Published September 25, 2023

Klapalekiana, **59**: 85–90, 2023
ISSN 1210-6100

First record of *Myzus mumecola* (Hemiptera: Aphididae) in the Czech Republic, and *Humulus lupulus* as its new secondary host in Europe

První nález mšice *Myzus mumecola* (Hemiptera: Aphidoidea) v České republice a chmel jako její nový sekundární hostitel v Evropě

Svatopluk RYCHLÝ[1)], Hana ORSAGOVÁ[1)], Pavel TÓTH[1)], Věra KOŠŤÁLOVÁ[2)], Ladislav PREČAN[2)] & Jakub BERÁNEK[3)]

[1)]Division of Plant Pest Diagnostics, Central Institute for Supervising and Testing in Agriculture, Šlechtitelů 773/23, CZ-779 00 Olomouc, Czech Republic; e-mails: svatopluk.rychly@ukzuz.cz, hana.orsagova@ukzuz.cz, pavel.toth@ukzuz.cz
[2)]Division of Field Inspection, Central Institute for Supervising and Testing in Agriculture, Jaselská 552/16, CZ-746 01 Opava, Czech Republic; e-mails: vera.kostalova@ukzuz, ladislav.precan@ukzuz.cz
[3)]Division of Plant Health, Central Institute for Supervising and Testing in Agriculture, Zemědělská 1a, CZ-613 00 Brno, Czech Republic; e-mail: jakub.beranek@ukzuz

Alien species, faunistics, pest, Sternorrhyncha, Aphidoidea, Asian apricot aphid, host plant, central Europe, Moravia, Silesia

Abstract. The Asian apricot aphid, *Myzus mumecola* (Matsumura, 1917) (Hemiptera: Sternorrhyncha: Aphididae) is native to eastern Asia and its primary host plants include several *Prunus* spp. In Europe, it was first detected in Italy in 2016, followed by later records from Hungary and Serbia. In 2020, this apricot pest was found for the first time in the Czech Republic. Since then, colonies of *M. mumecola* have been observed on apricot trees (*Prunus armeniaca*) which are known to be one of its primary host plant species, in different parts of the country. Spring populations induced curling and discoloration of apricot leaves. Despite the assumption that the species is dicyclic, the secondary host of *M. mumecola* in Europe was not known until now. In 2022, alate females and colonies of nymphs were first observed on hops (*Humulus lupulus*), both wild and in hop gardens, at several locations in the Czech Republic. Therefore, hop is reported here for the first time as a secondary host plant of *M. mumecola* in Europe.

INTRODUCTION

The apricot pest aphid *Myzus mumecola* (Matsumura, 1917) (Hemiptera: Sternorrhyncha: Aphididae) originates from Asia, where it is known from China, India, Japan, Taiwan, Russia and Eastern Siberia (Blackman & Eastop 2021). It is also reported in the literature under its original combination *Macrosiphum mumecola* Matsumura, 1917 and its junior synonym *Myzus umecola* Shinji, 1924. *Myzus mumecola* is morphologically very similar to *M. persicae* (Sulzer, 1776) and *Phorodon humuli* (Schrank, 1801) from both of which it differs in divergent frontal bumps, longer setae on the antennae and the tapering shape of the siphunculi (Borbély et al. 2021).

The primary hosts of *M. mumecola* are various species of apricots: common apricot (*Prunus armeniaca*), ansu apricot (*P. ansu*), Himalayan apricot (*P. cornuta*) and Japanese apricot (*P. mume*) (Petrović-Obradović 2021). Fundatrices can be observed on apricot leaves from

the beginning of their development, which indicates that *M. mumecola* overwinters in the egg stage on apricot trees. The next 2–3 generations are wingless and develop on the lower side of leaves (Borbély et al. 2021). By sucking, these aphids cause the leaves to roll up perpendicularly to the midrib, partially change colour and fall prematurely (Borbély et al. 2021). Winged forms appear from mid-May, and it is assumed that *M. mumecola* is a dicyclic species (Borbély et al. 2021).

In 2016, this aphid was first detected in Europe, on apricots in the Italian region of Emilia--Romagna (Panini et al. 2017). This finding was followed by records from Hungary in 2020 (Borbély et al. 2021) and from Serbia one year later (Petrović-Obradović 2021). The mode of this pest's introduction to Europe remains unknown (Panini et al. 2017). In the area of its origin, the secondary hosts of *M. mumecola* include *Lonicera quinquelocularis* in India and *Rubia cordifolia* in Kashmir (Blackman & Eastop 2021) but no secondary host has been recognised so far in Europe (Borbély et al. 2021, Petrović-Obradović 2021).

MATERIAL AND METHODS

Samples from targeted screening contained 100 leaves collected from an apricot orchard and three hop gardens in the Czech Republic in May 2022 and transported to the laboratory. One additional sample was taken from wild hop. Aphids found on leaves were transferred to 75% ethanol and identified using a stereomicroscope at 9 to 40x magnification. Permanent slides and specimens stored in a mixture of 75% denatured ethanol slightly enriched by several drops of glycerol are deposited in the aphid collection of the Laboratory of Plant Pest Diagnostics, Central Institute for Supervising and Testing in Agriculture, Opava, Czech Republic.

The morphological identification of aphids collected was based on species-specific characteristics of the genus *Myzus*, compared with the data published by Borbély et al. (2021). Molecular methods were used for confirmation of morphological identification.

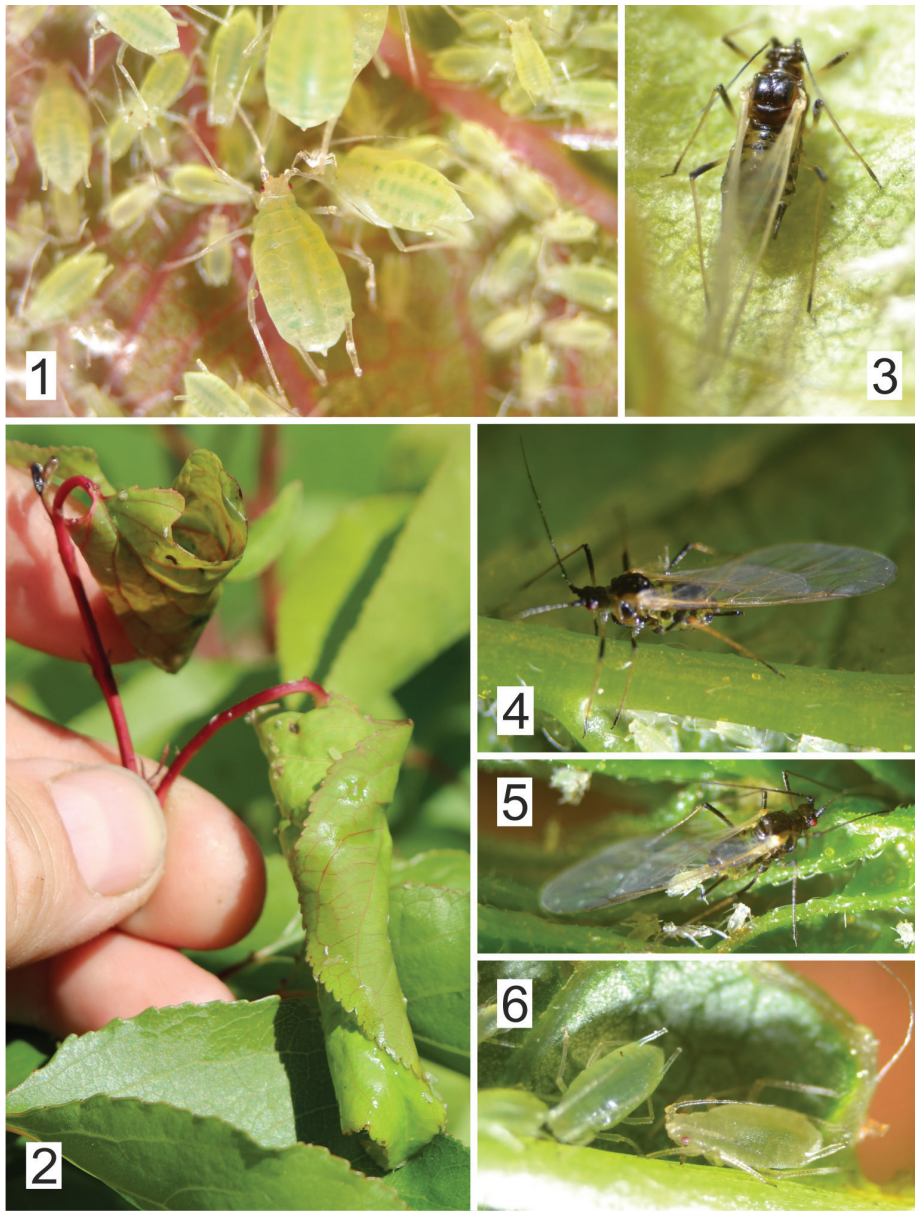
For molecular analysis, DNA from individual specimens was extracted using High Pure PCR Template Preparation Kit (Roche, Basel, Switzerland) after drying of the excessive ethanol by incubation of the insect on a piece of filter paper at laboratory temperature. The DNA barcoding method was used for species identification (EPPO 2021). Primers LCO1490 and HCO2198 (Folmer et al. 1994) targeting a 658 bp long fragment of mitochondrial COI gene were used for PCR amplification using a PCRBIO TaqMix (PCR Biosystems, London, UK). The PCR products were purified and sequenced forward and reverse (Eurofins Genomics, Germany). Obtained sequences were compared with sequences from the GenBank database.

RESULTS

The first specimens of *M. mumecola* in the Czech Republic were found on apricot leaves (*Prunus armeniaca*) during a random aphid survey on apricots in Opava in May 2020. After repeated detection of the species two years later on the same tree and records on apricots from two other localities in the Czech Republic, a targeted screening was organised in Opava in an apricot orchard near to the place of the first finding. At the same time, specimens of *M. mumecola* were randomly detected on hop (*Humulus lupulus*) in the Olomouc district which led to screening of hop at three sites in the eastern part of the Czech Republic.

So far, *M. mumecola* has been found at a total of eight localities in the Czech Republic, including three random findings (two on apricots, one on hop) and five records resulting from targeted screening (Tables 1–2).

On apricot trees, colonies of *M. mumecola* included only dozens of individuals, including adult apterous females (Fig. 1) and nymphs. Colonies were observed on both lower and upper sides of the leaves, which were longitudinally twisted along the main vein (Fig. 2). The de-



Figs 1–6. *Myzus mumecola* (Matsumura, 1917). 1 – fundatrices with nymphs, 2 – symptoms caused by *Myzus mumecola* on an apricot tree, 3 – alate female, 4 – alate female on hop, 5 – a female giving birth to a nymph, 6 – nymph, together with *Phorodon humuli* (Schrank, 1801). Photographs by S. Rychlý.
Obr. 1–6. *Myzus mumecola* (Matsumura, 1917). 1 – zakladatelky s potomstvem, 2 – příznak výskytu *Myzus mumecola* na meruňce, 3 – okřídlená samička, 4 – okřídlená samička na chmelu, 5 – samička rodící nymfu, 6 – nymfa, společný výskyt s mšicí chmelovou (*Phorodon humuli* (Schrank, 1801)). Fotografie S. Rychlý.

Table 1. Details of records of *Myzus mumecola* (Matsumura, 1917) on apricot (*Prunus armeniaca*) in the Czech Republic.
Tabulka 1. Detailní údaje k nálezům mšice *Myzus mumecola* (Matsumura, 1917) na meruňkách (*Prunus armeniaca*) v České republice.

Collection date / datum sběru	**Locality / lokalita**	**GPS coordinates / souřadnice**	**Collector / sběratel**
15.v.2020, 3.v.2022	Opava district, Opava, Ondříčkova street, private garden	49.9321969°N 17.8915658°E	S. Rychlý
10.vi.2021	Břeclav district, Lednice, Nejdek u Lednice, apricot orchard of the Central Institute for Supervising and Testing in Agriculture	48.8080583°N 16.7721475°E	S. Rychlý
6.v.2022	Opava district, Opava, Olomoucká street, apricot orchard of the School Farm	49.9300733°N 17.8685197°E	S. Rychlý
4.–12.v.2022	Brno-city district, Brno – Černá Pole, Trávníky street, private garden	49.2101639°N 16.6209867° E	J. Beránek

velopment of winged females (Fig. 3) was already observed in the first offspring generation of the fundatrices. In 2022, the occurrence of *M. mumecola* on apricots was observed from the beginning of May.

On hops, alate females and starting colonies of nymphs were observed from mid-May in tens to hundreds of individuals (Figs 4–6), together with thousands of individuals of *Phorodon humuli* both in hop gardens and on wild hop plants.

As these two aphid species found on hops are difficult to distinguish morphologically, especially as apterous females and at the nymphal stage, the identification of *M. mumecola* was confirmed using molecular methods. DNA barcoding was performed on three specimens: a winged female from an apricot leaf and a winged female and an apterous female, both collected from hop. Both sequences of the partial mitochondrial COI gene obtained from specimens on hops (658 bp) were identical to each other. The sequence was submitted to GenBank database (accession number OQ413104) and showed 100% similarity to the sequence of *M. mumecola* with acc. no. AB738876 from Japan. Only partial, 614 bp sequence was obtained from the specimen collected on apricot: it was identical to the sequences of specimens on hop (corresponding to their nucleotide positions 45 to 658) and the GenBank sequence of *M. mumecola* (AB738876). Sequence similarity with *Phorodon humuli* data from Genbank (e.g. OP103700 from Tunisia) was less than 95%.

DISCUSSION

Individuals of *M. mumecola* found in the Czech Republic corresponded well to the morphological description by Borbély et al. (2021). The obtained sequences of the partial mitochondrial COI gene obtained from one apricot and two hop specimens were identical to the COI sequence of *M. mumecola* from Japan (AB738876) and differed significantly from sequences of *Phorodon humuli*, enabling a reliable molecular differentiation between these two species found together on hops.

In view of increasing number of findings in Europe, spreading of *M. mumecola* to other apricot growing areas can be expected. However, direct damage to trees caused by this species is not significant and no fruit damage has yet been observed (Anonymus 2020). On the other hand, the species was confirmed to be a vector of the Plum pox virus (PPV) (Borbély et al. 2020), a causal agent of sharka disease, one of the most serious viral diseases of stone fruit

Table 2. Details of records of *Myzus mumecola* (Matsumura, 1917) on hop (*Humulus lupulus*) in the Czech Republic.
Tabulka 2. Detailní údaje k nálezům mšice *Myzus mumecola* (Matsumura, 1917) na chmelu (*Humulus lupulus*) v České republice.

Collection date / datum sběru	**Locality / lokalita**	**GPS coordinates / souřadnice**	**Collector / sběratel**
16.v.2022	Olomouc district, Prosenice-Proseničky, hop garden	49.4980769°N 17.4910369°E	P. Tóth
30.v.2022	Olomouc district, Velká Bystřice, hop garden	49.5828434°N 17.3620859°E	L. Prečan
30.v.2022	Opava city, Komárov u Opavy, wild hop	49.9182481°N 17.9428961°E	S. Rychlý
31.v.2022	Přerov district, Radvanice u Lipníka nad Bečvou, hop garden	49.5212681°N 17.4865541°E	V. Košťálová

crops. *M. mumecola* has not yet been included in the list of regulated harmful organisms for the European Union.

During the survey in the Czech Republic, winged females and nymphs of *M. mumecola* were recorded not only on apricots, but also on hops at different locations in the eastern part of the country, indicating that hop is a secondary host plant for *M. mumecola* in Central European conditions. However, economic aspects of the infestation of hop stands by *M. mumecola* still need to be assessed in the Czech Republic, together with a detailed survey and testing for viruses, especially PPV, in the Czech populations of this aphid species.

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SOUHRN

Mšice *Myzus mumecola* (Matsumura, 1917) (Hemiptera: Sternorrhyncha: Aphididae), pochází z východní Asie, kde jsou jejími primárními hostitelskými rostlinami některé druhy rodu *Prunus*. V Evropě se jedná o nepůvodní druh, poprvé potvrzený na meruňkách v Itálii v roce 2016, a následně i v Maďarsku a Srbsku. V roce 2020 byla *M. mumecola* poprvé zjištěna v České republice na primárním hostiteli, meruňce obecné (*Prunus armeniaca*) a její výskyt byl pak zaznamenán na několika dalších lokalitách. Jarní populace způsobovaly podélné stáčení

listů napadených rostlin ve směru hlavní žilky. Vývoj okřídlených samiček byl zaznamenán již v prvním pokolení potomků zakladatelek. Přesto, že se předpokládalo, že *M. mumecola* je dicyklický druh, sekundární hostitel v Evropě, tj. mimo původní oblast rozšíření, nebyl zatím znám. V roce 2022 byla *M. mumecola* autory poprvé pozorována na chmelu (*Humulus lupulus*), a to jak na planě rostoucím, tak ve chmelnicích. Vzhledem k tomu, že se tato mšice na chmelu úspěšně množí, lze chmel považovat za potvrzenou sekundární hostitelskou rostlinu pro *M. mumecola* v Evropě.