 1997, Malumphy et al. 2009). *Pseudaulacaspis pentagona* is thermophilous, origin from eastern Asia, and it is found only under glass in colder countries. It is recorded from hosts in 221 genera and 85 plant families (García et al. 2019, Watson 2002).

Eriococcidae Cockerell, 1899 – Felt scales

Cryptococcus fagisuga Lindinger, 1936 – Beech bark scale

Reported from Luxembourg by Ferrant (1910), Lies (1980) and Gertsson (2016). It is a Holarctic species. It feeds on *Fagus*. It is associated with the transmission of beech bark disease by *Nectria coccinea* var. *fasciata* Lohman, Watson & Ayers and *Neonectria galligena* (Bres.) Rossman & Samuels (Asco-

mycota: Hypocreales: Nectriaceae) (García et al. 2019, Malumphy 2009).

Gossyparia spuria (Modeer, 1778) – European elm scale

Reported by Ferrant (1910). The European elm scale is a typical Holarctic species. It is almost restricted to elms. The copious honeydew coats the trees and objects beneath them. It also favours the growth of sooty mold (García et al. 2019, Kosztarab & Kozár 1988).

Pseudochermes fraxini (Kaltenbach, 1860) – Ash bark scale

Reported from Luxembourg by Ferrant (1910) and García et al. (2019). A Palaearctic species that feeds on *Fraxinus*. It is often together with the willow scale, *Chionaspis salicis* (García et al. 2019, Gertsson 1997).

Margarodidae Morrison, 1927 – Giant scales

Matsucoccus pini (Green, 1925) – Pine bark scale

Reported from Luxembourg by Gertsson (2016). A trans-Palaearctic species that is feeding on *Pinus* sp. (Kosztarab & Kozár 1988).

Icerya purchasi Maskell, 1879* – Cottony Cushion scale

Schwebsange (mediterranean garden), 05.08.2018 on *Citrus limon* and *C. japonica*. This is a hermaphroditic, highly polyphagous and found worldwide. The species origin is Australia (García et al. 2019). In colder climate *I. purchasi* has been found breeding outdoors in France and England (Watson & Malumphy 2004).

Kermesidae Signoret, 1875 – Gall like scales

Kermes quercus (Linnaeus, 1758) – Kermes berry

Reported from Luxembourg by Ferrant (1910). A Palaearctic species, and it lives in bark crevices of trunk and on thick branches (García et al. 2019, Kosztarab & Kozár 1988).

Ortheziidae Amyot and Serville, 1843 – Ensign scales

Newsteadia floccosa (De Geer, 1778) – Boreal ensign scale

Reported from Luxembourg by Gertsson (2016). New locality: 2 km N Godbrange, in litter, 29.09.2011. It is a boreal trans-Palaearctic species that occurs in moist and cool habitats. It lives in leaf litter of mixed deciduous and coniferous forests (Kosztarab & Kozár 1988).

Orthezia urticae (Linnaeus, 1758) – Nettle ensign scale

Recorded in Luxembourg according to Kozár (1998). A cosmopolitan and polyphagous species that usually feeds on the underside of leaves of herbaceous plants (García et al. 2019, Kosztarab & Kozár 1988).

Ortheziola vejovskyi Sulc, 1895 – Moss ensign scale

Reported from Luxembourg by García et al. (2019). This is a Palaearctic species found in both moist and xerothermic habitats among mosses or lichens and leaf litter or on roots of grasses and other herbaceous plants (Kosztarab & Kozár 1988, Malumphy 2009).

Pseudococcidae Westwood, 1840 – Mealybugs

Fonscolombia europaea (Newstead, 1897) – Grass mealybug

Reported from Luxembourg by Gertsson (2016) and García et al. (2019). A common Palaearctic species living on roots of grasses and other herbaceous plants (Kosztarab & Kozár 1988).

Phenacoccus aceris (Signoret, 1875) – Polyphagous tree mealybug

Reported from Luxembourg by Ferrant (1910) and Gertsson (2016). A common Holarctic species on trees and shrubs (Kosztarab & Kozár 1988).

Phenacoccus piceae (Löw, 1883) – Spruce mealybug

Reported from Luxembourg by Gertsson (2016). This is a common Palaearctic species that feeds on needles of *Abies* and *Picea* (Kosztarab & Kozár 1988).

Planococcus citri (Risso, 1813) – Citrus mealybug

Reported from Luxembourg by Gertsson (2016). New locality: Ettelbruck, Lycée Technique Agricole (greenhouse), 27.09.2018, on *Ficus benjamina*. This is a cosmopolitan and widely polyphagous pest overwinters only indoors in Luxembourg (García et al. 2019).

Note: *Planococcus citri* is taxonomically very close to *P. ficus*. According to Danzig & Gavrillov-Zimin (2015) the two species are synonymized. But this is not shared by all scale insect researchers (e.g. Cox 1989, Williams 2004).

Planococcus vovae (Nassonov, 1909) – Nassonov's mealybug

Reported from Luxembourg by Gertsson (2016). This trans-Palaearctic oligophagous species lives on *Juniperus* spp. on branches and needles (García et al. 2019, (Kosztarab & Kozár 1988).

Pseudococcus longispinus (Targioni Tozzetti, 1867) – Long-tailed mealybug

Reported from Luxembourg by Gertsson (2016). New locality: Reckenthal, « service des Parcs de la Ville de Luxembourg » (greenhouses) 11.09.2019 on *Hoya carnosa* and *Epiphyllum* sp. It is a cosmopolitan and widely polyphagous species (García et al. 2019).

Pseudococcus viburni (Signoret, 1875)* – Obscure (glasshouse) mealybug

Reckenthal, « service des Parcs de la Ville de Luxembourg » (greenhouses) 11.09.2019 on *Philodendron scandens*. A polyphagous species with 292 host plants in 88 families (García et al. 2019).

Discussion

Significantly, thirteen of the recorded species, namely *Aspidiotus nerii*, *Coccus hesperidum*, *Pulvinaria floccifera*, *P. hydrangeae*, *P. regalis*, *Diaspis echinocacti*, *Icerya purchasi*, *Kuwanaspis pseudoleucaspis*, *Parasaissetia nigra*, *Planococcus citri*, *Pseudaulacaspis pentagona*, *Pseudococcus longispinus* and *P. viburni* are alien invasive species in Europe (Pellizari & Germain 2010).

Four species, *E. sericeum*, *P. regalis*, *M. pini* and *F. europaea*, are found in less than twenty countries (García et al. 2019).

This list should be considered as a starting point for future investigations. Giving that around two hundred species of scale insects have been recorded in the fauna of neighbouring Germany (García et al. 2019, Köhler & Kely 2011, Köhler & Kozár 2009, Schmutterer 2000). But in both the Netherlands (Jansen 2001, 2009) and Belgium (Malumphy 2016) the scale insect faunas are as poorly known as in Luxembourg, with 72 and 32 species, respectively. It is safe to assume that many more new discoveries of scale insect species will be made in Luxembourg.

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