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Aphids (Hemiptera, Aphididae) Chapter 9.2

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Abstract

Our study aimed at providing a comprehensive list of Aphididae alien *to* Europe. A total of 98 species originating from other continents have established so far in Europe, to which we add 4 cosmopolitan species of uncertain origin (cryptogenic). The 102 alien species of Aphididae established in Europe belong to 12 different subfamilies, five of them contributing by more than 5 species to the alien fauna. Most alien aphids originate from temperate regions of the world. There was no significant variation in the geographic origin of the alien aphids over time. The average introduction rate was 0.5 species per year since 1800. The mean number of newly recorded species per year decreased since 2000 but this pattern may change in the following years.

Keywords

alien, Hemiptera, Aphid, Aphididae, Europe

9.2.1. Introduction

About 4700 species of Aphididae have been described worldwide (Remaudière and Remaudière 1997). About one third of these species are present in Europe. As for many other taxonomic groups, very few checklists of alien Aphididae have been available for Europe until recently. In 2002, Geiter et al. (2002) published a list of 131 species

considered non-indigenous in Germany and Nobanis (2005) listed 34 species of non-native Aphididae in its geographic area in 2005. Lampel and Gonseth (2005) listed 37 species alien to Switzerland in 2005 whilst Rabitsch and Essl (2006) listed 40 alien aphid species from Austria in 2006. The differences in the number of species considered non-indigenous clearly reflect differences in the composition of the fauna of each country, but also reflect differences in the definition of 'alien'. Lampel and Gonseth (2005) considered only species of non-European origin whereas Geiter et al. (2002) included all species considered non-native to Germany.

The goal of this work is to provide a first comprehensive list of Aphididae alien *to* Europe. Aphid species originating from one European country and introduced into another, i.e. species alien *in* Europe such as *Diuraphis noxia* (Kurdjumov, 1913) and *Brachycorynella asparagi* (Mordvilko, 1929), will not be considered in this work. These species may have an invasive status in the area where they were introduced but it appeared difficult to disentangle human- mediated introductions from natural expansion.

To define the species present in Europe, we used the list of European Aphididae elaborated by Nieto Nafria for Fauna Europaea (Nieto Nafria et al. 2007). We compiled information about each species from published sources and experts to define their origin, i.e. European vs non-European. Among the references consulted, the lists cited above and the three comprehensive books by Blackman & Eastop (Blackman and Eastop 1994, 2000, 2006) proved to be particularly useful. Once a first list of alien aphids had been defined, we sought additional information, such as the date of first occurrence in Europe. June 2008 was the cut-off date for our literature survey. All the information collected for the 102 species considered is provided in Table 9.2.1.

9.2.2. Taxonomy of alien species

The delineation of the taxa included under the family name Aphididae has varied over the last 50 years. Here, we use Aphididae *sensu* Eastop and Hille Ris Lambers (1976) and Remaudière and Remaudière (1997). Therefore, we did not consider Adelgidae and Phylloxeridae in this chapter. Taxonomy and nomenclature are as described by Remaudière and Remaudière (1997), Nieto Nafria et al. (1998), Quednau (1999, 2003), and Eastop and Blackman (2005). Some of the names cited in published studies could not be clearly attributed to a currently valid taxon and were therefore excluded.

A total of 98 species present in Europe but originating from another continent have been listed to date, to which we can add four cosmopolitan species of uncertain origin (cryptogenic) (Table 9.2.1). For comparison, the European aphid fauna currently includes 1,373 species (Nieto Nafria et al. 2007), meaning that 7.4 % of the European aphid fauna is of alien origin.

The 102 alien species of Aphididae established in Europe belong to 12 different subfamilies, most of which are already represented among the native entomofauna (Figure 9.2.1). However, three subfamilies (Greenideinae, Lizerinae and Neophyllaphidinae) were not known in Europe before introductions. Each of these three subfamilies

is represented by a single species. *Greenidea ficicola* is a member of the Greenideinae subfamily widespread in eastern regions and living on several species of *Ficus.* It was introduced into Italy in 2004 and seems to be widespread in Southern Europe (Italy, Spain and Malta) (Barbagallo et al. 2005a, Mifsud 1998). *Paoliella eastopi*, a species belonging to the Lizerinae described from Kenya, has only been found in one European country, England. All *Paoliella* species are of African origin. *Neophyllaphis podocarpi*, the only Neophyllaphidinae species known in Europe, originates from Asia and was recorded on *Podocarpus* in Italy in 1990 (Limonta 1990) but appears to have spread. Five subfamilies contribute more than five species to the alien fauna (Figure 9.2.1). The subfamily Aphidinae predominates, accounting for 59% of the alien Aphididae, followed by Calaphidinae (16%), Lachninae (5.8%), Eriosomatinae (4.8%) and Chaitophorinae (4.8%). These five subfamilies are also the most species-rich in native species. Each of the other seven subfamilies accounts for less than 1% of the alien Aphididae (Figure 9.2.1). The Hormaphidinae is the only subfamily represented by more alien than native species (4 species vs 1).

The taxonomic composition of the alien entomofauna is highly diverse at genus level. The 102 alien species belong to 58 different genera (Table 9.2.1). Thirty-two (55%) of these genera are represented in Europe by only non-native species and 40 (69%) contribute only one species to the alien fauna. The genus *Aphis* is the most represented, with eight species. This is not surprising, given that this genus contains more than 10% of the world's Aphididae and is abundant in all biogeographical regions of the world. This is not the case for another two species-rich genera, the North American *Illinoia* (seven alien species *in* Europe and 54 species worldwide) and the Asian *Tinocallis* (six alien species *in* Europe and 25 species worldwide). Although the genus *Cinara* is the second most species-rich genus in the world, with 222 species worldwide, three quarters of which being of non-European origin, surprisingly only three alien species from this genus are present in Europe

9.2.3. Temporal trends

The date of the first record in Europe is known, with various degrees of precision, for 94 of the 102 alien aphid species (Table 9.2.1). The precise date of arrival is unknown for most species because their introduction was unintentional (see below 9.2.5) and large delays may occur between the date of introduction and the date of reporting. However, in certain cases, introduction is relatively well documented, available data suggesting that the date of the first report was close to the date of introduction. This is the case for recent introductions, such as the species detected and monitored by the permanent aerial suction-trap network "Euraphid". This system of aphid flight surveys, based on a 12.2 m.-high suction trap, was developed by the Rothamsted Experimental Station in the 1960s (Taylor and Palmer 1972). This device is now used in several European countries, as part of integrated control networks, and has also proved useful for studies of the long-range dispersal of alates and for the regular detection of

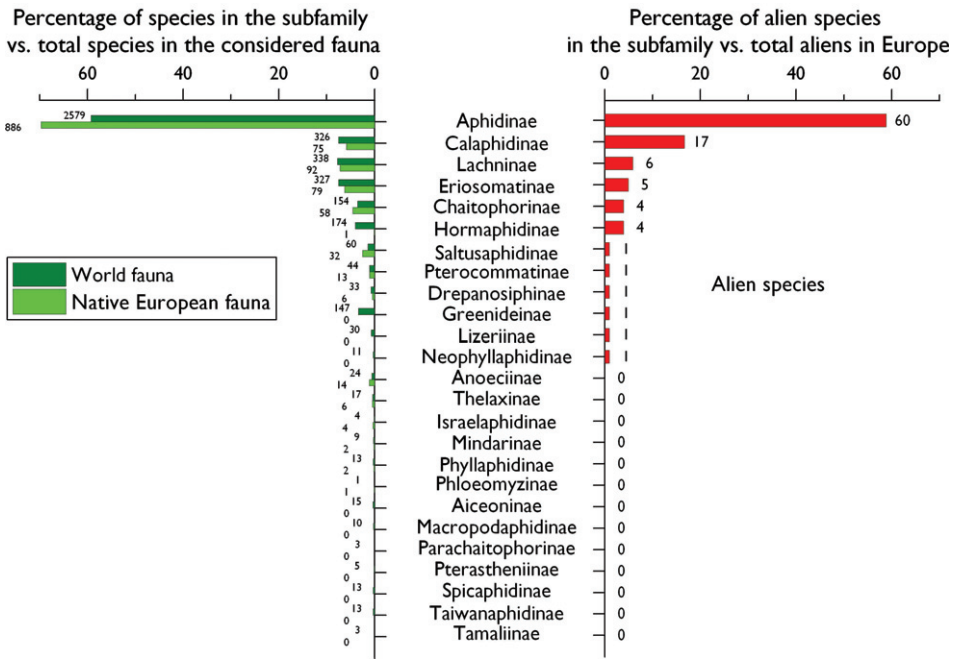

Figure 9.2.1. Taxonomic overview of the aphid species alien to Europe compared to the native European fauna and the world fauna. Subfamilies are presented in a decreasing order based on the number of alien species. Species alien *to* Europe include cryptogenic species. Data about native European aphids from Fauna europaea (Nieto Nafria et al. 2007); world data from Remaudière and Remaudière (1997). The number over each bar indicates the number of species observed per subfamily.

aphid species new to the national or European fauna (Hullé et al. 1998). In France, a network of five such traps spread over the territory has been monitoring the aphid species trapped since 1978. This system detected four species new to Europe between 1984 and 1988 (Hullé et al. 1998): *Essigella californica* (Turpeau and Remaudière 1990), *Klimaszewskia salviae* (Leclant and Remaudière 1986), *Myzocallis walshii* (Remaudière 1989), and *Tinocallis takachihoensis* (Leclant and Remaudière 1986), and has monitored the extension of their geographical range in France. In a very small number of cases, more ancient introductions have also been documented, generally for important pest species. For example, the occurrence of *Eriosoma lanigerum*, a pest of apple trees originating from North America, was noted for the first time in a nursery in the outskirts of London in 1787 (Balachowsky and Mesnil 1935). The species was described by Hausmann in 1802, based on material from Germany, where aphids had been found in nurseries, causing extensive damage. In 1812, the species was found in France, by 1841, it was found in Italy and in 1870 it was reported in Switzerland. *E. lanigerum* has subsequently spread gradually to all temperate countries of the world (Balachowsky and Mesnil 1935, Marchal 1928).

For most alien species, the date of first report sighting may not correspond to the date of introduction and secondary expansion. For example, the pest species *Myzus persicae*, *Panaphis juglandis*, and *Chromaphis juglandicola* were all reported for the

first time in Europe between 1800 and 1849, but they were probably introduced long before along with their host plants. The primary host of *Myzus persicae,* the peach tree, grown since classical times in the Mediterranean basin, was imported to Europe from Persia, but probably originated from western China, where it has been cultivated since 5,000 yr BP (Faust and Timon 1995). The host plant of *Chromaphis juglandidola* and *Panaphis juglandis,* the walnut, may have been introduced to Europe from Persia during the classical era, but this remains a matter of debate (Huntley and Birks 1983). Even for more recent introductions, the time lag between introduction and the first reported sighting may be considerable, particularly if the species concerned is not a pest. The date on which a taxonomic group was first recorded is therefore more likely to refer to the period during which it was studied for the first time. Börner between 1930 and 1952 made the largest single advance to studies of the aphid fauna of Europe, with the publication of "Europae Centralis Aphid" (Börner 1952). This catalysed intensive studies of the aphid fauna in various European countries over the following 20 years. The increase in the number of introduced species observed between 1950 and 1974 is partly attributable to this increase in taxonomic and faunistic activity.

Bearing these biases in mind, and taking the first recorded sighting as a proxy for the date of introduction, the mean rate of introduction since 1800 was 0.5 species per year. A similar rate has also been reported for a more recent period (0.42 between 2000 and 2007). The number of introductions increased in the second half of the 20th century (Figure 9.2.2). The mean number of new records increased from 0.3–0.4 per year before 1950 to more than 1.3 per year between 1950 and 1974. The mean number of introductions per year has decreased since 2000, but this pattern may change again in the future. The three most recent alien aphid species introduced to Europe are *Aphis illinoisensis*, a Nearctic species and a pest of vineyards introduced into Crete in 2005 (Tsitsipis et al. 2005), *Prociphilus fraxiniifolii*, also of Nearctic origin, introduced into Europe in 2003, (Remaudière and Ripka 2003), and *Greenidea ficicola*, a tropical species, probably originating from Asia, introduced into Sicily in 2004 (Barbagallo et al. 2005a).

9.2.4. Biogeographic patterns

9.2.4.1 Origin of alien species

A precise continent of origin was ascertained for 90.2% (92 species) of the alien Aphididae species, whereas 5.9% (six species) of the alien species were known only to be native to tropical or subtropical regions and 3.9% (four species) were of unknown origin (cryptogenic, Table 9.2.1, Figure 9.2.3).

The cryptogenic species include the polyphagous pest species *Myzus persicae* and *M. cymbalariae*, which have a cosmopolitan distribution. Data concerning their host plant relationships and the distribution of other species of the genus *Myzus*, strongly

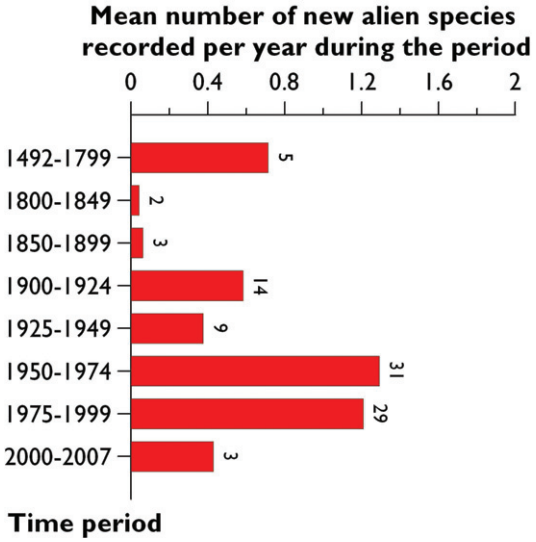

Figure 9.2.2. Changes over time in the mean number of first sightings per year of aphid species alien *to* Europe from 1492 to 2007. The number to the right of the bar indicates the absolute number of species reported for the first time during the corresponding time period.

suggest that these species originate from a continent other than Europe. Many other cosmopolitan species are not included in this list because they are thought to be of European origin, e.g. *Acyrthosiphon pisum*, *Brevicoryne brassicae*, although their origin is unclear and it remains possible that they were introduced into Europe by humans a long time ago.

Most of the alien aphid species in Europe originate from temperate regions of the world. Asia and North America have contributed the largest numbers (each 43.1%, Figure 9.2.3). Most of the Asian species originated from temperate zones (32 species), and only four species (*Cerataphis brasiliensis*, *Cerataphis orchidearum*, *Greenidea ficicola*, and *Stomaphis mordvilkoi*) are known to have originated from tropical Asia. Only four alien species in Europe are of African origin. Two of these species come from North Africa (*Cinara laportei* and *C. cedri*) and two from sub-Saharan regions (*Aloephagus myersi* and *Paoliella eastopi*). No alien aphid species has yet been introduced into Europe from Australasia or South America. The proportions of aphids of different geographical origins in the alien aphid fauna of Europe have remained fairly constant over time (Figure 9.2.4) and seem to reflect the species diversity of the donor continents. Most of the described aphid species are of temperate origin, with Aleyrodidae and Coccoidea appearing to replace aphids in the tropics and subtropics (Dixon 1998). With only 219 (Remaudière et al. 1985) and 180 (Hales 2005) species, respectively, sub-Saharan Africa and Australia have a very poor aphid fauna. By contrast, 1,416 species are found in North America (Foottit et al. 2006) and 1,007 species are found in China (Qiao and Zhang 2004). Thus, the origins of the alien species in Europe might reflect regional species di-

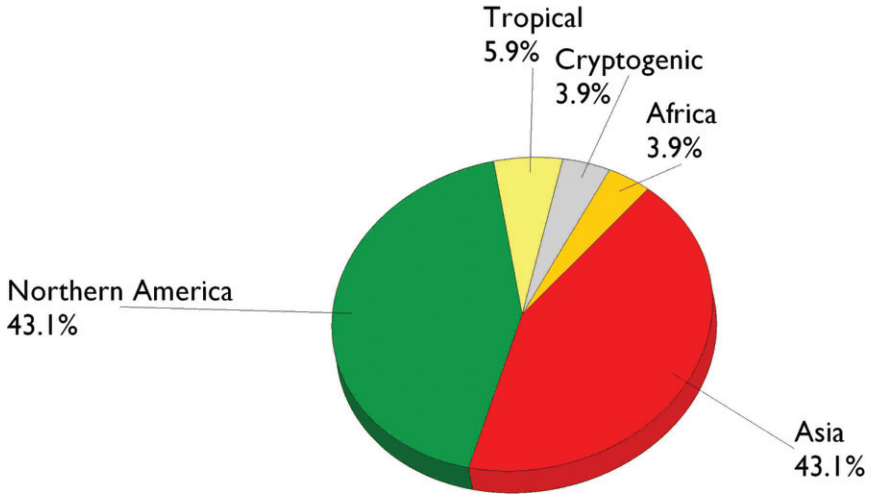

Figure 9.2.3. Geographic origin of the alien species of Aphididae established in Europe.

versity rather than preferential routes of introduction from North America and temperate Asia.

9.2.4.2. Distribution of alien species in Europe

Alien Aphididae species are not evenly distributed within Europe (Figure 9.2.5). The number of alien species present in a country is significantly and positively correlated with the number of native species recorded in that country ($r=0.6226$, $p<0.001$). This may reflect differences in sampling intensity and in the number of local taxonomists. The number of alien species also seems to be weakly positively correlated with the total area covered by each country ($r=0.3361$, $p=0.0182$). Similarly, the number of native species is strongly correlated with the area of the country ($r=0.6803$, $p<0.001$).

The top ten countries/regions within Europe with the largest numbers of recorded alien aphid species are: Great Britain (64), mainland France (63), mainland Italy (58), mainland Spain (56), Sicily (Italy) (45), Germany (44), Switzerland (37), Madeira (Portugal) (36), mainland Portugal (31), Czech Republic (29).

Alien aphid species are well distributed across Europe, with 58% present in at least five European countries and 38% occurring in more than 10 countries or regions. The polyphagous pest species, *Myzus persicae*, *Macrosiphum euphorbiae* and *Aphis gossypii* are the most widely distributed alien species: they have been recorded in 43, 41 and 40 countries or regions, respectively. Only one of the 15 species occurring in more than half of the countries of Europe, *Acyrthosiphon caraganae*, is not considered to be a pest of crop plants. This species, probably originating from the Altai region, is now found in temperate regions throughout the Northern hemisphere, where it lives on woody Leguminosae, particularly *Caragana* and *Colutea* species. In

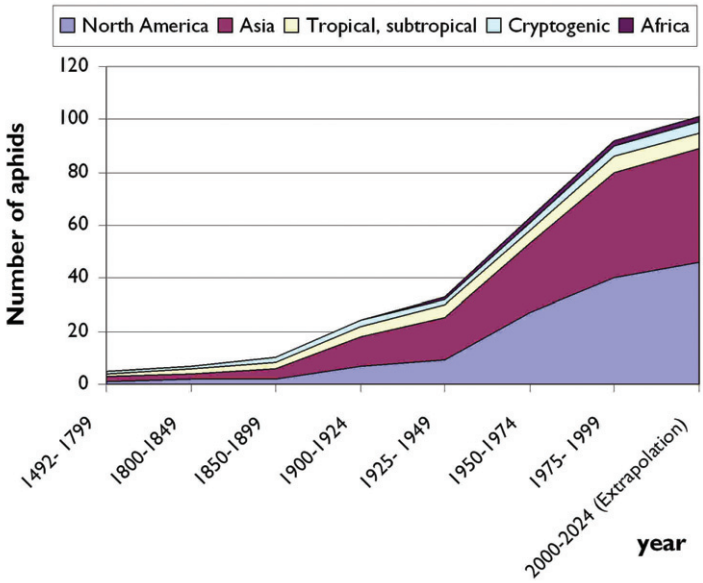

Figure 9.2.4. Cumulative numbers of alien aphid species established in Europe, by year and by geographic origin

most cases, it is not known whether the species expanded naturally after its establishment in a country, or whether the extension of its distribution was driven by repeated introductions from abroad.

Thirteen of the 19 species present in only two European countries have discontinuous distributions, probably resulting from independent introductions. Thus, for example *Ericaphis wakibae* has been found in Great Britain and the Czech Republic, *Chaitophotus populifolii* in Germany and Serbia and *Macrosiphum ptericolens* in Poland and Great Britain. A continuous but restricted area may be accounted for by recent introductions, as for *Aphis illinoisensis* Shimer, 1866, a pest of grapevines introduced into Greece in 2005 (Tsitsipis et al. 2005). This species has extended its range from Crete to continental Greece and recently (2007) to the Mediterranean part of Montenegro (Petrovic, personal communication).

Eight alien aphid species have each been found in only one European country. Four of these species are confined to England, two to Italy, one to Swirtzerland and one to the Ukraine. These species were all introduced before 2000 and have not spread elsewhere since. They may be unable to colonise a wider geographical area in Europe, they may have disappeared or they may simply have been overlooked.

9.2.5. Main routes and vectors for introduction into Europe

No cases of intentional introduction of aphids into Europe are known. All alien species were therefore introduced accidentally. In a very small number of cases, the pathway

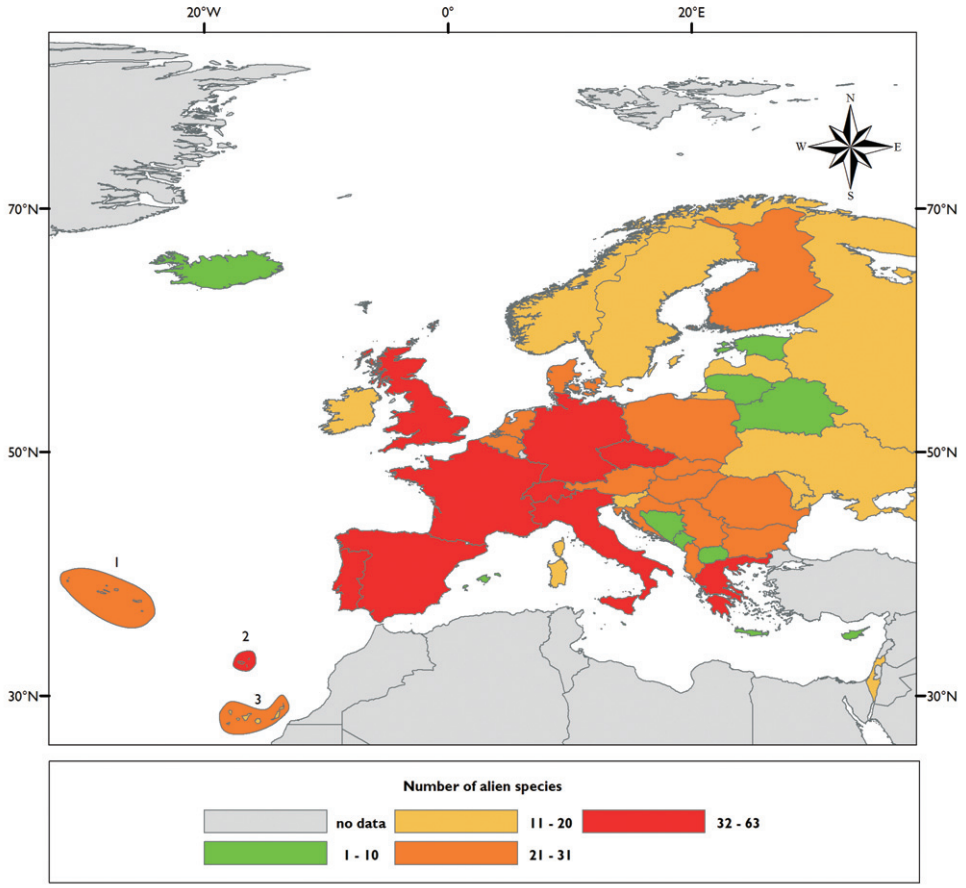

Figure 9.2.5. Comparative colonization of continental European countries and islands by Aphididae species alien to Europe. Archipelago: **1** Azores **2** Madeira **3** Canary islands.

and vector are precisely known. For example, two Japanese aphids, *Tinocallis ulmiparvifoliae* and *T. zelkovae* were introduced into Europe in 1973 with their hosts, bonsai trees that were imported into Great Britain directly from Japan. The infested bonsai trees had been in Great Britain for about six months before the aphids were detected, and were growing in slatted wood buildings providing no effective physical barrier to insect dispersal (Prior 1971).

In most cases, it is difficult to identify the vector of accidental introductions; most have been inferred from the known biological requirements of the aphid species. Most Aphididae have a high level of host-plant specificity and most alien species are therefore thought to have been introduced into Europe with their host plants. For example, the *Takecallis* species included in our list feed on bamboos of Asian origin. The Ne-

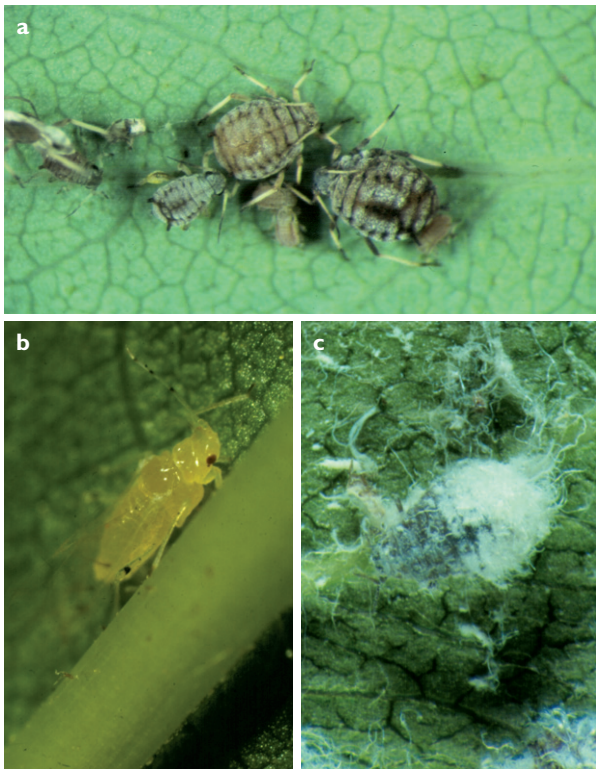

Figure 9.2.6. Some alien aphids. **a** Spiraea aphid, *Aphis spiraephaga*. (Credit: Olivera Petrović-Obradović) **b** Walnut aphid, *Chromaphis juglandicola*. (Credit: Olivera Petrović-Obradović) **c** Woolly apple aphid, *Eriosoma lanigerum*. (Credit: Olivera Petrović-Obradović).

arctic aphid *Prociphilus fraxinifolii* has recently been detected in Budapest (Hungary) (Remaudière and Ripka 2003), but only on the North American red ash tree, *Fraxinus pennsylvanica* Marsh. This aphid has not been found on European ash planted in the same area. Two oriental species, *Reticulaphis distylii* and *Greenidea ficicola,* live on several species of *Ficus,* all originating from tropical regions. These *Ficus* species have been planted as ornamental trees in the warmest areas of the Mediterranean basin (Barbagallo et al. 2005a). These two species of aphids are found on tropical fig trees, but never on *Ficus carica,* the only European species of this genus. All these alien species are thought to have been introduced into Europe through trade, but the aphid species may have been introduced several years after their hosts. *Impatientinum asiaticum* is a species originating from Central Asia. It was introduced into Europe in 1967, whereas its host, *Impatiens parviflora* DC. was introduced into Europe much earlier, in the 19th Century, subsequently escaping from botanic gardens to establish itself as a common weed. The aphid was not introduced at the same time as its host plant in this case because the host plant is an annual, which was imported in the form of seeds. The aphid arrived more than 100 years later, probably on an aeroplane (Holman 1971, Tambs-Lyche and Heie 1973). Another example is provided by *Rhopalosiphoninus latysiphon*,

a pest species particularly damaging to potato. This species was not introduced into Europe until the end of the 1st World War, long after the introduction of its host plant, and was transported with potatoes from the USA. It was subsequently found in Italy (1921), the Netherlands (1930), Germany (1943), England (1945), Switzerland and Austria (1949) (Remaudière 1952).

Finally, we cannot exclude the possibility that some species originating in areas close to Europe may have been transferred into Europe by wind, air streams or windstorms. For example, it is difficult to determine whether *Cinara laportei* and *C. cedri* were transferred with their host, the Atlas cedar, which was planted in Europe, or whether these species colonised Europe following their introduction via wind or air streams.

9.2.6. The ecosystems and habitats most frequently invaded

All aphids are phytophagous and their distribution is limited by the presence of their host plants. Aphid species with a limited spectrum of host plants of exotic origin, not present at natural sites, are restricted to artificial habitats, such as agricultural land, greenhouses and parks and gardens. For example, *Illinoia liriodendri* and *Neophyllaphis podocarpi* feed on exotic trees (*Liriodendron tulipifera* L. and *Podocarpus* spp., respectively). As a result, these aphids are restricted to parks, gardens and city areas in which these trees have been planted in Europe. Similarly, *Cinara cedri* and *C. laportei* which feed specifically on *Cedrus* are restricted to forest areas in which their hosts have been planted. Other species restricted to artificial habitats include tropical and subtropical aphids present only in indoor conditions in Europe. These species were included in the list because it is clear that they have become established in Europe. For example, *Cerataphis* spp., particularly *C. lataniae* and *C. orchidearum* have repeatedly been found in European greenhouses (Chapin and Germain 2005). Similarly, *Sitobion luteum* and *Pentalonia nigronervosa* are considered to have been introduced into hothouses in Europe (Blackman and Eastop 2000). Another subtropical *Cerataphis*, *C. brasiliensis*, has recently been found established outdoors in the south of the France (Chapin and Germain 2005, 2004). Some aphid species have a less limited host range spectrum. They can adapt to new hosts when introduced and may disperse in natural habitats. *Cinara curvipes*, a species recently introduced into Europe, is known to feed on various species of *Abies* in its native area (North America). In Europe, it is found on North American *Abies* species, but also on native *Abies* species and has recently been reported on many other conifers, including *Picea*, *Tsuga*, and *Pinus* (Scheurer and Binazzi 2004). *C. curvipes* is found in parks, gardens and forests. It could potentially colonise all European coniferous forests. Finally, polyphagous aphids, notably *Myzus persicae*, *M. ascalonicus*, *M. ornatus*, *Macrosiphum euphorbiae* and *Aphis gossypi,* have established themselves on many native plants in natural habitats.

Most of the alien aphids seem to have become established in the European environment and habitats. However, some species, such as *Paoliella eastopi* and *Macrosi-*

phum ptericolens have been recorded only once or twice, and it remains unclear whether these species are truly established. Other species, such as *Rhopalosiphum parvae* Hottes & Frison (1931), a North American aphid found in Sicily in 1982 (Barbagallo and Stroyan 1982), or *Tuberocephalus higansakurae hainnevilleae* Remaudière & Sorin, 1993, detected in France in 1990 on trees of *Prunus subhirtella* Miq. var. *pendula* Y.Tanaka imported from Japan (Remaudière and Sorin 1993), have been observed in Europe but have since been eradicated. Such species are not included in our list.

9.2.7. Ecological and economic impact

Most of the alien Aphididae are recognised pests, feeding on crops, ornamental plants and forest trees in Europe. Other alien Aphididae species may have remained undetected because they feed on plants that are not commercially exploited. As for most insects, much more is known about the economic impact of aphids than about their ecological impact. Aphids cause direct (sap-feeding, deformation of their hosts) and indirect (transmission of plant diseases, deposition of honeydew on the leaves) damage.

The economic impact of each species depends on (i) the type and extent of the damage caused and (ii) the economic importance of the host. Of the 102 alien aphid species in Europe, 52 are recognised pests of agricultural and horticultural crops (Blackman and Eastop 2000). The polyphagous species *Myzus persicae*, *Macrosiphum euphorbiae* and *Aphis gossypii* attack a wide range of vegetable crops, both indoors and outdoors. They are vectors of many viral diseases and are probably the aphids with the greatest economic impact in vegetable crops (Lampel and Gonseth 2005).

European orchards are attacked by several alien aphid species. Apple trees can be severely damaged by the North American wolly aphid *Eriosoma lanigerum* and the Asian species *Aphis spiraecola.* The recent introduction of *Toxoptera citricidus* into the Iberian Peninsula (Portugal and Spain) (Ilharco et al. 2005) poses a serious threat to Mediterranean citrus fruit production because this aphid is the principal vector of the *Triteza* closterovirus of *Citrus*. *Citrus* trees in Europe are also the hosts of *Aphis spiraecola* and *Toxoptera aurantii,* two polyphagous species also capable of transmitting this closterovirus, albeit with a lower efficiency.

The recent introduction and rapid dispersion of *Aphis illinoiensis,* a grapevine aphid, poses a particular threat to viticulture in the Mediterranean area (Remaudière et al. 2003, Tsitsipis et al. 2005). Some alien aphids attack agricultural crops, often as potential virus vectors. *Rhopalosiphum maidis* is known as a pest of maize and other grain crops in Europe and transmits the persistent luteovirus "yellow dwarf" virus of barley. The grass aphid, *Hysteroneura setariae* Thomas, 1878, has recently been recorded in Spain (Meliá Masiá 1995). Its impact it difficult to predict because it usually lives on wild grass species, but it may occasionally infect cereals and can transmit several viral diseases to these crops. *Macrosiphum albifrons* is a widespread species in North America that has been introduced into Europe (Stroyan 1981) where the damage it causes to

lupins (Ferguson 1994) has stimulated recent research (Blackman and Eastop 2000). Finally, *Acyrthosiphon kondoi*, which currently has a restricted distribution in Europe, is known to be a serious pest of lucerne (Blackman and Eastop 2000).

Exotic Aphididae are not considered to be serious pests of forest species in Europe (EUROFOR 1994) by contrast to the major damage caused to agricultural and horticultural crops. However, some species may cause economic losses. For example, the North African species *Cinara cedri* and *C. laportei* have been reported to damage plantations of *Cedrus* in southern France (Emonnot et al. 1967, Fabre 1976).

Finally, in addition to their measurable economic impact, some alien aphids may have an aesthetic impact. The production of abundant honeydew and the distortions induced by feeding may significantly modify the appearance of the foliage of ornamental plants in parks and private gardens. *Appendiseta robiniae* has such an aesthetic impact on *Robinia pseudacacia* L., as does *Prociphilus fraxinifolii* on the red ash tree *Fraxinus pennsylvanica* and *Illinoia liriodendri* on *Liriodendron tulipifera*.

9.2.8. Conclusion

There are several possible reasons for the overrepresentation of Aphididae in the alien insect fauna of Europe. First, aphids are phytophagous insects and many are pests of economically important host plants (Blackman and Eastop 2000). For this reason, many studies are carried out on the distribution, taxonomy and biology of this family. New alien species of Aphididae are therefore more likely to be detected than new members of other taxonomic groups, and this effect is enhanced by standard phytosanitary procedures. Second, aphids have the ability to reproduce both parthenogenetically and sexually. Several species can reproduce exclusively by parthenogenesis, and all species can potentially maintain parthenogenetic populations throughout the year in areas of mild climate. Consequently, very few introduction events, and theoretically even the introduction of a single parthenogenetic female, may lead to the development of a population and the establishment of an alien species. Third, although aphids, as a group, are cosmopolitan, they are most strongly represented in temperate regions. Consequently, most of the World's aphids live in climatic conditions similar to those of Europe and are therefore preadapted to establishment where suitable hostplants are present. Moreover, global warming is also likely to promote the survival of alien tropical and subtropical species, at least locally (e.g. along the Mediterranean coast). Finally, aphids are small insects easily transported around the globe with plant materials.

These factors and trends are unlikely to change and the number of introductions of alien Aphididae observed in Europe will probably continue to increase, due to both environmental (climate change) and economic factors (expanding markets and globalisation, and the ever increasing numbers of goods transported and agents of transport).

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Table 9.1.1. List and main characteristics of Aphididae species alien *to* Europe. Status: A: Alien *to* Europe; C: cryptogenic species. Country codes abbreviations refer to ISO 3166 (see appendix I). Habitat abbreviations refer to EUNIS (see appendix II). Only selected references are given. Last update February 2010.

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Acyrthosiphon Acyrthosiphon caraganae Cholodkovsky 1908	A	phyto-phagous	Asia-Temperate	1907, RU	AL, AT, BG, CH, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IT, IT-SIC, LT, LV, MK, NO, NL, NO, PL, RO, RS, RU, SE, SI, SK, UA	F, I2	*Caragana.* other Fabaceae	Cholodkovsky (1907), Hržič (1996), Mordvilko (1914), Petrović (1998), Remaudière (1951), Tashev (1982)
Acyrthosiphon Acyrthosiphon kondoi Shinji, 1938	A	phyto-phagous	Asia-Temperate	< 2004, FR-COR	FR-COR, GR	E, I1	*Medicago*	Eastop (1971), Nieto Nafria e al. (2007), Tsitsipis et al. (2007)
Acyrthosiphon Acyrthosiphon primulae Theoblad 1913	A	phyto-phagous	Asia-Temperate	1913, GB	BG, CH, CZ, DK, ES, FR, DE, GB, GR, IE, IT, IT-SIC, NL, PT, SE, SK	I2, J100	*Primula*	Heie (1994), Remaudière (1952), Theobald (1913), Tsitsipis et al. (2007)
Aloephagus myersi Essig, 1950	A	phyto-phagous	Africa	1937, GB	ES, FR, GB, GR, IT, IT-SIC	I2, J100	*Aloe, Haworthia, Gasteria*	Eastop (1956), Leclant (1978), Micieli De Biase (1988), Tsitsipis et al. (2007)
Aphis Aphis forbesi Weed, 1889	A	phyto-phagous	North America	1928, FR	AL, AT, BE, BG, CH, CZ, DE, DK, EE, ES, FR, HR, HU, IT, LV, MD, PL, RO, RS, SK	I1, J100	*Fragaria*	Balachowsky (1933), Heie (1986), Paillot (1928)
Aphis Aphis gossypii Glover 1877	A	phyto-phagous	Tropical, sub-tropical	<1758 Unknown	AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, ES-BAL, ES-CAN, FI, FR, FR-COR, GB, GR, GR-CRE, HR, HU, IL, IT, IT-SAR, IT-SIC, LT, LV, MD, MK, NO, PL, PT, PT-AZO, PT-MAD, RO, RS, RU, SE, SK, UA	I2, I1, J100, E, F	Polyphagous (mainly Cucurbi-taceae, Rutaceae and Malvaceae)	Blackman and Eastop (2006), Buckton (1879), Theobald (1927), Tschorbadjiev (1924), Vasilev (1910)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Aphis Aphis illinoisensis Shimer 1866	A	phyto-phagous	North America	2005, GR-CRE	GR-CRE, ME	FB	*Vitis*	Petrović-Obradović et al. (in press), Tsitsipis et al. (2005)
Aphis Aphis spiraecola Patch, 1914	A	phyto-phagous	Asia-Temperate	1961, PT	AT, BG, CH, DE, ES, ES-BAL, ES-CAN, FR, FR-COR, GB, GR, HR, IL, IT, IT-SAR, IT-SIC, MT, PT, PT-AZO, PT-MAD, RS, UA	E, I2, FA, FB, G	Polyphagous (*Citrus*, apple, *Spiraea*)	Blackman and Eastop (2000), Blackman and Eastop (2007), Ilharco (1968b)
Aphis Aphis spiraephaga F.P. Müller, 1961	A	phyto-phagous	Asia-Temperate	1955, CZ	AL, AT, CH, CZ, DE, DK, ES, FI, FR, HR, HU, IT-SIC, LT, LV, MD, MK, PL, PT, RO, RU, SE, SI, SK, UA	I2	*Spiraea*	Heie (1986), Holman (1971), Ilharco (1968b), Ilharco (1973), Tashev (1964)
Aphis Aphis spiraephila Patch, 1914	A	phyto-phagous	North America	1955 UA	UA	I2	*Spiraea*	Holman (1971), Nieto Nafria et al. (2007)
Aphis Bursaphis oenotherae oenotherae Oestlund 1887	A	phyto-phagous	North America	1972, DE	FR, DE, GB, IT-SIC, PL, RS	G3, I2	*Oenothera*	Barbagallo (1994), Műller (1974)
Aphis catalpae Mamontova, 1953	A	phyto-phagous	Asia	0	HU, UA	I2	*Catalpa*	Mamontova (1955), Petrović-Obradović et al. (in press), Ripka (2001)
Appendiseta robiniae (Gillette, 1907)	A	phyto-phagous	North America	1978, IT	BE, BG, CH, CZ, DE, ES, ES-BAL, FR, FR-COR, GB, GR, HR, HU, IT, IT-SIC, NL, RS, SK	I2, G5	*Robinia*	Arzone and Vidano (1990), Lampel (1983), Leclant and Remaudière (1986), Micieli De Biase and Calambuca (1979), Pati and Tomatore (1988), Petrović (1998)
Brachycaudus Mordvilkomemor rumexicolens (Patch, 1917)	A	phyto-phagous	North America	1953, GB	BE, CZ, DE, DK, ES, ES-CAN, FI, FR, GB, IT, IT-SAR, IT-SIC, MK, NL, NO, PL, PT, PT-MAD, RO, RU, SE, SK, UA	H5, I1	*Rumex;* other Polygonaceae	Barbagallo (1994), Barbagallo and Stroyan (1982), Heie (1973), Holman (1965), Ilharco (1974), Stroyan (1956)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Cerataphis brasiliensis (Hempel, 1901)	A	phyto-phagous	Asia-Tropical	1981, PT-MAD	ES-CAN, FR, PT-MAD	I2, J100	Palms	Chapin and Germain (2005), Germain and Chapin (2004), Ilharco (1984), Pérez Hidalgo et al. (2000)
Cerataphis lataniae (Boisduval, 1867)	A	phyto-phagous	Asia-tropical	1867, FR	CZ, ES-CAN, DE, FR, GB, IT, PL	I2, J100	*Areca, Musa*	Boisduval (1867), Chapin and Germain (2005), Pérez Hidalgo et al. (2000)
Cerataphis orchidearum (Westwood, 1879)	A	phyto-phagous	Asia-Tropical	1906, BE	BE, ES, FI, FR, GB, HU, PT-MAD, RU, SE	J100	Orchids	Germain and Chapin (2004), Heie (1980), Ilharco (1973), Ilharco (1974), Schouteden (1906)
Chaetosiphon Pentatrichopus fragaefolii (Cockerell, 1901)	A	phyto-phagous	North America	1912, GB	AT, BE, BG, CH, CZ, ES, ES-CAN, FR, DE, GB, HR, HU, IE, IL, IT-SIC, IT, LV, MK, NL, NO, PT, PT-AZO, PT-MAD, RO, RS, SI	I1, J100	*Fragaria*	Balachowsky (1933), Theobald (1912)
Chaitophorus populifolii (Essig, 1912)	A	phyto-phagous	North America	1956, DE	DE, RS	I2	*Populus*	Pintera (1987), Poljaković-Pajnik and Petrović-Obradović (2009)
Chaitophorus saliapterus quinquemaculatus Bozhko 1976	A	phyto-phagous	Asia	1953,UA	IT, UA	F9	*Salix*	Binazzi and Barbagallo (1991), Bozhko (1976), Pintera (1987)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Chromaphis juglandicola (Kaltenbach, 1843)	A	phyto-phagous	Asia-Temperate	< 1758 Unknown	AT, BE, BG, CH, CZ, DE, DK, ES, ES-CAN, FR, FR-COR, GB, HR, HU, IL, IT, IT-SAR, IT-SIC, MD, MK, PL, PT-AZO, PT-MAD, PT, RO, RS, SE, SI, SK, UA	I2, G5	*Juglans*	Balachowsky and Mesnil (1935), Heie (1982), Kaltenbach (1843), Schouteden (1906), Theobald (1927)
Cinara Cedrobium laportei (Remaudière, 1954)	A	phyto-phagous	Africa	1967, FR	ES, FR, GB, IT, IT-SAR, IT-SIC, NL, PT, SI	G3, G5, I2	*Cedrus*	Covassi (1971), Emonnot et al. (1967), Leclant (1978)
Cinara Cinara cedri Mimeur, 1936	A	phyto-phagous	Africa	1974,IT	BE, CH, DK, ES, FR, GB, HR, HU, IL, IT, IT-SAR, IT-SIC, RS, SI	I2, G5	*Cedrus*.	Covassi and Binazzi (1974), Fabre (1976)
Cinara Cinara curvipes (Patch, 1912)	A	phyto-phagous	North America	1999, GB	CZ, CH, DE, GB, RS, SK, SL	I2	*Abies*	Angst et al. (2007), Jurc et al. (2009), Martin (2000), Poljaković-Pajnik and Petrović-Obradović (2002), Scheurer and Binazzi (2004)
Drepanaphis acerifoliae (Thomas, 1878)	A	phyto-phagous	North America	1992, IT	IT , ES	I2	*Acer*	Lozzia and Binaghi (1992), Pérez Hidalgo et al. (2008)
Ericaphis scammelli Mason 1940	A	phyto-phagous	North America	1964, GB	FR, GB, IT, NL	I1, I2	*Vaccinium*	Barbagallo et al. (1999), Barbagallo et al. (1998), Prior (1971)
Ericaphis wakibae (Hottes, 1934)	A	phyto-phagous	North America	1963, GB	CZ, GB	I1, B3	*Fragaria*	Stroyan (1972)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Eriosoma lanigerum (Hausmann, 1802)	A	phyto-phagous	North America	1787, GB	AL, AT, BE, BG, CH, CY, CZ, DE, DK, ES, ES-CAN, FR, DE, GB, GR, HR, HU, IE, IL, IT, IT-SAR, IT-SIC, LT, LV, MD, NO, PL, PT, PT-AZO, PT-MAD, RO, RU, RS, SE, SI, SK, UA	I, I1	*Malus*; orchard trees	Balachowsky and Mesnil (1935), Marchal (1928)
Essigella Essigella californica (Essig, 1909)	A	phyto-phagous	North America	1988, FR	ES,FR, IT, IT-SAR, IT-SIC, PT-MAD	G5, I2	*Pinus radiata, P. pinaster*	Aguiar and Ilharco (2001), Turpeau and Remaudière (1990)
Greenidea Greenidea ficicola Takahashi 1921	A	phyto-phagous	Asia-Tropical	2004, IT	ES, IT, IT-SIC	I2	*Ficus*	Barbagallo et al. (2005a), Mifsud (1998)
Hysteroneura setariae (Thomas, 1878)	A	phyto-phagous	North America	1982, PT-MAD	ES, PT-MAD	E, I	*Prunus*, fruit trees, Graminae	Blackman and Eastop (2006), Meliá Masiá (1995), Van Harten (1982)
Idiopterus nephrelepidis Davis, 1909	A	phyto-phagous	Tropical, sub-tropical	1915, GB	BE, CH, CZ, DE, DK, ES, ES-CAN, FR, GB, GR, IE, IL, IT, IT-SIC, NL, PL, PT, PT-AZO, PT-MAD, PT, RU, SE, SI, SK	I2, J1, J100	Tropical ferns indoors	Heie (1994), Laing (1923), Theobald (1926), Tsitsipis et al. (2007)
Illinoia Illinoia andromedae (MacGillivray, 1958)]	A	phyto-phagous	North America	1960, GB	GB	I2	Asteraceae	Eastop (1962), Stroyan (1964)
Illinoia Illinoia azaleae Mason, 1925	A	phyto-phagous	North America	1950, GB	AT, CH, CZ, DK, ES, FI, FR, DE, GB, HU, IT, IT-SIC, NL, PL, PT, PT-AZO, PT-MAD, RO, RU, SE, SI	I2, J100	*Rhododendron*; Ericaceae	Biurrun and Nieto Nafría (1987), Heie (1995), Ilharco (1968b), Stroyan (1950)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Illinoia Illinoia goldamaryae (Knowlton, 1938)	A	phyto-phagous	North America	1960, GB	GB	I2, J100	Astereacae (*Aster, Erigero., Solidago*)	Eastop (1962), Stroyan (1964), Ward (1961)
Illinoia Illinoia liriodendri (Monell, 1879)	A	phyto-phagous	North America	1998, FR	DE, FR, GB, IT, SI	G5, I2	*Liriodendron*	Limonta (2001), Rabasse et al. (2005b)
Illinoia Illinoia morrisoni (Swain, 1918)	A	phyto-phagous	North America	1960, GB	FR, GB	I2	*Cupressus*	Eastop (1962), Prior (1975), Rabasse et al. (2005b) Stroyan (1964)
Illinoia Masonaphis lambersi (MacGillivray, 1960)	A	phyto-phagous	North America	1971, NL	BE, CH, CZ, DK, GB, NL, NO, PT-MAD, SK	I2	*Rhododendron, Kalmia*	Aguiar and Ilharco (2001), Heie (1995), Hille Ris Lambers (1973), Stroyan (1971), Stroyan (1972)
Illinoia Masonaphis rhododendri (Wilson, 1918)]	A	phyto-phagous	North America	1939, GB	GB, NL, SK	I2, J100	*Rhododendron*	Eastop (1956), Heie (1994), Stroyan (1950)
Impatientinum Impatientinum asiaticum Nevsky 1929	A	phyto-phagous	Asia-Temperate	1967, RU	AT, CH, CZ, DE, DK, EE, FI, FR, GB, LV, PL, RO, RU, SE, SI, SK	G, I2, X25	*Impatiens*	Heie (1994), Holman (1971), Ilharco (1968b), Tambs-Lyche and Heie (1973)
Iziphya flabella (Sanborn, 1904)	A	phyto-phagous	North America	1954, DE	DE, UA	I2	*Carex*	Quednau (1954)
Macrosiphoniella Macrosiphoniella sanborni (Gillette, 1908)	A	phyto-phagous	Asia-Temperate	1907, PT	AL, AT, BE, BG, CH, CY, CZ, DK, ES, ES-CAN, FI, FR, DE, GB, GR, HR, IE, IL, IT, IT-SIC, LT, LV, MD, NO, PL, PT, PT-AZO, PT-MAD, RO, RS, RU,SE, UA	I2, J100	*Chrysan-themum*	Balachowsky and Mesnil (1935), Del Guercio (1911), Del Guercio (1913), Holman (2009), Ilharco (1968b), Ilharco (1974), Theobald (1926)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Macrosiphum Macrosiphum albifrons Essig, 1911	A	phyto-phagous	North America	1981, GB	AT, BE, CH, DE, FR, GB, GR, IE, IT, IT-SIC, SE	I1, I2	*Lupinus, Fragaria*	Carter et al. (1984), Hullé et al. (1998), Meier and Schweizer (1987), Piron (1987), Stroyan (1981)
Macrosiphum Macrosiphum euphorbiae (Thomas, 1878)	A	phyto-phagous	North America	1917, GB	AL, AT, BE, BG, CH, CZ, DK, EE, ES, ES-CAN, FI, FR, FR-COR, DE, GB, GR, HR, HU, IS, IE, IL, IT, IT-SAR, IT-SIC, LT, LV, MD, MK, MT, NO, PL, PT, PT-AZO, PT-MAD, RO, RS, RU, SE, SI, SK, UA	E, F, I, J, J100	Polyphagous (vegetables, *Fragaria*)	Blackman and Eastop (2000), Eastop (1958)
Macrosiphum Macrosiphum ptericolens Patch, 1919	A	phyto-phagous	North America	1972, GB	GB, PL	G	*Pteridium aquilinum* (bracken)	Holman (2009), Lawton and Eastop (1975)
Megoura lespedezae (Essig & Kuwana, 1918)	A	phyto-phagous	Asia-Temperate	1994, CH	CH	I1	Polyphagous (vegetables; *Lespedeza*, Japanese clover)	Giacalone and Lampel (1996)
Melanaphis bambusae (Fullaway, 1910)	A	phyto-phagous	Asia-Temperate	1961, IT	ES, FR, GR, IT-SIC, IT, PT, PT-MAD, RS	I2	*Bambusa*	Hille Ris Lambers (1966), Nieto Nafria et al. (2007)
Melaphis rhois (Fitch, 1866)	A	phyto-phagous	North America	1902, GB	GB, SE	I2	*Rhus*	Blackman and Eastop (1994), Theobald (1918), Theobald (1929)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Monellia caryella (Fitch, 1855)	A	phyto-phagous	North America	1985, ES	IL, ES	G5	*Juglans, Carya*	Hermoso de Mendoza (1988), Nieto Nafría and Mier Durante (1998)
Monelliopsis caryae (Monell ex Riley & Monell, 1879)	A	phyto-phagous	North America	1984, FR	ES, FR, HU, IL, IT, PT	G5	*Juglans, Carya*	Hullé et al. (1998), Mier Durante and Pérez Hidalgo (2002)
Monelliopsis pecanis Bissell, 1983	A	phyto-phagous	North America	1995, PT-MAD	IT-SIC, PT-MAD	G5	*Carya*	Aguiar and Ilharco (1997), Barbagallo and Suma (1999)
Myzaphis turanica Nevsky, 1929	C	phyto-phagous	Crypto-genic	1976, ES	ES,FR, GB, IT-SIC, SE	I2	*Rosa rugosa*	Meliá Masiá (1998), Patti (1983)
Myzocallis Lineomyzocallis walshii (Monell ex Riley & Monell, 1879)	A	phyto-phagous	North America	1988, FR	BE, CH, CZ, DE, ES, FR, HU, IT, IT-SIC, RS	G, I2	*Quercus rubra*	Hullé et al. (1998), Petrović-Obradović et al. (2007), Remaudière (1989)
Myzus Myzus hemerocallis Takahashi, 1921	A	phyto-phagous	Asia-Temperate	1990, FR	FR, PT-MAD	I2	*Hemerocallis*	Aguiar and Ilharco (1997), Remaudière and Munoz Viveros (1992)
Myzus Myzus ornatus Laing, 1932	A	phyto-phagous	Asia-Temperate	1932 GB	AL, AT, BE, BG, CH, CZ, DE, DK, EE, ES, ES-CAN, FI, FR, FR-COR, GB, GR, HR, HU, IE, IT, IT-SAR, IT-SIC, LV, NO, PL, PT, PT-AZO, PT-MAD, RO, RS, RU, SE, SI, SK	I, J100, X8	Polyphagous (*Prunus cornuta*-primary host); many herbaceous plants and vegetables-secondary host)	Blackman and Eastop (2000), Ilharco (1969), Laing (1932)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Myzus Myzus varians Davidson, 1912	A	phyto-phagous	Asia-Temperate	1946, CH	AL, AT, BA, BE, BG, CH, CZ, DE, ES, FR, FR-COR, MK, DE, GB, GR, HR, HU, IT, IT-SIC, PL, RO, RS, RU, SI, SK	I2, G5	*Prunus persicae, Clematis*	Blackman and Eastop (2000), Börner (1952), Hille Ris Lambers (1947)
Myzus Nectarosiphon ascalonicus Doncaster, 1946	A	phyto-phagous	Asia-Temperate	1941, GB	AL, AT, BE, BG, CH, CZ, DE, DK, ES, ES-CAN, FI, FR, MK, DE, GB, GR, HR, IE, IS, IT, LT, LV, NL, NO, PL, PT, PT-AZO, RO, RS, RU, SE, SK	I2, E	*Fragaria, Allium*	Börner (1952), Doncaster (1946)
Myzus Nectarosiphon persicae Sulzer 1776	C	phyto-phagous	Crypto-genic	<1758 Unknown	AL, AT, BE, BG, CH, CY, CZ, DK, EE, ES, ES-BAL, ES-CAN, FI, FR, FR-COR, MK, DE, GB, GR, GR-CRE, HR, HU, IE, IT, IT-SAR, IT-SIC, LT, LV, ME, MD, MT, NO, PL, PT, PT-AZO, PT-MAD, RO, RU, RS, SE, SI, SK, UA	G5	Polyphagous	Balachowsky and Mesnil (1935), Blackman and Eastop (2000), Boisduval (1867), Buckton (1876), Koch (1855), Macchiati (1883), Schouteden (1906), Theobald (1926)
Myzus Sciamyzus cymbalariae Stroyan, 1954	C	phyto-phagous	Crypto-genic	1950, GB	BE, CH, CZ, DE, ES, FR, GB, GR, IT, PT-AZO, PT-MAD	I	Polyphagous	Blackman and Eastop (2000), Ilharco (1974), Stroyan (1954)
Nearctaphis bakeri (Cowen ex Gillette & Baker, 1895)	A	phyto-phagous	North America	1964,FR	AL, CH, ES, ES-BAL, FR, DE, GB, GR, IT, IT-SIC, PT, PT-AZO, SK UA	I, E	Maloideae (primary hosts) and Fabaceae (secondary hosts; e.g. *Trifolium*)	Heie (1992), Leclant (1967), Stroyan (1972)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Neomyzus circumflexus Buckton 1876	A	phyto-phagous	Asia	1876, GB	AL, AT, BE, BG, CH, CZ, DE, DK, EE, ES, ES-CAN, FI, FR, FR-COR, GB, HR, HU, IE, IT, IT-SIC, LT, LV, MD, NL, NO, PL, PT, PT-AZO, PT-MAD, RO, RU, SE, UA	I2, J100	Polyphagous flower crops	Blackman and Eastop (2000), Buckton (1876), Ilharco (1969)
Neophyllaphis podocarpi Takahashi, 1920	A	phyto-phagous	Asia-Temperate	1990, IT	IT	I2	*Podocarpus*	Limonta (2001)
Neotoxoptera formosana (Takahashi, 1921)	A	phyto-phagous	Asia	1994, FI	DE, FI, FR, GB, IT, NL, PT-MAD	I1, J1, J100	*Allium*	Aguiar and Ilharco (2001), Barbagallo Ciampolini (2000), Blackman and Eastop (2000)
Neotoxoptera oliveri (Essig, 1935)	A	phyto-phagous	Asia-Temperate	1959, PT	ES, FR, IT-SIC, PT-MAD, PT, RS	I1, J100	*Viola, Allium*	Ilharco (1960), Ilharco (1968b)
Neotoxoptera violae (Pergande, 1900)	A	phyto-phagous	Asia-Temperate	1939, IT	ES, ES-CAN, FR, IT IT-SIC	I2	*Viola*	Barbagallo and Coccuzza (1998), Germain and Deogratias (2008) Silvestri (1939)
Panaphis juglandis (Goeze, 1778)	A	phyto-phagous	Asia	<1758 unknown	AL, AT, BE, BA, BG, CH, CZ, DK, ES, ES-CAN, FR, FR-COR, DK, GB, GR, HR, HU, IL, IT-SIC, IT, MD, PL, PT, RO, RS, SE, SI, SK, UA	I2, G5	*Juglans*	Blanchard (1840), Goeze (1778), Ilharco (1968a), Kaltenbach (1843), Malkov (1908), Schouteden (1906), Walker (1848)
Paoliella eastopi Hille Ris Lambers, 1973	A	phyto-phagous	Africa	<2004, GB	GB	U	Passionfruit in native range (Kenya)	Nieto Nafria et al. (2007)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Pemphigus Pemphigus populitransversus Riley ex Riley & Monell, 1879	A	phyto-phagous	North America	1966, PT-MAD	GB, PT-AZO, PT-MAD	I2, F	*Populus*	Blackman and Eastop (1994), Ilharco (1974)
Pentalonia nigronervosa Coquerel, 1859	A	phyto-phagous	Tropical, subt-ropical	1922, GB	DK, DE, GB, IL, IT, NL, PT-AZO, ES-CAN	J100	*Musa* (preferred); Poly-phagous on tropical and subtropical ornamental plants	Cairaschi (1942), Sűss (1972–73)
Periphyllus californiensis (Shinji, 1917)	A	phyto-phagous	Asia-Temperate	1932, GB	HR, DK, DE, GB, IT, NL, CH	I2, G5	*Acer*	Blackman and Eastop (1994), Doncaster (1954), Eastop (1956),
Prociphilus Meliarhizophagus fraxinifolii Riley ex Riley & Monell, 1879	A	phyto-phagous	North America	2003, HU	BG, HU, RS	G, G5	*Fraxinus*	Petrović-Obradović et al. (2007), Remaudière and Ripka (2003)
Pterochloroides persicae (Cholodkovsky, 1899)	A	phyto-phagous	Asia-Temperate	1975, IT	AL, BG, CY, ES, FR, GR, IT, IT-SIC, RO, RS, UA	I2, G5	*Prunus*; fruit trees (peach)	Ciampolini and Martelli (1977), Petrović and Milanović (1999), Roberti (1975), Velimirovic (1976)
Pterocomma pseudopopuleum Palmer, 1952	A	phyto-phagous	North America	<2004, UA	EE, UA	G	Populus	Nieto Nafria et al. (2007)
Reticulaphis distylii vand der Goot 1917	A	phyto-phagous	Asia-Temperate	1998, PT	ES, PT	I2, G5	Ficus	Barbagallo et al. (2005b)
Rhodobium porosum (Sanderson, 1900)	A	phyto-phagous	Tropical, sub-tropical	1934, ES	AL, AT, BA, BG, CH, CZ, DE, DK, ES, ES-CAN, FI, FR, GB, GR, HU, IL, IT, IT-SIC, LV, NL, PL, PT, PT-MAD, RO, RS, SE, SI, SK	I2, J100	*Fragaria, Rosa* (in greenhouses in Central Europe)	Ilharco (1969), Mimeur (1936), Tashev (1964)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Rhopalosiphoninus Rhopalosiphoninus latysiphon (Davidson, 1912)	A	phyto-phagous	North America	1921, IT	AL, AT, BE, BG, CH, CZ, DE, ES, FR, GB, GR, HR, IT, IT-SIC, NL, PL, PT, PT-AZO, PT-MAD, RO, RU	I1	*Solanum;* polyphagous on vegetables (*Beta, Fragaria, Ipomea*) and flowers (*Gladiolus*)	Blackman and Eastop (2000), Remaudière (1952), Tashev (1961)
Rhopalosiphum insertum (Walker, 1849)	A	phyto-phagous	North America	1848 GB	AL, AT, BY, BE, BG, CH, CZ, DE, DK, EE, ES, ES-CAN, FI, YU, FR, FR-COR, DE, GB, GR, HU, IE, IT, LT, LV, MD, NL, NO, PL, PT, PT-AZO, PT-MAD, RO, RU, RS, SE, SI, SK, UA	I1, E	Graminae (*Poa, Festuca, Juncus*)	Blackman and Eastop (2000), Dospevski (1910), Ilharco (1968a), Walker (1849)
Rhopalosiphum maidis (Fitch, 1856)	A	phyto-phagous	Asia	1903, IT	AL, BE, BG, CH, CY, CZ, DE, DK, ES, ES-CAN, FI, ,FR, FR-COR, GB, GR, GR-CRE, HU, IT-SAR, IT-SIC, IT, LV, MD, NL, NO, PL, PT, PT-AZO, PT-MAD, RO, RS, RU, SE, ES, SK, UA	I1, E	Maize, sorghum; other crops	Blackman and Eastop (2000), Del Guercio (1913), Del Guercio (1917), Dospevski (1910), Eastop (1956), Heie (1986), Ilharco (1961)
Rhopalosiphum rufiabdominale (Sasaki, 1899)	A	phyto-phagous	Asia-Temperate	1960 PT	BG, DK, ES, FI, FR, GR, IT, IT-SIC, PT, PT-AZO, PT-MAD, RU, UA	I1	Rice roots, Gramineae	Blackman and Eastop (2006), Heie (1986), Ilharco (1968a), Ilharco (1973)
Sipha Sipha flava (Forbes, 1884)	A	phyto-phagous	North America	1979, PT-AZO	AL, PT-AZO	I1	Sugarcane	Sousa-Silva and Ilharco (1995)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Siphonatrophia cupressi Swain, 1918	A	phyto-phagous	North America	1999, FR	FR, IT	G5, I2, FA	*Cupressus*	Rabasse et al. (2005a)
Sitobion Sitobion alopecuri (Takahashi, 1921)	A	phyto-phagous	Asia-Temperate	<2004, GB	GB, NL	I2, E	Graminae	Blackman and Eastop (2006), Nieto Nafria ei al. (2007)
Sitobion Sitobion luteum (Buckton, 1876)	C	phyto-phagous	Crypto-genic	1875 GB	BE, DE, FR, GB, PT-MAD	J100	Orchidaceae, Bromeliaceae, Araceae	Blackman and Eastop (2006), Buckton (1876), Del Guercio (1911) Schouteden (1906)
Stomaphis mordvilkoi Hille Ris Lambers, 1933	A	phyto-phagous	Asia-Tropical	1980, IT	IT	G	*Juglans*	Colombo (1981)
Takecallis arundicolens (Clarke, 1903)	A	phyto-phagous	Asia-Temperate	1923, GB	CH, DE, ES, FR, GB, IE, IT, PT	I2	Bamboos	Hille Ris Lambers (1947), Ilharco (1969), Laing (1923), Stroyan (1964), Stroyan (1977), Theobald (1927)
Takecallis arundinariae (Essig, 1917)	A	phyto-phagous	Asia-Temperate	1961, GB	CH, DE, ES, GB, GR, IT, IT-SIC, PT-MAD	I2	Bamboos	Giacalone and Lampel (1996), Pati and Tomatore (1988), Stroyan (1964), Stroyan (1977)
Takecallis taiwana (Takahashi, 1926)	A	phyto-phagous	Asia-Temperate	1923, GB	CH, DE, ES, FR, GB, HR, IT, IT-SIC	I2	Bamboos (*Phyllostachys*)	Giacalone and Lampel (1996), Limonta (1990), Stroyan (1964)
Tinocallis Sappocallis nevskyi Remaudière, Quednau & Heie, 1988	A	phyto-phagous	Asia-Temperate	1978, PL	AT, BE, CH, CZ, DE, DK, FI, GB, HU, IT, NL, PL, SE	G, G5, I2, FA	*Ulmus*	Remaudière et al. (1988), Szelegiewicz (1978), Van Harten and Coceano (1981)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Tinocallis Sappocallis saltans (Nevsky, 1929)	A	phyto-phagous	Asia-Temperate	1976,RO	ES, FR, HU, IT, IT-SIC, MD, NL, PL, RO, RU, UA	G, G5, I2	*Ulmus*	Holman and Pintera (1981), Hullé et al. (1998), Remaudière et al. (1988), Van Harten and Coceano (1981)
Tinocallis Sappocallis takachihoensis Higuchi 1972	A	phyto-phagous	Asia-Temperate	1985, FR	ES, FR, IT, IT-SIC	G, G5, I2	*Ulmus*	Hullé et al. (1998), Leclant and Renoust (1986), Leclant and Remaudière (1986)
Tinocallis Sarucallis kahawaluokalani (Kirkaldy, 1906)	A	phyto-phagous	Asia-Temperate	1984, IT	DE, ES, FR, GR, IT, IT-SIC, ME	I2, G5	*Lagerstroemia indica*	Arzone and Vidano (1990), Leclant and Renoust (1986), Ossiannilsson (1959), Pati (1984), Petrović-Obradović et al. (in press)
Tinocallis Tinocallis ulmiparvifoliae Matsumura, 1919	A	phyto-phagous	Asia-Temperate	1973, GB	ES, GB, IT	I2, J100	*Ulmus*	Lucchi and Pollini (1995), Pérez Hidalgo and Nieto Nafria (2005), Prior (1971), Stroyan (1977)
Tinocallis Tinocallis zelkowae (Takahashi, 1919)	A	phyto-phagous	Asia-Temperate	1973, GB	FR, GB	I2, J100	*Zelkova*	Prior (1971), Stroyan (1977)
Toxoptera aurantii Boyer de Fonscolombe 1841	A	phyto-phagous	Tropical, sub-tropical	1841 FR	AL, BE, CH, CY, DE, ES, ES-BAL, FR, FR-COR, GB, GR, HR, IL, IT, IT-SAR, IT-SIC, ME, MT, PT-AZO, PT-MAD, PT, RO	I, G5, J100	Polyphagous (mainly *Citrus*)	Boyer de Foscolombe (1841), Del Guercio (1917), Passerini (1861), Stroyan (1984), Tavares (1900)

Species	Status	Feeding Regime	Native range	1st record in invaded areas	Invaded countries	Habitat	Hosts	References
Toxoptera citricidus Kirkaldy 1906	A	phyto-phagous	Tropical, sub-tropical	1994, PT-MAD	ES, PT, PT-MAD	I, G5	*Citrus*	Aguiar et al. (1994), Ilharco et al. (2005)
Trichosiphonaphis Xenomyzus polygonifoliae (Shinji, 1944)	A	phyto-phagous	Asia-Temperate	1990, FR	FR, GB, HU, IT, RS, UA	I2	*Lonicera, Polygonum*	Coceano and Petrovic-Obradovic (2006), Petrović-Obradović et al. (in press), Remaudière et al. (1992)
Tuberculatus Nippocallis kuricola (Matsumura, 1917)	A	phyto-phagous	Asia-Temperate	1981, PT-MAD	ES, PT, PT-AZO, PT-MAD	G1, I2	*Castanea, Quercus*	Ilharco (1984), Pedro Mansilla et al. (2001)
Uroleucon Lambersius erigeronense (Thomas, 1878)	A	phyto-phagous	North America	1952, FR	AT, BE, CH, CZ, DE, DK, ES, FI, FR, GB, GR, HU, IT, IT-SIC, LV, MD, NL, PL, PT-MAD, RO, RS, SE, SI, RK	J, J6	Asteraceae (*Erigeron, Coniza*)	Blackman and Eastop (2006), Heie (1995), Remaudière (1954)
Uroleucon Uroleucon pseudoambrosiae (Olive, 1963)	A	phyto-phagous	North America	<2004	PL	I	Asteraceae *(*Mainly *Lactuca* spp.*)*	Blackman and Eastop (2000), Blackman and Eastop (2006), Nieto Nafria et al. (2007)
Utamphorophora humboldti (Essig, 1941)	A	phyto-phagous	North America	1974, GB	FR, GB, GR, IE	I2	*Physocarpus*, Poaceae	Hullé et al. (1998), Prior (1975), Tsitsipis et al. (2007)
Wahlgreniella arbuti (Davidson, 1910)	A	phyto-phagous	North America	1905, PT	ES, ES-BAL, FR, FR-COR, GB, GR, IT, IT-SAR, IT-SIC, NL, PT, PT-MAD	I2, F6	*Arbutus, Arctostaphylos*	Heie (1995), Ilharco (1969), Tavares (1905), Tsitsipis et al. (2007)
Wahlgreniella nervata (Gillette, 1908)	A	phyto-phagous	North America	1973, GB	AT, BE, ES, ES-CAN, FR, GB, GR, IT-SIC	I2	*Rosa*	Blackman and Eastop (2006), Prior (1975), Tsitsipis et al. (2007)