

FIRST CHECKLIST OF THE DUTCH JUMPING PLANT LICE SINCE 93 YEARS (HEMIPTERA: PSYLLOIDEA)

Kees den Bieman, Igor Malenovsky, Daniel Burckhardt & Theodoor Heijerman

For a long time, Dutch entomologists showed limited interest in jumping plant lice (or psyllids). The most recent species list of the Netherlands dates back to 1926. Since then only a few short papers have appeared. This is surprising as some species are important agricultural pests. The pear psyllid causes harvest loss worth several tens of million euros every year. We critically checked previous reports on Dutch psyllids. Twenty-seven species are reported here for the first time from the Netherlands and 13 species are omitted from the list. This brings the number of confirmed, established psyllid species to 69.

INTRODUCTION

Psyllids or jumping plant lice (Hemiptera: Sternorrhyncha: Psylloidea) (fig. 1, 2) are a small group of around 4000 species worldwide. Fauna Europaea lists almost 400 species in Europe (Burckhardt 2013). Adult psyllids range from 1-10 mm in body length. They are always winged (with usually two pairs of wings) with a characteristic venation. The head bears short to very long antennae, usually with ten segments and a pair of terminal setae. The hind legs are modified for jumping, with the metacoxae generally greatly enlarged and fused to the metathorax. Psyllid immatures (fig. 3, 4) look quite different from the

adults, as they are usually dorso-ventrally flattened. There are five instars, the last three have distinct wing buds. The immatures are mobile, but often moving only up to a few centimeters on the hostplant (Ossiannilsson 1992, White & Hodkinson 1982).

FEEDING

Psyllids feed on phloem sap of vascular plants. The great majority of species are narrowly host-specific, i.e. for their development they are dependent on one (= monophagous) or a few closely related (= narrowly oligophagous) plant species



Figure 1. *Trioza urticae*. France, Marly-le-Roi (Yvelines), 19.IV.2013. Photo Gernot Kunz.

Figuur 1. *Trioza urticae*. Frankrijk, Marly-le-Roi (Yvelines), 19.IV.2013. Foto Gernot Kunz.



Figure 2. *Cacopsylla fulguralis*. Koudekerke (province of Zeeland). Photo Albert de Wilde.
 Figuur 2. *Cacopsylla fulguralis*. Koudekerke (Zeeland). Foto Albert de Wilde.

(Burckhardt et al. 2014b, Hodkinson 1974a). Closely related psyllid species often develop on related plant taxa, suggesting co-speciation between psyllids and their host plants (Ouvrard et al. 2015b). Adult psyllids are more mobile than the immatures and can be found on other plant species than their hosts, including shelter plants (often conifers) used by many psyllid species for overwintering (Burckhardt et al. 2014b, Hodkinson 2009). True polyphagy is known from less than a handful of *Bactericera* species, e.g. *B. cockerelli* (Šulc, 1909) and *B. nigricornis* (Foerster, 1848) (Triozidae), and *Russelliana solanicola* Tuthill, 1959 (Psyllidae) (Burckhardt & Lauterer 1997b, Hodkinson 1981, Ouvrard et al. 2015b, Serbina et al. 2015a).

The plant families which host most psyllids are perennial dicots like Fabaceae, Myrtaceae, Asteraceae, Rutaceae and Anacardiaceae (Ouvrard et al. 2015b). Those associated with monocots, such as the Holarctic *Livia* (Liviidae) on *Juncus* and *Carex* species (Hodkinson & Bird 2000), or conifers, such as the Neotropical *Ehrendorferiana* (Psyllidae) on *Austrocedrus* and *Fitzroya* (Cupressaceae) (Burckhardt 2005b), are exceptions. No psyllids are known from mosses, ferns and related groups (Ouvrard et al. 2015b).

OVIPOSITION

Psyllids deposit their eggs one by one or in clusters on the host plant. Depending on the species, eggs are laid on the new buds, in crevices of the bark or on leaves. Immatures of many species prefer specific feeding sites and are usually concentrated on parts with active growth: new leaves, flowers and sometimes even roots (Lauterer & Baudyš 1968). Immatures secrete wax and honeydew, sometimes in large quantities.

GALLS

Gall-inducing species are well-represented among the Psylloidea, but their distribution is taxonomically and geographically uneven (Burckhardt 2005a). For example, species of the large genus *Cacopsylla* (Psyllidae) only rarely induce galls, whereas most of the *Livia* species and many *Calophya* species (Calophyidae) do. Psyllid galls (fig. 5, 6) are known since the 16th century (Conci 1998, Weeda et al. 1994). The systematics, biology and ecology of cecidogenous psyllids were reviewed by Hodkinson (1984) and Burckhardt (2005a), including references to the most important historical literature, description of the types of galls, the physiology of gall induction and ecological and economic aspects of psyllid galls.



Figure 3. Immature of *Trioza remota* on *Quercus petraea*, Czech Republic, Brno-Bohunice, IX.2014. Photo Igor Malenovský.

Figuur 3. Larve van *Trioza remota* op *Quercus petraea*, Tsjechië, Brno-Bohunice, IX.2014. Foto Igor Malenovský.

COMMUNICATION

Psyllids communicate with substrate-born vibrations. These signals are surprisingly diverse (Eben et al. 2015, Percy 2005, Tishechkin 2006b). They are the primary mechanism for mate recognition and mate location (Percy et al. 2006). Tishechkin (1989, 2006a, 2007a,b) and Eben et al. (2015) described acoustic behaviour and illustrated sounds of several European species.

PESTS

Burckhardt (1994) and Percy (2014) present reviews of psyllids as pests of crop and ornamental plants. There are a few major and many minor pests. Among the most serious pests of citrus in Asia and the Americas is *Diaphorina citri* Kuwayama, 1908 (Liviidae) which vectors ‘*Candidatus Liberibacter asiaticus*’, the causal agent of huanglongbing (HLB, or citrus greening) (Burckhardt 1994, Halbert & Manjunath 2004). Several phytoplasma transmitting *Cacopsylla* species cause economic damage to apple, pear and stone fruit orchards in Europe and East Asia (Burckhardt & Hodkinson 1986, Burckhardt & Lauterer 2009a, Cho et al. 2017a,b, Seemüller et al. 2011, Steffek et al. 2012). In Europe, several, probably polyphagous, *Bactericera* species (Triozidae) damage crops: *B. tremblayi* (Wagner, 1961) on onions and



Figure 4. Immatures of *Lauritrioza alacris* on *Laurus nobilis*, Hungary, Budapest, 20.VI.2016. Photo Érsek László.

Figuur 4. Larven van *Lauritrioza alacris* op *Laurus nobilis*, Hongarije, Boedapest, 20.VI.2016. Foto Érsek László.



Figure 5. Gall of *Trichoermes walkeri* on *Rhamnus cathartica*, Czech Republic, Brno-Slatina, 3.VIII.2005. Photo Igor Malenovský.

Figuur 5. Gall van *Trichoermes walkeri* op *Rhamnus cathartica* Tsjechië, Brno-Slatina, 3.VIII.2005. Foto Igor Malenovský.

leek (Ouvrard & Burckhardt 2012), *B. nigricornis* on various vegetables (Hodkinson 1981), and *B. trigonica* Hodkinson, 1981 on carrots; the last are also harmed by *Trioza apicalis* Foerster, 1848 (Trioziidae) (Burckhardt & Freuler 2000, Láska 1974, 2011).

In North and Central America and, in New Zealand (introduced), *Bactericera cockerelli* (Šulc, 1909) is a major pest on potatoes and tomatoes by transmitting 'Candidatus Liberibacter solanacearum', the causal agent of zebra chip (Munyaneza et al. 2007). Feeding activities of psyllids may also weaken the host plant, making it more susceptible to diseases. In South America (Burckhardt et al. 1999, Queiroz et al. 2013, 2018, Queiroz & Burckhardt 2007) and Europe (Hodkinson 1999, 2007,

Laudonia & Garonna 2010, Laudonia et al. 2014), eucalypt trees are seriously damaged by the feeding activities of several introduced psyllid species. The feeding may result in excess honeydew which may cover leaves, fruits and flowers. This honeydew is often covered with black sooty mould which may impair photosynthesis and also renders fruits unmarketable (Burckhardt 1994).

BIOCONTROL

Some psyllids have been used or are considered for the control of invasive weeds. Examples are the Australian weed *Melaleuca quinquenervia* (Myrtaceae) in Florida with *Boreioglycaspis melaleucae* Moore, 1964 (Aphalaridae) (Morath et al. 2006) and the Brazilian peppertree *Schinus terebinthifolius* in Florida with *Calophya latiforceps* Burckhardt, 2011 from Brazil (Burckhardt et al. 2018). Japanese knotweed *Fallopia japonica* is invasive in most western European countries and has a severe impact upon biodiversity. Biocontrol research was initiated in Britain resulting in the release of the eastern Asian psyllid *Aphalara itadori* (Shinji, 1938) (Prat et al. 2013, Shaw et al. 2011). This was the first official intentional release of a non-native biological agent to control an invasive plant in Europe (Shaw et al. 2016, CABI 2018a). In the Netherlands research is ongoing and a decision on the release of this psyllid will soon be made (Jones et al. 2013).

ALIEN (EXOTIC) SPECIES

The number of psyllids that is unintentionally introduced into Europe has increased in the last decades. Mifsud et al. (2010) listed 14 species alien to Europe. The majority is associated with Asian and Australian species of the genera *Eucalyptus*, *Acacia* and *Albizia*. Among the recently discovered introductions are *Macrohomonotoma gladiata* Kuwayama, 1908 (Homotomidae) in Spain and Italy (Mifsud & Porcelli 2012, Pedata et al. 2012) and *Platyobria biemani* Burckhardt et al., 2014 (Aphalaridae) in Greece (Burckhardt et al. 2014a). Because of the growing international trade in



Figure 6. Galls of *Trioza flavipennis* on *Aegopodium podagraria* Czech Republic, Bílé Karpaty Mts, Korytná, 22.v.2016. Photo Igor Malenovský.

Figuur 6. Gallen van *Trioza flavipennis* op *Aegopodium podagraria*, Tsjechië, Bílé Karpaty Mts, Korytná, 22.v.2016. Foto Igor Malenovský.

agricultural products and ornamental plants, in combination with insufficient phytosanitary controls, we predict the arrival and establishment of more psyllid species in the future.

When appropriate, the alien status for Dutch psyllids is given based on the definition of Dutch Species Register (2019).

CLASSIFICATION

The classification of the world's jumping plant-lice by Burckhardt & Ouvrard (2012), dividing the superfamily into eight families, is adopted here. Nomenclature of psyllids follows Ouvrard (2018), that of the plants Van der Meijden (2005).

DUTCH PSYLOIDEA

There has always been only limited interest in the Dutch psyllid fauna, besides studies on some agricultural pests on apple, pear and *Buxus* (Wilcke 1941). The first list of psyllid species in the Netherlands was by De Graaf et al. (1862) who reported eight species. Van der Goot (1912) published the second list with 27 species. His list was based on the first one, including notes of G.A. Six and some additional material. However, for some new species no distribution data were given. Van der Goot was forced to finish his work prematurely by his leave for the Dutch East Indies.

The most recent list is by Blöte (1926b) counting 29 species. Since then some additional species were added and ecological information was provided (Blöte 1926a, 1926c, 1950, Cobben 1951, Docters van Leeuwen 1947, Van Frankenhuyzen & Freriks 1972, Gravestein 1944a,b, 1951, Lauterer & Malenovský 2002, Wilcke 1941, Woudstra 1996).

The paper by Blöte (1926a) was written in Dutch, which created some confusion. In addition to the confirmed Dutch species, Blöte listed many other species whose occurrence in the Netherlands he considered possible or which might be imported with horticultural plants. Some subsequent authors misinterpreted this paper and wrongly listed all species as members of the Dutch fauna, e.g. the mediterranean species *Arytaina adenocarpi* Löw, 1880 by Klimaszewski (1973). Blöte (1926b) indicated species that he himself had not seen with a question mark, but stated that he had no doubt on their identification made by colleagues. This question mark is the reason why some species have been unjustly listed as doubtful for the Netherlands in Fauna Europaea (Burckhardt 2013).

Much information on the Dutch gall-producing psyllids was summarized by Docters van Leeuwen (2009) and Grosscurt (2017). Ellis (2018) illustrates many galls of psyllids recorded in the Netherlands.

The species list in this paper is mainly based on material from the collection of the first author, the former collection of the Laboratory of Entomology of Wageningen University, and the former collection of the Zoölogisch Museum in Amsterdam. The last two collections are now part of the collection of Naturalis Biodiversity Center in Leiden (abbreviated as col. Naturalis in this paper). Species are omitted from the list when they are mentioned in the literature as occurring in the Netherlands, but without supporting material in the collections. Species reported based only on their galls are incorporated in case a good picture is available from a Dutch locality. Furthermore records from Waarneming.nl were included when they had a good photo which could be identified by the first author. Species that are reported from the Netherlands for the first time are marked with '(New for the Netherlands)'.

Dutch geographical coordinates (Amersfoort-coördinaten = AC) are given for the collecting sites, when available. Unless stated otherwise, the material was collected and identified by the first author and preserved in his collection. Photographs in figures 7-33 were taken by Theodoor Heijerman; the scale bar equals 0.5 mm.

PSYLLIDS AS PESTS IN THE NETHERLANDS

In the Netherlands several psyllid species are regarded as pests, for which details are given below. Minor damage can also be caused by *Cacopsylla fulguralis* and *Psylla buxi* on ornamental shrubs (*Elaeagnus* species and *Buxus sempervirens*, respectively).

In Eurasia and the Americas (introduced) pear psyllids (*Cacopsylla* species) are major pests of cultivated pear (Burckhardt & Hodkinson 1986, Cho et al. 2017b, Valle et al. 2017). In the Netherlands, the yearly losses are estimated at tens of million euros (Balkhoven 2015). The feeding of pear psyllids on the flower buds in autumn results in a reduced harvest the following year. The excretion of honeydew soils the fruits and promotes

growth of black sooty mould. Pear psyllids are also vectors of '*Candidatus Phytoplasma pyri*', the causal agent of the pear decline disease which is widespread in the Netherlands (CABI 2018b). *Cacopsylla pyri*, *C. pyricola* and *C. pyrisuga* often occur together in pear orchards, which can make it difficult to assess the economic impact of each species separately. The first two species are polyvoltine and probably cause most of the damage. In the Netherlands *C. pyri* is the main pest in commercial pear orchards (CAF 2003, Trapman & Blommers 1992, pers. comm. H. Helsen 2018). Research is ongoing regarding the biological control of the pear psyllids. The main predators are the earwig *Forficula auricularia* (Dermaptera) and the flower bug *Anthocoris nemoralis* (Heteroptera: Anthocoridae) (Trapman & Blommers 1992).

IDENTIFICATION

Both adult and immature psyllids can be identified to the species level. Unfortunately, there is no single paper for the identification of the complete Dutch psyllid fauna. Hodkinson & White (1979), White & Hodkinson (1982) and especially Ossiannilsson (1992) are very helpful for identifying most of the Dutch species. For species not included in Ossiannilsson (1992) references to literature are given below. *Cacopsylla* species associated with rosaceous host plants, including economically important species on fruit trees, can be identified using the pictorial key by Burckhardt (2010). A good reference collection is often essential for reliable identification.

The body colouration is often variable within a species and an individual may change from green or yellow to red, brown and black over the course of several months. Overwintering individuals are often much darker than specimens in summer. Wing venation and surface spinules, together with the male and female terminalia and the head morphology, provide the best identification cues for adults in many cases (Boffing & Bantock 2014, Ossiannilsson 1992).



Figure 7. *Aphalara avicularis* ♂ (genitalia removed). Kamperland (province of Zeeland), 21.VII.2017. Photos figure 7-33 Theodoor Heijerman.

Figuur 7. *Aphalara avicularis* ♂ (genitaliën verwijderd). Kamperland (Zeeland), 21.VII.2017. Foto's figuur 7-33 Theodoor Heijerman.



Figure 8. *Aphalara freji* ♂ (genitalia removed). Oude Buisse Heide (province of Noord-Brabant), 26.VII.2011.

Figuur 8. *Aphalara freji* ♂ (genitaliën verwijderd). Oude Buisse Heide (Noord-Brabant), 26.VII.2011.



Figure 9. *Aphalara polygona* ♂ (genitalia removed). Bergen op Zoom (province of Noord-Brabant), 21.IX.2006.
 Figuur 9. *Aphalara polygona* ♂ (genitaliën verwijderd). Bergen op Zoom (Noord-Brabant), 1.IX.2006.



Figure 10. *Aphalara purpurascens* ♂ (genitalia removed). Maarn (province of Utrecht), 24.VI.2006.
 Figuur 10. *Aphalara purpurascens* ♂ (genitaliën verwijderd). Maarn (Utrecht), 24.VI.2006.



Figure 11. *Aphalara ulicis* ♀. Czech Republic, Moravia, Hovorany 'Na pískách', 28.v.1974, leg. P. Lauterer.
 Figuur 11. *Aphalara ulicis* ♀. Tsjechië, Moravië, Hovorany 'Na pískách', 28.v.1974, leg. P. Lauterer.



Figure 12. *Craspedolepta flavipennis* ♀. France, Monts d'Olmes, 7 km sw Montferrier (Ariège) 1,630m, 7.vii.1996, det. D. Burckhardt.
 Figuur 12. *Craspedolepta flavipennis* ♀. Frankrijk, Monts d'Olmes, 7 km sw Montferrier (Ariège) 1.630m, 7.vii.1996, det. D. Burckhardt.



Figure 13. *Craspedolepta latior* ♂. Slovakia, Palúdzka near Liptovský Mikuláš, 15.vii.1963, leg. P. Lauterer.
 Figuur 13. *Craspedolepta latior* ♂. Slowakije, Palúdzka bij Liptovský Mikuláš, 15.vii.1963, leg. P. Lauterer.



Figure 14. *Craspedolepta nebulosa* ♂ (genitalia removed). France, Mt de Lure, 12 km N St. Etienne-les-Orgues (Alpes de Haute Provence), 1,680 m, 17.v.2011.
 Figuur 14. *Craspedolepta nebulosa* ♂ (genitaliën verwijderd). Frankrijk, Mt de Lure, 12 km N St. Etienne-les-Orgues (Alpes de Haute Provence), 1.680m, 17.v.2011.



Figure 15. *Craspedolepta omissa* ♂. Czech Republic, Mikulov, 7.vii.1989, leg. P. Lauterer.

Figuur 15. *Craspedolepta omissa* ♂. Tsjechië, Mikulov, 7.vii.1989, leg. P. Lauterer.



Figure 16. *Craspedolepta subpunctata* ♂ (genitalia removed). France: 5 km NW Paulhac: Bois des Faux (Cantal), 1,200 m, 7.vii.2006.

Figuur 16. *Craspedolepta subpunctata* ♂ (genitaliën verwijderd). Frankrijk: 5 km NW Paulhac: Bois des Faux (Cantal) 1.200m, 7.vii.2006.



Figure 17. *Psyllopsis distinguenda* ♂. Maasniel (Roermond) (province of Limburg), 28.vi.1954, leg. R.H. Cobben.
 Figuur 17. *Psyllopsis distinguenda* ♂. Maasniel (Roermond) (Limburg), 28.vi.1954, leg. R.H. Cobben.



Figure 18. *Camarotoscena speciosa* ♂ (genitalia removed). Herkenbosch (province of Limburg), 13.ix.1992.
 Figuur 18. *Camarotoscena speciosa* ♂ (genitaliën verwijderd). Herkenbosch (Limburg), 13.ix.1992.



Figure 19. *Cacopsylla affinis* ♂ (genitalia removed). Ouwerkerk (province of Zeeland), 4.VI.1990, det. I. Malenovsky.
 Figuur 19. *Cacopsylla affinis* ♂ (genitaliën verwijderd). Ouwerkerk (Zeeland), 4.VI.1990, det. I. Malenovsky.



Figure 20. *Cacopsylla ambigua* ♂ (genitalia removed). Wessem (province of Limburg), 30.IV.1997.
 Figuur 20. *Cacopsylla ambigua* ♂ (genitaliën verwijderd). Wessem (Limburg), 30.IV.1997.



Figure 21. *Cacopsylla crataegi* ♂ (genitalia removed). Oostkapelle (province of Zeeland), 21.VII.2014.
 Figuur 21. *Cacopsylla crataegi* ♂ (genitaliën verwijderd). Oostkapelle (Zeeland), 21.VII.2014.



Figure 22. *Cacopsylla pulchra* ♂ (genitalia removed). Vlijmen (province of Noord-Brabant), 20.V.1992.
 Figuur 22. *Cacopsylla pulchra* ♂ (genitaliën verwijderd). Vlijmen (Noord-Brabant), 20.V.1992.



Figure 23. *Cacopsylla pyrisuga* ♂ (genitalia separated). France, Mont d'Olmes 7 km sw Montferrier (Ariège), 1.600 m, 25.VII.1997.

Figuur 23. *Cacopsylla pyrisuga* ♂ (genitalia verwijderd). Frankrijk, Mont d'Olmes 7 km sw Montferrier (Ariège), 1.600 m, 25.VII.1997.



Figure 24. *Cacopsylla rhamnicola* ♂. France, Col de Legal, 11 km SE Salers (Cantal), 18.VII.1993.

Figuur 24. *Cacopsylla rhamnicola* ♂. Frankrijk, Col de Legal, 11 km SE Salers (Cantal), 18.VII.1993.



Figure 25. *Cacopsylla sorbi* ♂. Beegderheide (province of Limburg), 31.v.1997.
 Figuur 25. *Cacopsylla sorbi* ♂. Beegderheide (Limburg), 31.v.1997.



Figure 26. *Cacopsylla ulmi* ♂ (genitalia removed). Wageningen (province of Gelderland), 31.vii.2015.
 Figuur 26. *Cacopsylla ulmi* ♂ (genitaliën verwijderd). Wageningen (Gelderland), 31.vii.2015.



Figure 27. *Livilla variegata* ♂ (genitalia removed). Wageningen (province of Gelderland), 31.VII.2015.
 Figuur 27. *Livilla variegata* ♂ (genitaliën verwijderd). Wageningen (Gelderland), 31.VII.2015.

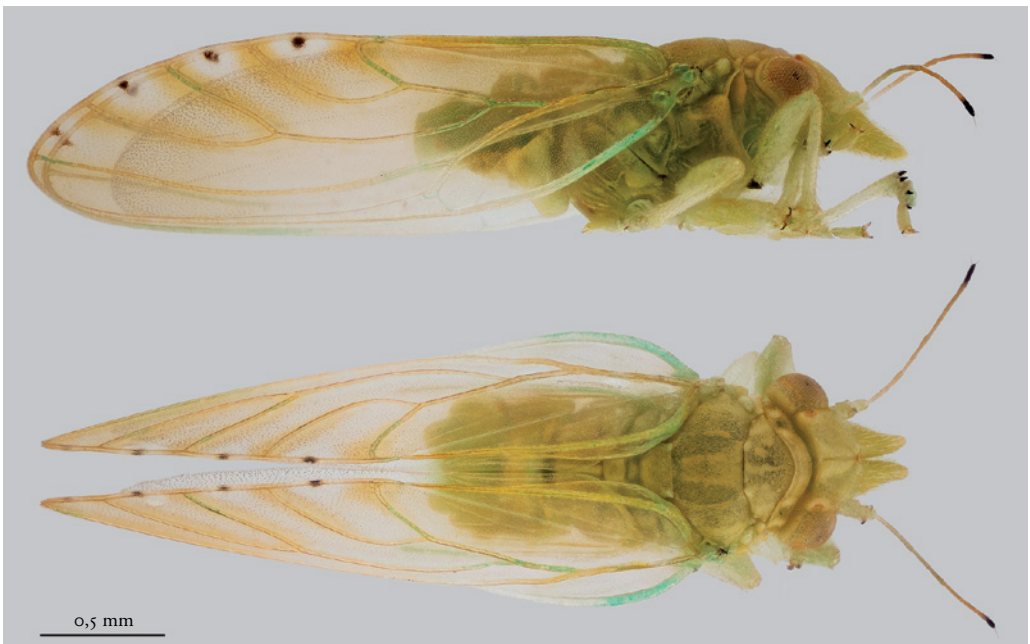


Figure 28. *Spanioneura foncolombii* ♂ (genitalia removed). Loon op Zand (province of Noord-Brabant), 10.VII.2013.
 Figuur 28. *Spanioneura foncolombii* ♂ (genitaliën verwijderd). Loon op Zand, (Noord-Brabant), 10.VII.2013.



Figure 29. *Bactericera curvatinervis* ♂ (genitalia removed). Breda (province of Noord-Brabant), 8.vii.2013.
 Figuur 29. *Bactericera curvatinervis* ♂ (genitaliën verwijderd). Breda (Noord-Brabant), 8.vii.2013.



Figure 30. *Bactericera reuteri* ♀. Heel (province of Limburg), 27.vi.2003, det. D. Burckhardt.
 Figuur 30. *Bactericera reuteri* ♀. Heel (Limburg), 27.vi.2003, det. D. Burckhardt.



Figure 31. *Bactericera silvarnis* ♂ (genitalia removed). Buren (province of Gelderland), 4.X.1992, det. D. Burckhardt.
 Figuur 31. *Bactericera silvarnis* ♂ (genitaliën verwijderd). Buren (Gelderland), 4.X.1992, det. D. Burckhardt.



Figure 32. *Bactericera substriola* ♂. Slovakia, Záhorie, Kúty-Čáry, 17.VII.1969, leg. P. Lauterer.
 Figuur 32. *Bactericera substriola* ♂. Slowakije, Záhorie, Kúty-Čáry, 17.VII.1969, leg. P. Lauterer.



Figure 33. *Trioza velutina* ♂ (genitalia removed). Spain, 11 km w Belseu (Huesca) 1,280 m, 17.vii.2008, det. I. Malenovský.
 Figuur 33. *Trioza velutina* ♂ (genitaliën verwijderd). Spanje, 11 km w Belseu (Huesca), 1,280 m, 17.vii.2008, det. I. Malenovský.

PSYLLID FAUNA OF THE NETHERLANDS

Aphalaridae Aphalarinae

Aphalara is a taxonomically difficult genus. Some species are hard to identify with morphological characters only and knowledge of the host plant is helpful for a reliable identification. The most relevant paper for the identification of Dutch *Aphalara* species is Ossiannilsson (1992). However, some corrections of the nomenclature in this paper are necessary:

Aphalara crispicola Ossiannilsson, 1987 is a junior synonym of *A. purpurascens* (Hartig, 1841) (Burckhardt 2008);

Aphalara pauli Loginova, 1979 is *A. ulicis* Foerster, 1848 (Burckhardt & Lauterer 1997a);

Aphalara polygoni Foerster, 1848 is *A. freji* Burckhardt & Lauterer, 1997 (Burckhardt & Lauterer 1997a);

Aphalara rumicicola Klimaszewski, 1966 is a junior synonym of *A. polygoni* Foerster, 1848 (Burckhardt & Lauterer 1997a).

Due to the taxonomic confusion, older records of most *Aphalara* species are unreliable and should be reevaluated. Only a small part of the Dutch collections has been reassessed.

Aphalara avicularis Ossiannilsson, 1981

New for the Netherlands

Noord-Brabant Chaam, Bleeke Heide nature reserve, AC 117,7-389,1, 20.vii.2007, 6 ♂, 4 ♀, det. I. Malenovský; Ulvenhout, Ulvenhoutse Bos near stream, AC 115,5-396,2, 5.viii.2008, 7 ♂, 2 ♀, det. I. Malenovský; idem, 8.vi.2009, 1 ♂, 1 ♀, det. I. Malenovský; Breda, Galderse Heide nature reserve, AC 111,3-394,4, 30.ix.2012, 1 ♂ on *Pinus sylvestris*, det. I. Malenovský; Breda, Hoogeind 11

industrial park, AC 116,8-400,9, 8.VII.2013, 2 ♀, det. I. Malenovský; Galder, Markdal, AC 113,2-392,6, 18.VI.2016, 1 ♂, 1 ♀; 2 km E Biesbosch Museum, Biesbosch nature reserve at a parking place, AC 114,6-419,4, 26.VII.2017, 1 ♂, 2 ♀. **Zeeland** 3 km NE Rilland, Rattekaai harbour, AC 72,5-383,9, 16.VIII.2012, 1 ♂, det. I. Malenovský; Kamperland, near de Banjaard at a housing construction area, AC 35,7-401,2, 21.VII.2017, 5 ♂, 7 ♀. **Limburg** Maasduinen national park, De Hamert reserve at a parking locality, AC 209,4-391,2, 13.VIII.2017, 4 ♂, 3 ♀. **Zuid-Holland** Hellegatsplein, AC 86,2-412,8, 30.IX.2013, 1 ♂, det. I. Malenovský. All but one (*P. sylvestris*) collected on *Polygonum aviculare* agg.

Aphalara avicularis (fig. 7) is quite common in the Netherlands, occurring wherever the host-plant (*Polygonum aviculare* agg.) grows, e.g. in roadside verges and on parking lots. These ruderal localities are often well-trodden which does not seem to impair the psyllid and its host plants. It has not been collected in the northern parts of the Netherlands yet but this is probably due to the shortage of collecting activities.

This species is widely distributed in Europe, with the exception of most mediterranean countries (Burckhardt 2013, Ossiannilsson 1992, Ripka 2008, Seljak 2006, Serbina et al. 2015b, Skipper 2018). Outside Europe it has been reported from South Korea (Cho et al. 2017a).

Immatures live in the stipulate sheaths at the branching points of ramification and on the stalks and leaves, near the top of the shoots (Ossiannilsson 1992). They can cause small pit galls on leaves (Ellis 2018). Adults have been found in the Netherlands from June to September. The adults overwinter on conifers (Ossiannilsson 1992). It is a bivoltine species but has perhaps more generations at some localities (Hodkinson 2009, Lauterer & Malenovský 2002).

Aphalara freji Burckhardt & Lauterer, 1997
New for the Netherlands

Noord-Holland Zeeburg, AC 127-484, 10.V.1918, 1 ♂, 2 ♀, leg. Van der Wiel, det. I. Malenovský, col. Naturalis. **Gelderland** Wageningen, AC 174-443, 10.II.1918, 1 ♂, collected from fire wood, det. I. Malenovský, col. Naturalis. **Noord-Brabant** Tilburg, Huis ter Heide, AC 130,6-404,0,6.X.2007, 3 ♂, 1 ♀, on *Fallopia japonica*, det. I. Malenovský; Breda, Wolfslaar, AC 114,6-397,0,7.IX.2007, 6 ♂, 2 ♀, det. I. Malenovský; idem, 31.VII.2008, 7 ♂, 4 ♀, on *Persicaria maculosa*, det. I. Malenovský; Ulvenhout, Ulvenhoutse Bos, near stream, AC 115,5-396,2, 25.VI.2008, 3 ♂, 1 ♀, det. I. Malenovský; 4 km NW Achtmaal, Oude Buisse Heide nature reserve, AC 98,4-387,3, 26.VII.2011, 7 ♂, 3 ♀, on *P. maculosa*, det. I. Malenovský; Gilze, Schouterveld, AC 120,1-393,7, 6.X.2012, 1 ♂, on *Quercus robur*, det. I. Malenovský; Chaam, Chaamse Beek, AC 116,4-392,7, 9.IX.2008, 1 ♂, det. I. Malenovský; Oosterhout, De 5 Eiken industrial area, AC 120,4-403,7, 25.VII.2017, 5 ♂ 4 ♀, on *P. maculosa*. **Zeeland** St. Philipsland, Rammevors nature reserve, AC 72,0-403,1, 15.VIII.2008, 1 ♂, det. I. Malenovský; 4,5 km SEE Waarde, Westerschelde shore, AC 67,2-379,8, 3.V.2011, 1 ♂, det. I. Malenovský. **Limburg** 2 km NW Bunde, Voulwames, AC 178-324, 4.VI.2017, 1 ♂, 1 ♀.

In the Netherlands *Aphalara freji* (fig. 8) is widely distributed. It occurs all over Europe, with the exception of the Iberian Peninsula (Burckhardt 2013, Jerinić-Prodanović 2010, Seljak 2006, Serbina et al. 2015b). It has also been reported from Algeria (Burckhardt & Lauterer 1997a), Iran (Zendedel et al. 2016) and South Korea (Cho et al. 2017a).

Aphalara freji lives on several *Persicaria* species: *P. amphibia*, *P. hydropiper*, *P. lapathifolium*, *P. mitis* and *P. maculosa* (Burckhardt & Lauterer 1997a), often in rather humid conditions like the edges of standing waters, ditches and sea dikes. Sometimes it is collected at sandy, dry ruderal localities, especially on *P. maculosa*. Immatures produce small

pit galls on the leaves (Ellis 2018), which are indistinguishable from those of *A. maculipennis*, sharing the same host species (Burckhardt & Lauterer 1997a). Only microscopic examination of fifth-instar immatures (Ossiannilsson 1992) or rearing to adults can show which species a gall on *P. amphibia* and *P. lapathifolium* belongs. However, it seems that only *P. freiji* occurs on *P. maculosa*.

In the Netherlands this species was collected from February until October. It overwinters in the adult stage on conifers but it can also be collected on other hiding places, as the collection on fire wood on February 10, 1918 showed. It has one or two generations a year (Hodkinson 2009).

Aphalara polygona Foerster, 1848

New for the Netherlands

Gelderland Bennekom, AC 177-446, 21.IX.2006, 1 ♂, 1 ♀, det. D. Burckhardt; Wageningen, Arboretum, AC 175-442, 7.VII.1954, 1 ♂, 3 ♀, on *Rumex acetosella*, leg. R.H. Cobben, col. Naturalis; Tongerense Heide, AC 190,4-483,2, 24.VII.1985, 2 ♂, 2 ♀; idem, 28.VII.1985, 1 ♂, 4 ♀; idem, 19.IX.1985, 2 ♂, 3 ♀, on *Rumex acetosella*, det. D. Burckhardt. **Noord-Brabant** Bergen op Zoom, De Duintjes nature reserve, AC 79,1-385,4, 1.IX.2006, 3 ♂, 2 ♀, det. D. Burckhardt; Ulvenhout, Ulvenhoutse Bos near stream, AC 115,5-396,2, 9.IX.2008, 1 ♂, 1 ♀, det. I. Malenovský.

Aphalara polygona (fig. 9) is widely distributed in Europe but is not reported from most mediterranean countries (Burckhardt 2013, O'Connor & Malumphy 2011, Ripka 2009). Reports from outside Europe should be critically evaluated due to the complex taxonomy (Burckhardt & Lauterer 1997a, Cho et al. 2017a).

In the Netherlands Doctors van Leeuwen (1982, 2009) reported galls on *Polygala vulgaris* (Polygalaceae) and attributed them to *A. polygona*, which is unlikely because all confirmed hosts of *A. polygona* are *Rumex acetosella*, *R. acetosa* and

R. scutatus (Polygonaceae) (Burckhardt 2002, Malenovský & Lauterer 2012, Ossiannilsson 1992). The immatures induce deformations of the leaf blade (Ellis 2018). Older reports of *A. polygona* on *Persicaria* species probably refer to *A. freiji*. The adults of the bivoltine species *A. polygona* overwinter on conifers (Hodkinson 2009).

Aphalara maculipennis Löw, 1886

The first Dutch record was by Gravestein (1944a); adults were collected in Amsterdam from 13.X to 2.XI.1943. In the Netherlands *A. maculipennis* is widely distributed. It has a wide distribution all over Europe and also in the East Palaearctic and North Africa (Burckhardt & Lauterer 1997a, Burckhardt 2013).

Aphalara maculipennis has been reported from *Persicaria amphibia*, *P. lapathifolium* and *P. tomentosum* (Burckhardt & Lauterer 1997a). It was reared out of galls on *Persicaria amphibia* in Belgium (Ellis 2018) and galls on this host plant were also reported from the Netherlands by Doctors van Leeuwen (1982, 2009) and Grosscurt (2017). The species is univoltine, the adults overwinter on conifers (Hodkinson 2009).

Aphalara purpurascens (Hartig, 1841)

New for the Netherlands

Utrecht Maarn, AC 152,4-452,8, 24.VI.2006, 3 ♂, 2 ♀, on *Rumex*, det. D. Burckhardt.

Aphalara purpurascens (= *A. crispicola*) (fig. 10) has a European distribution: Czech Republic, Finland, France, Germany, Great Britain, Poland, Romania, Slovakia, Slovenia, Sweden and Switzerland (Burckhardt 2013, Głowacka & Migula 1996, Ossiannilsson 1992, Seljak 2006, pers. obs. Daniel Burckhardt).

It has been reported from *Rumex aquatilis*, *R. conglomeratus*, *R. crispus*, *R. longifolius* and

R. obtusifolius (Malenovský & Lauterer 2012, Ossiannilsson 1992). In the Czech Republic it is bivoltine, the adults overwinter on conifers. The earliest adults were swept on meadows in mid April, but the migration from the conifers to their host plants takes some time and is completed at the beginning of June, when the oviposition starts. Adults of the new generation emerge at the end of July; immatures of the second generation can be found in August. Females oviposit on young unfolded leaves, most often in clusters of 2-3 eggs, up to 7-8 (Lauterer 1982, as *A. rumicicola*, see also Lauterer 1993a). Malformations on the host plants were described by Lauterer (1982) and Ellis (2018).

***Aphalara ulicis* (Foerster, 1848)**

New for the Netherlands

Limburg St. Odiliënberg, AC 199-350, 10.X.1954, 1 adult without terminalia, leg. R.H. Cobben, col. Naturalis.

Aphalara ulicis (fig. 11) is closely related to *A. exilis* (Weber & Mohr, 1804) and can be distinguished from the latter by the pattern of the surface spinules of the fore wings and details of the male paramere (Ossiannilsson 1992: as *A. pauli*, Burckhardt & Lauterer 1997a).

Aphalara ulicis has been reported from large parts of Europe but does not occur in most mediterranean countries (Burckhardt 2013, Jerinić-Prodanović 2010, O'Connor & Malumphy 2011). Based on observations in the Czech Republic, *A. ulicis* is more xerothermophilous than *A. exilis* and lives mainly in sandy lowland habitats. *Aphalara exilis* is hygrophilous and psychrophilous and is restricted to wet meadows, pastures and bogs (Burckhardt & Lauterer 1997a, Malenovský & Lauterer 2012). *Rumex acetosella* is the host plant of *A. ulicis*, while *A. exilis* lives on *R. acetosa* and *R. obtusifolius* (Burckhardt & Lauterer 1997a). When flowering starts *Aphalara ulicis* lays its eggs on the upper side of the leaves, mainly basally,

along the veins or on the stem in the upper flowering parts. Eggs are laid mostly one by one. The leaf galls are described by Ellis (2018). The adults of *A. ulicis* overwinter on conifers (Boffing & Bantock 2014). The species probably has one generation per year.

***Craspedolepta flavipennis* (Foerster, 1848)**

New for the Netherlands

Limburg Maastricht, VI.1909, 1 ♂, leg. Dammerman, col. Naturalis.

The only previous information on *C. flavipennis* (fig. 12) from the Netherlands is by Burckhardt (2013) reporting this species as doubtful for the country. The record from Maastricht is a confirmation that *C. flavipennis* occurs in the Netherlands. It is found in western, central and eastern Europe (Burckhardt 2013, Ripka 2008, Seljak 2006, Serbina et al. 2015b).

Leontodon hispidus is the only confirmed host plant of *C. flavipennis*, although some additional Asteraceae species were reported as hosts in the literature (Lauterer & Burckhardt 2004, Malenovský & Lauterer 2012). *Craspedolepta flavipennis* occurs in xerothermic, mesic and wet places. Adults emerge over a long period of time, and teneral specimens can be found from the end of May to the middle of August. *Craspedolepta flavipennis* has a wide altitudinal range, from 140 to 1950 m a.s.l. (Lauterer & Burckhardt 2004). It is a monovoltine species, the immatures overwinter on the shoots of the host plant (Hodkinson 2009).

For identification see Hodkinson & White (1979) and Lauterer & Burckhardt (2004).

***Craspedolepta latior* Wagner, 1944**

New for the Netherlands

Gelderland Berg en Dal, Wylterberg, AC 192,6-425,5, 22.VI.1986, 1 ♂, det. D. Burckhardt.

Craspedolepta latior (fig. 13) occurs mainly in central and northern Europe (Burckhardt 2013, Burckhardt & Lauterer 2009b, Lauterer 1965, Serbina et al. 2015b), but it has also been recorded in the East Palaearctic region (Ossiannilsson 1992, Tishetshkin 2007a). The Dutch record is located at the western border of the range.

The host plants of *C. latior* are *Artemisia vulgaris* in Europe (Burckhardt 2002) and *A. sericea* in Siberia (Tishetshkin 2007a). *Artemisia vulgaris* is a very common plant in the Netherlands (Floron 2015) and it has often been checked by the first author without finding this psyllid species. Probably it is a rare psyllid in the Netherlands. The immatures infest the shoot apices. Fourth and fifth instars were found at the end of May and beginning of June and adults can be found between June and August (Ossiannilsson 1992). Probably it is an univoltine species and the immatures overwinter on the host plant, as other *Craspedolepta* species.

***Craspedolepta nebulosa* (Zetterstedt, 1828)**
New for the Netherlands

Overijssel Weerselo, AC 256-485, 5.VI.1970, 1 ♂, leg. Gravestein, col. Naturalis.

Craspedolepta nebulosa (fig. 14) is a Holarctic species, known from most northern and central European countries (Burckhardt 2013, Ouvrard 2018), Turkey, Kazakhstan, Russian Far East and North America (Drohojowska & Burckhardt 2014, Hodkinson 1988, Ossiannilsson 1992).

Its host plant is *Chamerion angustifolium* (Burckhardt 2002, Ossiannilsson 1992). This plant is very common in the Netherlands (Floron 2015), but there has been only a single record of this psyllid. Oviposition takes place in May and June near the midrib of the underside of a young leaf. The growth of the leaf shifts the eggs to the leaf margin. This margin curls around the young first instars. Sometimes oviposition is at the leaf upper

side near the margin and also then the leaf curls over the eggs and the immatures live under the curled leaf margins. Before the first moult the first instars move to the roots of the host. Suction on the roots results in root galls. After overwintering the fourth instars move upwards to the leaves. The black fourth instars moult to the yellow-brown fifth instars at the underside of the leaves and after 1-2 weeks the adults appear. *Craspedolepta nebulosa* is among the few organisms that, during larval development, produces two different types of galls on the same host plant. It is a univoltine species (Hodkinson 2009, Lauterer 1993a, Ossiannilsson 1992).

***Craspedolepta nervosa* (Foerster, 1848)**

A rather common species in the Netherlands, from where it was first reported by Blöte (1926b). Adults were collected from the beginning of May until the end of July always on *Achillea millefolium* (observations by the first author).

Craspedolepta nervosa is widespread in Europe and in the Asian parts of the former USSR (Ossiannilsson 1992). It develops on *Achillea millefolium* and *A. ptarmica* but has also been found and reared on *Cirsium arvense* (Conci et al. 1993, Ossiannilsson 1992). It occurs in xerophilous and mesophilous habitats, including those heavily affected by man (Lauterer 1993b). It has one generation per year and overwinters in the larval stage on the roots of its host plant (Hodkinson 2009).

***Craspedolepta omissa* Wagner, 1944**
New for the Netherlands

Limburg Maastricht, St. Pietersberg, Kleine Pruisweg, AC 175-314, 9.VII.1949, 1 ♂; Maastricht, St. Pietersberg, east side near Belgium border, AC 175-313, 9.VII.1949, 1 ♀, all col. Naturalis.
Noord-Brabant 3 km E Lage Zwaluwe, shore Amer, AC 110,2-415,1, 19.VI.2017, 1 ♂.

Craspedolepta omissa (fig. 15) is a West Palaearctic species. It seems to be missing from Scandinavia, Great Britain and Ireland and most of the Mediterranean countries (Burckhardt 2013, Burckhardt & Önuçar 1993, Ripka 2009, Serbina et al. 2015b, Tishetchkin 2007a).

It lives on *Artemisia vulgaris* (Burckhardt 1983) which is one of the most common plants in the Netherlands on ruderal spots. However, *C. omissa* has been only rarely recorded in the Netherlands. Observations in the Czech Republic suggest that it is locally common on ruderal sites (Lauterer 1993 b, Malenovský & Lauterer 2012). In Italy adults were collected from June until August and immatures were observed in June (Conci et al. 1993). The Dutch samples fit in these data. Probably it is a univoltine species with larvae overwintering on the roots of its host (Conci et al. 1993, Hodkinson 2009).

For identification see e.g. Burckhardt (1983), Doboreanu & Manolache (1961), Klimaszewski (1973), Serbina et al. (2015b) and Vondráček (1957).

Craspedolepta sonchi (Foerster, 1848)

Gelderland Apeldoorn, AC 192-469, 8.VIII.1917, 1 ♀, leg. Mac Gillavry, col. Naturalis. This specimen was identified as *Aphalara picta* by Mac Gillavry and by Blöte in 1925 and as *C. sonchi* by J.H. Woudstra in 1992 and I. Malenovský in 2009.

Blöte (1926b) reported *Aphalara picta* (Zetterstedt, 1828) from Apeldoorn and Zundert. This name is a junior synonym of *Aphalara calthae* (Ossiannilsson 1951), but it was also used previous to that publication for *C. flavipennis* s.l. of which *C. sonchi* was considered a synonym. A single female was available for re-examination.

Based on published records, *C. sonchi* is a Holarctic species with a wide distribution (Ouvrard 2018),

but records outside Europe should be checked following the revision of Lauterer & Burckhardt (2004). Confirmed hosts are *Leontodon autumnale* and *L. hispidus* (Lauterer & Burckhardt 2004), but other Asteraceae are also mentioned in the literature (Ouvrard 2018). It is a univoltine species with immatures overwintering on the roots of the host (Hodkinson 2009, Lauterer & Burckhardt 2004).

Craspedolepta subpunctata (Foerster, 1848)

New for the Netherlands

Gelderland Wageningen, AC 175-442, 21.V.1953, 1 ♂, 5 ♀; Wageningen, harbour, AC 173-441, 26.V.1954, 1 ♂; Wolfheze, AC 182-446, 26.VI.1955, 2 ♂, 3 ♀, all leg. R.H. Cobben and col. Naturalis.

This Holarctic species lives in Europe mainly in western and northern countries (Burckhardt 2013, Serbina et al. 2015b, Ouvrard 2018).

Craspedolepta subpunctata (fig. 16) shares its host plant with *C. nebulosa*: *Chamerion angustifolium*. Lauterer & Baudyš (1968) and Lauterer (1993a) studied the bionomics of this univoltine psyllid. Oviposition takes place in early June at both sides of the leaves. The young immatures drop on the soil and feed on the roots, inducing root galls of about one centimetre in diameter. The dark coloured fourth instars overwinter in these root galls. The last instars crawl to the leaves. There is no gall formation on the leaves or stems. At medium altitudes in the Czech Republic, the first adults appear at the end of May and in early June. In Sweden adults were collected from the beginning of June until the beginning of August (Ossiannilsson 1992), the Dutch data fit into this pattern.

For identification see Hodkinson & White (1979) and Conci & Tamanini (1986).

Rhinocolinae

Rhinocola aceris (Linnaeus, 1758)

Gravestein (1944b) reported *R. aceris* for the first time from the Netherlands (Noord-Holland, Amsterdam, 8 & 9.vi.1943, several specimens on *Quercus robur*. It is a rather common psyllid in the Netherlands on *Acer* species. Adults were collected from May until July (data of the first author).

Rhinocola aceris occurs all over Europe (Burckhardt 2013) and also in Armenia, Georgia, Turkey and Middle Asia (Burckhardt & Lauterer 1989, Ossiannilsson 1992). It develops on different *Acer* species: *A. campestre*, *A. platanoides*, *A. pseudo-platanus* and *A. tataricum*. The life cycle of this univoltine psyllid was studied in Austria by Löw (1880) and described in detail by Ossiannilsson (1992). Oviposition takes place in August and September, beneath the outer bud scales of the host plant. After hatching the first instar remains on this site, feeding in the bud axils. The first instar overwinters in the buds. Other authors stated that the eggs overwinter (Conci et al. 1993, Hodkinson 2009). The larval development starts again at the time of the bud burst, about mid March. The fourth instar moves to the base of the young shoots, and remains there until close to the last moult. Then they move to the underside of the leaves.

Liviidae

Euphyllurinae

Psyllopsis distinguenda Edwards, 1913

New for the Netherlands

Limburg Maasniel (Roermond), AC 198-357, 28.vi.1954, 1 ♂, together with *P. fraxini*, leg. R.H. Cobben, col. Naturalis; Holland, no date,

1 ♂, leg. Fransen, col. Naturalis (identified by Blöte in 1925 as *P. fraxini*).

In Europe, *P. distinguenda* (fig. 17) has been recorded from most countries but not from Scandinavia nor from the mediterranean region (Burckhardt 2013, Lauterer & Eastop 1968, O'Connor & Malumphy 2011, Seljak 2006, Serbina et al. 2015b).

As the other *Psyllopsis* species, *P. distinguenda* develops on *Fraxinus*: *F. angustifolia*, *F. excelsior* and *F. oxycarpa* (Burckhardt 2002, Lauterer 1982, Lauterer & Eastop 1968). It overwinters in the egg stage in twigs of the host. Immatures emerge at the end of April, leaf galls appear in June and adults are found from early June onwards. According to Lauterer & Eastop (1968) this species is univoltine, though Hodkinson (2009) and Lauterer (1982) considered it a bivoltine species. The galls of the *Psyllopsis* species are indistinguishable (Ellis 2018, Ossiannilsson 1992).

For an identification key and illustrations of adults of the *Psyllopsis* species see Hodkinson & White (1979) and Conci & Tamanini (1990).

Psyllopsis fraxini (Linnaeus, 1758)

De Graaf et al. (1862) mentioned *P. fraxini* from the Netherlands and it was also listed by Van der Goot (1912) and Blöte (1926b). A rather common species in the Netherlands, collected from June until November. It is widely distributed throughout Europe, Asia Minor and introduced into North America, New Zealand and Tasmania (Ossiannilsson 1992, Ouvrard 2018).

Like the former species it lives on *Fraxinus* species and overwinters in the egg stage in the terminal buds of *Fraxinus* twigs (Ossiannilsson 1992). It has one to two generations a year (Hodkinson 2009).

Psyllopsis fraxinicola (Foerster, 1848)

The first Dutch report on *F. fraxinicola* is by Van der Goot (1912), also Blöte (1926b) mentioned this species. It is the most common *Psyllopsis* species in the Netherlands. Adults are collected from June to November.

Psyllopsis fraxinicola is widely distributed throughout Europe, North Africa, Armenia, Georgia, Israel and Kazakhstan and it has been introduced into Australia, New Zealand and North and South America (Burckhardt 1989, Ossiannilsson 1992, Ouvrard 2018).

Psyllopsis fraxinicola lives on *Fraxinus* species (Ossiannilsson 1992, Ouvrard 2018). The eggs are laid in summer on the terminal buds of the host plant, where they overwinter. The eggs hatch with the bud-burst in spring (Ossiannilsson 1992). Contrary to the former two species, *P. fraxinicola* does not induce leaf galls, but immatures are often found in the galls of *P. fraxini* and *P. discrepans* (Ossiannilsson 1992). Like the former species, it has one to two generations per year (Hodkinson 2009).

Strophingia ericae (Curtis, 1835)

This species was recorded from the Netherlands by De Graaf et al. (1862), Van der Goot (1912) and Blöte (1926b). It is quite common in the Netherlands. However, it is not often reported on Waarneming.nl, probably due to its tiny dimensions. With its body length of 0.9-1.6 mm it is by far the smallest Dutch psyllid. It was collected from May until September.

Strophingia ericae is widely distributed all over Europe (Burckhardt 2013, Ossiannilsson 1992). It is monophagous on *Calluna vulgaris*. Whether it can complete its whole life cycle on other Ericaceae is unclear (Ossiannilsson 1992). In the United Kingdom it is a univoltine species at lowland localities, whereas at upland sites it takes

two years to complete its cycle (Hodkinson et al. 1999). The immatures overwinter on the host. In Sweden immatures were found from March until November, adults from May until August (Ossiannilsson 1992).

Liiviinae

Camarotoscena speciosa (Flor, 1861)

New for the Netherlands

Limburg St. Odiliënberg, AC 199-350, I.XI.1953, 1 ♀, leg. R.H. Cobben, col. Naturalis; Roermond, in house, AC 196-356, IX.1969, 14 ♂, 10 ♀, leg. J. Hofhuis, col. Naturalis; Herkenbosch, AC 202-352, 13.IX.1992, 1 ♂, on *Populus*. **Zeeland** Krabbedijke, AC 66-384, 14.VIII.1983, 1 ♀, on *Populus tremula*; Haamstede, AC 42-414, 12.VI.1992, 1 ♂, on *Populus*, leg. B. Aukema, col. NWA Wageningen. **Gelderland** Wamel, AC 159,7-432,4, 8.IX.2006, 1 ♂, on *Populus*; Boven-Leeuwen, Kaliwaal, AC 165,2-433,8, 8.VII.2017, 1 ♀, on *Populus nigra*; 3 km NW Druten, Waal river beach, AC 166,9-434,5, 9.VII.2017, 4 ♂, 6 ♀, on *Populus*.

Camarotoscena speciosa (fig. 18) can be found all over Europe (Burckhardt 2013, Jerinić-Prodanović 2010, Ouvrard 2018, Seljak 2006, Serbina et al. 2015b). Outside Europe, it was also reported from the Caucasus, Turkestan, China and Mongolia (Ossiannilsson 1992).

Camarotoscena speciosa shows variability in colour, from light to dark brownish fore wings with dark brown mottling. It lives on *Populus* species (*P. alba*, *P. balsamifera*, *P. nigra* and *P. tremula*) and their hybrids (Ossiannilsson 1992), other *Populus* species are reported from outside Europe (Ouvrard 2018). In central Europe it prefers *P. alba* and *P. nigra* (Lauterer 1993b). It produces conspicuous pale coloured leaf-roll galls on the leaves of its host plants. Probably, *C. speciosa* is a bivoltine species, the adults overwinter on conifers and other sheltered places (Hodkinson 2009). In

autumn it is also found inside houses, as the above-cited record from Roermond showed.

Livia crefeldensis Mink, 1855

Gelderland Veenendaal, AC 166-445, 19.IX.1982, 1 ♂, marshy area in a sandpit.

Van der Goot (1912) was the first to report *L. crefeldensis* from the Netherlands referring to two specimens attributed by De Graaf et al. (1862) to *L. limbata* (Waga, 1842). Van der Goot did not see this material himself, nor did Blöte (1926b). The reports of *L. crefeldensis* by Ossiannilsson (1992) and Hodkinson & Bird (2000) from the Netherlands referred to Van der Goot (1912) and Blöte (1926a). However, the latter paper written in Dutch is just an overview of the psyllid species that occur or might be found in the future in the Netherlands, without an actual record of *L. crefeldensis*. Docters van Leeuwen (1941) reported galls on *Carex* attributed to *L. crefeldensis* from the Lindevallei (province of Friesland) and Groesbeek (province of Gelderland). Subsequent editions of the Gallenboek (Docters van Leeuwen 1957, 1982, 2009) were based on these findings and identified the host plant species as *Carex spicata*. However, in Docters van Leeuwen & Alta (1946) only galls on *Carex muricata* were mentioned. The oldest Dutch report on a gall probably produced by *L. crefeldensis* is found on a woodcut by Matthias de Lobel from 1581 in his *Kruidtboeck*. It showed a gall on *C. arenaria* from Zoutelande (province of Zeeland) (Weeda et al. 1994, pers. comm. Y. Baugnée). Until now there has been only one confirmed Dutch record of an adult *L. crefeldensis* (see the material cited above).

Burckhardt (2013) listed only a limited number of European countries in which *L. crefeldensis* is present: Denmark, Finland, Germany, Great Britain, Poland, Romania and Sweden. The presence in the Netherlands was considered doubtful. Hodkinson & Bird (2000) confirmed its presence in Russia (including Siberia). Ouvrard (2018)

cited a record from Spain but this needs confirmation.

Livia crefeldensis lives on *Carex* species. Its galls on *Carex spicata* were illustrated by Docters van Leeuwen (2009). It is a univoltine species, the adults overwinter on the host (Hodkinson 2009, Ossiannilsson 1992).

Livia junci (Schrank, 1789)

De Graaf et al. (1862) mentioned *L. junci* from the Netherlands and later also Van der Goot (1912) and Blöte (1926b). It is a very common species (in Waarneming.nl 359 records of adults and galls from all over the Netherlands). Adults were collected from March until November. *Livia junci* is distributed all over Europe (Burckhardt 2013). It is also known from the Caucasus, Kazakhstan, Russian Far East, India, Morocco, Turkey, Tadjhikistan and Turkmenistan (Hodkinson & Bird 2000).

Livia junci lives on a number of *Juncus* species: *J. acutiflorus*, *J. alpinoarticulatus*, *J. anceps*, *J. articulatus*, *J. bufonius*, *J. bulbosus*, *J. capitatus*, *J. conglomeratus*, *J. effusus*, *J. gerardii*, *J. inflexus*, *J. jacquinii* and *J. subnodulosus*. In Scandinavia it has one generation per year but perhaps it has more generations in the south. The adults overwinter (Hodkinson 2009, Ossiannilsson 1992), often on conifers. In spring, eggs are laid in the shoots of the host plant. After hatching, the young larvae migrate to the growing points of the developing shoots and start to induce galls (Ossiannilsson 1992). The galls were illustrated by Docters van Leeuwen (1957, 1982, 2009) and Ellis (2018). Galls induced by *L. junci* have been found in the Netherlands on *Juncus acutiflorus*, *J. alpinoarticulatus* (including subsp. *atricapillus*), *J. articulatus*, *J. bufonius*, *J. bulbosus* and especially on *J. gerardii* (Docters van Leeuwen & Alta 1946, Docters van Leeuwen 1982, 2009).

Psyllidae
Psyllinae

Arytaina genistae (Latreille, 1804)

De Graaf et al. (1862) reported *A. genistae* from the Netherlands as *Psylla ulicis* Curtis, 1835 (see also Van der Goot 1912). It is widely distributed in the Netherlands occurring at almost every locality where the common host plant *Cytisus* (= *Sarothamnus*) *scoparius* grows. Adults have been recorded almost all year round from March until December.

Arytaina genistae occurs almost all over Europe and it has been introduced into North America (Burckhardt 2013, Ossiannilsson 1992). Besides *C. scoparius* other Fabaceae were reported as host plants: *C. austriacus*, *C. heuffelii* and *Genista tinctoria*; *Ulex europaeus* is doubtful (Ossiannilsson 1992).

According to Ossiannilsson (1992), it is a bivoltine species, with adults of the second generation overwintering on the host plant. In Italy, Conci et al. (1993) found an almost continuous development with two or perhaps even three generations and all stages overwintering on the host plant.

Arytainilla spartiophila (Foerster, 1848)

The first report of *A. spartiophila* from the Netherlands was by Van der Goot (1912) as *Psylla spartii* Guérin-Meneville, 1843. This latter name was also used in Blöte (1926b). The species occurs on *Cytisus scoparius* as *A. genistae* but is, in comparison with the latter, less common in the Netherlands. Adults were collected from May until August.

Arytainilla spartiophila is a western European species that has also been introduced into Australia, New Zealand and North America (Burckhardt 2013, Ouvrard 2018). It is monophagous on *C. scoparius* (Burckhardt 2002, Ossiannilsson

1992). It is a univoltine species, overwintering in the egg stage. The eggs are laid under developing buds (Ossiannilsson 1992).

Baeopelma foersteri (Flor, 1861)

Van der Goot (1912) reported *B. foersteri* for the first time from the Netherlands and also Blöte (1926b) listed it. It is quite common in the Netherlands, with adults collected from June until August.

Baeopelma foersteri is a western Palaearctic species occurring in Europe, North Africa and the Near East (Burckhardt 2013, Ouvrard 2018). It lives on *Alnus glutinosa* and *A. incana*. It is univoltine, overwintering in the egg stage in the buds of the host plants. The immatures hatch at the time the buds start expanding. They expel their faeces in a caudal 'trail' consisting of a cluster of wax filaments. At times this trail is broken and gradually replaced by a fresh one (Ossiannilsson 1992). The immatures of *B. foersteri* are much more agile than the immatures of the genus *Psylla* (Lauterer 1998). In the Czech Republic, teneral adults were found from the beginning of June onwards, the first copulations were observed in mid June (Lauterer 1998).

Cacopsylla affinis (Löw, 1880)

New for the Netherlands

Zeeland Burgh-Haamstede, AC 38-411, 2.VI.1990, 1 ♂, on *Quercus robur*, det. D. Burckhardt; Ouwerkerk, AC 57-404, 4.VI.1990, 1 ♂, det. I. Malenovský. Limburg, 3 km NE Wijlre, Vrakelberg nature reserve, AC 192,8-317,1, 22.V.2009, 1 ♂.

Cacopsylla affinis (fig. 19) is known from most European countries with the exception of the Iberian Peninsula (Burckhardt 2013, Jerinić-Prodanović 2010, Ripka 2008, Seljak 2006) and Turkey (Burckhardt & Önuçar 1993). It develops on *Crataegus* species (Burckhardt 2002, Ossiannilsson

nilsson 1992) on sunny places, such as forest margins, often together with *C. melanoneura* (Lauterer 1982). The life cycle of both species is univoltine, the adults overwinter. The adults leave the host plant as early as mid July and then migrate to conifers (Lauterer 1982, Hodkinson 2009). During overwintering the colouration of adults changes from ferruginous and green (abdomen) to deep black or dark brown, the veins of the fore wings, head and terminalia being invariably the darkest (Lauterer 1999). After overwintering, the adults migrate back to the host in early March. In the Czech Republic, the first adults of the new generation were collected at the end of May (Lauterer 1999). The immatures of *C. affinis* can cause small deformations of the leaves as described by Ellis (2018).

Females of *C. affinis* and *C. melanoneura* cannot be reliably distinguished using morphological characters (Lauterer 1999).

Cacopsylla ambigua (Foerster, 1848)

New for the Netherlands

Friesland Terschelling, Kroonpolders, AC 142-599, 1.VI.1996, 1 ♂, 2 ♀, on *Salix*. **Noord-Holland** Bussum, Laegieskamp, AC 138,1-476,8, 31.V.1986, 2 ♂, 3 ♀ on *Salix*; Den IJp, AC 124,9-496,3, 5.VI.1991, 1 ♂, on *Salix*; Amsterdam, Amerikahaven, AC 112-493, 10.V.1994, 1 ♂, 1 ♀. **Zuid-Holland** Zoetermeer, AC 94-452, 28.V.1992, 1 ♂, on *Salix*. Utrecht Maarsbergen, AC 156-452, 21.V.1993, 4 ♂, 2 ♀ on *Salix*. **Gelderland** Veenendaal, AC 166-445, 19.VI.1994, 1 ♂. **Noord-Brabant** Udenhout, De Brand nature reserve, AC 137-405, 20.V.1992, 1 ♂, 2 ♀; Vlijmen, De Moerputten, AC 145-411, 20.V.1992, 1 ♂, on *Salix*; Ulvenhout, AC 116.2-395,2, 27.V.2012, 1 ♂; Breda, Hoogeind II industrial area, AC 117,2-400,7, 8.VII.2013, 1 ♂, on *Salix*. **Zeeland** St. Philipsland, Rammegors nature reserve, AC 72,1-403,2, 4.VI.2011, 2 ♂, 1 ♀; idem, 17.VI.2015, 1 ♂, 1 ♀; 5 km NEE Rilland, Kreekraksluizen east, AC 75-385, 11.VI.2013, 2 ♂. **Limburg** Wessem, AC 190-353, 30.IV.1997, 2 ♂, 2 ♀, on *Salix*; 1 km E

Nijswiller, Platte Bossen, AC 196,3-313,3, 24.V.2012, 1 ♂.

Van der Goot (1912) mentioned *Psylla betulae* Linnaeus, 1758 from the Netherlands with *P. ambigua* as a synonym, based on a written notice of G.A. Six in De Graaf et al. (1862). In the psyllid literature these species names have never been considered as synonyms. The identity of the material of Van der Goot (1912) is thus considered doubtful here. We provide the first confirmed records of *C. ambigua* from the Netherlands.

The Palearctic *C. ambigua* (fig. 20) has been found all over Europe (Jerinić-Prodanović 2010, Lauterer & Burckhardt 1997, Seljak 2006, Serbina et al. 2015b). It lives on various willow species: *Salix aurita*, *S. caprea*, *S. cinerea*, *S. elaeagnos*, *S. lapponum* and *S. viminalis* (Lauterer & Burckhardt 1997). There are reports on second instar immatures overwintering under the lateral buds of the host plant. It seems more probable that hibernation takes place in the egg stage. At some central European localities, it is a univoltine species but in Scandinavia it is bivoltine. In Scandinavia adults were found from May until August, in the Netherlands from April until August, suggesting that *C. ambigua* is bivoltine in the Netherlands (Hodkinson 2009, Lauterer 1999, Ossiannilsson 1992).

Cacopsylla crataegi (Schrank, 1801)

New for the Netherlands

Noord-Holland Bergen aan Zee, AC 103-518, 13.IX.1991, 1 ♀, on *Quercus robur*. **Zeeland** Oostkapelle, Duinweg, AC 26-400, 21.VII.2014, 5 ♂, 2 ♀, two adults on *Q. robur* and five on *Acer pseudoplatanus*; idem, 23.VII.2014, 2 ♂, 2 ♀, one adult on *Crataegus* and three on *Q. robur*; **Limburg** 3 km NE Wijlre, Vrakelberg nature reserve, AC 192,8-317,1, 10.V.2008, 1 ♀, on *Prunus spinosa*.

The Palearctic *C. crataegi* (fig. 21) is found all

over Europe (Burckhardt 2013, Jerinić-Prodanović 2010, Seljak 2006, Serbina et al. 2015b). Outside Europe it has been recorded from Algeria, Morocco, Georgia, Israel, Iran and India (Burckhardt 1989, Burckhardt & Lauterer 1993, Ossiannilsson 1992).

Its host plants are *Crataegus* species: *C. coccinea*, *C. laevigata* (= *C. oxyacantha*) and *C. monogyna*. The life cycle is univoltine, the adults overwinter on conifers (Hodkinson 2009). Oviposition takes place on young *Crataegus* leaves, especially on the veins and stalks. The immatures move onto young twigs later on (Ossiannilsson 1992). In the Czech Republic, the first adults of the new generation were found in mid June. Adults often migrate great distances and can be found on shelter plants, such as *Fagus* and *Salix* (Ossiannilsson 1992, see also data on Dutch specimens above). Well-sclerotized adults are rusty brown. During winter their colouration changes to deep black, including the characteristic dark spots on the forewings (Lauterer 1999). After overwintering adults return to their host for oviposition in late May (Lauterer 1999).

Cacopsylla fulguralis (Kuwayama, 1908)

Friesland Ameland, Hollum, AC 171,6-606,2, 4.VII.2014, 1 ♀, leg. M. de Bont (Waarneming.nl). **Noord-Holland** Amsterdam, 23.V.2005, 8 ♂, 7 ♀, on *Elaeagnus*, leg. L. Moraal; Den Helder, AC 112,6-552,1, 29.VIII.2015, 1 ♀; Den Helder, AC 115,1-547,8, 1.I.2016, 1 adult; Den Helder, AC 112,7-551,1, 4.VI.2016, 1 adult, all leg. M. Renden (Waarneming.nl), Bergen, AC 108,9-520,2, 29.VI.2016, 1 ♀, leg. T. de Graaf (Waarneming.nl); Hoofddorp, AC 107,5-479,2, 19.VII.2016, 6 adults, leg. T. Verwiël (Waarneming.nl). **Zuid-Holland** Hazerswoude, AC 100,9-460,3, 20.IV.2016, 1 ♀; idem, 21.V.2017, 1 adult, all leg. R. Verstraten (Waarneming.nl). **Drenthe** Emmen, AC 256,0-531,6, 28.V.2017, 1 adult, leg. B. de Ruiters (Waarneming.nl). **Flevoland** Almere, AC 147,6-490,8, 12.VIII.2011, 30 adults on *Elaeagnus*; idem, 21.VIII.2011, 15 adults; idem, 9.IV.2017, 100 larvae,

all leg. R. Heemskerck (Waarneming.nl). **Utrecht** Zeist, AC 146-457, 16.XI.2011, 1 adult; idem, 28.XI.2011 1 ♂, all leg. H. Jansen (Waarneming.nl); Zuilen, AC 134,1-458,4, 27.IV.2014, 1 ♀, leg. D. van Werven (Waarneming.nl). **Gelderland** Wageningen, AC 174,7-442,0,II.V.2015, 1 ♀, leg. D. Belgers (Waarneming.nl). **Noord-Brabant** Teteringen, Oosteinde nature reserve, AC 117,4-403,3, 15.VI.2015, 1 ♀ on *Pseudotsuga menziesii*; Breda, garden center, AC 112,9-401,7, 26.X.2017, 12 ♂, 8 ♀, third to fifth instar larvae, on *E. x ebbingei*; **Zeeland** Koudekerke, AC 28-390, 20.V.2007, 1 adult on *E. x ebbingei*, leg. A. de Wilde.

Cacopsylla fulguralis is native to eastern Asia: Japan, China, Taiwan, Korea, the Russian Far East and the Philippines (Ouvrard 2018). It has been introduced into Europe with its host plants of the genus *Elaeagnus* which are planted as ornamental shrubs. The first record in Europe was documented in 1999 from France (Cocquempot & Germain 2000), followed by Belgium (Baugnée 2003), Great Britain, Italy, Spain (Mifsud et al. 2010), Switzerland (Burckhardt & Mühlethaler 2003) and Croatia (Burckhardt 2013). It was also reported from the Netherlands by Baugnée (2003) without providing any specific records. For this reason, the Dutch records are listed here. According to the definition of Dutch Species Register (2019) it is an alien species (status 2b).

The host plants of *C. fulguralis* include *Elaeagnus glabra*, *E. macrophylla*, *E. cuprea* and *E. oldhamii*. In Europe, it is primarily found on *E. x ebbingei*, a hybrid between *E. macrophylla* and *E. pungens* (Baugnée 2003, Cocquempot & Germain 2000). Deformations of the host by *C. fulguralis* are illustrated by Ellis (2018). Probably there are more than two generations per year, as indicated by the observations of immatures from April until October. The adults overwinter, as shown by the observation of an adult on January 1 on the evergreen host plant.

In the Netherlands *C. fulguralis* is considered a

pest in greenhouse cultures of the host plant, but also in public parks. Experiments are ongoing with biological control of this psyllid with lacewings (Neuroptera: Chrysopidae), in the municipality of Noordwijk (Zuid-Holland).

For identification see Cocquempot & Germain (2000).

Cacopsylla hippophaes (Foerster, 1848)

The first Dutch report on *C. hippophaes* was by Van der Goot (1912) and this species was also listed by Blöte (1926b).

Cacopsylla hippophaes has a Palaearctic distribution. It occurs in western and central Europe (Burckhardt 2013), Egypt, Turkey, the Caucasus and Middle Asia (Ossiannilsson 1992, Ouvrard 2018). It is monophagous on *Hippophae rhamnoides*. Its sucking activities on the leaves result in a limited distortion (Ellis 2018). The life cycle is univoltine. In the Czech Republic oviposition starts as late as the beginning of October and continues until November (Lauterer 1982). The eggs overwinter (Ossiannilsson 1992).

In the Netherlands, *H. rhamnoides* grows on sea dunes and at inland sites with supplemented sea sand as industrial areas and rail road dikes (Floron 2015). *Cacopsylla hippophaes* is quite common in the sea dunes and occurs on almost all places where its host plant grows. It has also been collected in a few inland industrial areas recently created by sea sand supplies. Adults were found from May until September.

Cacopsylla mali (Schmidberger, 1836)

Both Van der Goot (1912) and Blöte (1926b) reported *C. mali* from the Netherlands. In the Netherlands it is a common species with adults collected from May until September.

Cacopsylla mali is a Palaearctic species which

occurs all over Europe (Burckhardt 2013) and has been introduced into Australia, Canada, USA and South Africa (Burckhardt 1994). It develops on *Malus* species (Ossiannilsson 1992, Ouvrard 2018). The life cycle is univoltine with overwintering eggs. The immatures hatch in spring and migrate to the buds. The larger instars live on the flowers and leaves. The adults emerge at the end of May, during summer they disperse on various plant species and return to the host plant for mating in late summer. In summer the adults are green but later they become ochreous to brown. In Germany, adults were found from May until mid October, oviposition starts at the beginning of September. One female produces about 100 eggs, laid singly or in clusters from 2-10 on the bark or in crevices near the buds (Burckhardt 1994).

In the Netherlands *C. mali* is considered only a minor pest in apple cultures. It reaches a pest status only in unkept and, sometimes, organic orchards (Van Frankenhuyzen & Gruys 1978). Young immatures live in buds where wax and honeydew can cause slight damage to leaves. The sucking activities of later instars result in sap loss, damage to flowers leading to their destruction or malformation of fruits, and sometimes also partial defoliation. Honeydew serves as substrate for mould. A reduced condition of the tree may result in a lower production next year (Burckhardt 1994).

Cacopsylla melanoneura (Foerster, 1848)

After the first report of Van der Goot (1912) of *C. melanoneura* also Blöte (1926b) listed this species from the Netherlands. It is common in the country, with adults collected from April until August.

Cacopsylla melanoneura is widely distributed in Europe (Burckhardt 2013) and has also been found in Siberia, Mongolia, the Russian Far East, Japan and China (Ossiannilsson 1992). It develops on *Crataegus* species: *C. monogyna*, *C. laevigata*

and *C. maximowiczii* and also on *Malus* species and *Pyrus communis* (Ossiannilsson 1992). *Cacopsylla melanoneura* is a univoltine species overwintering in the adult stage on conifers. Migration to conifers begins as early as July (Burckhardt 1994, Ossiannilsson 1992). As in many other *Cacopsylla* species the body colour changes from rusty and green to deep black during overwintering (Lauterer 1999, Burckhardt & Lauterer 2009a). The adults return to the host as early as the end of February; the oviposition commences in mid March (data from the Czech Republic). Eggs are laid in the buds and on young leaves. The first adults of the new generation appear in mid May. Though copulations sometimes occur in autumn, fertilization takes place the next year (Lauterer 1999).

Cacopsylla melanoneura is considered one of the most important vectors of ‘*Candidatus Phytoplasma mali*’, the phytoplasma associated with apple proliferation disease, especially in Italy (Pizzinat et al. 2011). It was also reported as a pest of cultivated apple trees in Norway (Ossiannilsson 1992).

Cacopsylla moscovita (Andrianova, 1948)

The first record of *C. moscovita* from the Netherlands was published by Lauterer & Malenovský (2002). This species is not common in the Netherlands, being known altogether only from three coastal localities and two inland spots. Adults occur from May until August.

Cacopsylla moscovita occurs all over Europe except the mediterranean area, and it is also present in Turkey, the Caucasus, Siberia and the Russian Far East (Burckhardt 2013, Lauterer & Burckhardt 1997, Ossiannilsson 1992, Serbina et al. 2015b). It lives on a number of *Salix* species: *S. aurita*, *S. cinerea*, *S. caprea*, *S. lapponum*, *S. repens* and *S. viminalis* (Lauterer 1999, Ossiannilsson 1992). On three Dutch coastal localities it was collected on *S. repens*, the usual host plant in England (White & Hodkinson 1982). *Cacopsylla moscovita*

is a univoltine species, the adults overwinter, perhaps in leaf litter (Hodkinson 2009).

Cacopsylla parvipennis (Löw, 1878)

Blöte (1926b) published the first finding of *C. parvipennis* from the Netherlands and gave seven localities, all at the Dutch sea coast. Blöte (1926c) indicated that it was a very common species on *Salix repens* in the dune nature reserve of Meijendel (near The Hague). From the current perspective, *C. parvipennis* is uncommon and only found in the Dutch coastal area with adults collected from June until April.

Cacopsylla parvipennis is distributed in northern and central Europe; it is missing from the mediterranean area and the Balkans. Host plants are *Salix repens* and *S. rosmarinifolia* (Lauterer & Burckhardt 1997, Ossiannilsson 1992), the latter is a non-indigenous plant in the Netherlands. It is a univoltine species, the adults overwinter in the leaf litter. Larvae are feeding on both sides of the leaves of *S. repens* and also on the female catkins (Lauterer 1965, Ossiannilsson 1992). Blöte (1926c) mentioned the yellow to green colour of the adults in summer, later they become darker and after overwintering they are almost black.

Cacopsylla peregrina (Foerster, 1848)

Van der Goot (1912) included *C. peregrina* in his list of Dutch psyllids, but Blöte (1926a,b) omitted this species as he probably considered it a synonym of *C. mali*. Gravestein (1944a,b) mentioned *C. peregrina* as new for the Netherlands. He studied Blöte’s material of *C. mali* and concluded that most of it belonged to *C. peregrina*. In his opinion *C. peregrina* was very common in the Netherlands on its host, *Crataegus*. He noticed different colour forms from May until October. We can confirm that it is a very common species in the Netherlands on its host with adults collected from April until October.

Cacopsylla peregrina is widely distributed in Europe (Burckhardt 2013, Serbina et al. 2015b), Northern Africa, Turkey, Japan and North America (Ouvrard 2018). *Crataegus oxyacantha*, *C. monogyna*, *C. arnoldiana* and *C. maximowiczii* were listed as host plants (Ossiannilsson 1992). Like in *C. mali*, the adults can be collected on a number of other plants during summer, e.g. *Corylus avellana*, *Malus* species, *Populus tremula*, *Salix* species, *Taxus baccata*, *Ulmus ×hollandica* and *Quercus robur* (pers. obs. Kees den Bieman). In late August and September, the adults return to *Crataegus* for oviposition. At this time their colour changes from green to rusty brown (Lauterer 1982). *Cacopsylla peregrina* is a univoltine species which usually overwinters in the egg stage (Conci et al. 1993, Lauterer 1999, Ossiannilsson 1992).

Cacopsylla pruni (Scopoli, 1763)

Blöte (1954) reported *C. pruni* for the first time from the Netherlands. It is quite common in the Netherlands, mainly collected on *Prunus spinosa*. Adults were collected from March until July.

Cacopsylla pruni is found all over Europe and also in Turkey, the Caucasus, Iran and Siberia (Burckhardt 2013, Burckhardt & Lauterer 1993, Ossiannilsson 1992, Ouvrard 2018). It develops on several *Prunus* species including cultivated fruit trees (Ouvrard 2018), being usually the most common on *P. spinosa* at sunny and warm localities (Lauterer 1999). It is univoltine, overwintering as adult on conifers. Spring migration to the host starts in the beginning of April, followed by copulation and oviposition. The eggs are laid on both sides of the leaves and on the leaf stalks. Young immatures develop there and beneath the bud scales. The new generation emerges from June onwards. Shortly after emergence the adults start to migrate to their shelter plants (Lauterer 1999, Ossiannilsson 1992).

Adults and immatures of *C. pruni* are vectors of ‘*Candidatus* Phytoplasma prunorum’, the causal

agent of the European stone fruit yellows disease. Apricot *Prunus armeniaca*, Japanese plum *Prunus salicina* and peach *Prunus persica* are seriously affected by the disease while *Prunus domestica* is tolerant. This phytoplasma was found in most European countries and causes substantial impact especially in central and southern Europe (Carraro et al. 1998, Steffek et al. 2012).

Perhaps *C. pruni* is a complex of two cryptic species (Peccoud et al. 2013).

Cacopsylla pulchra (Zetterstedt, 1838)

New for the Netherlands

Friesland Terschelling, Kroonpolders, AC 142-599, 1.VI.1996, 1 ♂, 2 ♀, on *Salix*. Noord-Holland Den IJp, AC 124,9-496,3, 5.VI.1991, 1 ♂, on *Salix*; Texel, 3 km N Den Hoorn, AC III-563, 15.IV.2013, 1 ♂, on *Pinus*, leg. C. Gielis; Texel, 5 km S De Koog, AC II2-563, 22.IV.2014, 3 ♂, 4 ♀. Zuid-Holland Hellegatsdam, Ventjagersgaatje nature reserve, AC 8,20-413,7, 18.VI.2013, 1 ♂. Gelderland Leuvenum, AC 178-479, 27.V.1992, 3 ♂, on *Salix*. Noord-Brabant Vlijmen, De Moerputten, AC 145-411, 20.V.1992, 3 ♂, 1 ♀, on *Salix*; Vlijmen, Haarsteeg, AC 141-414, 20.V.1992, 2 ♂; 7 km NW Zundert, ‘80 Bunder’, AC 100-391, 23.V.2004, 2 ♂, 2 ♀, on *Salix*; Vortum Mullem, AC 196-404, 17.V.1992, 2 ♂, 2 ♀; Breda, Wolfslaar, AC II4,8-397,2, 2.V.2007, 1 ♂, 1 ♀; idem, 9.V.2008, 3 ♂, 3 ♀; Breda, Mastbos, AC II2-396, 4.VI.2016, 1 ♂, on *Pinus sylvestris*; Chaam, Chaamse Beek, AC II7-392, 9.V.2009, 5 ♂, 2 ♀; Ulvenhout, AC II4,4-396,3, 1.V.2011, 1 ♂, 1 ♀, on *Salix*; Ulvenhout Alphen-Chaam, Royaaldreef, AC II7,9-394,7, 9.II.2015, 1 ♂, on *Vaccinium myrtillus*; idem, 29.II.2016, 1 ♂, on *Vaccinium myrtillus*; Achtmaal, De Matjens nature reserve, AC 95,8-382,4, 24.IV.2008, 1 ♂. Zeeland St. Philipsland, Rammevors nature reserve, AC 72,0-403,1, 12.V.2008, 7 ♂, 4 ♀; idem, 26.V.2012, 3 ♂.

Cacopsylla pulchra (fig. 22) is found all over Europe with the exception of the Iberian Peninsula,

and also in the Causasus, Russian Far East and Japan (Burckhardt 2013, Jerinić-Prodanović 2010, Ossiannilsson 1992, Seljak 2006, Serbina et al. 2015b). It lives on a number of *Salix* species: *S. caprea*, *S. cinerea*, *S. myrsinifolia*, *S. pentandra*, *S. purpurea*, *S. repens*, *S. viminalis* and *S. triandra* x *viminalis*, along streams and around ponds, in forest clearings and on shrubs scattered in wet meadows (Lauterer & Burckhardt 1997, Malenovský et al. 2011). It is univoltine, the adults overwinter mainly on conifers and other evergreen plants, such as *Vaccinium myrtillus*. In the Netherlands and also in Scandinavia adults were collected throughout the year (Ossiannilsson 1992, pers. obs. Kees den Bieman). In the Czech Republic copulations were observed at the end of March (Lauterer 1999).

Cacopsylla pyri (Linnaeus, 1761)

De Graaf et al. (1862) and Van der Goot (1912) mentioned *C. pyri* in their lists of Dutch psyllids, while Blöte (1926b) omitted it. It is a rather common species in the Netherlands where adults were collected from July until October.

Cacopsylla pyri is a seasonally dimorphic species. The fore wings of the summer generations are transparent, while in overwintering generations there are conspicuous black shadows in the cells. The genal cones of the summer generation are usually pale, overwintering specimens have the whole cones or at least their tips black or brown.

It is a Palaearctic species which occurs all over Europe, the Caucasus, Iran, Middle Asia and China (Burckhardt 2013, Burckhardt & Lauterer 1993, Cho et al. 2017b, Ossiannilsson 1992, Serbina et al. 2015b). The host plants of *C. pyri* are *Pyrus communis* and *P. elaeagrifolia*. It is a bivoltine species in Scandinavia, multivoltine in countries with a warmer climate. In France there are 4-8 generations per year. The adults overwinter in bark crevices on pear trees. In southern and eastern Europe also the eggs overwinter (Lauterer 1999).

Egg clusters are laid on young shoots, later on the underside of the leaves (Burckhardt 1993, Ossiannilsson 1992). In the Netherlands the earliest observations of matings are from January and oviposition starts as early as February. Fifth instar immatures were observed as late as December and on sunny December days the adults appear (Van Frankenhuijzen & Freriks 1972). There are four generations per year in the Netherlands of which the second generation causes the most problems in pear orchards (CAF 2003). Considerable damage can be caused by immatures feeding on flower stalks and leaves (Ossiannilsson 1992). The species is also a vector of '*Candidatus Phytoplasma pyri*', the causal agent of the pear decline disease (Seemüller et al. 2011) and of '*Candidatus Liberibacter europaeus*'. The latter bacterium does not cause symptoms in pears and is probably a symbiont of the psyllid rather than a pathogen (Camerota et al. 2012, Cho et al. 2017b).

Cacopsylla pyricola (Foerster, 1848)

Blöte (1926b) mentioned *C. pyricola* for the first time from the Netherlands. Gravestein (1944a,b) reported *Psylla simulans* Foerster, 1848 as a new species for the fauna of the Netherlands; however, this is a synonym for *C. pyricola*. *Cacopsylla pyricola* is uncommon in the Netherlands; adults were collected from February until August.

Cacopsylla pyricola is seasonally dimorphic: the summer form is light orange to reddish brown with darker markings and largely pale genal cones. The winter form is darker and also the genal cones are dark (see Ossiannilsson (1992) for more details).

Cacopsylla pyricola occurs throughout Europe and it has been introduced into Canada and USA (Burckhardt 2013, Ouvrard 2018). The reports of *C. pyricola* from South America, Japan, Korea and China proved to be other *Cacopsylla* species (Cho et al. 2017b, Valle et al. 2017).

Cacopsylla pyricola lives on *Pyrus communis* and *P. pyraeaster*. It is polyvoltine, with two generations in Scandinavia and four to five in France. The adults overwinter on the host and in leaf litter. In early spring, eggs are laid in clusters on the buds, the underside of the leaves and on leaf stalks. A female may lay over 400 eggs. The immature development takes about 35-40 days. Serious damage is caused by injection of salivary phyto-toxins, transmission of pathogens ('*Candidatus Phytoplasma pyri*') causing pear decline and removal of large quantities of plant nutrients resulting in premature leaf drop, reduced terminal and trunk growth, reduced fruit size and poor fruit set in the following year. The secretion of honeydew by immatures creates an ideal medium for the growth of sooty mould on leaves and fruits (Burckhardt 1994, CABI 2017, Lauterer 1999, Ossiannilsson 1992). Also *C. pyricola* bears the bacterium '*Candidatus Liberibacter europaeus*' (see the remark on *C. pyri*).

Cacopsylla pyrisuga (Foerster, 1848)

New for the Netherlands

Utrecht Utrecht, AC 137-455, 21.VI.1947, 1 ♂, 3 ♀, on *Pyrus communis*, leg. Dikstaal; Rhenen, AC

166-441, 9.VII.1967, 1 ♂, 1 ♀, leg. R.H. Cobben.

Gelderland Wageningen, AC 175-443, v.1953, 1 ♂, 2 ♀, leg. H.H. Evenhuis, all col. Naturalis.

The Netherlands was one of the few European countries from which *C. pyrisuga* (fig. 23) had not been reported yet (Burckhardt 2013, Serbina et al. 2015b). Outside Europe it is also known from the Caucasus, Iran, Israel, Lebanon and Turkey (Burckhardt & Lauterer 1993, Burckhardt & Önuçar 1993, Cho et al. 2017b, Ouvrard 2018, Spodek et al. 2017). The published records of *C. pyrisuga* from Japan, Korea and China proved to be *Cacopsylla burckhardti* Luo et al., 2012 (Cho et al. 2017b).

Cacopsylla pyrisuga lives on *Pyrus* species: *P. communis*, *P. amygdaliformis*, *P. pashia* and *P. salicifolia*

(Cho et al. 2017b). It is a univoltine species with overwintering adults, mainly on conifers. The adults return to the host plant from mid March to April. The eggs are deposited when the leaf buds are opening, mainly on the median veins and stalks on young leaves. Mature leaves and woody parts of twigs are avoided. A female may produce up to 1000 eggs which are deposited in small clutches of 2-6. The eggs produce deformations of leaf buds. The young immatures may cause conspicuous leaf-roll deformations. Later they migrate from the leaves to the woody twigs where they often crowd together in dense aggregations, producing honeydew which attracts ants. Later, the immatures return to the leaves where the last moult takes place. The adults of the new generation appear in early June. Shortly after sclerotization the adults migrate to their shelter plants (Burckhardt 1994, Lauterer 1999, Ossiannilsson 1992).

Cacopsylla pyrisuga is vector of '*Candidatus Phytoplasma pyri*', causing the pear decline disease, and the bacterium '*Candidatus Liberibacter europaeus*' (Cho et al. 2017b). However, the economic impact of *C. pyrisuga* in the Netherlands is limited due to its rarity.

Cacopsylla rhamnicola (Scott, 1876)

New for the Netherlands

Noord-Brabant Chaam, Chaamsche Beek nature reserve, AC 117,0-393,3, 25.VI.2010, 1 ♂, on *Rhamnus cathartica* at a sunny roadside, det. I. Malenovský. **Zuid-Holland** Schoonrewoerd, Schaapskooi, AC 135-438, 12.VI.2013, 3 ♂, 1 ♀, leg. C. Gielis.

An Eurosiberian species occurring in most European countries, but not yet reported from Belgium (Burckhardt 2013, Jerinić-Prodanović 2010, Ossiannilsson 1992, Ripka 2008); present also in Turkey, the Caucasus, Kazakhstan and Mongolia (Burckhardt & Önuçar 1993, Ossiannilsson 1992).

Cacopsylla rhamnicola (fig. 24) is monophagous on *Rhamnus*, mainly *R. cathartica* but in Slovenia also on *R. fallax* (Seljak 2006) and in Italy also on *R. saxatilis* and *R. alpinus* (Conci et al. 1993). It often occurs in relatively warm habitats such as sun-exposed shrubs scattered in dry grassland, meadows or fens, along forest margins and in open forests (Malenovský et al. 2011). It is univoltine, the adults overwinter mainly on conifers, mainly *Abies alba*, *Pinus sylvestris* and *Picea abies*. During overwintering, the body colouration changes from ochreous with a green abdomen to deep black-brown, with minute paler spots on the head and with longitudinal stripes on the thorax. The wing venation turns to black but the wing membrane remains transparent (Lauterer 1999). Eggs are deposited in the inflorescences and on the young folded leaves of *Rhamnus* at the beginning of June, the fifth instars were found as late as in August. The first adults were observed at the end of June. The migration to the overwintering plants seems to start early as shown by a young female on July 11 on *Pinus sylvestris* (Lauterer 1999, Ossiannilsson 1992).

Cacopsylla saliceti (Foerster, 1848)

Both Van der Goot (1912, as *Psylla salicola* Foerster, 1848) and Blöte (1926b) reported *C. saliceti* from the Netherlands. This species is distributed all over the Netherlands but is not common and occurs only locally. Adults were collected from February until November.

Cacopsylla saliceti has a Palaearctic distribution and occurs all over Europe with the exception of Scandinavia and the greater part of the Balkans. It is also present in Turkey, the Caucasus and the Russian Far East (Lauterer & Burckhardt 1997). The host plants include several species of *Salix*: *Salix alba*, *S. aurita*, *S. cinerea*, *S. elaeagnos*, *S. fragrans*, *S. fragilis* and *S. purpurea* (Lauterer & Burckhardt 1997), growing in various habitats, e.g. banks of small streams, shores of ponds or roadside verges (Malenovský et al. 2011). *Cacopsylla*

saliceti is a univoltine species. The adults overwinter on conifers and in leaf litter (Hodkinson 2009). In the Czech Republic overwintering adults were found until the beginning of June. Oviposition starts in April. The first specimens of the new generation were found as early as mid May (Lauterer 1999).

For identification see Lauterer & Burckhardt (1997). This species shows a remarkable variation in the shape of the parameres.

Cacopsylla sorbi (Linnaeus, 1758)

New for the Netherlands

Gelderland Bennekom, AC 176-446, 16.VIII.1986, 11 ♀, on *Sorbus aucuparia*. **Overijssel** 5 km SE Holten, De Borkeld nature reserve, AC 230-476, 6.VI.1993, 1 ♂, on *Crataegus*. **Limburg** Beegderheide, AC 191,5-357,2, 31.V.1997, 3 ♂, on *Sorbus aucuparia*; 2 km SE Voerendaal, Kunderberg nature reserve, AC 194,5-319,7, 13.VII.2009, 1 ♂.

Cacopsylla sorbi (fig. 25) is an uncommon species in the Netherlands. On many locations with stands of *Sorbus aucuparia* it has not been found. It has a Palaearctic distribution and has been recorded all over Europe with the exception of the Iberian Peninsula (Burckhardt 2013, Jerinić-Prodanović 2010, Seljak 2006, Serbina et al. 2015b). It has also been introduced into North America (Ossiannilsson 1992).

Cacopsylla sorbi is closely related and morphologically similar to *C. mali*. Besides *Sorbus aucuparia*, it also develops on *S. amurensis*. Even in cases of heavy infestation of the host plant in the Czech Republic no damage has been observed, such as contamination with honeydew or deformation of leaves and sprouts. The reason for this may be that the species attacks the host plant at a later physiological stage, when the leaves and inflorescences are larger, compared to the case of *C. mali* and its host plant. Copulations were observed from late June onwards. Oviposition starts in

August. *Cacopsylla sorbi* shows no long summer migrations to other plants as *C. mali* and *C. peregrina*. This might be related to the early ripening of the ovaries. The life cycle is univoltine with overwintering in the egg stage (Lauterer 1999, Ossiannilsson 1992).

Cacopsylla ulmi (Foerster, 1848)

New for the Netherlands

Gelderland Wageningen, Klein Arboretum, AC 175,0-442,1, 31.VII.2015, 1 ♂, 1 ♀, on *Ulmus laevis*. **Noord-Brabant** Breda, Klokkenberg, AC 112,6-394,8, 17.VI.2007, 1 ♂. **Limburg** Houthem, AC 184-321, 22.VIII.1955, 6 ♂, 3 ♂, on *Ulmus*, det. D. Burckhardt; Schin op Geul, nature reserve Gerendal, AC 188,5-317,3, 21.VII.2009, 1 ♂.

Despite intensive collection activities, this species was not found at many stands of *Ulmus laevis* and *U. glabra* in the provinces of Noord-Brabant and Zeeland and generally it appears uncommon in the Netherlands. *Cacopsylla ulmi* (fig. 26) has a Palaearctic distribution. In Europe, it has been recorded from many countries with the exception of the Iberian Peninsula. From neighbouring Belgium, it has not yet been reported (Baugnée et al. 2012 Burckhardt 2013, Jerinić-Prodanović 2010, Ripka 2008, Seljak 2006, Serbina et al. 2015b). It is also present in the Caucasus and in Kazakhstan (Ossiannilsson 1992).

Host plants are *Ulmus* trees: *U. laevis*, *U. glabra* and *U. minor* (Ossiannilsson 1992, Ripka 2008). The life cycle is univoltine, the eggs overwinter. In Scandinavia adults were collected between June and September (Ossiannilsson 1992) and in the Czech Republic from May until November (Lauterer 1999). Copulations were observed as early as June, however oviposition starts much later, from mid-September onwards. Eggs are laid mostly singly on sprouts and around buds, mainly on the lower branches of older trees. In spite of heavy infestations, no deformation of leaves, stalks or stems were observed in the Czech

Republic. The immatures hatch at the time of budding of elm trees, phenologically much later than in the closely related *C. mali* on apple trees and *C. peregrina* on hawthorn bushes.

Cacopsylla visci (Curtis, 1835)

Cobben (1951) collected *C. visci* (reported as *Psylla viscicola* Haupt, 1935) for the first time in the Netherlands, see also Gravesteyn (1951). Adults have been collected in the Netherlands from June to August. *Cacopsylla visci* has a Palaearctic distribution and has been recorded from a number of European countries, North Africa, as well as eastern Asia including Japan and Korea (Burckhardt 2013, Burckhardt et al. 2017, Cho et al. 2017a, Hansen & Hodkinson 2006, Ripka 2008, Seljak 2006, Struwe et al. 2009).

The host plants of *C. visci* are *Viscum album* and *Loranthus europaeus* (Burckhardt et al. 2017). Both plants have a hemiparasitic life style on various trees and shrubs. *Cacopsylla visci* has 2-3 generations a year and overwinters in the egg stage (Hodkinson 2009), although based on data from Norway, it was suggested that it overwinters as fourth and fifth instars (Hansen & Hodkinson 2006, Lauterer 1999).

In the Netherlands *V. album* only occurs in the utmost southern part of the province of Limburg. However, *V. album* is also sometimes cultivated in botanical gardens and *C. visci* can also be found there. In several gardens the cultivation started from seeds and the occurrence of *C. visci* at these places show that *C. visci* can be dispersed by wind to far distant places.

Cacopsylla zetterstedti (Thomson, 1877)

Lauterer & Malenovský (2002) reported *C. zetterstedti* for the first time from the Netherlands in the province of Zuid-Holland, 2 km NE Scheveningen, 7.VII.2002, 8 ♂, 6 ♀, on *Hippophae*

rhamnoides. This species is common in the Dutch sea dunes.

Cacopsylla zetterstedtii is widely distributed in the western Palaearctic region, being recorded throughout Europe and also Turkey, the Caucasus and the Altai in Russia (Burckhardt 2013, Burckhardt & Önuçar 1993, Labina 2008, Ossiannilsson 1992). *Cacopsylla zetterstedtii* is closely related to *C. hippophaes*, has the same life cycle (univoltine, with overwintering eggs) and shares the same host plant (*Hippophae rhamnoides*). However, in the Netherlands and also in the Czech Republic *C. zetterstedtii* is much less common than *C. hippophaes* (Lauterer 1982, Lauterer & Malenovský 2002, pers. obs. Kees den Bieman). Both species occur together in the Dutch sea dunes and at inland localities as described for *C. hippophaes*.

Chamaepsylla hartigii (Flor, 1861)

The first Dutch report on *C. hartigii* was by Blöte (1926b). From the current perspective, it is a common species in the Netherlands. Adults were collected from May until August.

Chamaepsylla hartigii is a Holarctic species occurring all over Europe with the exception of most Balkan countries. It also occurs in the Caucasus, the Russian Far East, Japan and North America (Burckhardt 2013, Ossiannilsson 1992, Ouvrard 2018). It lives on various *Betula* species (Ouvrard 2008). *Betula pendula* is the most common host plant in the Netherlands. The life cycle of *C. hartigii* is probably univoltine with overwintering eggs (Hodkinson 2009, Lauterer 1998, Ossiannilsson 1992). Adults in Scandinavia and the Czech Republic appear from May until August or the beginning of September (Ossiannilsson 1992, Lauterer 1998), just as in the Netherlands.

Livilla variegata (Löw, 1881)

New for the Netherlands

Gelderland Wageningen, Klein Arboretum, AC 175,0-442,1, 31.VII.2015, 2 ♂, on *Laburnum anagyroides*; idem, 23.VII.2016, 2 ♀, on *L. anagyroides*.

Livilla variegata (fig. 27) is considered native to southern or southwestern Europe and the Alps but it has expanded its range to the north, to urban areas since the 1970s (Burckhardt & Mühlethaler 2003). Currently it is widespread in western and central Europe: Austria, Bosnia and Herzegovina, Czech Republic, France, Germany, Great Britain, Hungary, Italy, Romania, Slovakia, Slovenia, Spain and Switzerland (Burckhardt 2013, Hodkinson & Hollis 1987, Lauterer & Malenovský 2002, Malenovský & Kment 2004, Seljak 2006). It has also been introduced into Canada (Wheeler & Hoebeke 2017). For the Netherlands it is an alien species (status 2c, Dutch Species Register 2019).

It is strictly oligophagous on *Laburnum anagyroides* and *L. alpinum*. *Laburnum anagyroides* is a mediterranean tree often planted as an ornamental plant in parks and gardens (Hodkinson & Hollis 1987). Damage to host plants has not yet been reported (Malenovský & Kment 2004). In Italy, it has one generation per year, adults occur from April to August, immatures were collected in April and May. Probably the eggs or the first instars overwinter (Conci et al. 1993).

For identification see Hodkinson & Hollis (1987).

Psylla alni (Linnaeus, 1758)

De Graaf et al. (1862) mentioned *P. alni* from the Netherlands and also Van der Goot (1912) and Blöte (1926b) listed this species. It is currently very common in the Netherlands with adults collected from May until the beginning of October. *Psylla alni* occurs all over Europe and also in the East Palaearctic region and North America (Burckhardt 2013, Ossiannilsson 1992).

The life history of *P. alni* was studied by De Geer (1773); Lauterer (1998) gave an extensive description. The host plants are alder species: *Alnus glutinosa*, *A. incana* and *A. viridis* in Europe and *A. japonica* and *A. hirsuta* in Japan. The life cycle is univoltine. In late autumn the female deposits groups of 4-5 eggs on the host plant buds. The eggs overwinter (Ossiannilsson 1992, Lauterer 1998, Hodkinson 2009). Hatching starts at the time of bud break, in late March and the beginning of April. Immatures are coated in white flocculent wax and stay on the young shoots in the axis of leaves (Ossiannilsson 1992). Young instars are sedentary, the last two instars often move on the host plant. In Central Europe the first adults were observed in May (Lauterer 1998) as in the Netherlands.

Psylla buxi (Linnaeus, 1758)

Van der Goot (1912) was the first to mention *P. buxi* from the Netherlands, Blöte (1926b) also listed it. This species can be found in almost every Dutch garden with its host *Buxus sempervirens*. This is a non-indigenous plant in the Netherlands (alien species status 2a, Dutch Species Register 2019). Adults were collected between June and the beginning of October. *Psylla buxi* was the subject of one of the few Dutch studies on the biology of a psyllid (Wilcke 1941).

Psylla buxi is perhaps native to western and southern Europe and it has been introduced into central and northern Europe a long time ago and, probably more recently, also to North America and the Pacific (Malenovsky & Lauterer 2011). It is narrowly oligophagous on *Buxus* species, mainly found on *Buxus sempervirens*, but also on *B. microphylla* and *B. balearica* (Hodkinson & White 1979, Wilcke 1941). It is a univoltine species. From mid July until the end of August eggs are laid in the terminal buds of the host plant. Eggs hatch from mid August to the end of October. Remarkably, the first instar remains in the open egg shell until the next moult in the

following year. Hodkinson (2009) suggested that eggs overwinter but perhaps he did not consider that the first instars remain in the egg shell. The second instar appears at the beginning of April, it leaves the egg shell and crawls to just opening buds. The development of the immatures takes a long time and three or four different instars can occur simultaneously. The immatures are covered with wax. The development of immatures is completed before mid June (Conci et al. 1993, Wilcke 1941). In spring and early summer, the immatures produce leaf galls, each leaf being transformed into a bowl-like formation (Docters van Leeuwen & Alta 1946, Docters van Leeuwen 2009, Grosscurt 2017, Ossiannilsson 1992, Wilcke 1941).

Psylla buxi is a minor pest for commercial box cultivation. Regular pruning is advised as precautionary measure (Groenkennisnet 2017).

Spanioneura fonscolombii Foerster, 1848

New for the Netherlands

Zuid-Holland Leidschendam, AC 86,1-456,7, 9.X.2011, 5 ♂, 3 ♀; Lexmond, AC 130-442, 2.II.2015, 21 ♂, 21 ♀, leg. C. Gielis; Boskoop, AC 103,9-456,7, 24.VIII.2009, 1 ♂, 1 ♀, leg. A. de Wit, col. NVWA; Boskoop, AC 105,1-455,1, 17.VIII.2009, 2 ♂, 5 ♀, leg. A. de Wit, col. NVWA; Waddinxveen, AC 105,5-448,5, 25.VIII.2009, 2 ♂, 3 ♀, leg. A. de Wit, col. NVWA; Reeuwijk, AC 110-451, 18.VIII.2009, 1 ♂, 2 ♀, leg. A. de Wit, col. NVWA; Reeuwijk, AC 106,0-452,1, 17.VIII.2009, 2 ♂, 9 ♀, leg. A. de Wit, col. NVWA; Hazerswoude, AC 101,2-457,7, 19.VIII.2009, 1 ♂, 3 ♀, leg. A. de Wit, col. NVWA; Leiden, Merenwijk, AC 95,0-466,0, 26.V.2016, 1 ♂, 1 ♀, leg. V. Kalkman (Waarneming.nl); Waddinxveen, AC 104,7-449,6, 11.VI.2016, 5 ♂, 6 ♀, leg. V. Kalkman (Waarneming.nl); Voornes Duin, AC 64,4-435,7, 24.VI.2016, 3 ♀, leg. V. Kalkman (Waarneming.nl); Hoorbaar, AC 124,9-431,8, 3.III.2017, 1 ♀, leg. P. Kersten (Waarneming.nl). **Flevoland** Lelystad, Archipel, AC 161,6-502,6, 30.V.2011, 1 ♀, leg. J. Windig (Waarneming.nl). **Utrecht** Utrecht,

AC 137,0-457,2, 2.IX.2016, 1 ♂, leg. H. de Vries (Waarneming.nl). **Gelderland** Wageningen, AC 175,0-443,8, 10.VIII.2010, 2 ♀; Wageningen, Klein Arboretum, AC 175,0-442,1, 31.VII.2015, 1 ♂, 1 ♀; Wamel, cemetery, AC 160,5-432,5, 13.VI.2015, 1 ♂, 2 ♀; Geldermalsen, orchard, AC 149,8-433,3, 24-30.VI.2013, 4 ♂, 6 ♀, collected with white pan, L. Sijstermans; Beek, AC 192,1-426,8, 12.VI.2016, 1 ♂, leg. V. Kalkman (Waarneming.nl); Wijchen, AC 179,0-422,6, 15.II.2017, 1 ♀, leg. J. Houkes (Waarneming.nl). **Overijssel** Rijssen, AC 232,4-480,2, 9.III.2014, 1 ♀, leg. G. van der Maat (Waarneming.nl); Weerselo, AC 255,0-485,5, 15.VII.2009, thousands of adults, leg. A. Sonnemans (Waarneming.nl); Weerselo, AC 254,1-485,6, 29.VI.2009, 1 ♀, col. NVWA; Zwolle, AC 203,7-498,9, 11.XII.2010, 1 ♀, leg. G. Veurink (Waarneming.nl); Grafhorst, AC 191,9-510,8, 21.II.2017, 1 ♀, leg. H. van Dodewaard (Waarneming.nl). **Noord-Brabant** Ulvenhout, cemetery, AC 114,0-396,0, 10.IX.2010, 4 ♂, 3 ♀; idem, 3.X.2013, 2 ♂, 1 ♀; idem, 2.VII.2016, 1 ♂; Ulvenhout, tuin, AC 114,8-395,2, 11.II.2016, 1 ♂, 1 ♀; Loon op Zand, AC 133,6-404,6, 10.VII.2013, 2 ♂, 1 ♀; 2 km E Biesbosch Museum, AC 114,6-419,4, 29.VII.2017, 1 ♀, not on *Buxus sempervirens*; Grave, Blindeninstituut, AC 179,4-418,5, 23.I.2013, 1 ♂, leg. A. den Ouden (Waarneming.nl). **Limburg** Beutenaken, AC 188,0-310,2, 3.VI.2014, 1 ♂, 1 ♀; Maasduinen, AC 201-392, 13.VII.2017, 2 ♂, 2 ♀. Only new localities listed on Waarneming.nl included.

In the Netherlands *S. fonscolombii* (fig. 28) was collected for the first time in 2009 by A. Sonnemans. In a few years it has dispersed all over the Netherlands, on its host plant in gardens but also into almost every commercial *Buxus* nursery. On its host plant it often occurs together with *P. buxi*. Sampling in the Netherlands for *P. buxi* before 2009 has never resulted in the discovery of *S. fonscolombii* suggesting that *S. fonscolombii* is a recently introduced species (alien species, status 2c, Dutch Species Register).

Spanioneura fonscolombii originally had a limited

distribution in southern and western Europe: Belgium, France, Great Britain, Italy, Ireland, Luxembourg, Slovenia, Spain and Switzerland (Burckhardt 2013, O'Connor & Malumphy 2011, Seljak 2006) but it has recently also reached as far north as the southern provinces of Sweden (Gertsson 2015). It has also been introduced to Connecticut and Massachusetts in the USA (Hodkinson 1988, Conci et al. 1993).

Spanioneura fonscolombii is monophagous on box *Buxus sempervirens*, with a single generation per year. The adults overwinter on the host plant. Hodkinson (2009) suggested that there might be more than one generation per year and that perhaps also the eggs overwinter. As the Dutch data show, adults can be collected throughout the year. The species is sometimes abundant, without reaching a pest status in box cultures (Conci et al. 1993).

For identification see Hodkinson & White (1979).

Triozidae

Bactericera acutipennis (Zetterstedt, 1828)

Zuid-Holland, Scheveningen, AC 78-458, June 1922, 1 ♀, identified by Blöte as *T. saundersi*. **Gelderland** Staverden, AC 179-477, 11.IV.1966, 1 ♀, leg. P. Poot. Both identified by I. Malenovsky and col. Naturalis.

The first Dutch report on *B. acutipennis* (as *Triozsa saundersi* Meyer-Dür, 1871) was made by Blöte (1926b). There are only few data on this species from the Netherlands. The Palaearctic *B. acutipennis* occurs throughout Europe, with the exception of most mediterranean countries (Burckhardt 2013, Burckhardt & Lauterer 1997b, Serbina et al. 2015b).

Its host plant is *Comarum* (= *Potentilla*) *palustre*. A suggested second host plant needs confirmation:

Alchemilla xanthochlora (Burckhardt & Lauterer 1997b). Both plants belong to Rosaceae but usually grow in different habitats.

Bactericera acutipennis is a bivoltine species with a strong seasonal dimorphism between the two generations in colouration and distribution of the surface spinules on the fore wings, which is induced by differences in photoperiod (Burckhardt & Lauterer 1997b, Lauterer 1982, Ossiannilsson 1992). The adults overwinter, usually on conifers (Hodkinson 2009, Ossiannilsson 1992).

***Bactericera albiventris* (Foerster, 1848)**

After the first report of *B. albiventris* from the Netherlands by Van der Goot (1912) also Blöte (1926b) listed this species. It is quite common in the Netherlands with adults collected throughout the year.

Bactericera albiventris is a widely distributed Palaearctic species found in most European countries (Burckhardt 2013, Ripka 2008, Seljak 2006), as well as eastern Asia (Burckhardt & Lauterer 1997b, Ossiannilsson 1992).

A number of *Salix* species are known hosts: *Salix alba*, *S. caprea*, *S. gracilis*, *S. lapponum*, *S. myrsinifolia*, *S. rosmarinifolia*, *S. triandra*, *S. pentandra*, *S. purpurea* and *S. repens* (Burckhardt & Lauterer 1997b, Ossiannilsson 1992). The life cycle is bivoltine, the adults overwinter on conifers (Hodkinson 2009).

***Bactericera curvatinervis* (Foerster, 1848)**

New for the Netherlands

Gelderland Buren, AC 152-436, 4.X.1992, 1 ♂, 1 ♀. **Noord-Brabant** 4 km NW Achtmaal, Oude Buisse Heide nature reserve, AC 98,4-387,3, 26.VII.2011, 1 ♂, on *Salix*; Gilze, Ossegoor nature reserve, AC 121,1-392,2, 5.VIII.2012, 1 ♂; Breda, Hoogeind II industrial park, AC 116,8-400,9, 08.VII.2013, 1 ♂,

on *Salix*; 4 km s Ulvenhout, Heistraat, AC 115,5-391,2, 19.X.2017, 1 ♂, 2 ♀, on *Salix*.

Bactericera curvatinervis (fig. 29) has been recorded from most European countries with the exception of the Iberian Peninsula. This Palaearctic species reaches eastern Siberia and Japan (Burckhardt 2013, Burckhardt & Lauterer 1997b, Jerinić-Prodanović 2010, Konovalova 1988, O'Connor & Malumphy 2011, Seljak 2006, Serbina et al. 2015b). It is one of the many *Salix*-feeding *Bactericera* species, reported from *Salix alba*, *S. aurita*, *S. caprea*, *S. cinerea*, *S. purpurea*, *S. repens* and *S. viminalis* (Burckhardt & Lauterer 1997). In Scandinavia immatures were observed from July until October on both sides of willow leaves. Adults were found throughout the year (Ossiannilsson 1992). Probably it has only one generation per year and the adults overwinter on conifers (Burckhardt & Lauterer 1997b, Hodkinson 2009).

***Bactericera maura* (Foerster, 1848)**

Noord-Holland Zaandam, AC 115-495, 9.X.1991, 1 ♂, 8 ♀; idem, 22.X.1991, 4 ♂, 3 ♀; idem, 1.III.1992, 2 ♂; idem, 9.III.1992, 1 ♂, 1 ♀; idem, 13.X.1994, 3 ♂, 11 ♀; idem, 17.X.1994, 1 ♂ all leg. J.H. Woudstra, col. Naturalis. **Flevoland** Lelystad, sand stock, AC 162-505, 11.V.1982, 3 ♀; Lelystad, Houtrib-zand, AC 158-504, 20.X.1985, 2 ♀, all leg. H. Vallenduuk, col. Naturalis. **Noord-Brabant** 2 km E Biesbosch Museum, AC 114,6-419,4, 16.X.2017, 5 ♂, 3 ♀, on *Salix alba*, collecting activities in September 2017 on this locality were in vain.

Van der Goot (1912) included *B. maura* in the Dutch fauna based on a note of G.A. Six, however no collecting record was given. Blöte (1926b) and Burckhardt (2013) omitted this species. Labina et al. (2014) cited *B. maura* from the Netherlands without providing a reference or collecting data. For this reason, the available collection data are given here.

Bactericera maura has been reported in Europe from Austria, Czech Republic, France, Germany, Poland, Romania, Russia (European part), Slovakia, Spain, Switzerland and Ukraine, and outside Europe also from the Caucasus, Kazakhstan and the Russian Far East; published records from the USA proved to be *B. salicivora* (Burckhardt 2013, Burckhardt & Lauterer 1997b, Hodkinson 1981, Konovalova 1988).

Bactericera maura occurs on *Salix* species: *Salix alba*, *S. fragilis*, *S. triandra* and *S. purpurea* (Dobreaanu & Manolache 1961). It is often found on *S. purpurea* along streams and around springs and ponds (Malenovský & Lauterer 2012). It is a bivoltine species (Lauterer 1993b). The samples from early March (from Zaandam) confirm that *B. maura* overwinters as adult.

For identification see Burckhardt & Lauterer (1997b) and Dobreaanu & Manolache (1961).

***Bactericera nigricornis* (Foerster, 1848)**

Blöte (1926a,b,c) reported the first observations of *B. nigricornis* from the Netherlands. It is probably an uncommon species. The most recent data from the Netherlands date back to 1955.

Bactericera nigricornis occurs all over Europe (with the exception of Great Britain and Ireland), North Africa, Central Asia and the East Palaearctic region including the Russian Far East (Burckhardt 2013, Burckhardt & Lauterer 1997b, Ossiannilsson 1992, Ouvrard 2018).

In contrast to the overwhelming majority of the European psyllids *B. nigricornis* is a polyphagous species (Hodkinson 1981, 2009) feeding on a variety of herbaceous dicotyledonous plants, including cultivated crops: carrot *Daucus carota*, parsley *Petroselinum crispum* (Apiaceae), *Datura stramonium*, potato *Solanum tuberosum*, *S. nigrum*, *Convolvulus arvensis* (Solanaceae), beet *Beta vulgaris*, *Chenopodium album* (Amaranthaceae),

Brassica rapa, *B. campestris*, *Erysimum cheiranthoides*, *Capsella bursa-pastoris*, *Thlaspi arvense*, *Raphanus raphanistrum* (Brassicaceae) (Burckhardt & Lauterer 1997b, Hodkinson 1981). The life cycle is univoltine in Scandinavia but multivoltine in other areas (Burckhardt & Lauterer 1997b, Ossiannilsson 1992). Adults overwinter on conifers and other plants (Lauterer 1991, Ossiannilsson 1992). Adults and immatures were found simultaneously on the host plant in the Netherlands, up until December (Gravestein 1949). In the Netherlands *B. nigricornis* was found on *Brassica rapa* f. *rapifera* and has at least three generations a year (Gravestein 1949).

***Bactericera reuteri* (Šulc, 1913)**

New for the Netherlands

Limburg Heel, Ossen nature reserve, AC 192,6-354,1, 27.VI.2003, 1 ♀, det. D. Burckhardt.

Bactericera reuteri (fig. 30) is distributed mainly in central and northern Europe. Outside Europe it has also been recorded from the Altai Mts. and Mongolia (Burckhardt 2013, Burckhardt & Lauterer 1997b, Labina 2008, Ossiannilsson 1992, Serbina et al. 2015b). The record from the Netherlands is probably the westernmost in Europe.

Bactericera reuteri develops on *Potentilla* (= *Argentina*) *anserina*, with immatures staying on the underside of the leaves. In the Czech Republic it often occurs in salt marshes. It is a bivoltine species, the adults overwinter. The body of adults of the summer generation is orange brown with extensive dark brown markings on head, thorax and abdomen, while specimens of the overwintering generation are almost uniformly dark brown to black (Burckhardt & Lauterer 1997b, Lauterer 1993b, Ossiannilsson 1992, Seljak et al. 2008).

The fifth instar immatures of *Bactericera* species associated with Rosaceae including *B. reuteri* can be identified using the key by Seljak & Malenovský (2014).

***Bactericera silvarnis* (Hodkinson, 1974)**

New for the Netherlands

Gelderland Buren, AC 152-436, 4.X.1992, 1 ♂, det. D. Burckhardt; Ede, AC 175,2-448,1, 14.VII.2017, 1 ♂, 1 ♀ on broad-leaved *Salix*. **Noord-Brabant** Breda, Mastbos, AC 112-394, 25.VII.1996, 1 ♂, 1 ♀.

The distribution of *B. silvarnis* (fig. 31) is insufficiently known. At the moment records are available from the following European regions: Belgium, France, Great Britain, and perhaps also from former Czechoslovakia, Greece and Sicily (Baugnée et al. 2002, Bolzern & Burckhardt 2004, Burckhardt 2005b). It also occurs in Algeria (Burckhardt & Lauterer 1997b). This species was raised from subspecies to species level relatively recently. It is closely related to *B. curvatinervis* and shares the same host plants: *Salix* species, especially *Salix caprea* and *S. cinerea* (Burckhardt & Lauterer 1997b, Hodkinson 1974b). Its life cycle has not been extensively studied. The adults overwinter on conifers (Burckhardt 2005b).

For identification of adults, see Burckhardt & Lauterer (1997b). The last instar was described by Bolzern & Burckhardt (2004). This paper also includes the most recent key to the fifth instars of the European *Salix*-feeding *Bactericera* species.

***Bactericera substriola* Ossiannilsson, 1992**

New for the Netherlands

Noord-Brabant Ulvenhout Alphen Chaam, AC 115,5-391,3, 22.IX.2016, 1 ♂, 1 ♀, on *Salix*, det. I. Malenovský.

So far, *B. substriola* (fig. 32) has been recorded only from the following European countries: Austria, Belarus, Czech Republic, Germany, Great Britain, Sweden and Switzerland (Burckhardt 2013, Malenovský & Lauterer 2012, Serbina et al. 2015b). It is a member of a taxonomically difficult group of *Salix*-feeding species (Burckhardt & Lauterer 1997b). Its biology is poorly known.

Ossiannilsson (1992) described it from *Salix lapponum*, Burckhardt & Lauterer (1997b) also mentioned *S. elaeagnos* as a hostplant. However, none of these *Salix* species occur in the Netherlands (Floron 2015). In the Czech Republic *B. substriola* probably develops on additional *Salix* species (Malenovský & Lauterer 2012). Its life cycle is not fully known. In Sweden adults were collected in June and July (Ossiannilsson 1992), in the Czech Republic in June and September (Malenovský & Lauterer 2012) and in the Netherlands in September.

***Heterotrioza chenopodii* (Reuter, 1876)**

Based on a single record from Noord-Holland (Zeeburg, Amsterdam), Van der Goot (1912) and Blöte (1926b) reported *H. chenopodii* from the Netherlands for the first time. Currently, it is a rather common species in the Zeeland delta, mostly found on *Atriplex littoralis* and *A. prostrata* growing at the foot of sea dikes in a salty environment. *Heterotrioza chenopodii* has also been found in similar habitats in the north of the Netherlands in the Waddensea area (col. R. van Klink). Adults were collected from June until September.

Heterotrioza chenopodii is a Palaearctic species widely distributed throughout Europe, North Africa, the Middle East and temperate Asia. It has been introduced into North and South America (Burckhardt 2013, Malenovský & Lauterer 2012, Ossiannilsson 1992, Ouvrard 2018). It lives on a number of Amaranthaceae taxa: *Atriplex* species, *Beta vulgaris*, *Chenopodium* species, *Spinacia oleracea* and perhaps also *Halimione portulacoides* (Aguilar & Martin 1999, Hodkinson & White 1979, Ossiannilsson 1992, Spodek et al. 2017). In the Netherlands it is a typical species of the sea coast, while inland (e.g. in the Czech Republic) it is mainly collected at ruderal localities (Lauterer 1982). However, in the latter type of habitat *H. chenopodii* has never been observed in the Netherlands.

The number of generations varies regionally. In northwestern Europe there are probably two generations per year, the adults overwinter on the shoots of the host plant. Adults have never been observed on conifers (Hodkinson 2009, Ossianilsson 1992). *Heterotrioza chenopodii* shows a pronounced seasonal dimorphism between the summer (long-day) and overwintering (short-day) generations which differ in colouration as well as wing length and shape (Lauterer 1982, Ossianilsson 1992).

Lauritrioza alacris (Flor, 1861)

Van der Goot (1912) and Blöte (1926b) reported *L. alacris* from the Netherlands. Burckhardt (2013) mentioned it as doubtfully present there. We can confirm that it is a rather common species on ornamental laurel in the Netherlands (alien species, status 2b, Dutch Species Register 2019). Adults were collected from June until September.

Lauritrioza alacris is native to the mediterranean region, the Caucasus and Crimea. It has been introduced into many countries of central and northern Europe as well as North and South America (Burckhardt 2013, Burckhardt & Mühlethaler 2003, Burckhardt & Queiroz 2012, Ouvrard 2018).

It is narrowly oligophagous on *Laurus nobilis* and *L. azoricus* (Ossiannilsson 1992). Reports of *Prunus laurocerasus* as a host plant are erroneous and probably based on the confusion of the French and Italian names for these two plants (Conci & Tamanini 1985; in Dutch, the plant names are similarly confusing: laurier for *L. nobilis* and laurierkers for *P. laurocerasus*).

On *L. nobilis*, *L. alacris* induces leaf galls (Docters van Leeuwen & Alta 1946, Docters van Leeuwen 1957, 1982, 2009). These galls and also the eggs and immatures were beautifully illustrated by Ellis (2018) and Grosscurt (2017). The life history of

L. alacris was summarized by Conci & Tamanini (1985). The female oviposits near and along the margin of the lower surface of young leaves. The female stays close to the eggs first and inserts its rostrum repeatedly in the leaf. On the following day a characteristic leaf winding becomes apparent, and remains for about a week as a thin roll, after which it increases rapidly to the characteristic gall form. One gall normally contains immatures of various instars, exuviae and wax threads, all in sticky honeydew. The mature fifth instars leave the gall, the fifth instar is also covered with abundant white wax secretions. The number of generations is variable according to climatic factors: from one or two generations in England (Hodkinson & White 1979) up to five generations per year in Italy. The adults overwinter on the host plant (Conci & Tamanini 1985). In England and Italy adults are found throughout the year (Conci & Tamanini 1985, Hodkinson & White 1979).

Laurus nobilis is a non-indigenous plant in the Netherlands and *L. alacris* was undoubtedly introduced to the country due to the trade with ornamental plants. However, in the garden of the first author two larger laurel plants were growing and in the first seven years no psyllid or gall was observed. Later *L. alacris* was found, suggesting that it can actively disperse by flying and successfully find its host plant.

The aesthetic damage on ornamental laurel can be so high that gardeners sometimes use chemical treatment (Conci et al. 1993).

Trichohermes walkeri (Foerster, 1848)

Gelderland Appeltern, AC 169-426, 28.VIII.1982, 1 ♀ on *Rhamnus cathartica*.

The first report on *T. walkeri* in the Netherlands was by Docters van Leeuwen & Alta (1946) who reported the leaf galls caused by this species on *Rhamnus cathartica*. These galls are common on this plant (Docters van Leeuwen 1982, 2009). The

few reports of *Waarneming.nl* are based on the observation of the galls. At this moment only one adult has been examined by us from the Netherlands. *Trichoermes walkeri* is easily recognizable due to the colour of the forewing and other characters. It occurs throughout Europe with the exception of the major part of the Balkan area (Burckhardt 2013, Ouvrard et al. 2015a). In western, northern and central Europe it is monophagous on *Rhamnus cathartica*, on which it induces a leaf-margin rolling gall (Docters van Leeuwen & Alta 1946, Ellis 2018, Grosscurt 2017). These galls are initiated in spring by the feeding of the immatures. Other published host plants, such as *Frangula alnus* (Hodkinson & White 1979), need confirmation.

Trichoermes walkeri is a univoltine species. Oviposition starts mid October and continues until November. The eggs are laid under the bark of young twigs. The first eggs hatch in May and the first adults occur in July in the Czech Republic (Lauterer 1982). In England adults were found from June to October (Hodkinson & White 1979), in Scandinavia from July until September (Ossiannilsson 1992). The eggs overwinter, which is uncommon in European Triozidae (Conci et al. 1993, Ossiannilsson 1992).

Trioza apicalis Foerster, 1848

Zeeland Dishoek-Zuid, AC 25,6-388,1, 27.III.2009, galls on *Anthriscus sylvestris*, leg. F. Grotenhuis, for photos see *Waarneming.nl* (Docters van Leeuwen 2009). **Zuid-Holland** Voorburg, AC 85,2-453,9, 16.XI.2016, galls on *Anthriscus sylvestris*, leg. N. Peeters, for photos see *Waarneming.nl*.

Trioza apicalis (as *Dyspersa apicalis* in Ouvrard 2018) has been reported from the Netherlands only based on galls, adults have not yet been collected. As there is another psyllid species associated with *A. sylvestris* in Europe, *Trioza anthrisci* Burckhardt, 1986, the presence of *T. apicalis* in the Netherlands still needs to be confirmed by

a detailed examination of a sample including immatures and/or adults. However, Burckhardt (1986) stated that *T. anthrisci* does not induce any deformation and discoloration of its host plant.

Trioza apicalis is an Eurosiberian species which occurs in most of Europe (with the exception of the Iberian Peninsula and Belgium) (Burckhardt 2013, Ossiannilsson 1992, Ripka 2008, Seljak 2006, Serbina et al. 2015b) and also in Daghestan, Mongolia and the Russian Far East (Ossiannilsson 1992).

Láska (2011) summarized the biology of *T. apicalis*. It lives on a number of Apiaceae species, e.g. *Aethusa cynapium*, *Anthriscus cerefolium*, *A. sylvestris*, *Carum carvi*, *Coriandrum sativum*, *Daucus carota*, *Foeniculum vulgare*, *Heracleum latifolium*, *Pastinaca sativa*, *Petroselinum crispum*, *Pimpinella saxifraga* and *P. anisum* (Hodkinson & White 1979, Láska 2011, Ossiannilsson 1992). *Daucus carota* is the preferred host (Burckhardt 1986). It is a univoltine species, the adults overwinter on conifers. Post overwintering migration results in infestation of carrot fields from May onwards. A short summer migration is possible. Feeding of the immatures and adults on leaves and leaf stalks of carrots causes severe curling of the leaves and also results in their discoloration (Ellis 2018, Láska 2011, Ossiannilsson 1992).

Trioza apicalis is a serious pest of carrots in northern and occasionally central Europe since the beginning of the 20th century. Heavy harvest losses have been reported from Scandinavia, Latvia, Germany and the Czech Republic (Láska 2011). In the Netherlands this species has not reached pest status.

Trioza centranthi (Vallot, 1829)

Noord-Holland Naardermeer nature reserve, station IV, AC 134-480, 5.VI.1923, 1 ♂, heavily damaged, leg. M.L., col. Naturalis. **Zeeland** Hoofdplaat, Westerscheldedijk, 28.VIII.2009, galls

on *Centranthus ruber* (Grosscurt 2017); Biggekerke, Groede, Haamstede, Kamperland, Koudekerke, Middelburg, Oostkapelle, Sint Anna ter Muiden, Veere, Vlissingen, Zierikzee, Zoutelande, all photos of galls on *C. ruber* at Waarneming.nl. **Zuid-Holland** Zevenhuizen, photo of gall on *C. ruber* at Waarneming.nl. **Limburg** Groot Welsden, Maastricht, Mechelen, Reijmerstok, Vijlen; all photos of galls on *C. ruber* at Waarneming.nl.

The first report of *T. centranthi* from the Netherlands was by Docters van Leeuwen & Alta (1946): flower galls on *Valerianella dentata*. Docters van Leeuwen (1957, 1982, 2009) reported galls of *T. centranthi* from the province of Limburg (Nijswiller and Gulpen).

Trioza centranthi has been reported throughout Europe, but not on the Iberian Peninsula and northern Scandinavia (Burckhardt 2013, Jerinić-Prodanović 2010, Ripka 2008, Seljak 2006). It is also known from North Africa, Turkey, the Caucasus and Israel (Burckhardt 1989, Burckhardt & Önuçar 1993, Ossiannilsson 1992, Spodek et al. 2017).

Ossiannilsson (1992) listed as host plants, besides the already mentioned *Valerianella dentata* and *Centranthus ruber*, also *Fedia cornucopiae*, *C. angustifolius*, *V. carinata* and *V. locusta*. Immatures living in leaf axils and inflorescences cause severe malformations: curling of the leaves, flowers fail to develop and remain green (Ellis 2018, Grosscurt 2017, Ossiannilsson 1992). *Trioza centranthi* is a univoltine species, the adults overwinter on conifers. In some southern regions overwintering can also take place as egg and immature, and the life cycle may comprise more than one generation per year (Hodkinson 2009).

Trioza cerastii (Linnaeus, 1758)

Galls induced by *T. cerastii* on leaves and flowers of *Cerastium arvense*, *C. fontanum* subsp. *vulgare* and *C. semidecandrum* were reported from the

Netherlands by Docters van Leeuwen & Alta (1946) and Docters van Leeuwen (1957, 1982, 2009) based on material from Castricum (Noord-Holland) and Bergeijk (Noord-Brabant). Waarneming.nl gives only one recent report of a gall produced by *T. cerastii*: Ede (Gelderland), gall on *C. fontanum* subsp. *vulgare*, leg. M. van Bergen. Adults of this species have not been collected in the Netherlands yet.

Trioza cerastii is widespread in Europe (Baugnée 2013, Burckhardt 2013, Ripka 2009, Seljak 2006, Serbina et al. 2015b, Ossiannilsson 1992). The report of this species from China (Ossiannilsson 1992) needs confirmation (Baugnée 2013).

Trioza cerastii develops on *Cerastium* species, besides the already mentioned three species also on *C. fontanum* subsp. *holosteoides* (Ossiannilsson 1992) and *C. alpinum* (Hansen & Greve 1999). Malformations caused by the immatures include strongly shortened apical internodes and fusiform flowers and buds in which the immatures develop. Flowers are more or less chlorotic (Baugnée 2013, Docters van Leeuwen 2009, Ossiannilsson 1992). There is one generation per year, the adults overwinter on conifers. Adults can be found throughout the year (Hodkinson 2009, Ossiannilsson 1992).

Trioza flavipennis Foerster, 1848

Docters van Leeuwen & Alta (1946) reported the galls of *T. flavipennis* for the first time from the Netherlands. Docters van Leeuwen (2009) illustrated the leaf galls on *Aegopodium podagraria* induced by this psyllid and mentioned this species as rather common. Material of adults from the Netherlands has not been available. On Waarneming.nl, data on galls of *T. flavipennis* on the leaves of *A. podagraria* are available from all over the country, documented with photographs: Friesland (Buitenpost), Overijssel (Losser, Zalk), Noord-Holland (Bloemendaal, Haarlem), Zuid-Holland (Delft, Den Haag, Leiden, Rotterdam),

Flevoland (Almere), Utrecht (Breukelen, Soest), Gelderland (Ellecom, Nijmegen, Oosterhout, Wageningen), Noord- Brabant (Breda, Gilze).

Trioza flavipennis occurs all over Europe (Burckhardt 2013, Hansen & Greve 1999, Malumphy et al. 2009, Ripka 2009, Seljak 2006, Serbina et al. 2015b, Ossianniilsson 1992). It is monophagous on *A. podagraria*. Eggs are deposited on the underside of the leaves and around each egg a typical pit gall develops (Conci et al. 1993, Ellis 2018). The immatures remain on the underside of the leaf, moving only after each moult. Oviposition and gall formation have also been observed on *Heracleum sphondylium*. However, it seems improbable that *T. flavipennis* can complete its life cycle on this plant (Lauterer 1993a). It is a univoltine species, the adults overwinter on conifers (Ossianniilsson 1992).

***Trioza galii* Foerster, 1848**

Trioza galii was reported from the Netherlands for the first time by Van der Goot (1912) and Blöte (1926b). It is quite common in the Dutch meadows that are not intensively used. Adults were collected from May until September.

Burckhardt & Lauterer (2006) unravelled the *T. galii* complex and recognized four species of which *T. drosopouli* Burckhardt & Lauterer, 2006 is a Greek endemic, *T. cocquempoti* Burckhardt & Lauterer, 2006 is a mediterranean species and *Trioza galii* and *T. velutina* Foerster, 1848 are widely distributed in the Palearctic region. Due to the critical taxonomy older records are questionable.

Trioza galii is widely distributed in the West Palearctic region and Central Asia. The older records from the East Palearctic area need confirmation. The presence of *T. galii* has been confirmed from Algeria, Armenia, Austria, Bulgaria, Czech Republic, Cyprus, France, Germany, Great Britain, Greece, Israel, Italy, Jordan, Kazakhstan,

Kyrgyzstan, Malta, Slovakia, Slovenia, Spain, Switzerland, Turkey and Tunisia (Burckhardt & Lauterer 2006).

Trioza galii lives on *Galium album*, *G. aparine*, *G. palustre* and *Asperula cynanchica* but may occur on other host plants (from Rubiaceae) as well. The number of generations is unclear; in respect of the relatively short adult period in the Netherlands one generation seems probable. Adults overwinter on conifers or in leaf litter (Burckhardt & Lauterer 2006, Hodkinson 2009).

For identification we refer to Burckhardt & Lauterer (2006). *Trioza galii* was also reported from the Netherlands based on galls found on *Galium verum* (Docters van Leeuwen & Alta 1946, Docters van Leeuwen 1957). However, in more recent publications of Docters van Leeuwen (1982, 2009) *Trioza velutina* Foerster, 1848 replaced *T. galii*, with the same description as previously given for *T. galii*. This mutation was probably initiated by W.H. Gravestein. Because the fifth instar larva of *T. velutina* is unknown it is not possible to identify immatures from the galls at this moment. Consequently, there is no justified reason to change the name from *T. galii* to *T. velutina* in these cecidological publications.

***Trioza remota* Foerster, 1848**

Blöte (1926b) reported *T. remota* from the Netherlands for the first time. Throughout the Netherlands it is a widespread species occurring on *Quercus*. Leaf galls induced by *T. remota* on *Q. robur* and *Q. petraea* were reported from the Netherlands by Docters van Leeuwen (2009) and Grosscurt (2017). Adults were recorded from February until December.

Trioza remota occurs throughout Europe but has not been reported from the Iberian Peninsula and parts of the Balkan. It has also been recorded from North Africa and the East Palearctic region, including Japan (Burckhardt 2013, Ossianniilsson

1992). The records from East Asia may refer to other species and need revision (pers. obs. D. Burckhardt).

Trioza remota is narrowly oligophagous on deciduous oaks such as *Quercus boissieri*, *Q. pubescens*, *Q. robur*, *Q. petraea* and perhaps other species (Ossiannilsson 1992, Seljak 2006, Spodek et al. 2017). It is an univoltine species overwintering in the adult stage on conifers. Oviposition on oaks starts in May, immatures then induce small pit galls on the lower leaf surface which are present on the leaves from May until October. Adults emerge in September and stay on oaks for another month before migrating to conifers (Ellis 2018). Like in the Netherlands, adults can be collected throughout the year (Hodkinson 2009, Ossiannilsson 1992).

Trioza urticae (Linnaeus, 1758)

Van der Goot (1912) and Blöte (1926b) reported *T. urticae* from the Netherlands. It is by far the most common psyllid species occurring throughout the Netherlands. Adults were collected from January until November.

Trioza urticae is widely distributed throughout the Palaearctic region and has been reported from almost every European country (Burckhardt 2013, Ossiannilsson 1992, Ouvrard 2018, Wonglersak et al. 2017). In Europe *T. urticae* lives primarily on *Urtica dioica* and *U. urens* but also on *U. dubia* (Hodkinson & White 1979). Single eggs are laid on both sides of the leaves and on young twigs. Bladder-like leaf galls on *Urtica dioica* and *U. urens* were found in the Netherlands (Docters van Leeuwen & Alta 1946, Docters van Leeuwen 1957, 1982, 2009, Grosscurt 2017). *Trioza urticae* is a multivoltine species with up to four generations in England. The adults overwinter on conifers but also in the litter under nettles and can be found throughout the year (Conci et al. 1996, Ossiannilsson 1992).

The adults of *T. urticae* are very variable in colour. The thorax and head of young adults is light green or yellowish. Older adults darken gradually and bear extensive fuscous markings.

Trioza velutina Foerster, 1848

New for the Netherlands

Zeeland St. Philipsland, Rammegors nature reserve, AC 72,0-403,1, 12.V.2008, 1 ♂ on a dry and sunny sea dike.

In comparison to *T. galii*, *T. velutina* (fig. 33) is much less common in the Netherlands. However, older records of the *T. galii* complex should be re-examined because the distinction between *T. galii* and *T. velutina* has been made only recently (Burckhardt & Lauterer 2006).

Trioza velutina is probably widely distributed in the Palaearctic region. So far it has been recorded from the following European countries: Austria, Belarus, Croatia, Czech Republic, France, Germany, Great Britain, Greece, Hungary, Italy, Russia, Slovakia, Slovenia, Spain and Switzerland, and also from Algeria, Altai, Armenia, Dagestan, Turkey and Turkestan (Burckhardt & Lauterer 2006, Seljak 2006, Serbina et al. 2015b).

The biology of *T. velutina* is insufficiently known. Probably it develops on *Galium* species on which adults have been collected (Burckhardt & Lauterer 2006). It occurs in sunny, dry to mesic grasslands, e.g. meadows, pastures and waysides (Malenovský & Lauterer 2012).

For identification see Burckhardt & Lauterer (2006).

**INTRODUCED PSYLLOIDEA, NOT
ESTABLISHED IN THE NETHERLANDS**

**Aphalaridae
Spondyliaspidae**

***Ctenarytaina eucalypti* (Maskell, 1890)**

Limburg Melderslo, Flores in Terra nursery, AC 202,3-385,5, 10.VI.2010, numerous ♂, ♀ and immatures on young shoots of *Eucalyptus gunnii*, leg. A. Sonnemans, det. I. Malenovský, col. Moravian Museum, Brno.

This species is native to Australia and has been introduced into New Zealand, New Guinea, Sri Lanka, South Africa, South America, southeastern USA, Great Britain, Ireland, Spain (including Canary Islands), Portugal (including Azores and Madeira), France and Italy (Hodkinson 1999, Ouvrard 2018). Occasionally, it has also been recorded from greenhouses in central European countries (Czech Republic, Germany, Hungary, Switzerland) into which it is being repeatedly introduced with potted *Eucalyptus* trees but cannot survive outdoors (Burckhardt & Lauterer 2003, Burckhardt & Mühlethaler 2003, Ripka & Czóka 2016, I. Malenovský unpublished data). This is probably also the case of the Dutch record which concerned *Eucalyptus* plants imported to the Netherlands from Italy.

Ctenarytaina eucalypti is narrowly oligophagous on several *Eucalyptus* species (Hodkinson 1999, Ouvrard 2018, Queiroz & Burckhardt 2007). It causes problems particularly on *E. globulus*, *E. pulverulenta* and *E. dunnii* which are widely grown in plantations (Hodkinson 1999, Queiroz & Burckhardt 2007). The life cycle in Great Britain is continuous with several overlapping generations a year and both immatures and adults overwintering together in the rolled evergreen leaves of the host plant (Hodkinson 1999). The immatures preferably develop on the growing shoots of young succulent plants or on the new growth of older trees. Mature

trees with older foliage are less susceptible than young saplings or seedlings. *Ctenarytaina eucalypti* is considered a pest of *Eucalyptus* nurseries and newly established plantations, causing serious shoot dieback, leaf curl and leaf discoloration, massive production of honeydew and cosmetic damage in foliage used for decorative purposes (Hodkinson 1999, Queiroz & Burckhardt 2007).

For identification see Hodkinson (2007).

**Liviidae
Euphyllurinae**

***Euphyllura olivina* (Costa, 1839)**

Zuid-Holland Leiden, 10.VII.2009, numerous immatures on shoots of potted *Olea europaea*, leg. D. Burckhardt, col. Naturhistorisches Museum Basel.

This is a western mediterranean species associated with *Olea* species and other Oleaceae. It has been introduced into North America (Ouvrard 2018). It is a pest on cultivated olive in the mediterranean. In Central Europe, potted olive trees are becoming fashionable. Psyllid infected potted trees have also been found in Germany (Freiburg i. B.), Switzerland (Basel) (pers. obs. D. Burckhardt, col. Naturhistorisches Museum Basel) and the Czech Republic (pers. comm. J. Beránek, Brno). The presence of immatures is readily visible as they secrete large amounts of white flocculent wax which covers the leaves.

**Psyllidae
Acizziinae**

***Acizzia uncatoides* (Ferris & Klyver, 1932)**

Zuid-Holland Lisse tradingcenter Royal Flora Holland, AC 98-475, 27.X.2005, 2 ♂, 1 ♀, leg. C.A. Schulz, col. Naturalis.

This Australian species has been introduced into different continents: North and South America, Africa and Europe (Hodkinson & Hollis 1987). In Europe it has been found in the Azores, Canary Islands, France, Great Britain, Italy, Malta, Montenegro and Portugal (Burckhardt 2013, Halstead 1992, Mifsud et al. 2010).

In Europe, *A. uncatoides* occurs on *Acacia floribunda*, in Israel on *A. saligna* and elsewhere on *Acacia confusa*, *A. koa*, *A. koaia*, *A. verniciflua* and *Albizia lophantha*. In several areas it has become a minor pest on ornamental or native acacias (Hodkinson & Hollis 1987).

In the Netherlands, *A. uncatoides* has been noted only once in a big center for ornamental plant trade. The potential for this pest to establish and cause damage is considered to be low due to unfavorable climatic conditions and because the host plants cannot survive outside of greenhouses and households in the Netherlands. *Acizzia uncatoides* has multiple generations per year, all stages (eggs, immatures and adults) are able to overwinter (Hodkinson 2009).

For identification see Hodkinson & Hollis (1987). Other imported Australian psyllid species can be expected considering the situation in the United Kingdom (Malumphy & Luker 2014).

SPECIES DELETED FROM THE DUTCH LIST

Aphalaridae Aphalarinae

Aphalara calthae (Linnaeus, 1761)

Both Van der Goot (1912) and Blöte (1926b) mentioned *A. calthae* from the Netherlands. Fauna Europaea listed this species as doubtfully present in the Netherlands (Burckhardt 2013). All available specimens previously identified as *A. calthae* in the Dutch collections turned out to be *A. freji*.

Therefore, *A. calthae* is deleted from the list of Dutch psyllid taxa.

Aphalara exilis (Weber & Mohr, 1804)

Van der Goot (1912) included *A. exilis* in the Dutch faunal list based on a note of G.A. Six, however no collecting data were given. Blöte (1926b) did not cite this species from the Netherlands. Docters van Leeuwen (2009) attributed galls on the flower buds of *Rumex acetosella* to psyllids cf. *A. exilis* based on Redfern & Shirley (2002; pers. comm. J.C. Roskam). However, *A. polygoni* and *A. ulicis* also develop on *R. acetosella* (Burckhardt 2002) and can produce deformations of the host plant.

No reliable record of *A. exilis* from the Netherlands is known to us, therefore this species is deleted from the Dutch psyllid list.

Craspedolepta artemisiae (Foerster, 1848)

Blöte (1950) reported three specimens (as *Aphalara artemisiae*) from the utmost south of the Netherlands close to the Belgian border: Sint Pietersberg (province of Limburg). Two of Blöte's specimens were retrieved from the Naturalis collection and both proved to be *C. omissa*. Therefore, the report of *C. artemisiae* from the Netherlands is based on a misidentification.

Craspedolepta artemisiae is known from central and eastern Europe as well as Kazakhstan and the Russian Far East. The reports from Spain and Japan seem doubtful (Burckhardt 2013, Klimaszewski 1973, Konovalova 1988, Lauterer & Malenovský 2002, Loginova 1963, Ouvrard et al. 2015a).

In central Europe, *C. artemisiae* seems to be monophagous on *Artemisia campestris* (Burckhardt 2002, Lauterer & Malenovský 2002, Ouvrard et al. 2015a). This plant is scarce in the Netherlands and occurs in two subspecies *A. campestris maritima* in the sea dunes and *A. campestris camp-*

estris at some inland localities. It has never been reported from Sint Pietersberg (Floron 2015), an area thoroughly researched by Dutch botanists.

Looking at the distribution of the host plant and the distribution of *C. artemisiae*, it seems improbable that *C. artemisiae* is a member of Dutch fauna.

For identification see Burckhardt (1983), Loginova (1963) and Wagner (1947).

Craspedolepta innoxia (Foerster, 1848)

Blöte (1954) collected one female near Sint Pietersberg: Nieuwe Doline (Maastricht, Limburg) on 19.vii.1950. Based on the female terminalia and another male collected close to the collecting site in 1949, the material of Blöte (1954) has been reidentified here as belonging to *C. omissa*. As there is no other record of *C. innoxia* from the Netherlands, this species is omitted from the Dutch list.

Craspedolepta innoxia is distributed in central and eastern Europe and Algeria, Armenia, Israel, Kazakhstan and Turkey (Burckhardt 1989, Drohojowska & Burckhardt 2014, Loginova 1963, Spodek et al. 2017). *Daucus carota* and *Seseli leucospermum* (Apiaceae) are reported as the host plants of *C. innoxia* (Burckhardt 2002, Lauterer 1965). Nothing has been published on the lifecycle of this species.

For identification see Burckhardt (1983), Loginova (1963) and Vondráček (1957).

Aphalaridae Rhincocolinae

Agonoscena targionii (Lichtenstein, 1874)

Agonoscena targionii was mentioned by Aulman (1913) from the Netherlands. Based on this catalogue also Blöte (1926b) mentioned this species for the Netherlands. No Dutch museum material

is available. *Agonoscena targionii* develops on *Pistacia* species, a mediterranean plant which is not indigenous in the Netherlands.

For identification see Burckhardt & Lauterer (1989).

Liviidae Liviinae

Livia limbata (Waga, 1842)

This species was published from the Netherlands by De Graaf et al. (1862) based on two individuals collected in August by G.A. Six near Utrecht (province of Utrecht). However, they stated that these specimens lacked the darker brown pattern at the tip of the fore wing. This character distinguishes *L. limbata* from all other European *Livia* species (Hodkinson & Bird 2000). Therefore, this material probably did not belong to *L. limbata*. Hodkinson & Bird (2000) mentioned *L. limbata* from the Netherlands based on the paper of Van der Goot (1912) who referred to the same material as De Graaf et al. (1862) but did not examine it himself. In Dutch collections, no material of *L. limbata* is available. For these reasons, *L. limbata* is not included in the list of Dutch psyllid fauna here.

Liviidae Euphyllurinae

Psyllopsis discrepans (Flor, 1861)

Psyllopsis discrepans was reported from the Netherlands by Doctors van Leeuwen (2009) who stated that the immatures were different from *P. fraxini* and that both species produced the same type of gall on the leaves of *Fraxinus excelsior*. However, no reference to material or literature was given. The first author sampled *F. excelsior* extensively

for psyllids without ever collecting *P. discrepans* in the Netherlands.

Currently no Dutch material of *P. discrepans* is available and therefore it is tentatively removed from the list. However, this species occurs in all neighbouring countries and therefore it can be expected in the Netherlands.

Psyllidae Psyllinae

Cacopsylla alaterni (Foerster, 1848)

Van der Goot (1912) reported *C. alaterni* from the Netherlands based on Six (1876). *Cacopsylla alaterni* is monophagous on *Rhamnus alaternus* (Conci et al. 1993), a mediterranean plant species that does not occur in the Netherlands. Six indicated that he collected '*C. alaterni*' on *Hippophae* in the dune area. The association with *Hippophae* suggests that the report concerns *Cacopsylla hippophaes* or *C. zetterstedti*, not *C. alaterni*. The occurrence of *C. alaterni* in the Netherlands is highly unlikely.

For identification see Burckhardt (1989) and Loginova (1975).

Cacopsylla elegantula (Zetterstedt, 1840)

De Graaf et al. (1862) and Van der Goot (1912) mentioned the only Dutch record of *C. elegantula* from the environs of Utrecht, leg. G.A. Six. Blöte (1926b) and Burckhardt (2013) did not list this species from the Netherlands. *Cacopsylla elegantula* has mainly a northern and central European distribution (Burckhardt 2013). It develops on *Salix* species (Ossiannilsson 1992, Lauterer & Burckhardt 1997). Despite extensive search on willows in the Netherlands by the first author, *C. elegantula* has never been found and no material of

C. elegantula is present in the Dutch collections. Because of this, *C. elegantula* is not included among species occurring in the Netherlands at present. However, its discovery in the Netherlands in the future is probable (table 1).

Cacopsylla nigrita (Zetterstedt, 1828)

Blöte (1926b) listed *C. nigrita* from seven Dutch localities (Den Haag, Overveen, Bodegraven, Zierikzee, Rhenen, Putten, Arnhem). *Cacopsylla nigrita* is widespread in the western Palaearctic region and perhaps also Japan. It occurs all over Europe except for the Balkan, Great Britain and Ireland (Burckhardt 2013, Lauterer & Burckhardt 1997, Ossiannilsson 1992). *Cacopsylla nigrita* is another of the many *Salix* feeding *Cacopsylla* species. It is associated with the broad-leaved species *Salix caprea*, *S. lapponum*, *S. myrsinifolia* and *S. phylicifolia*. The life cycle is univoltine with overwintering in the adult stage. Immatures are found in the female catkins. In Scandinavia, adults were captured throughout the year (Ossiannilsson 1992).

Cacopsylla nigrita is relatively easily recognizable by its characteristic brownish spot on its fore wings and the male parameres (Lauterer & Burckhardt 1997, Ossiannilsson 1992). Blöte (1926a) published an identification key but his description of the parameres resembles *C. moscovita* and other related species more than *C. nigrita*. The first author collected extensively on *Salix* species but has never found this species in the Netherlands. In the Dutch collections no material of *C. nigrita* could be located. Thus, as there is no confirmed record of *C. nigrita* from the Netherlands, this species is not included in the list of Dutch psyllids here. However, *C. nigrita* occurs in the neighbouring countries and it is likely it will be recorded in the Netherlands in future.

Psylla betulae (Linnaeus, 1758)

Van der Goot (1912) cited *P. betulae* from the Netherlands based on a note of G.A. Six without giving details on the material. However, the identification is doubtful, as he mentioned '*Psylla ambigua*' as a synonym (see also the note under *Cacopsylla ambigua* in the present paper). No material of *P. betulae* is available in the Dutch collections and therefore it is not considered as confirmed from the Netherlands here, although it occurs in the neighbouring countries (table 1).

Triozidae

Bactericera femoralis (Foerster, 1848)

Burckhardt (2013) is the only source which mentions *B. femoralis* from the Netherlands. In the Dutch collections there are no specimens of this species available. Therefore, *B. femoralis* is omitted from the Dutch list of psyllid fauna for the moment. *Bactericera femoralis* is a widely distributed Palaearctic species present in the neighbouring countries. It develops on *Alchemilla* species, the adults overwinter on conifers (Burckhardt 2013, Burckhardt & Lauterer 1997b, Ossiannilsson 1992). Its discovery in the Netherlands in the future is probable.

Bactericera salicivora (Reuter, 1876)

Gravestein (1949) published a record of *B. salicivora* by Van de Bunt and Van Rossem from Wageningen on *Brassica rapifera* on 24.XI.1947, but suggested that this specimen originated from adjacent willows. Unfortunately, this material could not be traced in the Dutch collections. Because the taxonomy of the *Salix*-feeding *Bactericera* species is critical, *B. salicivora* is not incorporated in the Dutch psyllid list until some material

is available and can be revised based on modern taxonomic works (Burckhardt & Lauterer 1997b, Ossiannilsson 1992).

Bactericera salicivora develops on several *Salix* species, the adults overwinter on conifers (Ossiannilsson 1992). It is widely distributed throughout the Holarctic region and occurs in neighbouring countries with the exception of Belgium (Burckhardt 2013, Burckhardt & Lauterer 1997b). Its discovery in the Netherlands in the near future seems likely.

CONCLUSION

Together with the 27 species reported here for the first time from the Netherlands, the Dutch psyllid fauna includes 69 species. In addition, there are three alien species (*Acizzia uncatoides*, *Ctenarytaina eucalypti* and *Euphyllura olivina*) not yet established in the Netherlands. Of the five established alien species one has a non-European origin (*Cacopsylla fulguralis*) and four originate from southern Europe: *Livilla variegata*, *Psylla buxi*, *Spanioneura fonscolombii* and *Lauritrioza alacris*.

Records of 13 species that were reported from the Netherlands in the past are considered erroneous or doubtful and have been removed from the list for various reasons, such as misidentification, absence of reference material or lost material.

The number of collectors in the Netherlands is low and the size of psyllid collections in the Netherlands relatively small. Although several psyllid species are potentially or actually severe pests, this has not aroused much attention for this insect group. Some regions of the Netherlands are clearly under-investigated, especially the northern and eastern parts of the country. This bias is due to the residence of the main collectors: H.C. Blöte (Voorburg), Wim Gravestein (Amsterdam), René Cobben (St. Odiliënberg and Rhenen) and Kees den Bieman (Wageningen and Ulvenhout). In contrast, the galls induced by psyllids have always received much attention

from Dutch botanists and entomologists. Several psyllid species in the Netherlands are only known from their galls (Ellis 2018, Doctors van Leeuwen 1941, 1947, 1957, 1987, 2009, Doctors van Leeuwen & Alta 1946, Grosscurt 2017).

The Dutch psyllid fauna as a whole has not been extensively studied. However, in comparison to neighbouring countries the number of Dutch psyllid species is relatively high. Belgium counts 67 species (Bagnée et al. 2002, Bagnée 2003, 2013), 82 psyllid species have been recorded from

Great Britain (Boffing & Bantock 2014) and 119 from Germany (Burckhardt & Lauterer 2003).

Many more species are to be expected in the Netherlands. Table 1 gives an overview of species most likely to be found in the Netherlands based on the presence of their host plants and established occurrence in neighbouring countries. We hope our contribution will stimulate entomologists to study this interesting group in the Netherlands more intensively in future.

Table 1. Psylloidea to be expected in the Netherlands. BE = Belgium, GE = Germany, GB = Great Britain
Tabel 1. Psylloidea die in Nederland verwacht worden.

Species	Host plant(s)	BE	GE	GB
Aphalaridae				
<i>Aphalara calthae</i> (Linnaeus, 1761)	<i>Caltha palustris</i>		×	
<i>Aphalara exilis</i> (Weber & Mohr, 1804)	<i>Rumex</i> species		×	×
<i>Craspedolepta malachitica</i> (Dahlbom, 1851)	<i>Artemisia absinthium</i> , <i>A. maritima</i>		×	×
Liviidae				
<i>Psyllopsis discrepans</i> (Flor, 1861)	<i>Fraxinus</i> species	×		×
Psyllidae				
<i>Cacopsylla brunneipennis</i> (Edwards, 1896)	<i>Salix</i> species	×	×	×
<i>Cacopsylla elegantula</i> (Zetterstedt, 1840)	<i>Salix</i> species		×	
<i>Cacopsylla nigrita</i> (Zetterstedt, 1828)	<i>Salix</i> species	×	×	
<i>Cacopsylla picta</i> (Foerster, 1848)	<i>Malus sylvestris</i> , <i>Malus domestica</i>	×	×	
<i>Cacopsylla viburni</i> (Löw, 1877)	<i>Viburnum dilatatum</i> , <i>V. furcatum</i> , <i>V. lantana</i>	×	×	×
<i>Livilla ulicis</i> Curtis, 1836	<i>Cytisus scoparius</i> , <i>Genista tinctoria</i> , <i>Ulex europaeus</i>	×	×	×
<i>Psylla betulae</i> (Linnaeus, 1758)	<i>Betula pubescens</i> , <i>B. pendula</i>	×	×	×
Triozidae				
<i>Bactericera crithmi</i> (Löw, 1866)	<i>Chritimum maritimum</i>			×
<i>Bactericera femoralis</i> (Foerster, 1848)	<i>Achemilla</i> species	×	×	
<i>Bactericera salicivora</i> (Reuter, 1876)	<i>Salix</i> species		×	×
<i>Bactericera striola</i> (Flor, 1861)	<i>Salix</i> species	×	×	
<i>Triozia proxima</i> Flor, 1861	<i>Hieracium pilosella</i>	×	×	×
<i>Triozia rhamni</i> (Schrank, 1801)	<i>Rhamnus cathartica</i>		×	×
<i>Powellia vitreoradiata</i> (Maskell, 1879)	<i>Pittosporum</i> species			×

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SAMENVATTING

De eerste naamlijst van Nederlandse bladvlooien sinds 93 jaar (Hemiptera: Psylloidea)

De Nederlandse bladvlooien hebben altijd maar beperkt in de belangstelling gestaan van Nederlandse entomologen. Dat blijkt al uit het jaartal van de laatste naamlijst (Blöte 1926b). Daarna zijn wel enkele losse artikelen verschenen maar nooit meer een overzicht. Deze geringe belangstelling is verwonderlijk omdat een aantal soorten schadelijk kunnen zijn. Met name de perenbladvlooien veroorzaken jaarlijks voor enkele tientallen miljoen euro schade. De gallen die sommige bladvlooien veroorzaken op hun waardplant hebben de aandacht getrokken van Nederlandse botanici met als belangrijkste pionier Docters van Leeuwen. Verschillende soorten bladvlooien zijn uit ons land alleen bekend door hun gallen. Echter deze botanische kennis heeft geen ingang gevonden in de entomologische literatuur.

In dit overzicht van de Nederlandse bladvlooien zijn meldingen in de literatuur van nieuwe soorten zoveel als mogelijk gecontroleerd aan de hand van museummateriaal. Soorten zonder ondubbelzinnig bewijs dat zij in Nederland voorkomen zijn niet opgenomen. Als bewijs geldt museummateriaal of goede foto's van gallen op de waardplant. In totaal worden 27 soorten als nieuw voor ons land gemeld: *Aphalara avicularis*, *A. freji*, *A. polygona*, *A. purpurascens*, *A. ulicis*, *Craspedolepta flavipennis*, *C. latior*, *C. nebulosa*, *C. omissa*, *C. subpunctata*, *Camarotoscena speciosa*, *Psyllopsis distinguenda*, *Cacopsylla sorbi*, *C. ulmi*, *C. ambigua*, *C. pulchra*, *C. affinis*, *C. crateagi*, *C. pyrisuga*, *C. rhamnicola*, *Livilla variegata*, *Spanioneura fonscolombii*, *Bactericera curvatinervis*, *B. reuteri*, *B. silvarnis*, *B. substriola* en *Trioza velutina*. In totaal telt de lijst van Nederlandse bladvlooien nu 69 soorten. Dertien soorten zijn afgevoerd van de naamlijst: *Aphalara calthae*, *A. exilis*, *Craspedolepta artemisiae*, *C. innoxia*, *Agonosцена targionii*, *Livia limbata*, *Psyllopsis discrepans*, *Cacopsylla elegantula*, *C. nigrita*, *C. alaterni*, *Psylla betulae*, *Bactericera femoralis* en *B. salicivora*.

Drie soorten (*Acizzia uncatoides*, *Ctenarytaina eucalypti* and *Euphyllura olivina*) zijn als importsoort bekend maar hebben zich nog niet gevestigd. Vijf soorten zijn aan te merken als exoten waarvan er één van buiten Europa komt (*Cacopsylla fulguralis*) en vier afkomstig zijn uit Zuid-Europa: *Livilla variegata*, *Psylla buxi*, *Spanioneura fonscolombii* en *Lauritrioza alacris*.

Van elke soort wordt de biologie besproken waarbij vooral aandacht gegeven wordt aan de waardplanten, het aantal generaties, de wijze van overwintering en de eventuele schadelijkheid. Tot slot wordt een overzicht gegeven van soorten die in Nederland te verwachten zijn, gebaseerd op de verspreiding in buurlanden en de biologie van deze soorten.

C.F.M. (Kees) den Bieman
Ulvenhout, The Netherlands
cdbieman@planet.nl

D. Burckhardt
Naturhistorisches Museum
Basel, Switzerland

I. Malenovský
Department of Botany and Zoology
Faculty of Science
Masaryk University
Brno, Czech Republic

Th. Heijerman
Wageningen, The Netherlands