The presence of *Aphis* (*Toxoptera*) *aurantii* (Homoptera: Aphididae) in the Netherlands

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The black citrus aphid *Aphis* (*Toxoptera*) *aurantii* was described in 1841 from *Citrus aurantium* in France. From that time this aphid has also been observed in other European countries and in 1995 the species was observed for the first time in the Netherlands. The black citrus aphid is a pest of, among others, *Citrus* and *Coffea* since it damages the leaves and transmits viruses resulting in smaller trees and shrubs and fewer and smaller fruits. It has more than a hundred host plants mainly growing in the tropics and subtropics.

Introduction

The black citrus aphid *Aphis* (*Toxoptera*) *aurantii* Boyer de Fonscolombe 1841 (figures 1-3) is known from the tropics and subtropics and can be found in all citrus and coffee growing countries. Boyer de Fonscolombe found this aphid in Aix-en-Province (France) in 1841 on *Citrus aurantium* and described it in the genus *Aphis* (Boyer de Fonscolombe 1841). In 1861 Passerini placed the aphid in the genus *Toxoptera* (Passerini 1861). The last 10-15 years a new technique (DNA barcoding) has been developed for identification on species level to produce molecular phylogenetic trees. By using this technique, it is possible to classify insects into genus or subgenus. Kim & Lee (2008), Wang & Qiao (2009) and Lagos-Kutz *et al.* (2014) used this molecular test for aphid species in the Aphididae. These three groups all choose among others *Toxoptera aurantii* for classification and concluded independently of each other that *Toxoptera* is a subgenus in the *Aphis* genus (Lagos-Kutz *et al.* 2014).

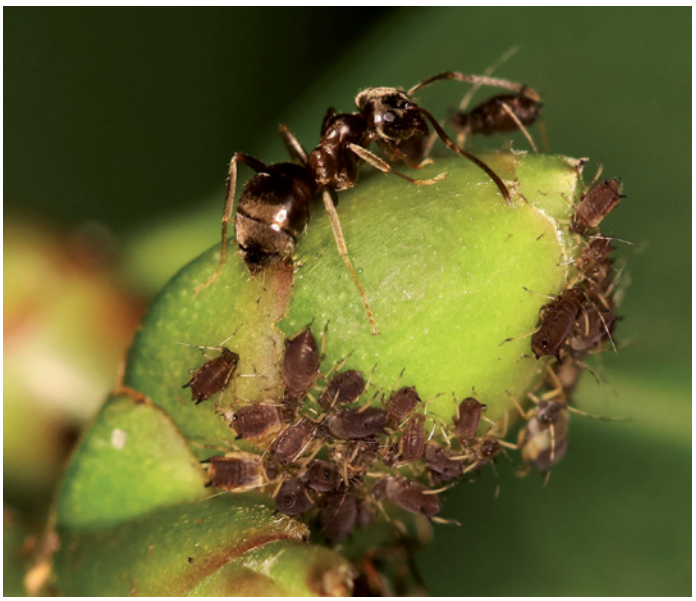
Aphis aurantii is a serious pest of *Citrus* and *Coffea* plants and has many other host plants too. Like many other aphids, it causes physical damage to the plants and transmits viruses (e.g. Piron 2017). *Aphis aurantii* lives in colonies on the underside of young leaves and shoots, causing bending or rolling of the mid rib and is attended by ants. *Citrus* also suffers from several viral diseases of which citrus tristeza virus is well known. This virus is transmitted by a small number of aphid species, including *A. aurantii*. This results in decreased tree vigor and reduced fruit yield (Berk 2016). *Aphis aurantii* is also able to transmit the non-persistent viruses cucumber mosaic virus and zucchini yellow mosaic virus (Blackman & Eastop 2000).

Distribution

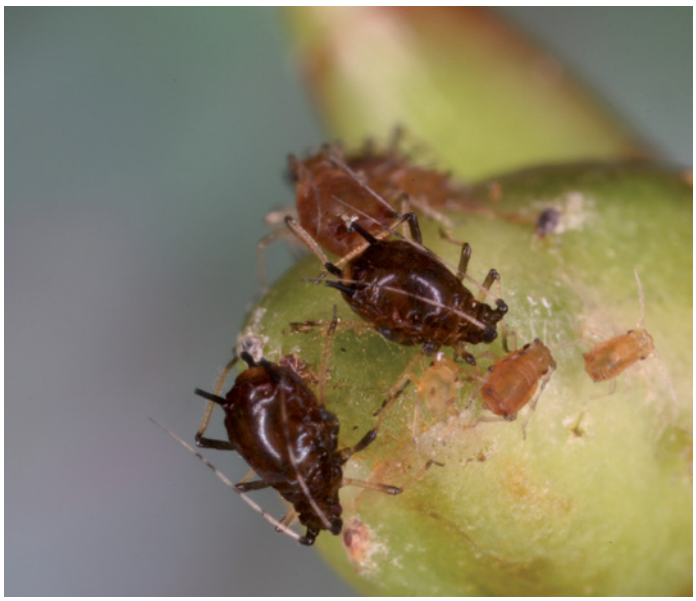
Originally, *A. aurantii* was described from *Citrus aurantium* growing in a conservatory in the south of France (Boyer de Fonscolombe 1841). After its description, it was found in Italy (Ferrari 1872), Belgium (Schouteden 1903), the United Kingdom (Stroyan 1964), Greece (Remaudière 1983), Azores, Bulgaria, Canary Islands, Corsica, Germany, Madeira, Sicily, Portugal and Spain (Nieto Nafría 2013). Blanchard (1925) mentioned the presence of *A. aurantii* in Argentina, which was the first record outside Europe. Nowadays, *A. aurantii* is present throughout the tropics and subtropics. Currently, it is considered cosmopolitan: the aphid is present in South America, Central America, the southern parts of the United States of America, Africa, Australia and eastern Asia (Carver 1978).

During 1995-2000 the Netherlands Food and Consumer Product Safety Authority (NVWA, Wageningen) recorded *A. aurantii* in the province of Noord-Holland in Aalsmeer and Rijsenhout, in the province of Zuid-Holland in De Lier, Wateringen and Woubrugge and in the province of Utrecht in Mijdrecht. The aphids were recorded on *Camellia*, *Coffea*, *Ficus*, *Gerbera* and *Serissa* (NVWA personal communication).

Two of the authors recorded *A. aurantii* from five other locations (figure 4). The third author observed *A. aurantii* in the province of Noord-Brabant in Boxtel in an unheated greenhouse (12.xii.2007 and 22.i.2008), in Bakel in and around an unheated greenhouse (22.x.2008), in Deurne in and around a greenhouse (25.vii.2012) and in Ommel in and around a greenhouse (20.vii.2018). All these observations were made on *Camellia japonica*. Especially the plants growing outside in 2012 and 2018 were heavily infested with *A. aurantii*. In the province of Gelderland, the species was found in Ede on *Camellia* 'cornish spring' growing year round in a garden by the second author (5.ix.2018) and here *A. aurantii* was attended by *Lasius niger* (Linnaeus) (figure 1). It is unknown what the origin is of these populations in both provinces, but *A. aurantii* absolutely have come along with imported plants (NVWA personal communication), and thanks to the sheltered conditions during winter in the unheated greenhouses, the aphid could survive low outdoor temperatures and could spread in the following years. In adjacent countries *A. aurantii* has been recorded too (Schouteden 1903, Nieto Nafría 2013), making natural spread into the Netherlands another option. But spread in the Netherlands also has been seen. This year (2019) the *Camellia* 'cornish spring' growing in the garden in Ede was, as in 2018, heavily infested with *A. aurantii* from which



1. *Aphis* (*Toxoptera*) *aurantii* attended by *Lasius niger* on *Camellia* 'cornish spring', Ede (province of Gelderland), 5.ix.2018. Photo: G.J. Assink
1. *Aphis* (*Toxoptera*) *aurantii* in symbiose met *Lasius niger* op *Camellia* 'cornish spring', Ede (Gelderland), 5.ix.2018.



2. *Aphis* (*Toxoptera*) *aurantii* on *Camellia* 'cornish spring', Ede (province of Gelderland), 5.ix.2018. Photo: Paul Piron
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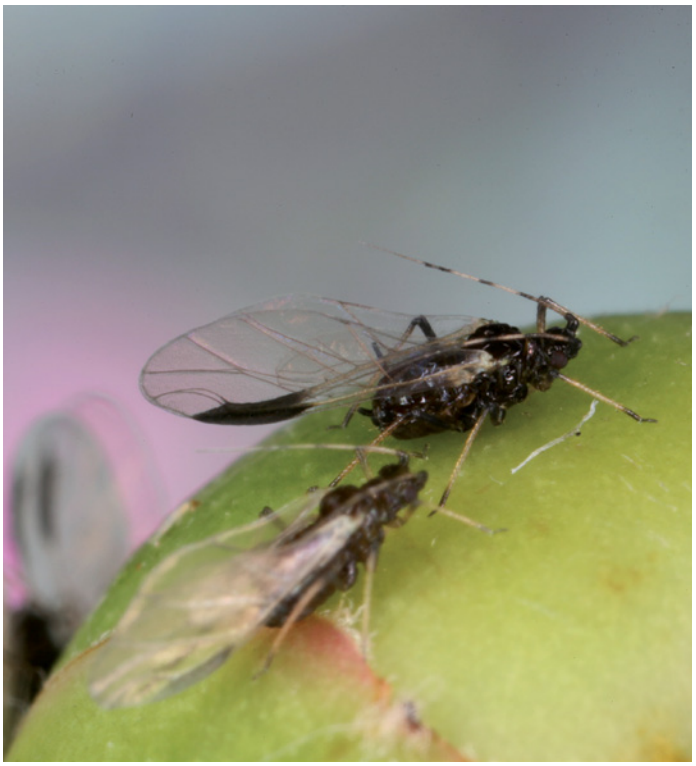

3. *Aphis* (*Toxoptera*) *aurantii* on *Camellia* 'cornish spring', Ede (province of Gelderland), 5.ix.2018. Photo: Paul Piron
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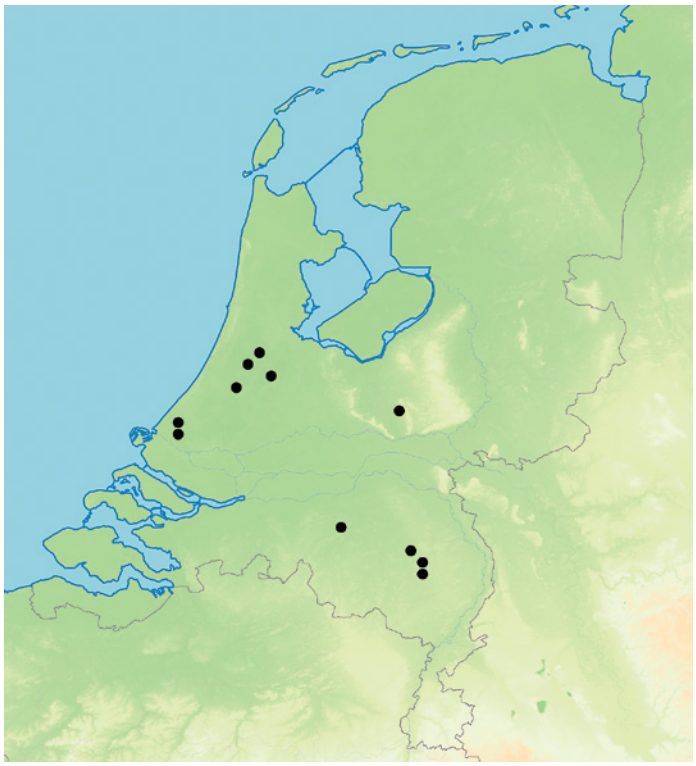

4. Localities of *Aphis* (*Toxoptera*) *aurantii* in the Netherlands.
4. Vindplaatsen van *Aphis* (*Toxoptera*) *aurantii* in Nederland.

the conclusion can be drawn that the aphid can easily survive the Dutch climate without any protection. It seems likely that rising temperatures in Europe and other temperate areas allow *A. aurantii* to rather easily adapt to these regions.

Biology

Although *A. aurantii* has been discovered long ago in France, little is yet known on the biology of this aphid species. Only anholocyclic overwintering has been described and it has been suggested that no (or maybe seldom) sexual reproduction occurs (Blackman & Eastop 2000). Anholocyclic aphids do not leave their host plant and overwinter in the open, which is not too difficult in the tropics and subtropics. Until now, just two winged males of *A. aurantii* were collected on *Citrus* in Palestine in December 1935 by F.S. Bodenheimer. The first oviparous female ever was collected in December 2008 by Tabone in Malta from *Sambucus nigra* (Hidalgo & Mifsud 2011).

Aphis aurantii is very polyphagous and has more than a hundred host plants in different plant families, mainly in the tropics and subtropics. Many are economically important plants, such as *Citrus* (Rutaceae), *Coffea arabica* (Rubiaceae), *Macadamia integrifolia* (Proteaceae), *Camellia theifera* (Theaceae), *Mangifera indica* (Anacardiaceae) and *Punica granatum* (Lythraceae) (Carver 1978). In the Netherlands *A. aurantii* has been found also on *Ficus* sp. (Ficeae), *Gerbera* sp. (Asteraceae) and *Serissa* sp. (Rubiaceae).

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Samenvatting

***Aphis (Toxoptera) aurantii* (Homoptera: Aphididae) aanwezig in Nederland**

In 1841 is de zwarte citrusluis *Aphis* (*Toxoptera*) *aurantii* Boyer de Fonscolombe voor het eerst in Europa, in Frankrijk, gesignaleerd. Sindsdien is ze ook in onder andere Italië, België, Duitsland Portugal, het Verenigd Koninkrijk en Griekenland aangetroffen. Vanaf 1995 is de zwarte citrusluis ook in Nederland verschillende keren op geïmporteerde *Camellia japonica*, *Ficus* sp., *Serissa* sp. en *Camellia* 'cornish spring' in een tuin waargenomen. *Aphis aurantii* is schadelijk voor citrusbomen en koffiestruiken doordat ze zuigt op de jonge bladeren en scheuten van de planten, resulterend in ernstige bladmisvorming. Citrusbomen kunnen ook geïnfecteerd worden met onder andere het 'citrus tristeza virus'. De gevleugelde individuen van *A. aurantii* kunnen dit virus en het non-persistente 'cucumber mosaic virus' en 'zucchini yellow mosaic virus' verspreiden en daardoor meer citrusbomen besmetten met virussen. Wanneer citrusbomen geïnfecteerd zijn met het 'citrus tristeza virus' blijven ze kleiner en produceren ze minder en kleinere vruchten. *Aphis aurantii* is polyfaag en heeft meer dan honderd waardplanten in verschillende families, die hoofdzakelijk in de tropen en subtropen voorkomen. Recentelijk wordt *A. aurantii* ook steeds vaker in gematigde streken gevonden en dan vooral op kuipplanten die 's winters in een oranjerie of serre worden gezet. Waar de bladluizen vandaan komen die in Nederland gevonden zijn is niet bekend maar hoogstwaarschijnlijk via de import van planten. Een andere optie is dat ze op natuurlijke wijze vanuit de ons omringende landen hier komt. De planten waarop *A. aurantii* in Nederland werd aangetroffen stonden gedurende de winter niet alleen in een koude kas maar ook buiten in de natuur en ondanks dat overleefden de bladluizen de Nederlandse winters. Doordat in Ede de *Camellia* 'cornish spring' in 2019 weer massaal gekoloniseerd was door *A. aurantii* kan dus met een hoge mate van zekerheid gesteld worden dat deze bladluis ingeburgerd is in Nederland.

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