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## New data on the scale insects (Hemiptera: Coccoidea) of Vienna, including one invasive species new for Austria

Ch. Malumphy\* & A. Kahrer\*\*

### Zusammenfassung

Sammeldaten von 30 im März 2008 in Wiener Parks und Palmenhäusern gesammelten Schild- und Wolllausarten (Hemiptera: Coccoidea) werden aufgelistet. Dreizehn dieser Arten (43 %) sind tropischen Ursprungs. Die San José Schildlaus (*Diaspidiotus perniciosus* (COMSTOCK)), die rote Austernschildlaus (*Epidiaspis leperii* (SIGNORET)) und die Maulbeerschildlaus (*Pseudaulacaspis pentagona* (TARGIONI-TOZZETTI)) (alle Diaspididae) rufen schwere Schäden an ihren Wirtspflanzen – im Freiland kultivierten Zierpflanzen hervor. Die ebenfalls nicht einheimische, invasive Art *Pulvinaria floccifera* (WESTWOOD) (Coccidae) wird für Österreich zum ersten Mal gemeldet.

### Summary

Collection data are provided for 30 species of scale insects (Hemiptera: Coccoidea) found in Vienna during March 2008. Thirteen (43 %) of these species are of exotic origin. *Diaspidiotus perniciosus* (COMSTOCK), *Epidiaspis leperii* (Signoret) and *Pseudaulacaspis pentagona* (TARGIONI-TOZZETTI) (Diaspididae) were found causing serious damage to ornamental plants growing outdoors. The non-native, invasive *Pulvinaria floccifera* (WESTWOOD) (Coccidae) is recorded from Austria for the first time.

**Keywords:** Non-native introductions, invasive species, *Diaspidiotus perniciosus*, *Epidiaspis leperii*, *Pseudaulacaspis pentagona*, *Pulvinaria floccifera*.

### Introduction

The scale insect (Hemiptera: Coccoidea) fauna of Austria has been inadequately studied. For example, the most up-to-date catalogues of the world fauna (BEN-DOV et al. 2010, database access on 2 March 2011) and European fauna (DANZIG & WATSON 2010) list 78 and 81 species from Austria, respectively. This compares with 203 and 198 species from neighbouring Hungary, which lies on a similar latitude. There appear to be no specific published records for some of the common cosmopolitan scale insect species from Austria, especially for those that occur on indoor plantings. The purpose of this communication is to present collection data on scale insects found in Vienna during March 2008 by the authors, together with Dr. Giselher Grabenweger, Dr. Christa Lethmayer, Gudrun Strauss and Dr. Norbert Zeisner of the Institut für Pflanzengesundheit, Österreichische Agentur für Gesundheit und Ernährungssicherheit (AGES).

National checklists are essential as baseline data from which faunistic changes, due to factors such as international trade and climate change can be monitored and accurately assessed. Exotic plant pests are regularly dispersed among countries as a

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\* Dr. Chris Malumphy (Contact author), FERA – The Food and Environment Research Agency, Sand Hutton, YO41 1LZ, United Kingdom, E-Mail: [c.malumphy@fera.gov.uk](mailto:c.malumphy@fera.gov.uk)

\*\* Dr. Andreas Kahrer, AGES, Institut für Pflanzengesundheit, Spargelfeldstrasse 191, 1220 Wien, Österreich, E-Mail: [andreas.kahrer@ages.at](mailto:andreas.kahrer@ages.at)

consequence of trade, and scale insects are one of the arthropod groups most commonly transported. They are also one of the most successful groups in terms of invading new geographical areas (PELLIZZARI & DALLA MONTÁ 1997, SMITH et al. 2007, THOMAS 2004) and many species have become cosmopolitan due to anthropogenic activities. Climate change will also influence the distribution of scale insects within Europe, as species once restricted to the Mediterranean are likely to expand their range into more northerly latitudes (WATSON & MALUMPHY 2004). Milder winters mean that winter mortality rates of some species will decrease and they may start breeding earlier in the year. Changes in regional faunas and phenology have implications for agricultural and horticultural industries and the environment. Two non-native species that have already naturalised in Austria and become economic pests are San José scale (*Diaspidiotus perniciosus* (COMSTOCK)) (Figs 1 - 2), a pest of apple and pear (WATZL 1938) and white peach scale (*Pseudaulacaspis pentagona* (TARGIONI-TOZZETTI)) (Figs 3-4), a pest of deciduous fruit trees, currants, grapevine and ornamental plants (KOZÁR et al. 1995).

The scale insect faunas of some countries bordering Austria have been studied in detail and the extensive but desperate literature on the scale insects of Central Europe have been reviewed by KOSZTARAB & KOZÁR (1988). The latter work provides morphological descriptions, identification keys and biological information on almost all scale insects that are likely to be found in Austria. BEN-DOV et al. (2010) provide references to more recent studies on the fauna of Central Europe.

### Material and Methods

Approximately 90 samples of scale insects were collected mainly in the public parks Karlsplatz [48° 11' 58.5594" N – 16° 22' 9.8394" E], Volksgarten [48° 12' 31.6794" N – 16° 21' 41.0394" E], Rathauspark [48° 12' 41.7594" N – 16° 21' 35.2794" E], Praterstern [48° 13' 5.52" N – 16° 23' 31.9194" E], Nordwestbahnstrasse [48° 13' 32.8794" N – 16° 22' 59.1594" E], Stadtpark [48° 12' 16.2" N – 16° 22' 44.04" E], Schönbrunner Schlosspark [48° 10' 51.96" N – 16° 18' 10.44" E], AGES-Areal [48° 15' 13.6794" N – 16° 28' 56.2794" E], Flughafen Schwechat [48° 7' 12.36" N – 16° 33' 39.24" E] and in glasshouse botanical collections (Schmetterlingshaus Burggarten [48° 12' 17.9994" N – 16° 21' 54.36" E], Palmenhaus Schönbrunn [48° 11' 3.48" N – 16° 18' 10.8" E]), Schottenstift [48° 12' 43.2" N – 16° 21' 54.72" E] in Vienna between the 2<sup>nd</sup> and 6<sup>th</sup> March 2008. Whereas Schönbrunner Schlosspark shows elements of autochthonous vegetation (woods dominated by *Quercus cerris* trees) the other locations are planted with native or exotic ornamentals.

Several scale insect species were only found when plant material was examined in the laboratory and were not seen in the field due to their small size and cryptic nature. Specimens were slide-mounted according to published methods (MALUMPHY 2002) and identified using the following diagnostic keys: KOSZTARAB & KOZÁR (1988)



Figures 1-4: (1) *Diaspidiotus perniciosus* causing drying out and bark splitting to *Cotoneaster*. (2) *Diaspidiotus perniciosus* female scale. (3) *Pseudaulacaspis pentagona* female scale. (4) *Pseudaulacaspis pentagona* causing bark splitting and dieback to *Morus* sp. (all Photos: FERA)

and WILLIAMS & WATSON (1988a, b & 1990). Nymphal stages were identified by comparison with verified material deposited at The Food and Environment Research Agency (Fera). The nomenclature used follows BEN-DOV et al. (2010). Slide-mounted specimens have been deposited at Fera and AGES.

## Results

Thirty species belonging to four families were collected (22 native and non-native naturalised species; 8 introduced species restricted to indoor plantings).

### Native and non-native naturalised species

#### Fam. Pseudococcidae – mealybugs

*Phenacoccus aceris* (SIGNORET) – polyphagous tree mealybug (Fig. 5)

A Holarctic species that is broadly polyphagous on woody plants and an occasional pest of deciduous fruit trees, currants and woody ornamentals. It is recorded in Austria by KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, Schönbrunn, nymphs on *Quercus cerris* L. (Fagaceae), 6.03.2008; Stadtpark, nymphs on unidentified tree, 2.3.2008.

*Phenacoccus piceae* (LÖW, 1883) – spruce mealybug (Fig. 6)

Originally described by LÖW (1883a) from specimens collected in Austria on *Picea abies* (L.) H.KARST. (= *Abies excelsae*) (Pinaceae). It occurs widely in Europe, most commonly on *Picea*, but also on *Abies* (Pinaceae) and *Taxus* (Taxaceae). It is recorded in Austria by LÖW (1883a), BORATYNSKI (1955) and KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, Stadtpark, nymphs on *P. abies*, 6.3.2008.

**Fam. Coccidae – soft scales**

*Coccus hesperidum* LINNAEUS, 1758 – brown soft scale (Fig. 7)

Native to the tropics/subtropics although the precise region is not known as it is now cosmopolitan. It is broadly polyphagous, being recorded on plants belonging to at least 90 families, and is an important pest of numerous crops and ornamentals. It is commonly recorded on indoor plantings in Europe but is also widely naturalized outdoors, particularly on evergreen plants in urban areas (JANSSEN 2009, MALUMPHY, 2009, 2010).

Collection data: All records are on plants grown indoors and include all developmental stages, unless specified otherwise. Vienna, AGES, abundant on *Dieffenbachia seguine* (Jacq.) SCHOTT (= *D. picta*) (Araceae), 3.3.2008; Burggarten, butterfly house, huge population causing leaf drop on *D. seguine*, abundant on *Ficus benjamina* L. (Moraceae), sparse on *Orphium* sp. (Gentianaceae) and *Spathiphyllum* sp. (Araceae) (attended by ants *Technomyrmex vitiensis* MANN (Hymenoptera: Formicidae: Dolichoderinae)), 4.3.2008; Kärntner Straße, sparse on *Laurus nobilis* L. (Lauraceae) growing outdoors, 2.3.2008; Schönbrunn, palm house, sparse on *Heliconia* sp. (Heliconiaceae), *Kigelia africana* (LAM.) BENTH. (Bignoniaceae) and ?Polygoniaceae, 4.3.2008; Schottenstift, Benediktushaus, sparse on *Hoya carnosa* (L.) R.Br. (Asclepiadaceae), 6.3.2008.

*Eulecanium tiliae* (LINNAEUS, 1758) – nut scale (Fig. 8)

A European species that also occurs in the Middle East and North Africa and has been introduced to North America and Tasmania. It is broadly polyphagous on woody plants belonging to 19 families, and is most frequent on Rosaceae. It is widespread and common in Central Europe and occasionally enormous populations develop, which may damage woody ornamentals and fruit trees. It is recorded in Austria by KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, AGES, two nymphs on *Quercus robur* L. (Fagaceae), 4.3.2008.

*Parthenolecanium corni* (BOUCHÉ, 1844) – European fruit lecanium (Fig. 9)

Occurs widely in temperate regions and is broadly polyphagous on woody plants belonging to at least 52 families. It is widespread and common in Central Europe and occasionally enormous populations develop, which damage ornamental plants and fruit crops. It is recorded in Austria by BORATYNSKI (1955) and KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, International Airport, nymphs (adult visible inside one of the nymphs) on *Cotoneaster* sp. (Rosaceae), 2.3.2008.

*Parthenolecanium rufulum* (COCKERELL, 1903) – oak soft scale (Fig. 10)

A common and widespread, polyphagous species in Europe, recorded feeding on plants belonging to 10 families. It is most frequently found on *Quercus* and occasionally heavy infestations cause damage to ornamental oaks. It is recorded in Austria by KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, AGES, nymphs (adult visible inside one of the nymphs) on *Q. robur*, 4.3.2008.

*Physokermes hemicryphus* (DALMAN, 1826) – small spruce bud scale (Fig. 11)

A common and widespread species in Europe that feeds on *Picea* (rarely on *Abies*) and has been introduced to North America. It is a frequent pest of spruce in Central Europe. It is recorded in Austria by KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, Schönbrunn, adult on *P. abies*, 6.3.2008; Stadtpark, adult and nymphs on *P. abies*, 6.3.2008.

*Pulvinaria floccifera* (WESTWOOD, 1870) – cottony camellia scale (Fig. 12)

Native to temperate Asia but is highly invasive and now almost cosmopolitan. It is widely naturalized in Europe and is recorded here for the first time from Austria. It is broadly polyphagous, being recorded feeding on plants belonging to at least 35 families and a pest of citrus and many ornamentals, particularly camellia, holly, rhododendron and yew.

Collection data: Vienna, Rathauspark, abundant on *Taxus baccata* L. (Taxaceae), 2.3.2008; Schönbrunn, sparse on *Ilex aquifolium* L. (Aquifoliaceae) and *T. baccata*, 6.3.2008.

*Pulvinaria vitis* (LINNAEUS, 1758) – woolly vine scale (Fig. 13)

Occurs throughout Europe and has been introduced to North America. It is broadly polyphagous, recorded feeding on plants belonging to at least 16 families. It is common on Betulaceae, Grossulariaceae, Rosaceae, Salicaceae and Vitaceae and is a pest of grapevine, peach and currants. It is recorded in Austria by KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, Stadtpark, nymphs on *Corylus* sp. (Betulaceae), 2.3.2008.

### **Fam. Asterolecaniidae – pit scales**

*Asterodiaspis variolosa* (RATZEBURG, 1870) – pit-making oak scale (Fig. 14)

Occurs widely in Europe, the Middle East, North and South America, and Australia. It feeds on the bark of *Quercus* and occasionally large infestations develop, causing dieback and killing young trees. It is recorded in Austria by RUSSELL (1941) and KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, AGES, abundant on apical twigs of *Q. robur*, 4.3.2008.

*Asterodiaspis viennae* (RUSSELL, 1941) – Viennese pit scale (Fig. 15)

Originally described by RUSSELL (1941) from specimen collected near Vienna, at Rekawinkel on *Quercus cerris*. It is a very rare species, previously only known from Rekawinkel and Budapest, Hungary. It feeds exclusively on the bark of *Q. cerris* and is recorded in Austria by RUSSELL (1941) and KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, Schönbrunn, low numbers of live adult females and numerous empty shallow pits on *Q. cerris*, 6.3.2008.



Figures 5-19: (5) *Phenacoccus aceris* adult female, (6) *Phenacoccus piceae* adult female, (7) *Coccus hesperidum* adult female, (8) *Eulecanium tiliae* adult female, (9) *Parthenolecanium corni* adult female, (10) *Parthenolecanium rufulum* adult females, (11) *Physokermes hemicryphus* adult females, (12) *Pulvinaria floccifera* adult female with ovisac, (13) *Pulvinaria vitis* adult female with ovisac, (14) *Asterodiaspis variolosa* adult female in a pit gall, (15) *Asterodiaspis viennae* adult female in a pit gall, (16) *Aulacaspis rosae* female scales, (17) *Carulaspis juniper* male and female scales, (18) *Carulaspis minima* female scale, (19) *Chionaspis ?austriaca* female scale (all Photos: FERA).

### Fam. Diaspididae – armoured scales

*Aulacaspis rosae* (BOUCHÉ, 1833) – rose scale (Fig. 16)

Cosmopolitan on *Rosa* and *Rubus* (Rosaceae). It is a serious pest of roses and cane-berries, particularly in damp, shaded locations. It is recorded in Austria by KOSZTARAB & KOZÁR (1988), DANZIG & PELLIZZARI (1998) and WATSON (2002).

Collection data: all records are on *Rosa* sp. Vienna, Prater, outside station, sparse, 4.03.2008; Schönbrunn, abundant, 6.3.2008; Volksgarten, sparse, 2.3.2008.

*Carulaspis juniperi* (BOUCHÉ, 1851) – juniper scale (Fig. 17)

Occurs widely in Europe, North America, Australia and New Zealand. It feeds primarily on Cupressaceae including *Chamaecyparis*, *Cupressus*, *Juniperus*, *Sequoia* and *Thuja*. It is a widespread and serious pest of Cupressaceae in Europe. It is recorded in Austria by BORATYNSKI (1955) and KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, Karlsplatz, sparse on ?*Juniperus* sp., 6.3.2008; Stadtpark, sparse on *Thuja* sp., 2.3.2008. Schönbrunn, sparse on *Thuja* hedge, 6.3.2008.

*Carulaspis minima* (SIGNORET, 1869) – juniper scale (Fig. 18)

A Mediterranean species that has spread to the Middle East, West Africa, Hawaii, North and South America and the Caribbean. It feeds primarily on Cupressaceae and is a widespread and serious pest of Cupressaceae in Central Europe. It is recorded in Austria by KOSZTARAB & KOZÁR (1988) and MILLER & DAVIDSON (2005).

Collection data: Vienna, Rathauspark, sparse on ?*Juniperus*, 2.3.2008.

*Chionaspis ?austriaca* LINDINGER, 1912 – Austrian pine scale (Fig. 19)

A rare European species recorded on the needles of *Abies* and *Pinus* (Pinaceae). It is the only *Chionaspis* species recorded on conifers in Europe.

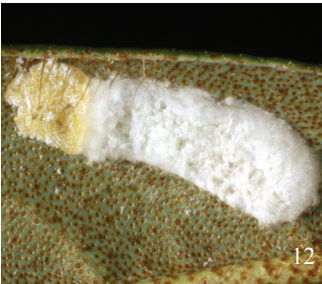
Collection data: Vienna, Schönbrunn, on *P. abies* (single scale cover with adult missing; second instar exuvia morphologically consistent with *Chionaspis*), 6.3.2008.

*Diaspidiotus perniciosus* (COMSTOCK, 1881) – San José scale (Figs. 1 - 2)

Native to temperate Asia, it has spread widely in all temperate regions. It is highly polyphagous and is recorded from woody hosts belonging to at least 81 plant families, but favours the Rosaceae. It is a major economic pest of deciduous fruit trees in many regions of the world and recorded in Austria by WATZL (1938) and JAHN & POLESNY (1999).

Collection data: Vienna, International Airport, huge population causing drying out, bark splitting and dieback to *Cotoneaster* sp. (Fig. 1), 2. and 6.3.2008.

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*Dynaspidotus abietis* (SCHRANK, 1776) – conifer-needle scale (Fig. 20)

Originally described by SCHRANK (1776) from specimens collected from *Pinus* in Austria. It occurs widely in Europe, the Middle East and North America. It feeds on Cupressaceae and Pinaceae and is an occasional pest. It is recorded in Austria by SCHRANK (1776), BORATYNSKI (1955) and KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, Schönbrunn, sparse on *P. abies*, 6.3.2008.

*Epidiaspis leperii* (SIGNORET, 1869) – Italian pear scale (Fig. 21)

Occurs widely in Europe and also present in the Middle East, North Africa, and North and South America. It is polyphagous on woody plants and is an important pest of pear and plum in central Europe, causing growth deformation of twigs and branches. It is recorded in Austria by KOSZTARAB & KOZÁR (1988) and DANZIG & PELLIZZARI (1998).

Collection data: Vienna, Schönbrunn, huge population smothering bark causing deformation (Fig. 21) to ?*Prunus* sp. (Rosaceae), 6.3.2008.

*Lepidosaphes newsteadi* (ŠULC, 1895) – pine oyster shell scale (Fig. 22)

Occurs widely in Europe and North America. It is polyphagous on Cupressaceae, Pinaceae and Theaceae and is a pest of pine. It is recorded in Austria by BORATYNSKI (1955) and KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, Rathauspark, single adult female on *T. baccata* (the scale was not firmly attached and yew is not confirmed here as a host), 2.3.2008; Schönbrunn, sparse on *P. abies*, 6.3.2008.

*Leucaspis pusilla* Löw, 1883 – small pine scale (Fig. 23)

Originally described by Löw (1883b) from specimens collected in Austria on *Pinus sylvestris* L. It occurs widely in Europe and has also been recorded from South America. It feeds on *Cedrus* (Pinaceae) and *Pinus* and is occasionally a serious pest of pines in Central Europe, particular in urban areas and parks. It is recorded in Austria by Löw (1883b) and KOSZTARAB & KOZÁR (1988).

Collection data: In all cases the scales were found in large numbers and were heavily parasitized. Vienna, Karlsplatz, on *Pinus nigra* J.F. Arnold, 6.3.2008; Nordwestbahnstraße, on *P. nigra*, 4.3.2008; Rathauspark, on *P. nigra*, 2.3.2008; Stadtpark, on *Pinus* sp., 2.3.2008.

*Pseudaulacaspis pentagona* (TARGIONI TOZZETTI, 1886) – white peach scale (Figs. 3 - 4)

Native to tropical Asia but now widespread in the tropics, subtropics and warm temperate regions. It is broadly polyphagous, recorded from plant hosts belonging to at least 55 families. It is a serious pest of Rosaceae fruit trees and regularly kills ornamental trees and shrubs in Central Europe. It was found to be the most common species of scale insect found in Vienna during March 2008. Large populations cause desiccation, bark splitting (Fig. 4), die back and may kill the host. On occasions the male tests are so numerous that they turn the bark of the host white. It is recorded in Austria by KOZÁR et al. (1995) and KOZÁR & NAGY (1998).



Collection data: Vienna, AGES, sparse on *Euonymus* sp. (Celastraceae), 4.3.2008; Karlsplatz, sparse on *Betula pendula* ROTH 'Youngii' (Betulaceae), abundant on *Lonicera nitida* (Caprifoliaceae) and *Mahonia* sp. (Berberidaceae), 6.3.2008; Rathauspark, huge population on main stem, killing a large *Morus nigra* (Moraceae) (Fig. 4), 2.3.2008; Schönbrunn, abundant on *Cotoneaster* sp., *Morus alba* L., 6.3.2008; Stadtpark, sparse on *Corylus* sp., *Salix* sp. (Salicaceae) and unidentified trees, 2.3.2008, abundant on *Ribes sanguineum* PURSH (Grossulariaceae) and *Salix* sp., 6.3.2008.

*Unaspis euonymi* (COMSTOCK, 1881) – euonymus scale (Figs 24 - 25)

Native to tropical Asia but is now widespread in Europe and North and South America. It is polyphagous, recorded from plants belonging to at least 20 families, and is most commonly found on *Euonymus*. Large populations cause severe chlorosis, premature leaf loss, bark splitting, dieback and may kill hosts plants. It is recorded in Austria by KOSZTARAB & KOZÁR (1988).

Collection data: Vienna, AGES, on *Euonymus* sp. and ?*Rhamnus* (Rhamnaceae), 4.03.2008; Schönbrunn, *Euonymus*, 6.03.2008 (numerous, patchy).

### Introduced species established on indoor plantings

#### Fam. Pseudococcidae – mealybugs

*Planococcus citri* (RISSE, 1813) – citrus mealybug (Fig. 26)

Cosmopolitan and broadly polyphagous, recorded from plants belonging to at least 70 families. It is a major pest of ornamentals grown indoors in Central Europe.

Collection data: Vienna, Burggarten, butterfly house, abundant on *Codiaeum variegatum* (L.) A. Juss. (Euphorbiaceae) and *Hibiscus rosa-sinensis* L. (Malvaceae), low numbers on *Sanchezia nobilis* HOOK.F. (Acanthaceae), 4.3.2008; Schönbrunn, palm house, low numbers on *Kigelia africana*, abundant on unspecified plants, 4.3.2008.

*Pseudococcus longispinus* (TARGIONI TOZZETTI, 1867) – long-tailed mealybug (Fig. 27)

Cosmopolitan and broadly polyphagous, recorded from plants belonging to at least 91 families. It is a major pest of ornamentals grown indoors in central Europe.

Collection data: Vienna, Burggarten, butterfly house, sparse on *H. rosa-sinensis* and Arecaceae, 4.3.2008; Schönbrunn, palm house, abundant on *Maranta* sp. (Marantaceae) (ant attended), 4.3.2008.

*Pseudococcus viburni* (SIGNORET, 1875) – glasshouse mealybug (Figs. 28 - 29)

Cosmopolitan and broadly polyphagous, recorded from plants belonging to at least 89 families. It is a major pest of ornamentals and occasionally vegetable crops grown indoors in central Europe.

Collection data: Vienna, Burggarten, butterfly house, sparse on *Caryota mitis* Loureiro (Arecaceae), *Sanchezia nobilis*, *Spathiphyllum* sp., and various unidentified herbaceous and woody plants, 4.3.2008; Kärntner Straße, sparse on *Laurus nobilis* (growing outdoors), 2.3.2008; Schönbrunn, palm house, sparse on *Alocasia odora*

Figure 20-21: (20) *Dynaspidotus abietis* female scale, (21) *Epidiaspis leperii* causing distortion to bark, (22) *Lepidosaphes newsteadi* female scale, (23) *Leucaspis pusilla* female scales, (24) *Unaspis euonymi* female scale, (25) *Unaspis euonymi* male scales, (26) *Planococcus citri* adult female, (27) *Pseudococcus longispinus* adult female, (28) *Pseudococcus viburni* adult females, (29) *Pseudococcus viburni* adult male, (30) *Saissetia coffeae* adult female and first instars, (31) *Aspidiotus nerii* female scales, (32) *Diaspis bromeliae* female scales, (33) *Furchadiaspis zamiae* female scales, (34) *Hemiberlesia lataniae* female scales (all Photos: FERA)

(ROXBURGH) K. KOCH (Araceae), *Carapa guianensis* AUBL. (Meliaceae), *C. mitis*, *Chamaerops humulis* L. (Arecaceae), *Freycinetia insignis* BLUME (Pandanaeae) and *Plectranthus* sp. (Lamiaceae), enormous populations on unspecified herbaceous plants causing flower stalks to die (ant-attended), 4.03.2008.

### **Fam. Coccidae – soft scales**

*Saissetia coffeae* (WALKER, 1852) – hemispherical scale (Fig. 30)

Native to the Afrotropical region but now cosmopolitan and widely polyphagous, recorded feeding on plants belonging to at least 81 families. It is an important pest of many ornamental plants.

Collection data: Vienna, Burggarten, butterfly house, low numbers on *Sanchezia nobilis*, 4.3.2008; Schönbrunn, palm house, abundant on ?Polygoniaceae, *Ixora acuminata* ROXB. (Rubiaceae), *K. africana* and *Schinus terebinthifolius* RADDI (Anacardiaceae), 4.3.2008.

### **Fam. Diaspididae – armoured scales**

*Aspidiotus nerii* BOUCHÉ, 1833 – oleander scale (Fig. 31)

Native to the Afrotropical region but now cosmopolitan and widely polyphagous, recorded feeding on plants belonging to more than 100 families, including many crops and ornamentals. It is a pest of citrus and olive in the Mediterranean basin and a troublesome pest of many ornamental plants in Central Europe.

Collection data: Vienna, sparse on *Cycas revoluta* THUNB. (Cycadaceae), 3.3.2008, (leg. G. Grabenweger); Schönbrunn, palm house, sparse on *Chamaerops humulis* L. (Arecaceae), 4.3.2008.

*Diaspis bromeliae* (KERNER, 1778) – pineapple scale (Fig. 32)

Native to South America but now pantropical, subtropical and present on indoor plantings in Europe. It is recorded in Austria by WATSON (2002).

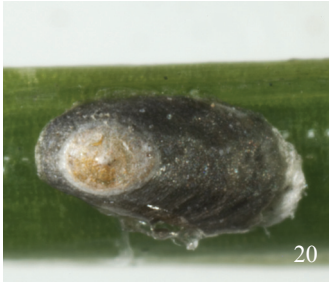
Collection data: Vienna, Burggarten, butterfly house, abundant on Bromeliaceae, 4.3.2008.

*Furchadiaspis zamiae* (MORGAN, 1890) – cycad scale (Fig. 33)

Native to the Afrotropical region, now widespread in tropical, subtropical and warm temperate regions. Polyphagous, recorded from 10 plant families but most frequently on Cycadaceae.

Collection data: Vienna, Schönbrunn, palm house, abundant on *Cycas revoluta*, 4.3.2008.

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*Hemiberlesia lataniae* (SIGNORET, 1869) – latania scale (Fig. 34)

This species is native to the tropics/subtropics although the precise region is not known as it is now cosmopolitan. Polyphagous, recorded from host plants (mostly woody) belonging to 78 families. It is a serious pest of many agricultural crops and ornamental plants and is recorded in Austria by WATSON (2002).

Collection data: Schönbrunn, palm house, abundant on *Carapa guianensis* AUBL. (Meliaceae) and *Chamaerops humilis* L. (Arecaceae), 4.3.2008.

### Discussion

Thirty species of scale insect belonging to four families were collected from Vienna during March 2008. Seventeen of these are native, or at least European in origin, and 13 (43%) are non-native introductions and usually restricted to indoor plantings (they are not able to overwinter outdoors), with the exception of *Coccus hesperidum* and *Pulvinaria floccifera*. The latter species is recorded in Austria for the first time, and has become an increasing important pest to horticulture and rhododendrons in parkland in Britain in recent years (MALUMPHY 2009b). Seven non-native species (*Aspidiotus nerii*, *C. hesperidum*, *Furchadiaspis zamiae*, *Planococcus citri*, *Pseudococcus longispinus*, *Pseudococcus viburni* and *Saissetia coffeae*), which were not recorded from Austria in recent European (DANZIG & WATSON 2010) and World catalogues (BEN-DOV et al. 2010), are confirmed as present. Most of these species are cosmopolitan and are likely to have been present in Austria for many years, but have simply been overlooked.

The most common species found outdoors in Vienna was the white peach scale *Pseudaulacaspis pentagona*. Three species were found outdoors at very high densities causing serious plant damage: *Diaspidiotus perniciosus* (Fig. 1), *Epidiaspis leperii* (Fig. 21) and *P. pentagona* (Fig. 4). *Diaspidiotus perniciosus* and *P. pentagona* were observed causing desiccation, bark splitting and die back of *Cotoneaster* sp. and *Morus nigra*, respectively. *Epidiaspis leperii* was observed causing deformation of the bark, branches and twigs of a ?*Prunus* tree. *Asterodiaspis variolosa* was also observed at high densities on the apical twigs of *Q. robur* and was inducing pit galls but there was no significant damage. The plants most susceptible to damage by scale insects are often those already stressed by growing in urban environments, due to factors such as pollution, cramping of the roots and lack of water. The glasshouse mealybug *P. viburni* was the most common species found on indoor plantings and occurred at very high densities, killing the flowering shoots of an ornamental plant.

The most notable native species detected was *Asterodiaspis viennae*, which appears to have been previously recorded from only two localities, Rekawinkel, Austria and Budapest, Hungary. There were low numbers of live adults present on *Q. cerris* in Schönbrunn, but there were also large numbers of empty shallow pit-galls in the bark of apical twigs and along thin branches, indicating large populations had occurred in previous years. It has to be stated that they were found in naturally growing woods,



so their occurrence also seems to be autochthonous.

It is probable that only just over half of the scale insect species actually present in Austria have so far been recorded and there is plenty of scope to detect species new for the country, especially on plant families such as Cyperaceae and Poaceae. The coccoid fauna of Austria is also likely to change in the future as a result of exotic introductions. For example the Asian species *Pulvinaria hydrangeae* (STEINWEDEN) has recently been introduced (MÁTRAHEGYI & KOZÁR 2008) and *Pulvinaria regalis* CANARD is expanding its range in Central Europe (HIPPE & FREY 2001).

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